Sacramento Regional 2015 NAAQS 8-Hour Ozone Attainment & Reasonable Further Progress Plan

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SACRAMENTO REGIONAL

2015 NAAQS

8-HOUR OZONE ATTAINMENT &

REASONABLE FURTHER PROGRESS PLAN

August 2023

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ACCII -	Advanced Clean Cars II
ACF -	Advanced Clean Fleets
ACT -	Advanced Clean Tricks
APCD -	Air Pollution Control District
APU -	auxiliary power units
AQMD -	Air Quality Management District
AQMIS -	Air Quality and Meteorological Information System (https://www.arb.ca.gov/aqmis2/aqmis2.php)
AQS -	Air Quality System (https://www.epa.gov/aqs)
Auto GC -	Automated Gas Chromatograph
AVG -	Average
BACT -	Best Available Control Technology
BVOC -	Biogenic Volatile Organic Compound
BY -	Baseline Year
CAA -	Clean Air Act
CACs -	County Agricultural Commissioners
CAMx -	Comprehensive Air Quality Model with Extensions
CARB -	California Air Resources Board
CASAC -	Clean Air Scientific Advisory Committee
CDFA -	California Department of Food and Agriculture
CEPAM -	California Emissions Projection Analysis Model
CFR -	Code of Federal Regulations
CHCs -	commercial harbor crafts
CHE -	Cargo Handling Equipment
CI -	compression-ignition
CMAQ -	Community Multiscale Air Quality Model (Chapter 6)
CMAQ -	Congestion Mitigation and Air Quality Improvement (Chapter 7)
CO -	Carbon Monoxide
CO_2 -	Carbon Dioxide

COVID-19 - Coronavirus disease 2019

CTG - Control Techniques Guidelines

DPFs - diesel particulate filters

DPR - California Department of Pesticide Regulation

DV - Design Value

EDCAQMD - El Dorado County Air Quality Management District

EMFAC - Emissions Factor California's on-road motor vehicle emission factor model

EPA - United States Environmental Protection Agency

ERCs - Emission Reduction Credits

FHWA - Federal Highway Administration

FR - Federal Register

FRAQMD - Feather River Air Quality Management District

FY - Future Year

GDF - Gas dispensing facilities

GHG - Greenhouse Gases

HC - Hydrocarbon

HDVIP - Heavy-Duty Vehicle Inspection Program

HFC-12a - hydrofluorocarbon-152a

Hp - horsepower

ICT - Innovative Clean Transit

kW - kilowatts

MCD - Milestone Compliance Demonstrations

MEGAN - Model of Emissions of Gases and Aerosols from Nature

MPO - Metropolitan Planning Organization

MTC - Metropolitan Transportation Commission (Bay Area)

MTIP - Metropolitan Transportation Improvement Program

MTP - Metropolitan Transportation Plan

MVEB - Motor Vehicle Emissions Budget

NAAQS - National Ambient Air Quality Standard

NNSR - New Source Review

NO_X - Nitrogen Oxides

NO_y -	NO_X plus nitric acid, nitrous acid (HONO), dinitrogen pentoxide (N_2O_5), peroxyacetyl nitrate (PAN), alkyl nitrates ($RONO_2$), peroxyalkyl nitrates ($ROONO_2$), the nitrate radical (NO_3), and peroxynitric acid (HNO_4)
NYQ -	Not yet quantified.
O_3 -	Ozone
OEHHA -	Office of Environmental Health Hazard Assessment
PAMS -	Photochemical Assessment Monitoring Stations
PCAPCD -	Placer County Air Pollution Control District
PM -	Particulate Matter
$PM_{2.5}$ -	Particulate Matter with diameter less than 2.5 micrometer
ppb -	parts per billion
ppm -	parts per million
PSIP -	Periodic Smoke Inspection Program
RACM -	Reasonably Available Control Measure
RACT -	Reasonably Available Control Technology
RFP -	Reasonable Further Progress
ROG -	Reactive Organic Gases
RPP -	Regional Planning Partnership
RRF -	Relative Response Factor
RTG -	Rubber Tired Gantry
RY -	Reference Year
SACOG -	Sacramento Area Council of Governments
SACSIM -	SACOG's Activity-Based Travel Simulation Model
SFNA -	Sacramento Federal Nonattainment Area
SMAQMD -	Sacramento Metropolitan Air Quality Management District
SIP -	State Implementation Plan
SORE -	Small Off-Road Engine
SO_X -	Sulfur Oxides
SV -	Sacramento Valley
TCMs -	Transportation Control Measures
TIF-	totally impermeable film

TNCs - transportation network companies

tpd - tons per day

tpy - tons per year

TRU - Transport Refrigeration Unit

VMT - Vehicle Miles Traveled

VOC - Volatile Organic Compounds

WOE - Weight of Evidence

YSAQMD - Yolo-Solano Air Quality Management District

ZE - Zero-Emission

1 EXECUTIVE SUMMARY

In 2015, the United States Environmental Protection Agency (EPA) promulgated a new National Ambient Air Quality Standard (NAAQS) for ozone (O_3) at a maximum daily 8-hour average concentration of 70 parts per billion (ppb). The O_3 design value, which is a 3-year average of the fourth highest O_3 concertation at the peak ozone monitoring site, in the Sacramento Federal Ozone Nonattainment Area (SFNA) exceeded the 2015 O_3 NAAQS. The SFNA, which comprised of Sacramento and Yolo counties, western portion of El Dorado and Placer counties, southern portion of Sutter County, and northeastern portion of Solano County, is classified as a “serious” nonattainment area for the 2015 standard. Preliminary photochemical modeling results showed that attainment of the standard by the serious attainment date of August 3, 2027, was not practical or achievable, and additional time is necessary to allow for the adoption and implementation of state measures to get the needed emission reductions in the Sacramento region. The SFNA air districts have requested a reclassification to "severe” with attainment deadline of August 3, 2033. Attainment of the 2015 O_3 standard will be shown by the data from the last full O_3 season prior to the attainment deadline, referred to as the attainment year, or 2032. The chapters and appendices in this plan address the Clean Air Act (CAA) requirements associated with the “severe” classification and how the SFNA can attain the standard by the attainment date.

The SFNA has made great strides reducing O_3 concentrations as it progresses to meeting its clean air goals. It has seen a declining trend of the number of exceedance days in the last two decades from 66 days in 2000 to 34 days in 2021, and a decrease in the design value from 107 ppb in 2000 to 82 ppb in 2021 at the region’s peak air monitoring site. This decline is expected to continue, which is supported by the forecasted emissions inventories. Emissions for both O_3 precursors, nitrogen oxides (NO_X) and volatile organic compounds (VOC), are expected to significantly decrease between the baseline year 2017 and attainment year 2032. The forecasted emissions inventories for 2032 will be 34 and 80 tons per day (tpd) for NO_X and VOC, respectively. These represent a 52% decrease of NO_X and 17% decrease of VOC from the 2017 base year levels of about 71 and 97 tpd of NO_X and VOC, respectively. These emission reductions are results of new statewide control measures and the current existing federal, state, regional, and local control programs. During the same period, the SFNA population is expected to increase by 16% from 2.4 million to 2.9 million and an increase of vehicle miles traveled (VMT) by 12% from 61 to 68 million miles.

The photochemical modeling results confirmed that existing air quality control programs, including the continuation of the Spare the Air Program, with the new statewide control measures are sufficient to demonstrate attainment by the end of 2032. New control measures at the regional and local levels are not needed to attain the standard by the attainment date. Supplemental analysis in the Weight of Evidence supported the attainment demonstration. Further sensitivity analysis through the photochemical modeling indicated that the NO_X emission reductions are more effective than VOC emission reductions in reducing ambient ozone concentrations. The sensitivity analysis results also confirmed that the combination of NO_X and VOC estimated emissions reductions from all reasonably available control measures (RACM) are less than the threshold for advancing attainment.

The forecasted emission reductions in SFNA also meet reasonable further progress (RFP), which is a requirement to show the minimum VOC emissions reduction of 3% per year are achieved through VOC and NO_X substitution reductions for the 2023, 2026, and 2029 milestone years, and the 2032 attainment year. If EPA makes a finding that the SFNA fails to meet RFP or fails to attain the NAAQS by the attainment date, contingency measures are triggered. In this plan, CARB is proposing amendments to the current Smog Check Program as a statewide contingency measure. At the local levels, the SFNA air districts make a commitment to amend their existing architectural coating rules to add contingency measure provisions. Each district will take its amended rule to its respective air district board for adoption prior to submitting the amended rule to CARB and EPA. The SFNA air districts also commit to evaluate additional potential options for contingency measures after EPA finalizes its guidance on contingency measures.

In the SFNA, one of the main emissions source categories that contributes to the ozone problem is motor vehicles. This plan establishes motor vehicle emissions budgets (MVEB) for the milestone years and attainment year to ensure that motor vehicles emissions from regional transportation plans and projects will not interfere with timely attainment of the standard. When the regional transportation planning agencies, Sacramento Area Council of Governments and Metropolitan Transportation Commission, develop their metropolitan transportation plans and transportation improvement programs, the SFNA aggregate transportation emissions must be equal to or less than the approved MVEB. In addition, a VMT offset demonstration was performed that showed that the current transportation control strategies and measures in the SFNA are sufficient to offset the increase in motor vehicle emissions in the attainment year due to the projected growth in VMT.

This plan meets the CAA requirements for the ozone nonattainment area with a “severe” classification and includes ozone trends, emissions inventories, photochemical modeling, attainment demonstration, ozone transport, transportation and general conformity, MVEB, and RFP demonstration. The attainment demonstration is supported by photochemical modeling, weight of evidence, and RFP. With existing federal, state, regional and local control programs, new statewide control and contingency measures, and local contingency measures, the SFNA is expected to attain the 2015 ozone NAAQS by the attainment year of 2032.

2 BACKGROUND AND NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) OVERVIEW

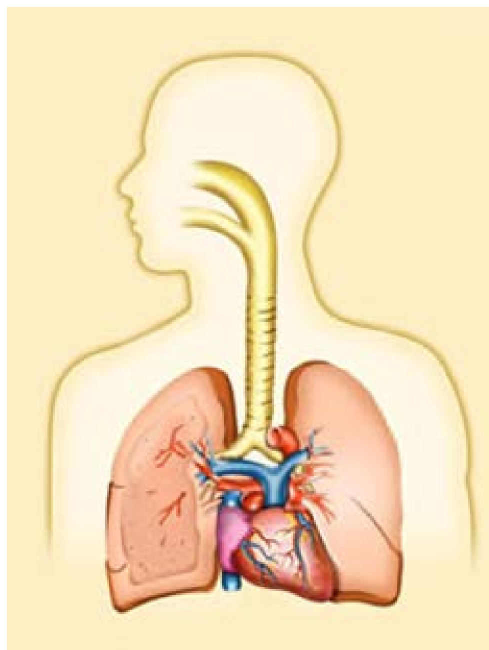
The Sacramento Regional 2015 National Ambient Air Quality Standards (NAAQS) 8-Hour Ozone Attainment and Reasonable Further Progress (RFP) Plan (referred to as the 2015 Ozone NAAQS Plan) demonstrates how the Sacramento Federal Nonattainment Area (SFNA) meets the Clean Air Act (CAA) and RFP requirements and attainment of the 2015 ozone NAAQS of 70 parts per billion (ppb). This plan addresses attainment demonstration requirements based on the severe-15 classification of the SFNA for the 2015 ozone NAAQS. It includes an updated emissions inventory, new motor vehicle emissions budgets (MVEB), results of the photochemical modeling used to support the attainment demonstration, and reasonably available control measure (RACM) evaluation.

The 2015 Ozone NAAQS Plan will be part of California's State Implementation Plan (SIP). The California SIP includes plans for each of the state's nonattainment areas, along with rules, regulations, and other control strategies adopted by air districts and the California Air Resource Board (CARB). After this plan is reviewed and approved by CARB, it will be submitted to the United States Environmental Protection Agency (EPA) for federal review and approval.

2.1 Background Information

2.1.1 Ozone Health Effects

Ground-level ozone is one of the air pollutants regulated by both federal and state laws. It is a colorless gas formed when nitrogen oxides (NO_X) and volatile organic compounds (VOC) (known as precursor pollutants) react in the presence of sunlight.



Effects on the Airways. Ozone is a powerful oxidant that can irritate the air ways causing coughing, a burning sensation, wheezing and shortness of breath and it can aggravate asthma and other lung diseases.

Ozone is a strong irritant that adversely affects human health. Ozone exposure can cause respiratory problems, especially in sensitive groups: children, the elderly, people suffering from chronic diseases, and outdoor workers. Children are at greater risk from exposure to ozone, especially at higher concentrations, because their respiratory systems are still developing, and they are likely to be outdoors and more active.

Breathing ozone can trigger a variety of respiratory problems, which may:

- Create difficulty breathing deeply and vigorously
- Create shortness of breath and pain when taking a deep breath
- Cause coughing and create a sore or scratchy throat
- Inflame and damage the airways and lung tissue
- Exacerbate lung diseases such as asthma, emphysema, and chronic bronchitis
- Increase risk of cardiovascular problems, such as heart attacks and strokes
- Make the lungs more susceptible to infection
- Continue to damage the lungs even when the symptoms have disappeared

Ground level ozone is absorbed by the leaves of plants, where it can reduce photosynthesis, damage leaves and slow growth. It can also make sensitive plants more susceptible to certain diseases, insects, harsh weather and other pollutants.

These effects may lead to an increase in school absences, medication use, visits to doctors and emergency rooms, and hospital admissions. Research suggests a correlation between air pollutant exposure (ozone and $PM_{2.5}$) and the increased occurrence of mental health conditions (Nguyen, 2021) including neurotic/stress, substance use, depression, bipolar and other mental health conditions. Research also indicates that ozone exposure may increase the risk of premature death from heart or lung diseases (EPA, 2020).

Reducing ground-level ozone to concentrations below federal and state standards is one of the primary goals of the air districts in the SFNA.

2.1.2 Ecosystem Effects

In addition to health effects, ozone also affects vegetation and ecosystems, such as forests, parks, wildlife refuges, and wilderness areas. Ozone harms sensitive vegetation by reducing photosynthesis, which is the process that plants use to convert sunlight to energy to live and grow. This can slow down tree and plant growth, especially during the prime growing season.

Plant species that are sensitive to ozone are potentially at an increased risk from exposure, disease, damage from insects, and harm from severe weather. This includes trees such as black cherry, quaking aspen, ponderosa pine, and cottonwood, which are found in many areas of the country, including the SFNA.

When sufficient ozone enters the leaves of a plant, it can:

- Interfere with the ability to produce and store food; and
- Visibly damage the leaves of trees and other plants, degrading the appearance of vegetation in urban areas, national parks, and recreation areas.

These effects can also have adverse impacts on ecosystems, including loss of species diversity and changes to habitat quality, water, and nutrient cycles (EPA, 2020).

2.1.3 Ozone Formation and Precursor Pollutants

Ozone is not emitted directly into the air from pollution sources. Instead, it is a gas composed of three oxygen atoms. At ground level, it is generated through a chemical reaction between VOCs (also known as reactive organic gases, ROG) and NO_X in the presence of sunlight. VOCs and NO_X are known as ozone precursors.

These precursors are emitted by different types of anthropogenic (man-made) sources but are also emitted by biogenic sources such as trees and crops. Anthropogenic sources include on-road and off-road combustion engine vehicles, power plants, industrial facilities, gasoline stations, organic solvents, and consumer products.

2.2 Planning Boundaries

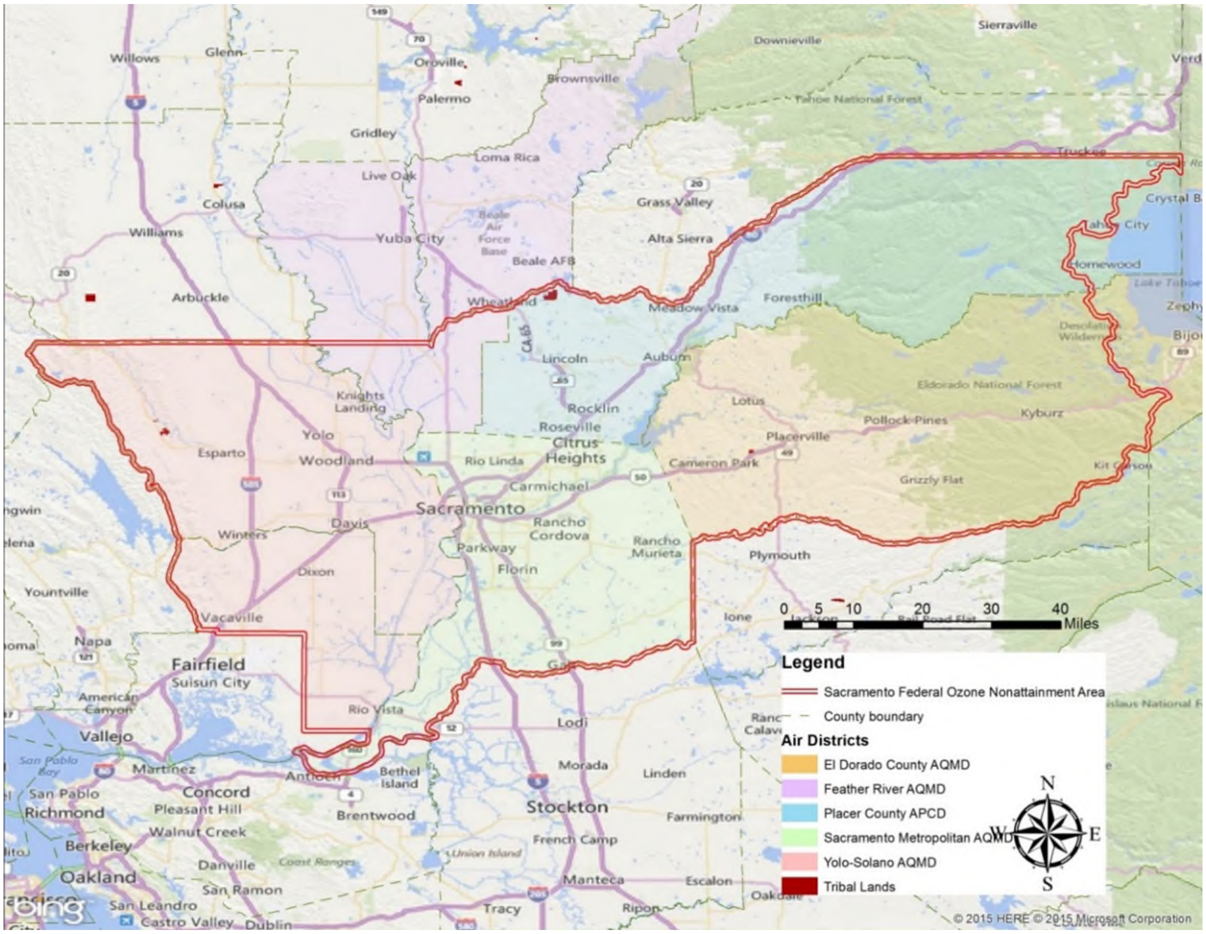
Figure 2-1 shows the SFNA boundaries, which include all of Sacramento and Yolo counties and portions of Placer, El Dorado, Solano, and Sutter counties. The ozone non-attainment area boundaries have not changed and are the same boundaries as they were for the 1997 and 2008 8-hour ozone standards (69 FR 23858, 77 FR 30088).

The SFNA planning boundaries for ozone include five air districts: El Dorado County Air Quality Management District (EDCAQMD), Feather River Air Quality Management District (FRAQMD), Placer County Air Pollution Control District (PCAPCD), Sacramento Metropolitan Air Quality Management District (SMAQMD), and Yolo-Solano Air Quality Management District (YSAQMD).

2.3 NAAQS for Ozone

The CAA requires that EPA review the NAAQS for all criteria pollutants, including ozone, once every 5 years to determine if each standard adequately protects public health and the environment (CAA Sections 108 and 109). EPA must conduct a comprehensive review of the most policy-relevant science and evaluate whether it is appropriate to maintain or revise a health standard, considering all risks and impacts to human health or the environment. As required by the CAA Section 109, this review process is also supported by an independent body known as the Clean Air Scientific Advisory Committee (CASAC). The CASAC's role is to provide EPA with advice and recommendations on retention of the existing standard or revisions that may be appropriate to consider based on science. EPA may establish a new NAAQS after considering information from this review process as well as from public and agency comments.

Figure 2-1 Sacramento Federal Ozone Nonattainment Area



After a new standard has been set, EPA is required to designate areas as attainment or nonattainment based on how measured pollutant levels compare to the NAAQS. For ozone, nonattainment areas are classified as marginal, moderate, serious, severe, or extreme (Figure 2-2) based on “such factors as the severity of nonattainment in such area and the availability and feasibility of the pollution control measures that the Administrator (EPA) believes may be necessary to provide for attainment of such standard in such area” (CAA Section 172).

Figure 2-2 Air Quality Classifications

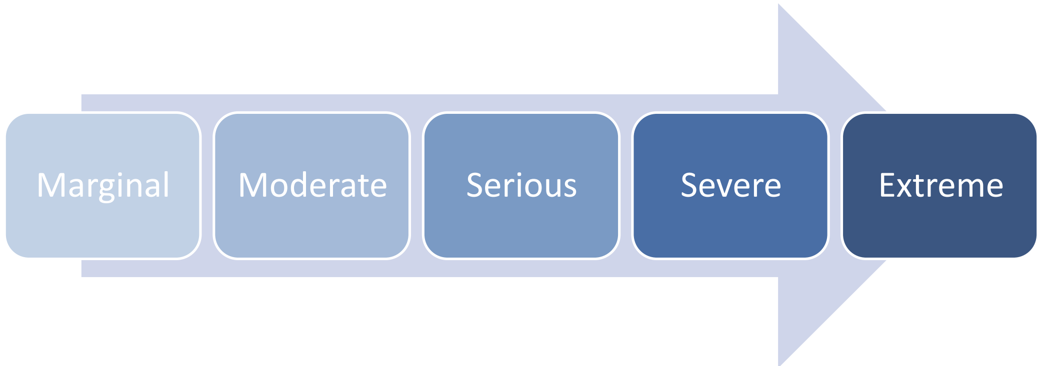


Table 2-1 Overview of Ozone Standards, Classification and Attainment Status

	1979	1997	2008	2015
Standard	120 ppb (44 FR 8202)	80 ppb (62 FR 38856)	75 ppb (73 FR 16436)	70 ppb (80 FR 65292)
Averaging Time	1 hour	8 hours	8 hours	8 hours
Standard Status	Revoked[1] (69 FR 23951)	Revoked[1] (80 FR 12264)	Active	Active
Classification	Severe-15 (60 FR 20237)	Severe-15 (75 FR 24409)	Severe-15 (77 FR 30088)	Severe-15[2] (see footnote)
Attainment Date (month-year)	11/2005	06/2019	07/2025	08/2033
Approved Attainment Demonstration and RFP Plan	01/08/1997 (62 FR 1150)	01/29/2015 (80 FR 4795)	10/22/2021 (86 FR 58581)[3]	The purpose of this plan
Status	Clean data finding issued on 01/18/2012 (77 FR 64036)	2020-2022 design value is less than standard	In progress	In progress

1. Nonattainment areas designated for a revoked standard are required to meet the Clean Air Act requirements before the nonattainment area can be redesignated to attainment.
2. The SFNA is currently classified as serious (86 FR 59648). The SFNA air districts have requested the area to be voluntarily reclassified to severe.
3. EPA approved all plan elements except for the contingency measures elements where EPA is deferring action.

Ozone NAAQS were developed in 1979 for a 1-hour standard, and in 1997, 2008, and 2015 for an 8-hour standard. Table 2-1 provides the following information for all ozone standards, and Sections 2.3.1 and 2.3.2 provide a summary of the active 2008 and 2015 ozone standards:

- Standard and averaging time,
- status (revoked or active),

- classification and corresponding attainment date,
- approval date for the Attainment Demonstration and RFP Plan; and
- attainment status.

2.3.1 2008 8-hour Ozone NAAQS

On March 27, 2008, EPA promulgated an 8-hour ozone NAAQS of 75 ppb based on findings from the health studies available at the time (73 FR 16436). EPA classified the SFNA as a severe-15 (77 FR 30088), which gave an attainment deadline of July 2027 according to the schedule outlined in CAA Section 181. This attainment deadline requires that the SFNA demonstrate attainment one full year prior to the attainment date, referred to as the attainment year, or 2026. Photochemical modeling (SMAQMD, 2017, Appendix B) conducted by CARB showed that the SFNA could attain the 2008 ozone NAAQS earlier than 2026. Based on the modeling results and discussion with the SFNA air districts, CARB, and EPA, the attainment year was determined to be 2024 (where July 2025 is the attainment date). The SFNA air districts submitted the Sacramento Regional 2008 NAAQS 8-hour Ozone Attainment and Reasonable Further Progress Plan (2008 Ozone Plan) to CARB, and CARB approved and submitted it to EPA on December 18, 2017 (CARB, 2017).

Actions by EPA to approve or disapprove the 2008 Ozone Plan were delayed by two court decisions[1, 2]. These decisions affected the approvability of specific SIP elements, which included the ozone RFP, baseline inventory years, and contingency measures. In collaboration with affected nonattainment areas, including the SFNA, CARB developed and adopted the 2018 Updates to the California State Implementation Plan (2018 SIP Update) (CARB, 2018), to address the issues identified by the court findings. In addition, CARB developed an updated version of its on-road mobile source EMission FACtor model, EMFAC2017, which included updated activity levels and emission rates for on-road heavy-duty vehicles and other mobile sources. EMFAC2017 was used to update the motor vehicle emission budgets, which were included as part of the 2018 SIP Update.

A Final Rule was issued by the EPA in the Federal Register (86 FR 58581) on October 22, 2021, approving all revisions to the SIP except for the contingency measures revision where EPA is deferring final action due to a court decision on approving SIP contingency measures[3]. On June 15, 2023, EPA disapproved the SFNA SIP contingency measures

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1 United States, Court of Appels for the Ninth Circuit. *Bahr v. U.S. Environmental Protection Agency*. Docket no: 14-72327, Citation: 836.F3d 1218, United States Court of Appels for the Ninth Circuit,

2 United States, Court of Appels for the D.C. Circuit. *South Coast Air Quality Management District v. U.S. Environmental Protection Agency.* Docket no. 15-1115,C/w 15-1123, Citation: 882 F3d 1138, 16 February 2018. United States Court of Appels for the D.C. Circuit.

3 United States, Court of Appels for the Ninth Circuit. *Association of Irritated Residents v. U.S. Environmental Protection Agency*. Docket No. 19-71223, 26 August 2021, United States Court of Appeals for the Ninth Circuit.

because the 2008 Ozone Plan did not include measures that would be triggered if the area fails to attain the NAAQS or make reasonable further progress (88 FR 39179).

Responding to the court decision, EPA proposed updates to the contingency measure guidance on March 17, 2023 (88 FR 17571) to help state and local air agencies identify technological feasible and reasonably available contingency measures. The draft guidance titled, "Guidance on the Preparation of State Implementation Plan Provisions that Address the Nonattainment Area Contingency Measure Requirements for Ozone and Particulate Matter" is currently under EPA's review and is expected to be finalized by the end of 2023. When EPA finalizes its guidance, the SFNA air districts will continue to work with CARB and EPA to meet the contingency measure requirements and submit the necessary documentations to EPA to receive full approval for the 2008 Ozone Plan.

2.3.2 2015 8-hour Ozone NAAQS

On October 26, 2015, EPA issued a revised, more stringent 8-hour standard of 70 ppb (80 FR 65292). The revised NAAQS strengthens the nation's air quality standards for ground-level ozone to improve public health and environmental protection, especially for at-risk groups including children and older adults.

On June 4, 2018, EPA classified the SFNA as a moderate nonattainment area based on the SFNA design value using air quality data from 2013 – 2015 and a request from CARB and the SFNA air districts (83 FR 25776). On May 26, 2020, the SFNA air districts requested a voluntary reclassification because more recent ambient air quality data and modeling did not support the moderate attainment deadline of August 2024. This attainment deadline was also one year before the attainment date of the less stringent 2008 NAAQS of 75 ppb discussed in Section 2.3.1. Data and modelling now demonstrate that the SFNA needs additional time to attain and a reclassification to serious extends the attainment deadline to August 2027. This request was forwarded by CARB to EPA and was approved by EPA on October 28, 2021 (effective November 29, 2021) (86 FR 59648).

In May 2022, during the SIP development process, CARB conducted photochemical modeling that showed that the SFNA cannot attain the 2015 ozone NAAQS by the serious attainment date of August 2027. Because of this conclusion, the SFNA air districts have submitted another request to be voluntarily reclassified to severe-15, which will allow the region until August 2033 to demonstrate attainment. The request was forwarded by CARB and is pending action by EPA. This plan was developed to meet the requirements of a severe-15 nonattainment classification.

2.4 Development of the 2015 8-hour Ozone NAAQS Plan

2.4.1 Responsible Agencies

This 2015 8-hour Ozone NAAQS Plan was developed for the Sacramento region by the five air districts in the nonattainment area in collaboration with the CARB, the Sacramento

Area Council of Governments (SACOG), and the Bay Area Metropolitan Transportation Commission (MTC)[4]. The five local air districts include: EDCAQMD, FRAQMD, PCAPCD, SMAQMD, and YSAQMD. SACOG and MTC are the metropolitan planning organizations (MPO) for transportation planning in the SFNA.

2.4.2 Interagency Collaboration

Several committees and working groups provided input on technical and policy issues during the development of this plan.

- The Regional Planning Partnership (RPP) consisted of participants from the California Department of Transportation (CDOT), EPA, and Federal Highways Administration (FHWA). The RPP was assembled to coordinate the efforts of the local, state, and federal government agencies directly involved in the preparation or review of the Metropolitan Transportation Plan (MTP) and was responsible for interagency consultation on motor vehicle emissions budgets, conformity determinations and transportation control measures.
- The State Implementation Plan Inventory Working Group (SIPIWG) provided a platform for sharing information and updating status regarding the emissions inventory development among the air districts, EPA, and CARB.

2.4.3 Public Input and Review Process

This plan meets the requirements of CAA Section 110(a)(2), which requires reasonable notice and public hearings before plan adoptions. The Board of Directors for each of the air districts in the SFNA will provide a public notice, accept public comments, and hold a hearing prior to acting on the plan.

Stakeholder groups will help to disseminate information and seek input during the development of the plan. These include the SACOG's Regional Planning Partnership and other stakeholder groups throughout the SFNA. These stakeholders represent citizens in the region, business interests, environmental groups, transportation agencies, local government, and other community organizations. In addition, representatives for the various Native American tribes in the Sacramento region were contacted and invited to participate in the process.

2.5 Contents of 8-Hour Ozone Plan

This document includes information and analyses that fulfill the 2015 8-hour ozone NAAQS attainment demonstration and reasonable further progress planning requirements for the SFNA.

[4] MTC is the MPO for the east Solano County portion of the Sacramento nonattainment area.

Table 2-2 SIP Plan Chapter Description

Chapter	Title	Descriptions
1	Executive Summary	Executive summary of the Attainment and Reasonable Further Progress Plan for the 2015 8-hour ozone NAAQS
2	Background Information and National Ambient Air Quality Standards (NAAQSs) Overview	An introduction that contains background information on ozone health effects, ozone formation, the federal ozone standards, and an overview of the plan's development process
3	Clean Air Act Plan Requirements	Discusses the CAA and Attainment Plan Requirements for the 2015 ozone NAAQS
4	8-Hour Ozone Air Quality Trends	Analyzes and illustrates 8-hour ozone air quality trends in the SFNA
5	Emissions Inventory	Presents the 2017 base year emissions inventory and the emission forecasts that are based on existing control strategies and growth assumptions
6	Air Quality Modeling and Attainment Demonstration	Characterizes the air quality modeling simulations and predictions, and shows the 8-hour ozone attainment demonstration for the SFNA using the emission forecasts, photochemical modeling results, and the proposed control strategies
7	Control Measures	Describes the existing control programs and control measure commitments. Discuss the Reasonable Available Control Measure (RACM) analysis that was conducted
8	Contingency Measures	Explains contingency measures and discuss the status of developing these measures
9	Transport Analysis	Discusses inter-basin pollutant transport issues and addresses transport assumptions included in the photochemical modeling
10	Transportation Conformity and Emissions Budget	Documents the motor vehicle emissions budgets for transportation conformity purposes
11	General Conformity	Explains general conformity requirements
12	Reasonable Further Progress Demonstrations	Demonstrates how the Reasonable Further Progress emission reduction requirements will be achieved
13	Summary and Conclusions	Summarizes the key points and major conclusions of this plan, and discusses expected future air quality planning efforts by the air districts

Additional documentation for the more technical sections of the 8-hour ozone attainment plan is contained in the following Appendices.

Table 2-3 SIP Plan Appendix Description

Appendix	Title	Descriptions
A	Emissions Inventory	Includes the spreadsheet from CEPAM 2019 v1.04 Outputs and CARB's emissions inventory writeup
B	Photochemical Modeling	Photochemical modeling documentations: conceptual model, modeling protocol, modeling results, attainment demonstration, and gridded emissions inventory development
C	Current Control Programs	Detail descriptions for CARB's proposed statewide control measures and existing regional and local control measures
D	Reasonably Available Control Measures (RACM) Analysis	RACM analysis from air districts, Sacramento Area Council of Governments, and attainment year VOC and NO_X trading ratio
E	Contingency Control Measures	Includes CARB's assessment of statewide contingency measures and the air districts' report for contingency measure commitments.
F	Weight of Evidence	Weight of Evidence analysis that supports the results of photochemical modeling
G	Vehicle Miles Traveled (VMT) Offset Analysis	Detailed writeup for VMT Offset demonstration

2.6 References

Nguyen, Angela-Maithy et al. "*The association between ozone and fine particles and mental health-related emergency department visits in California, 2005-2013.*" PloS one vol. 16,4 e0249675. 2 Apr. 2021, doi:10.1371/journal.pone.0249675 Web. 25 May 2023. < https://pubmed.ncbi.nlm.nih.gov/33798241/ >

CARB. *2018 Updates to the California State Implementation Plan*, 25 October 2018. Web, 25 May 2023. < https://www.arb.ca.gov/planning/sip/2018sipupdate/2018update.pdf >

CARB, Letter from Corey (CARB) to Strauss (EPA Region IX). 18 December 2017. Print.

EPA. (44 FR 8202–8237) *Revisions to the National Ambient Air Quality Standards for chemical Oxidants; Final Rulemaking.* Federal Register, Volume 44, 8 February, 1979, p. 8202 – 8237. Web 05 June 2023. < https://archives.federalregister.gov/issue_slice/1969/5/27/8206-8209.pdf#page=3 >

---. (60 FR 20237-20238) *California, Sacramento Ozone Nonattainment Area, Reclassification to Severe; Final Rule*. Federal Register, Volume 60, 25 April, 1995, p. 20237 - 20238. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-1995-04-25/pdf/95-10099.pdf >

---. (62 FR 1150-1187) *Approval and Promulgation of Implementation Plans; California—Ozone; Final Rule*. Federal Register, Volume 62, 8 January 1997, p. 1150 - 1187.

Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-1997-01-08/pdf/97-144.pdf >

---. (62 FR 38856-38896) *National Ambient Air Quality Standards for Ozone. Final Rule.* Federal Register, Volume 62, 18 July 1997., p.38856 – 38896. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-1997-07-18/pdf/97-18580.pdf >

--- (69 FR 23858-23951) *Air Quality Designations and Classifications for the 8-Hour Ozone National Ambient Air Quality Standards; Early Action Compact Areas With Deferred Effective Dates*. Federal Register, Volume 69, 30 April 2004, p 23858 - 23951. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2004-04-30/pdf/04-9152.pdf >

---. (69 FR 23951-24000) *Implement the 8-Hour Ozone National Ambient Air Quality Standard – Phase 1: Final Rule.* Federal Register 69, 30 April 2004, p. 23951 – 24000. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2004-04-30/pdf/04-9153.pdf >

---. (73 FR 16436-16514) *National Ambient Air Quality Standards for Ozone; Final Rule.* Federal Register, Volume 73, 17 March 2008, p. 16436 – 16514. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2008-03-27/pdf/E8-5645.pdf >

---. (75 FR 24409-24421) *Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley, South Coast Air Basin, Coachella Valley, and Sacramento Metro 8-Hour Ozone Nonattainment Areas; Reclassification: Final Rule*. Federal Register, Volume 75, 5 May 2010, p. 24409 - 24421. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2010-05-05/pdf/2010-9599.pdf >

---. (77 FR 30088-30160) *Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards; Implementation of the 2008 National Ambient Air Quality Standards: Final Rule*. Federal Register, Volume 77, 21 May 2012, p. 30088-30160. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2012-05-21/pdf/2012-11618.pdf >

---. (77 FR 64036-64039) EPA. *Air Quality Designations for the 2008 Ozone National Ambient Air Quality Stand* Determination of Attainment of the 1-Hour Ozone National Ambient Air Quality Standards in the Sacramento Metro Nonattainment Area in California. Federal Register, Volume 77, 21 May 2012, p. 64036-64039. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2012-10-18/pdf/2012-25547.pdf >

---. (80 FR 4795-4799) *Approval and Promulgation of Implementation Plans; State of California; Sacramento Metro Area; Attainment Plan for 1997 8-Hour Ozone Standard. Final Rule.* Federal Register, Volume 80, 29 January 2015, p. 4795 –

4799. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2015-01-29/pdf/2015-01609.pdf >

---. (80 FR 12264-12319) *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements: Final Rule.* Federal Register, Volume 80, 6 March 2015, p. 12264-12319. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2015-03-06/pdf/2015-04012.pdf >

---. (80 FR 65292-65467) *National Ambient Air Quality Standards for Ozone*; Final Rule. Federal Register, Volume 80, 26 October 2015, p. 65292 – 65467. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2015-10-26/pdf/2015-26594.pdf >

---. (83 FR 25776–25848) *Additional Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards: Final Rule.* Federal Register, Volume 83, 4 June 2018, p. 25776 – 25848. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2018-06-04/pdf/2018-11838.pdf >

---. (86 FR 58581–58592) *Approval of Air Quality Implementation Plans; California; Sacramento Metro Area; 2008 8-Hour Ozone Nonattainment Area Requirements; Final Rule.* Federal Register, Volume 86, 22 October 2021, p. 58581 - 58592. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2021-10-22/pdf/2021-22661.pdf >

---. (86 FR 59648–59651) *Approval of Air Quality Implementation Plans; California; Sacramento Metro Area; 2008 8-Hour Ozone Nonattainment Area Requirements; Final Rule.* Federal Register, Volume 86, 28 October 2021, p. 59648 - 59651. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2021-10-28/pdf/2021-23454.pdf >

---. (88 FR 17571-17572) *Draft Guidance on the Preparation of State Implementation Plan Provisions That Address the Nonattainment Area Contingency Measure Requirements for Ozone and Particulate Matter, Notice of availability and public comment period.* Federal Register, Volume 88, 23 March 2023, p. 17571 - 17572. Web 11 July 2023. < https://www.govinfo.gov/content/pkg/FR-2023-03-23/pdf/2023-06010.pdf >

---. (88 FR 39179-39182) *Disapproval of Clean Air Plans; Sacramento Metro, California; Contingency Measures for 2008 Ozone Standards, Final Rule.* Federal Register, Volume 88, 15 June 2023, p. 39479 - 39182. Web 11 July 2023. < https://www.govinfo.gov/content/pkg/FR-2023-06-15/pdf/2023-12634.pdf >

---. *Heath Effects of Ground-level Ozone,* 26 November 2020. Web, 25 May 2023. < https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution >

SMAQMD, *Sacramento Regional 2008 NAAQS 8-hour Ozone Attainment and Reasonable Further Progress Plan*, 24 July [2017.] Web, 25 May 2023. < https://www.airquality.org/ProgramCoordination/Documents/Sac%20Regional%202008%20NAAQS%20Attainment%20and%20RFP%20Plan%20-%20Plan%20Only.pdf >

3 CLEAN AIR ACT PLAN REQUIREMENTS

The Clean Air Act (CAA), Sections 171-193 and 211 outline the plan requirements for a nonattainment area. In addition, the U.S. Environmental Protection Agency (EPA) published the 2015 ozone National Ambient Air Quality Standard (NAAQS) State Implementation Plan (SIP) Requirement Rule on December 6, 2018 (83 FR 62998), which includes requirements for specific elements of the SIP, including attainment demonstrations, reasonable further progress (RFP) and associated milestone demonstrations, reasonably available control technology (RACT), reasonably available control measures (RACM), nonattainment new source review (NSR), emissions inventories, vehicle miles traveled offset demonstrations, the timing of required SIP submissions and compliance with emission control measures in the SIP. The requirements that were addressed outside of the scope of this plan, unless otherwise specified, are discussed below.

3.1 Reasonably Available Control Technology (RACT)

CAA Sections 182(b)(2) and 182(f) require the nonattainment area to implement RACT for:

- Each category of volatile organic compound (VOC) sources covered by a Control Techniques Guidelines (CTG) document issued by EPA[5]; and
- All major stationary sources of VOC or nitrogen oxides (NO_X)

RACT (44 FR 53762) is “the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.” EPA is retaining the existing general RACT requirements for purposes of the 2015 ozone NAAQS SIP Requirements Rule (83 FR 63007), which requires each state or district to submit a SIP revision that meets the RACT requirements for VOC and NO_X in CAA Sections 182(b)(2) and 182(f). To address this requirement, each air district in the Sacramento Federal Nonattainment Area (SFNA) prepared a document called a Reasonably Available Control Technology State Implementation Plan (RACT SIP), which demonstrated how each air district implemented RACT for the affected sources and source categories. If a source or source category does not meet RACT, then the air district will need to commit to adopt or amend regulations as needed to meet RACT. RACT SIPs are not included in this plan and were prepared separately by each air district for submittal. RACT SIPs were due on August 3, 2020.

[5] CTG provide EPA’s recommendations on how to control emissions of VOCs from a specific type of product or process (source category) in an ozone nonattainment area. Each CTG includes emissions limitations based on RACT to address ozone nonattainment. This list can be found at https://www.epa.gov/ground-level-ozone-pollution/control-techniques-guidelines-and-alternative-control-techniques

3.2 Milestone Compliance Demonstrations (MCD)

CAA Sections 182(g) and 189(c)(2) require that six years after designation and at three-year intervals thereafter through the region's attainment year, each nonattainment area submit an MCD to demonstrate a reduction in emissions and a control measures adoption schedule for the preceding intervals. The MCD includes a periodic emissions inventory of emissions sources in the area to meet CAA Section 182(a)(3)(A) requirements. The purpose of the MCD is to ensure that the region achieves the incremental emissions reductions projected in RFP demonstrations. The actual emissions reductions must equal or exceed the emissions reductions shown in the RFP analysis. CAA Section 182(g)(2) requires the nonattainment area to submit an MCD within 90 days after the date on which an applicable RFP milestone occurs. For the 2015 NAAQS, the first MCD is due March 30, 2024, which is for the milestone year 2023, six years after the designation/baseline year (83 FR 63011). CAA Section 182(g)(3) states that failure of the nonattainment area to submit an adequate MCD by the deadline could cause the nonattainment area to be reclassified to the next higher classification, forced to implement contingency measures, or forced to adopt an economic incentive program.

CAA Section 182(c)(5) requires that six years after the designation and at three-year intervals thereafter, the State submit a demonstration as to whether current aggregate vehicle mileage, aggregate vehicle mileage, aggregate vehicle emissions, congestion levels, and other relevant parameters are consistent with those used for the area's demonstration of attainment. This will also be addressed in the upcoming MCD.

3.3 Vehicle Miles Travelled (VMT) Offset Demonstration

CAA Section 182(d)(1)(A) applies to nonattainment areas classified as severe or extreme. It requires SIPs to adopt "specific enforceable transportation control strategies and transportation control measures to offset any growth in vehicle miles traveled or numbers of vehicle trips in such area." The VMT offset demonstration is due two years after the area's initial designation or August 3, 2020. A VMT offset demonstration has not yet been submitted because EPA has not acted on the air districts' request to voluntarily reclassify the SFNA to severe. A VMT offset demonstration is included in this plan in Appendix G and was prepared using EPA's guidance (EPA, 2012).

3.4 Severe or Extreme Area Fee Program

CAA Section 185 is a fee program applied to all major stationary sources when a nonattainment area with a classification of severe and extreme failed to attain the standard by the attainment deadline. The CAA Section 185 fee program requires a fee to be assessed each year after the attainment date until the area is redesignated to attainment (CAA Section 182(d)(3)). This fee rule is required to be in place 10 years after the area's initial designation or August 2028. The SFNA air districts have adopted rules or will be developing rules that will satisfy the CAA Section 185 fee rule requirement.

3.5 Nonattainment New Source Review (NNSR) for Major Sources

CAA 172(c)(5) requires permits for the construction or operation of new or modified major stationary sources[6] of air pollution in a nonattainment area regardless of classification. For a severe area, the major source threshold is 25 tons per year (tpy) of VOC or NO_X emissions (CAA Sections 182(d) and 182(f)). This SIP element was due on August 3, 2021.

These NNSR requirements are established in rules adopted by each air district. Since the SFNA was classified as severe for the 1997 and 2008 8-hour Ozone NAAQS, all SFNA air districts have in place a NNSR rule with the severe area thresholds for NO_X and VOC. The SFNA air districts can certify their existing SIP-approved NNSR rule as meeting the 2015 ozone NAAQS SIP requirements unless EPA has found deficiencies in their NNSR rule, in which case, the air district will be required to amend their NNSR rule. NNSR rule certifications or amendments are not included in this plan and are prepared separately by each air district for submittal.

3.6 Periodic Emissions Inventory

CAA Section 182(a)(3) requires all nonattainment areas to submit emissions inventories every 3 years until the nonattainment area is designated to attainment. In collaboration with all air districts, CARB periodically revises the emissions inventory. The last emission inventory update was completed on July 24, 2020. CARB's submittal satisfies the requirements of Sections 172(c)(3) and 182(a)(1).

3.7 Emission Statement

CAA Section 182(a)(3)(B) requires all ozone nonattainment areas to have a program that requires emissions statements from stationary sources of NO_X and VOC. Specifically, CAA Section 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 NO_X and VOC emissions, beginning in 1993 and annually thereafter. This SIP element was due on August 3, 2020.

All SFNA air districts have established an emission reporting program for NO_X and VOC sources through their respective rules and programs and fulfilled the CAA Section 182(a)(3)(B) emissions statement requirements by certifying that the existing SIP-approved rules remain adequate to meet these requirements. Emission statement certifications are not included in this plan and are prepared separately by each air district for submittal.

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6 For severe ozone nonattainment areas, a major source is defined by CAA §182(d) as a source that has the potential to emit 25 tons or more per year of NO_X or VOC.

3.8 Gasoline Vapor Recovery

CAA Section 182(b)(3) requires owners and operators of gasoline dispensing systems in nonattainment areas with moderate or above classification to install and operate a system for gasoline vapor recovery of emissions from the fueling of motor vehicles. The California legislature and California Air Resources Board (CARB) passed laws, executive orders, and regulations to address this requirement. The gasoline vapor recovery program details are available on CARB's webpage (https://ww2.arb.ca.gov/our-work/programs/vapor-recovery). In addition, all SFNA air districts have SIP-approved rules for gas dispensing facilities (GDFs) where owner or operators of GDFs are required to install and operate gasoline vapor recovery systems. All nonattainment areas in California, including the SFNA, have satisfied this requirement.

3.9 Enhanced Ambient Monitoring

CAA Section 182(c)(1) requires areas classified as serious, severe, or extreme to establish Photochemical Assessment Monitoring Stations (PAMS) sites, which provide enhanced monitoring of ozone, NO_X, VOCs, and meteorological parameters. New PAMS requirements took effect with the 2015 revision of the NAAQS for Ozone (80 FR 65292). The Sacramento Metropolitan Air Quality Management District (SMAQMD) 2022 Annual Network Plan (SMAQMD, 2022) discusses its air monitoring network, including PAMS network, and addresses future year changes and requirements. EPA approved the SMAQMD's 2022 Annual Network Plan SMAQMD on January 4, 2023. SMAQMD PAMS network and how it meets the new PAMS requirement are also discussed in Appendix A of CARB's 2020 Monitoring Network Assessment (CARB, 2020). For the air monitoring network in the SFNA outside of Sacramento County, CARB prepared a 2022 Annual Network Plan (CARB, 2022) for the remaining SFNA air districts to address future year changes and requirements[7]. EPA approved CARB's 2022 Annual Network Plan on October 28, 2022.

3.10 Enhanced Vehicle Inspection and Maintenance Program

CAA Section 182(c)(3) applies to all nonattainment areas classified as serious or above. The enhanced vehicle inspection and maintenance program includes emissions testing with an inspection to detect tampering with emissions control devices and misfuelling, and program administration to assure adequate management resources, tools, and practices. The state of California adopted the program in the mid-1990s and revised it in 2009. EPA approved the original inspection and maintenance program in January 1997 (62 FR 1150) and subsequently the revised program in July 2010 (75 FR 38023). CARB adopted the Smog Check Program Certification for the 2015 O_3 NAAQS SIP on March

[7] The SMAQMD is the only air district in the SFNA that has its own monitoring network plan. All the other plans are covered in CARB's monitoring network plan.

23, 2023. The enhanced vehicle inspection and maintenance program are available on CARB's webpage (https://ww2.arb.ca.gov/resources/documents/smog-check-psm-certification).

3.11 Clean Fuels for Fleets

CAA Section 182(c)(4) applied to all nonattainment areas classified as serious or above. The program requires the implementation of a clean-fuel vehicle program for fleets. A specified portion of all new covered fleet vehicles purchased by fleet operators must be clean-fuel vehicles and use clean fuels when operating in the nonattainment area. CARB has submitted the California Clean Fuels for Fleets Certification for the 70 ppb Ozone Standard for ozone nonattainment in California and adopted the certification in January 2022. The certification was submitted to EPA, and EPA approved the certification on May 25, 2023 (88 FR 33830). The Clean Fuels for Fleets details are available on CARB's webpage (https://ww2.arb.ca.gov/70ppb-clean-fuels-fleet-certification).

3.12 Reformulated Gasoline

CAA Section 211(k) requires reformulated gasoline to be used in gasoline-fueled vehicles in specified nonattainment areas, including the SFNA. CARB implemented the first phase of the reformulated gasoline requirements in January 1992, the second phase in March 1996, and the third phase in May 2003. SFNA was reclassified from serious to severe classification for the 1-hour standard in June 1995 and became a reformulated gasoline area in June 1996 (60 FR 20237). The details of the reformulated gasoline are available on CARB's webpage (https://ww2.arb.ca.gov/our-work/programs/fuels-enforcment-program/california-reformulated-gasoline).

3.13 References

CARB. *2020 Monitoring Network Assessment.* California Air Resources Board: Sacramento, CA. October [2020.] Print.

---. *Annual Network Plan. Covering monitoring Operations in 25 California Air Districts.* California Air Resources Board: Sacramento, CA. July [2022.] Print.

EPA. 2012 *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 Travelled*. United States Environmental Protection Agency - Office of Transportation and Air Quality, [2012.] Web. 11 August 2023. < https://nepis.epa.gov/Exe/ZyPDF.cgi/P100EZ4X.PDF?Dockey=P100EZ4X.PDF >

---. (44 FR 53761 - 53763) *State Implementation Plans; General Preamble for Proposed Rulemaking on Approval of Plan Revisions for Nonattainment Areas-Supplement* *(on Control Techniques Guidelines).* Federal Register, Volume 44, 16 September 1979, p. 53761-53763. Web. 01 June 2023. < https://archives.federalregister.gov/issue_slice/1979/9/17/53760-53764.pdf#page=2 >

---. (60 FR 20237 - 20238) *California, Sacramento Ozone Nonattainment Area, Reclassification to Severe: Final Rule.* Federal Register, Volume 60, 25 April 1995, p. 20237 - 20238. Web. 01 June 2023. < https://www.govinfo.gov/content/pkg/FR-1995-04-25/pdf/95-10099.pdf >

---. (62 FR 1150 – 1187) *Approval and Promulgation of Implementation Plans; California—Ozone. Final Rule.* Federal Register, Volume 62, 08 January 1997, p. 1150 - 1187. Web. 01 June 2023. < https://www.govinfo.gov/content/pkg/FR-1997-01-08/pdf/97-144.pdf >

---. (75 FR 38023 – 38026) *Approval and Promulgation of Air Quality Implementation Plans; California; Motor Vehicle Inspection and Maintenance Program: Final Rule.* Federal Register, Volume 75, 01 July 2010, p. 38023-38026. Web. 01 June 2023. < https://www.govinfo.gov/content/pkg/FR-2010-07-01/pdf/2010-16028.pdf >

---. (80 FR 65292-65467) *National Ambient Air Quality Standards for Ozone*; Final Rule. Federal Register, Volume 80, 26 October 2015, p. 65292 – 65467. Web. 01 June 2023. < https://www.govinfo.gov/content/pkg/FR-2015-10-26/pdf/2015-26594.pdf >

---. (83 FR 62998–63036) *Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements: Final Rule.* Federal Register, Volume 83, 06 December 2018, p. 62998 – 63006. Web 01 June 2023. < https://www.govinfo.gov/content/pkg/FR-2018-12-06/pdf/2018-25424.pdf >

---. (88 FR 33830 - 33831) *Clean Air Plans; 2015 8-Hour Ozone Nonattainment Area Requirements; Clean Fuels for Fleets; California: Final rule.* Federal Register, Volume 88, 25 May 2023, p. 33830 - 33831. Web. 09 August 2023. < https://www.govinfo.gov/content/pkg/FR-2023-05-25/pdf/2023-11006.pdf >

SMAQMD. *2022 Annual Network Plan*. Sacramento Metropolitan Air Quality Management District, Sacramento, CA. 01 August [2022.] Web. 14 February 2023. < https://www.airquality.org/ProgramCoordination/Documents/2022%20Annual%20Monitoring%20Network%20Plan.pdf >

4 8-HOUR OZONE AIR QUALITY TRENDS

4.1 Introduction

This chapter evaluates the ambient ozone concentrations collected at the air monitoring stations in the Sacramento Federal Nonattainment Area (SFNA) between 2000 – 2021 and compares the concentrations to the 2015 Ozone National Ambient Air Quality Standards (NAAQS) of 70 parts per billion (ppb). This evaluation analyzed the number of days exceeding the federal standard and the design values from the past 22 years. A design value is a mathematically determined pollutant concentration at a particular air monitoring site that must be reduced to or maintained at or below the NAAQS to reach and remain in attainment. For the 2015 8-hour ozone NAAQS, it is calculated by averaging the fourth-highest daily 8-hour ozone concentration for each of the three most recent years at a monitoring site[8]. For example, the 2021 8-hour ozone design value for an air monitoring site is calculated by taking the average of the fourth highest daily 8-hour average ozone concentrations in 2019, 2020, and 2021. The peak design value for the SFNA is the highest design value of all the SFNA sites.

Ambient ozone data collected between January 2015 through a portion of May 2019 at the Auburn, Colfax, and Lincoln air monitoring stations were invalidated as a result of a United States Environmental Protection Agency (EPA) technical systems audit finding that the calibration procedures did not fully meet EPA's data quality regulations. These stations are located in the eastern portion of the SFNA, which are typically the highest ozone sites in the SFNA. Correlation and regression analyses in the Weight of Evidence (Appendix F) of this plan concluded that using invalidated data for these sites was more conservative compared with using values determined from regression analyses. Thus, for the purposes of this plan, the invalidated data at the Auburn, Colfax, and Lincoln monitoring station were used in the ozone trend analyses.

4.2 Ozone Monitoring Sites

The SFNA has 15 active ozone monitoring stations[9] that are operated by either the air districts or the California Air Resources Board (CARB). Figure 4-1 shows the ozone monitoring stations that were operating in the SFNA at the end of 2022. Most ozone monitoring sites are also equipped with meteorological instruments, and some sites also measure ambient concentrations of ozone precursors, nitrogen oxides (NO_X) and volatile

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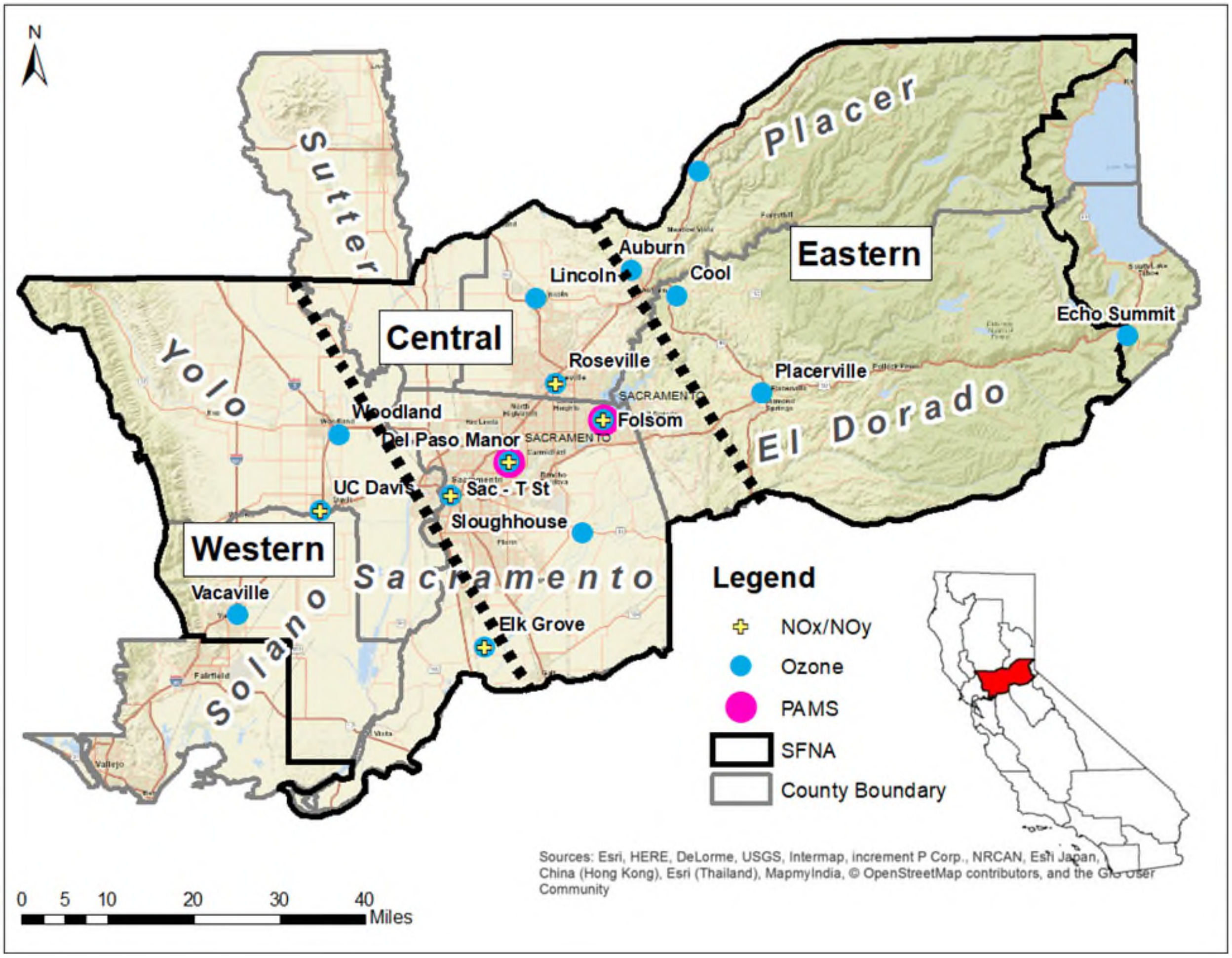
8 The calculation methodology is shown in 40 CFR 50 Appendix U. Due to truncation, EPA uses the value of 70.9 ppb to determine attainment.

9 More information about the monitoring sites in Sacramento County can be found at http://www.airquality.org/Air-Quality-Health/Air-Monitoring, and the monitoring sites in the other districts at http://www.arb.ca.gov/aqd/amnr/amnr.htm.

organic compounds[10] (VOCs). Figure 4-2 shows the 2021[11] design value contours for 75 ppb (2008 standard) and 70 ppb (2015 standard). The highest measured ozone concentrations are consistently in the eastern portion of the SFNA. As shown in Table 4-2, the peak design value site has shifted over the years from the Folsom air monitoring station (2005 through 2014) to the Placerville air monitoring station (2015 to 2016) to the Auburn air monitoring station (2017 to 2021).

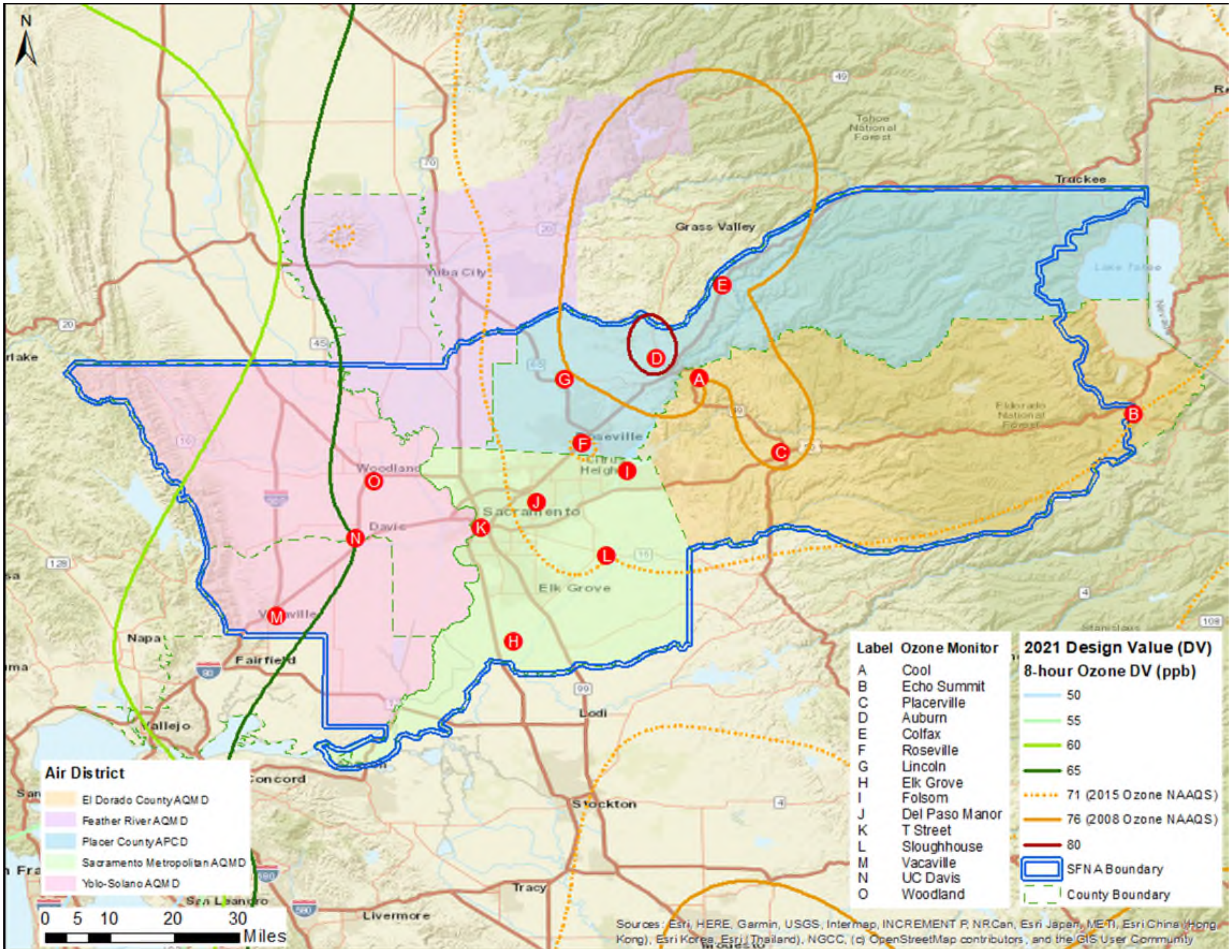
Figure 4-1 SFNA Subregions and Monitoring Station Locations



10 The Del Paso Manor monitoring station is currently undergoing renovation and as a result, VOC data has not been collected since January 2021. VOC monitoring will resume once renovation has been completed in 2023 with an Automated Gas Chromatograph (Auto GC) and Carbonyls sampling.

11 Contour lines were created by Golden Software Surfer 24 using Kriging gridding method with resolution of 0.01 degree.

Figure 4-2 SFNA Ozone Monitoring Stations and 2021 Design Value Contours



Note: The area inside a contour line is estimated to be higher than the specified design value

4.3 Annual Number of Exceedance Days and Trend

Table 4-1 shows the number of days that exceeded the 2015 ozone NAAQS of 70 ppb at the monitoring sites in the SFNA between 2000 and 2021. The highest number of exceedances mainly occurred at the region's eastern monitoring sites (Cool, Placerville, Auburn, and Colfax). The year-to-year differences in which monitoring station has the highest number of exceedances are caused by meteorological variability and changes in concentrations of precursor emissions.

Figure 4-3 shows the highest number of exceedance days each year recorded at a monitoring station in the SFNA from 2000 to 2021. The trendline has a downward slope of 2.73 days per year, which indicates an annual decline in the number of exceedance days over the past 22 years. The number of days exceeding 70 ppb decreased from a high of 97 days in 2002 down to 34 days in 2021. Figure 4-3 shows that the Auburn monitoring site had the highest number of exceedances in 2021 (see Table 4-1).

Table 4-1 Number of Days exceeded the 2015 NAAQS of 70 ppb for the SFNA Monitoring Sites

The site with the highest number of exceedance days for the year is in red.

County	Monitoring Site	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
El Dorado	Cool	66	72	97	61	47	54	73	41	39	35	17	39	15	9	33	13	19	28	26	3	7	13
El Dorado	Echo Summit [1]	13	19	22	5	11	0	10	7	9	1	0	1	9	1	2		2	1	10	0	7	6
El Dorado	Placerville	53	58	62	57	35	47	62	20	52	31	19	16	41	21	32	19	41	18	28	4	20	10
Placer	Auburn [2, 3]	56	46	53	41	56	42	66	19	35	26	18	29	30	6	15	15	27	29	35	8	22	34
Placer	Colfax[3]	0	9	53	45	42	45	64	24	29	12	10	10	15	5	6	12	14	14	30	4	18	17
Placer	Lincoln[3,4]													13	1	3	4	11	11		3	9	15
Placer	Roseville	21	29	32	24	13	27	38	19	38	30	21	21	27	6	19	6	20	9	11	1	3	4
Sacramento	Elk Grove	6	22	3	26	10	22	29	12	12	11	6	6	10	0	1	2	1	3	2	4	2	5
Sacramento	Folsom[5]	30	55	60	56	40	39	61	34	63	47	25	46	53	16	34	11	23	17	18	2		29
Sacramento	North Highlands[6]	33	32	36	21	14	11	40	4	4	18	10	20	20	6	12	8	16	8	10	2	5	0
Sacramento	Sacramento-Del Paso Manor[6]	27	26	57	51	22	28	35	16	22	30	7	8	21	6	16	8	10	5	6	0	10	17
Sacramento	Sacramento-Airport Rd -> Goldenland Ct[7]	18	9	12	6	2	8	11	6	15	11	1	1	7	1	3	4	8	0				
Sacramento	Sacramento-T Street	10	7	12	7	2	4	14	7	17	13	1	5	9	0	3	4	3	3	1	1	3	1
Sacramento	Sloughhouse	42	40	43	50	37	29	44	16	36	32	13	26	23	5	10	14	17	6	4	1	5	13
Solano	Vacaville[8]	5	5	6	7	3	5	9	4	7	2	2	2	3	2	1	0	1	2	1	0	2	2
Yolo	UC Davis	15	7	6	8	5	5	8	4	9	6	2	1	4	0	0	1	1	1	1	0	0	2
Yolo	Woodland	15	8	21	19	3	11	23	4	12	8	0	1	8	0	1	3	4	2	2	0	2	2
	Peak Site	66	72	97	61	56	54	73	41	63	47	25	46	53	21	34	19	41	28	35	8	22	34

Data source: EPA AQS database (https://www.epa.gov/aqs) downloaded on 02/02/2023.

1 This is a seasonal monitor that only operates during the summer months.

2 Auburn monitor was moved from 108 C Ave, Auburn to 11645 Atwood St, Auburn in 2011.

3 Data invalidation issues at the Auburn, Colfax, and Lincoln monitoring stations from January 1, 2015, through May 20, 2019 –data highlighted in **blue** reflects use of invalidated data. Ozone data was disqualified by EPA.

4 The Lincoln Monitoring Station began operations in 2012. No data was collected from September 30, 2017 to October 31, 2018.

5 No data was available for the Folsom Monitoring Station as it was under construction in 2021.

6 Orange highlighted areas indicate data that is currently under review at North Highlands and Del Paso Manor and may be invalidated. Del Paso Manor data may be invalidated from 2/27/2020 to 3/4/2020 and 3/29/2021 to 6/23/2021, and the North Highlands Station from 5/4/2021 to1/18/2022. The North Highlands Station was also closed in July 2022.

7 Sacramento-Goldenland Ct monitor was moved from Airport Road in 2009. This monitor was closed in 2017.

8 Vacaville monitor was moved from 1001 Allison Drive to 2012 Ulatis Drive in 2003.

Figure 4-3 2015 O_3 NAAQS Exceedance Days Count Trend at the highest count monitor in SFNA

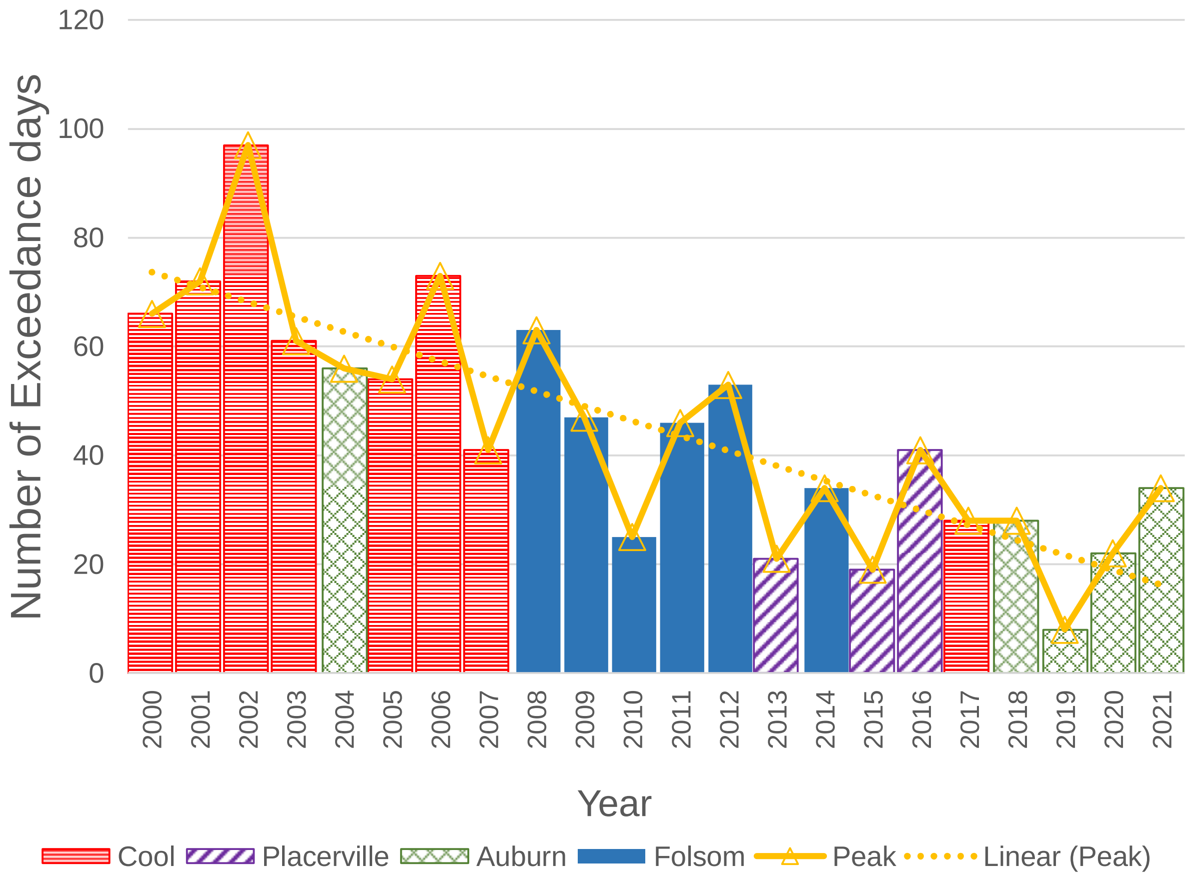


Table 4-2 8-Hour Ozone Design Values (ppb) Sacramento Nonattainment Area – Ozone Monitoring Sites

The peak site for the year is highlighted in red.

County	Monitoring Site	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
El Dorado	Cool	107	104	106	107	102	97	95	96	98	93	89	84	83	81	80	79	82	80	84	80	80	76
El Dorado	Echo Summit [1]	74	75	75	75	74	71	72	72	75	73	71	67	69	69	69	67	69	68	70	66	69	71
El Dorado	Placerville	99	96	94	95	94	94	94	93	96	92	90	80	81	82	84	81	85	83	88	81	84	77
Placer	Auburn [2,3]	102	101	101	99	95	92	93	89	90	86	87	85	84	80	78	80	84	84	88	86	87	82
Placer	Colfax[3]	79	73	77	88	92	91	97	94	89	79	78	74	75	73	73	73	76	78	85	82	83	76
Placer	Lincoln[3,4]													77	71	71	72	77	79		70	74	75
Placer	Roseville	93	90	92	90	87	86	89	89	90	89	90	86	85	81	81	77	80	79	81	75	72	70
Sacramento	Elk Grove	85	84	75	80	77	82	82	83	82	79	77	74	74	71	70	66	68	68	67	68	68	70
Sacramento	Folsom[5]	104	99	100	100	97	97	97	98	102	100	102	95	95	90	85	80	83	82	82	75		
Sacramento	North Highlands[6]	89	89	92	91	85	80	82	80	78	74	75	77	77	76	75	74	77	78	78	74	72	71
Sacramento	Sacramento-Del Paso[6]	95	92	95	97	95	92	90	90	87	86	85	81	78	77	77	76	77	77	75	71	73	75
Sacramento	Sacramento-Airport Rd -> Sacramento-Goldenland Ct[7]	82	79	78	77	74	73	73	76	78			69	69	70	71	69	71					
Sacramento	Sacramento-T Street	82	80	79	79	75	73	76	78	79	77	75	71	71	70	69	68	69	69	67	67	65	66
Sacramento	Sloughhouse	105	98	95	95	94	94	96	93	95	91	92	87	88	84	80	76	79	78	75	70	70	71
Solano	Vacaville[8]	85	77	72	72	71	71	73	74	75	72	71	68	69	67	66	66	67	67	65	64	63	65
Yolo	UC Davis	85	81	77	76	74	73	74	75	76	74	72	70	70	66	64	62	64	63	62	62	63	65
Yolo	Woodland	84	82	83	83	79	77	79	80	79	74	72	69	69	69	68	67	69	69	68	66	66	67
	Peak Site	107	104	106	107	102	97	97	98	102	100	102	95	95	90	85	81	85	84	88	86	87	82

Data source: EPA AQS database (https://www.epa.gov/aqs) downloaded on 02/01/2023.

1 This is a seasonal monitor that only operates during the summer months.

2 Auburn monitor was moved from 108 C Ave, Auburn to 11645 Atwood St, Auburn in 2011.

3 Data invalidation issues at the Auburn, Colfax, and Lincoln monitoring stations from January 1, 2015, through May 20, 2019 –DV highlighted in blue reflects use of invalidated data. Ozone data was disqualified by EPA.

4 The Lincoln Monitoring Station began operations in 2012. No data was collected from September 30, 2017, to October 31, 2018.

5 The Folsom Monitoring Station was temporarily closed in 2020 so no Design Value is available in 2020 and 2021.

6 Orange highlighted areas indicate years when the design value may be impacted from data that have been proposed to be invalidated. Del Paso Manor data may be invalidated from 2/27/2020 to 3/4/2020 and 3/29/2021 to 6/23/2021, and the North Highlands Station from 5/4/2021 to1/18/2022. The North Highlands Station was also closed in July 2022.This data is currently under review.

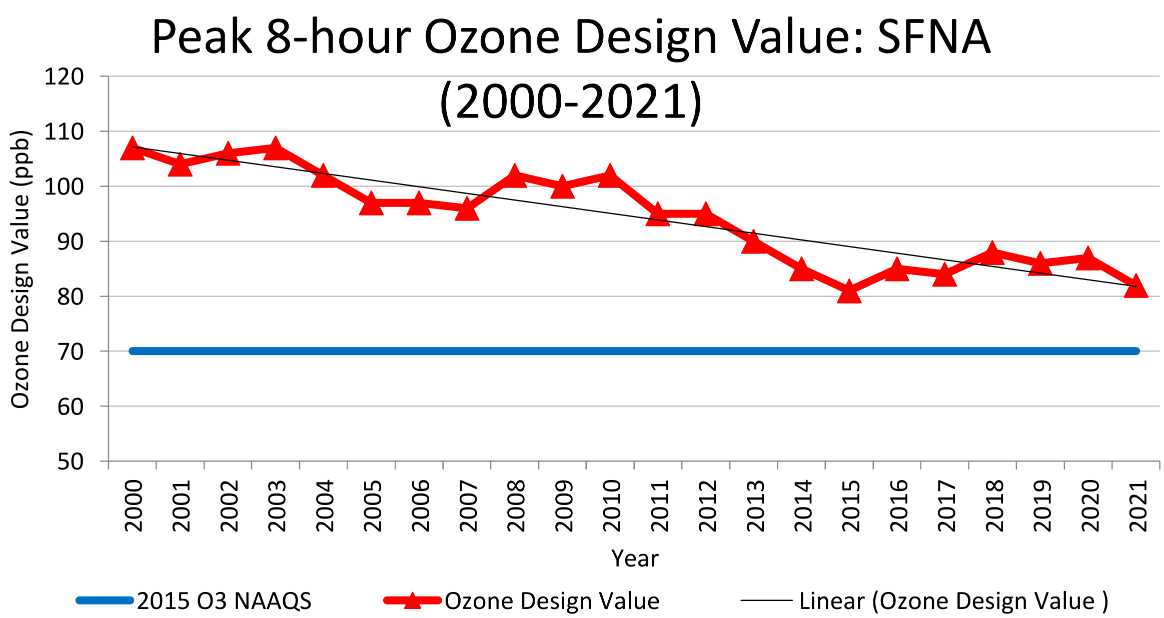
7 Sacramento-Goldenland Ct monitor was moved from Airport Road in 2009. This monitor was closed in 2017.

8 Vacaville monitor was moved from 1001 Allison Drive to 2012 Ulatis Drive in 2003.

4.4 Ozone Design Values and Trend

Table 4-2 lists the 8-hour ozone design value concentrations for each of the ozone monitoring sites in the SFNA from 2000 to 2021. Figure 4-4 shows the peak ozone design value trend (based on the annual peak design values shown in Table 4-2 from 2000 to 2021). The trendline indicates a decline from a peak design value of 107 ppb in 2000 at the Cool monitoring station to 82 ppb in 2021 at the Auburn monitoring station. This is a declining trend rate of about 1.5 ppb per year. Design value trends will be discussed below in more detail categorically as the eastern, central, and western regions of the SFNA.

Figure 4-4 Peak 8-Hour Ozone Design Value Trends in the SFNA (2000 – 2021)



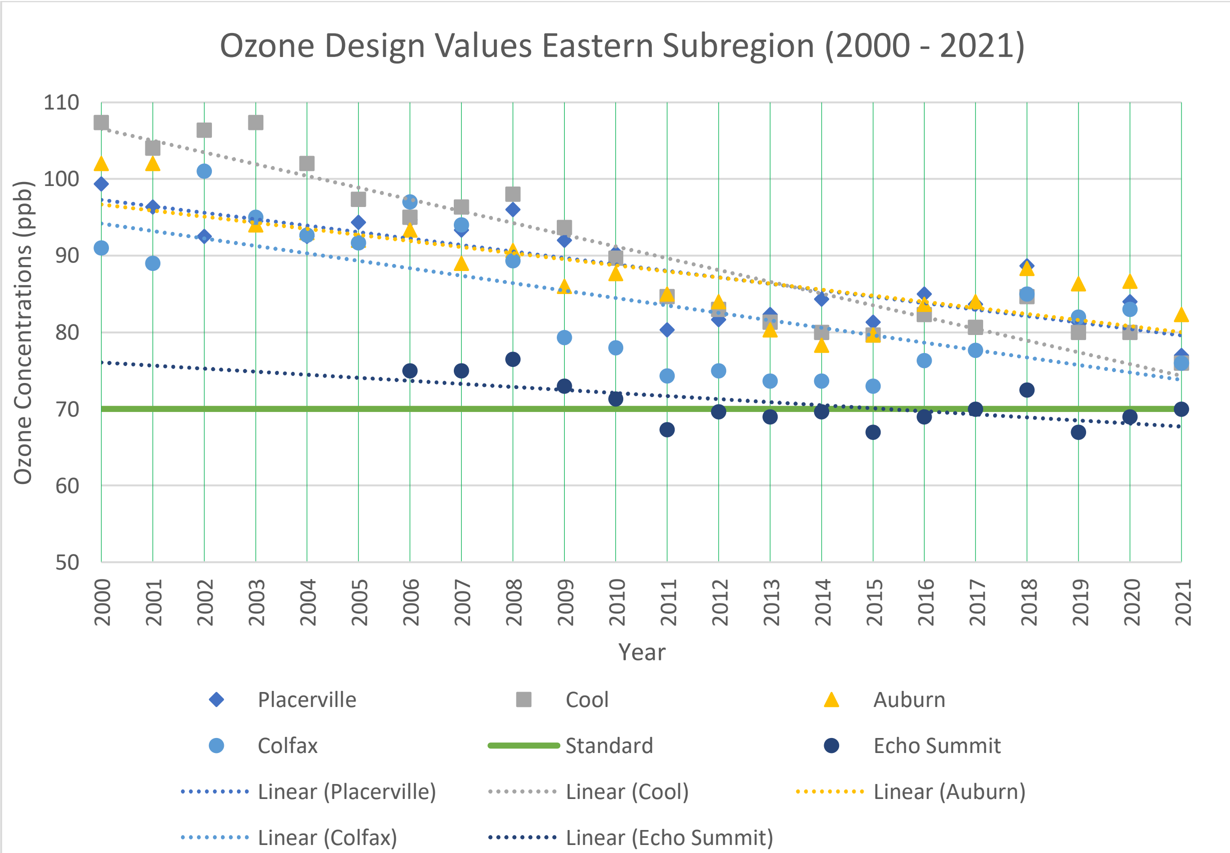
Sources: 1990-2020 Design Values were extracted from AQS Report (AMP 480) and downloaded on December 22, 2021. 2021 DV is calculated based on the combination of the AQS data and preliminary AQMIS data downloaded on 02/16/2022.

Notes: The SFNA was impacted by wildfires in summer 2018 which causes unusual high 4th highest ozone concentration for 2018. The peak design value calculation in this chart included the days impacted by wildfires and demonstrated a declining trend, despite smoke impacts.

4.4.1 Eastern SFNA

Figure 4-5 shows the 8-hour ozone design values and trends from 2000 – 2021 for each of the five monitoring stations in the eastern SFNA: Echo Summit, Placerville, Cool, Auburn, and Colfax monitoring stations. Although all stations in the SFNA demonstrated a decline in ozone concentrations, concentrations at most of these monitoring stations in the eastern portion remained higher compared to the other two regions of the SFNA. The following observations were made regarding ozone trends at each of these sites:

Figure 4-5 Eastern Subregion Ozone Design Value Trends in the SFNA (2000 – 2021)



- The Echo Summit monitoring station data showed that the design value has gradually decreased from 75 ppb in 2006 to 70 ppb in 2021 with a downward trendline slope of 0.40 ppb per year.
- The Placerville monitoring station data showed a gradual decline in the ozone design value from a high of 99 ppb in 2000 to 77 ppb in 2021. Placerville's trendline displays a downward slope of 0.84 ppb per year.
- The Cool monitoring station data demonstrated a more considerable decrease in design value from a high of 107 ppb in 2000 to 76 ppb in 2021 with a downward slope of 1.53 ppb per year.
- The Auburn monitoring station data showed a decrease from a design value of 102 in 2000 to 82 in 2021, and the trendline slope for the design value at this site indicates a downward trend of 0.79 ppb per year. Although Auburn data showed a decline in concentrations from 2000 to 2021, the design values from 2021 indicated that Auburn is the peak design value site in the SFNA. This is consistent with the design value contour map shown in Figure 4-2.
- The Colfax monitoring station data demonstrated a similar pattern in design value trends compared with values from the Auburn and Cool monitoring sites. The

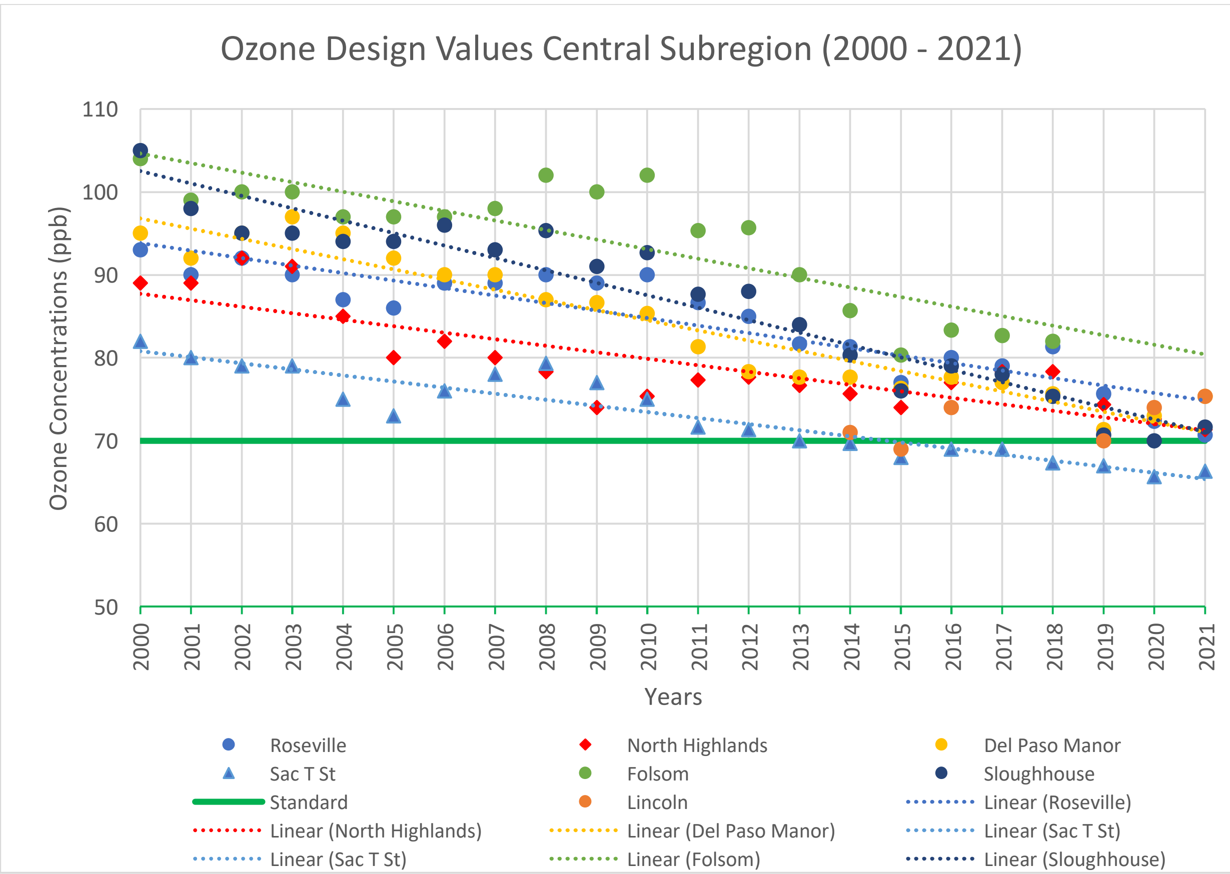
design values have decreased from 91 ppb in 2000 to 76 ppb in 2021 with a downward trendline slope of 0.97 ppb per year.

The decline rates of the design value for each station in the eastern subregion vary greatly from site to site with approximate downward trendline slopes ranging from 0.40 to 1.53 ppb per year.

4.4.2 Central SFNA

Figure 4-6 shows the 8-hour ozone design values and trends for the seven monitoring stations in the central SFNA: Folsom, Roseville, Sloughhouse, Lincoln, Del Paso Manor, T-Street, and North Highlands monitoring stations. The following observations were made regarding ozone trends at each of these sites:

Figure 4-6 Central Subregion Ozone Design Value Trends in the SFNA (2000 – 2021)



- The Folsom monitoring station data[12] showed that the design value decreased from a high of 104 ppb in 2000 to 75 ppb with a downward trendline slope of 1.15 ppb per year. The Folsom monitoring station was the peak monitoring site for the Sacramento Regional 2008 NAAQS 8-hour Ozone Attainment and Reasonable

12 Data for 2020 were not available due to construction at the Folsom monitoring station, so the trendline goes through 2019.

Further Progress Plan, but concentrations have significantly decreased over the past several years. This has allowed the peak site to shift to a different station.

- The Roseville monitoring station data showed that the design value decreased from 93 ppb in 2000 to 71 ppb in 2021 with a downward trendline slope of 0.9 ppb per year.
- The Sloughhouse monitoring station data showed a decrease in the design value from 95 ppb in 2000 to 67 ppb in 2021. The trendline slope for this site demonstrates a more significant improvement in concentrations at a declining rate of 1.50 ppb per year.
- The T Street monitoring station data showed a more gradual improvement in concentrations as they decreased from a design value of 82 ppb in 2000 to 66 ppb in 2021 with a downward trendline slope of 0.73 ppb per year.
- The Del Paso Manor[13] monitoring station data demonstrated a downward trend in concentrations with a design value of 97 ppb in 2003 to 75 ppb in 2021 and a downward trendline slope of 1.23 ppb per year.
- The North Highlands[14] monitoring station data showed a decline in the design values from 92 ppb in 2002 to 71 ppb in 2021 with a downward trendline slope of 0.78 ppb per year.

Overall, the sites in the central subregion had greater improvements in ozone concentrations compared to the other two subregions, with downward trendline slopes ranging from 0.73 to 1.50 ppb per year.

4.4.3 Western SFNA

Figure 4-7 shows the 8-hour ozone design values and trends from 2000 - 2021 for each of the four monitoring stations in the western SFNA: Elk Grove, Woodland, Vacaville, and UC Davis. The 2021 design value of the monitoring stations in the Western SFNA were all at or below the 2015 NAAQS standard of 70 ppb. The following observations were made at each of these sites in the western portion:

- The highest 2021 design value in the western SFNA was 70 ppb at the Elk Grove monitoring station. The Elk Grove monitoring design value has decreased from a design value of 85 ppb in 2000 to 70 ppb in 2021 with a downward trendline slope of 0.82 ppb per year.

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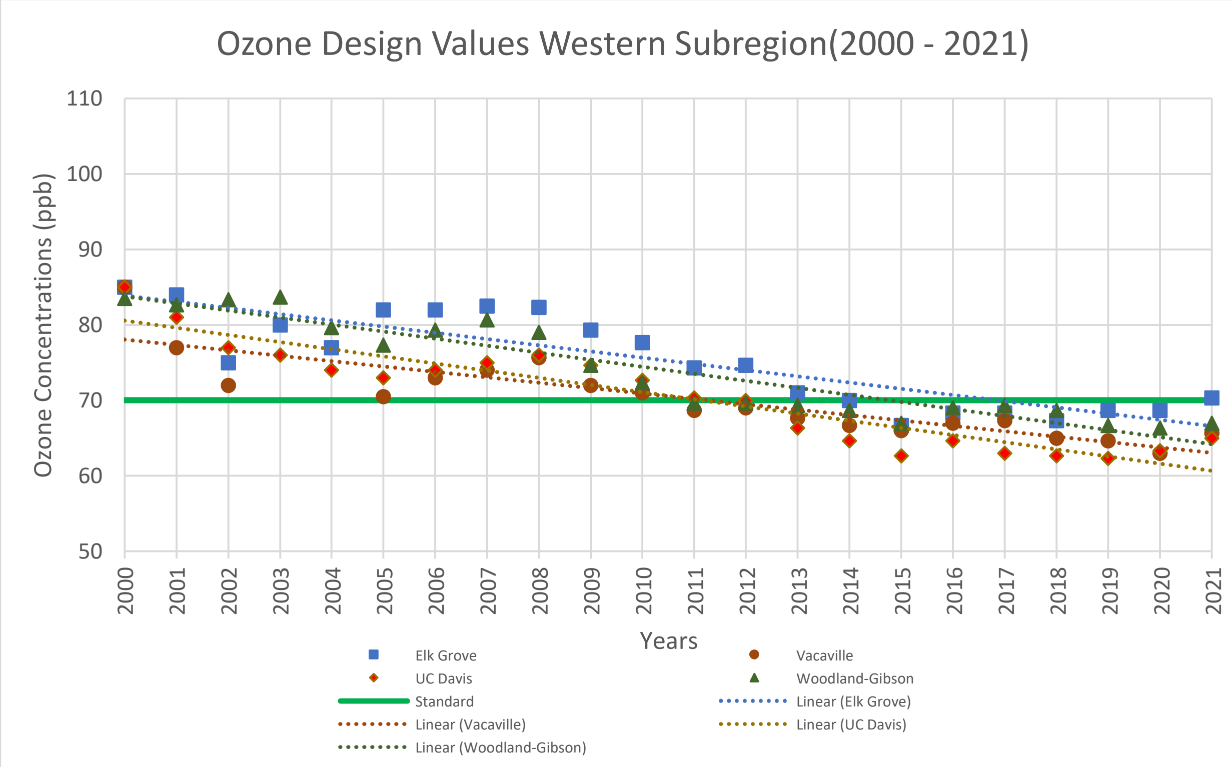
13 The Del Paso Manor monitoring station trend includes data that are proposed to be invalidated during the period from 2/27/2020-3/4/2020 and 3/29/2021 to 6/23/2021. The data is currently under review. Historically, the Del Paso Manor Station has not been a peak monitoring site for the SFNA and evaluation of both use and exclusion of invalidated data does not impact the peak design values for the SFNA.

14 North Highlands data includes data that are proposed to be invalidated from 5/4/2021 to 1/18/2022. This station also shut down on July 31, 2022. The data is currently under review. Historically, the North Highlands Station has also not been a peak monitoring site for the SFNA and evaluation of both use and exclusion of invalidated data does not impact the peak design values for the SFNA.

Figure 4-7 Western Subregion Ozone Design Value Trends in the SFNA (2000 – 2021)



- The Woodland monitoring station design value decreased from 84 ppb in 2000 to 67 ppb in 2021 with a downward trendline slope of 0.93 ppb per year.
- The Vacaville monitoring station data showed a decrease in a design value of 85 ppb in 2000 to 64 ppb in 2019 with a downward trendline slope of 0.72 ppb per year.
- The UC Davis monitoring station data showed that the design value decreased from 85 ppb in 2000 to 66 ppb in 2021 with a downward trendline slope of 0.95 ppb per year.

The sites in the western subregion had a more gradual improvement in ozone design value with downward trendline slopes ranging from 0.72 to 0.95 ppb per year.

4.5 Wildfire Impacts

In a 2016 study, Sonoma Technology Institute (STI) evaluated the smoke impacts and transport patterns in the Sacramento region on multiple days between 2011 – 2015 when ozone concentrations exceeded 70 ppb. This study found that wildfire smoke impacts on ozone concentrations at the Auburn, Colfax, Folsom and/or Placerville monitoring sites were likely substantial on 35% of those days. One conclusion from this study was that "given that smoke contributed to ozone concentrations on many high ozone days, including days that are considered in design value calculations, smoke events are likely to impact the Districts toward future attainment of the NAAQS" (STI, 2016).

In 2018, the SFNA experienced multiple days at multiple sites where high ozone concentrations coincided with high fine particulate matter ($PM_{2.5}$) concentration, indicating that the area was impacted by wildfire smoke. The following days were identified as dates likely impacted by smoke from wildfires and therefore, affected the ambient concentrations at many of the sites (especially in the eastern portion of the SFNA). These values were included in the trend analyses to demonstrate that despite wildfire impacts, the number of days exceeding the standard and ozone design values continue to show a downward linear trend since 2000.

- July 31, and August 1, 2, 8, 9 and 10 in 2018 were identified as days impacted by the Carr Wildfires, Mendocino Complex Wildfire, and/or Ferguson Wildfire

Wildfire Impacts on ozone concentrations are discussed in further detail in the Weight of Evidence (Appendix F.6.2). Ozone concentrations impacted by wildfires are allowed to be excluded from attainment demonstrations if concurred by the EPA under its exceptional event rule.[15]

4.6 Summary

Ozone air quality data trends for all monitoring stations in the SFNA between 2000 – 2021 demonstrate a decline in design values and a reduction in the number of days that exceeded the 2015 NAAQS of 70 ppb. Despite wildfire impacts in 2018, all stations continue to experience a downward trend in concentrations with trendline slopes ranging from approximately 0.40 ppb per year to as much as 1.53 ppb per year. In 2021, the air quality data showed that the four highest design values were measured in the eastern portion at the Auburn, Colfax, Placerville, and Cool monitoring stations. Concentrations at these sites were approximately 10 to 15 percent higher than monitoring stations in the central or western portions. Collectively, the SFNA design values and exceedances have decreased over time and analyses indicate that concentrations will continue to follow this trend barring any substantial impacts from wildfires.

4.7 References

EPA, *40 CFR Appendix U – Part 50 Interpretation of the Primary and Secondary National Ambient Air Quality Standards for Ozone,* Web 01 June 2023. < https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-50/appendix-Appendix%20U%20to%20Part%2050 >

STI, *Impacts of Wildfires on Ozone Concentrations in Sacramento (prepared for Sacramento Air Quality Management District).* Petaluma, CA: Sonoma Technology Institute. [2016.] Print.

15 Treatment of Data Influenced by Exceptional Events are described in 40 CFR Parts 50 and 51.

5 EMISSIONS INVENTORY

5.1 Introduction to Emissions Inventory

Planning efforts to evaluate and reduce ozone air pollution include identifying and quantifying the various processes and sources of volatile organic compound (VOC) emissions (such as solvents, surface coatings, and motor vehicles) and nitrogen oxides (NO_X) emissions (such as motor vehicles and other fuel combustion equipment). VOC pollutants are also known as reactive organic gases (ROG), and the two are considered to be synonymous for this report. By understanding the emissions inventories over time, it can help determine whether existing, planned, or new emission reduction strategies are needed to reach the attainment deadline.

Tables and figures show a summary of VOC and NO_X emissions estimates by different air pollutant source categories for each of the State Implementation Plan (SIP) planning years (2017 base year, 2023, 2026, 2029 milestone years, and 2032 attainment year). The emission inventories are based on the latest planning assumptions and emissions data in California Air Resources Board's (CARB's) California Emission Projection Analysis Model (CEPAM) 2019 v1.04 with External Adjustment, abbreviated CEPAM 2019 v1.04. These inventories, presented in tons per day (tpd) for an average summer day, are forecasted using the latest socio-economic growth indicators and applying for the emission reduction benefits from adopted control strategies. Emission reduction credits are then added to the emissions inventory forecasts. More detailed information and emissions inventory tables are provided in Appendix A – Emissions Inventory.

5.2 Emission Inventory Requirements

Emissions are required to be updated to include "a comprehensive, accurate, current inventory of actual emissions from all sources of the relevant pollutant or pollutants" under Clean Air Act (CAA) Sections 172(c)(3) and 182(a)(1). The baseline year for the 2015 ozone SIP planning emissions inventory is identified as 2017.

The U.S. Environmental Protection Agency (EPA) emission inventory guidance (EPA, 2017) and 2015 O_3 NAAQS SIP Requirement Rule (83 FR 62998) set specific planning requirements pertaining to future milestone years for reporting reasonable further progress (RFP) and attainment demonstration. The emissions inventory years included in this plan are 2017 (base year), 2023, 2026, 2029 (milestone and Reasonable Further Progress years), and 2032 (attainment year). EPA emission inventory guidance (EPA, 2017, p.21) also requires the SIP planning emissions inventory to be based on estimates of actual emissions for an average summer weekday, typical of the ozone season (May – October).

5.3 Emission Inventory Source Categories

Due to the large number and wide variety of emission processes and sources, a hierarchical system of emission inventory categories was developed for more efficient use of the data. The anthropogenic (man-made) emissions inventory is divided into four broad categories: stationary, area-wide, on-road motor vehicles, and other mobile sources. These major categories are subdivided into more descriptive subcategories and further defined into more specific emission processes.

5.3.1 Stationary Sources

The stationary sources category of the emissions inventory includes non-mobile, fixed sources of air pollution. They are mainly comprised of individual industrial, manufacturing, and commercial facilities called "point sources." The more descriptive subcategories include fuel combustion (e.g., electric utilities and agricultural processing), waste disposal (e.g., landfills and soil remediation), cleaning and surface coatings (e.g., printing and laundering), petroleum production and marketing, and industrial processes (e.g., chemical and metal processes). The facility operators report the process and emissions data to their local air district, which uses the information to calculate emissions from point sources. More detailed information on the stationary source emissions can be found in Appendix A.2.4.

5.3.2 Area-Wide Sources

The area-wide sources category includes aggregated emissions data from processes that are individually small and widespread or not well-defined point sources. The area-wide subcategories include solvent evaporation (e.g., consumer products and architectural coatings) and miscellaneous processes (e.g., residential fuel combustion and farming operations). Emissions from these sources are calculated from product sales, population, employment data, and other parameters for a wide range of activities that generate air pollution across the Sacramento Federal Nonattainment Area (SFNA). More detailed information on the area-wide source emissions category can be found in Appendix A.2.5 and CARB's website: https://ww2.arb.ca.gov/emission-inventory-documentation.

5.3.3 On-Road Motor Vehicles

The on-road motor vehicles inventory category consists of trucks, automobiles, buses, and motorcycles. On-road motor vehicle emission estimates were developed using the latest available transportation data and California's EMFAC2017 model. EMFAC (EMission FACtor) is California's model for estimating emissions from on-road motor vehicles operating in California. Pollutant emissions for hydrocarbons (HC), carbon monoxide (CO), NO_X, coarse particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), lead, carbon dioxide (CO_2), and sulfur oxides (SO_X) are output from the model. Emissions are calculated for different vehicle classes composed of passenger cars, various types of trucks and buses, motorcycles, and motor homes. EMFAC has undergone many revisions over the years and the current emissions inventory uses EMFAC2017. More detailed information on the on-road mobile source emissions categories can be found in Appendix A.2.3.1.1.

5.3.3.1 Motor Vehicle Emissions Model, EMFAC2017

CARB has continued to update and improve its EMFAC on-road motor vehicle emissions model. Effective August 15, 2019, EPA has approved the EMFAC2017 emissions model (CARB, 2017) for SIP and conformity purposes (84 FR 41717). EMFAC2017 replaced EMFAC2014 and the model's major improvements include updated emissions factors and data on car and truck activities and emissions reductions associated with new regulations supporting new estimates of emissions from heavy-duty diesel trucks and buses. EMFAC2017 software and detailed information on the vehicle emission model can be found on the CARB website: https://arb.ca.gov/emfac/2017/.

5.3.3.2 Motor Vehicle Emissions Model, EMFAC2021

CARB released EMFAC2021 in January 2021. Effective November 15, 2022, EPA has approved the EMFAC2021 emissions model (87 FR 68483). The new model includes the features of plug-in hybrid and natural gas-powered vehicles, ammonia emissions, and new forecasting approaches for heavy-duty and light-duty vehicles. Although EPA has approved EMFAC2021, the data to support this plan (including the development of the emission inventory and motor vehicle emissions budgets and the inputs into photochemical modeling) was based on EMFAC2017. This new model EMFAC2021 will be used for all new regional emissions analyses for transportation conformity purposes starting on or after November 15, 2024, and any future SIPs. EMFAC2021 software, web interface, and technical information on the motor vehicles emissions model can be located on CARB's website: https://arb.ca.gov/emfac/.

5.3.3.3 Vehicle Activity Data

The on-road motor vehicle emissions are from CARB's CEPAM 2019 v1.04, which were generated using EMFAC2017 with vehicle activity data from the Sacramento Area Council of Governments' (SACOG) 2020 Metropolitan Transportation Plan (2020 MTP)(SACOG, 2019) and the Plan Bay Area 2050 from the Metropolitan Transportation Commission (MTC). Although there are small differences between the on-road inventory and the motor vehicle emissions budgets included for eastern Solano as part of the 2050 Bay Area Plan (MTC, 2021), these differences do not impact the RFP or attainment demonstration.

5.3.4 Other Mobile Sources

The emission inventory category for other mobile sources includes aircraft, trains, ships, and off-road vehicles and equipment used for construction, farming, commercial, industrial, and recreational activities. Like EMFAC, the off-road emissions model underwent a significant update. The OFFROAD2007 model is being replaced by category-specific methods. The categories listed below have been or are being updated with new methods and data. Where available, new inventories and models are provided. If a category is not listed below, OFFROAD2007 is the current tool for estimating emissions.

- The Gasoline-Fueled equipment categories using the category-specific method include: Pleasure Craft, Recreational Vehicles, Outboard Marine Tanks, Portable Fuel Tanks, and Lawn and Garden equipment.
- The diesel equipment categories using the category-specific method include: In-Use Off-Road Equipment (Construction, Mining, Industrial, Ground Support, and Oil Drilling); Cargo Handling Equipment; In-Use Mobile Agricultural Equipment; Locomotives; Forestry, Forklift, Transport Refrigeration Units; Locomotives, Commercial Harbor Craft; Ocean Going Vessels; Portable Engine, and Stationary Commercial Engines.

In general, emissions are calculated by using estimated equipment population, engine size and load, usage activity, and emissions factors.

More detailed information on the latest off-road motor vehicle emissions inventory, including can be found in Appendix A.2.3.1.2 and CARB's website: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-modeling-tools.

5.3.5 Natural Sources

Biogenic emissions are emissions from natural sources, such as plants and trees. CARB estimated the emissions of biogenic volatile organic compounds (BVOC) from vegetation for natural areas, agricultural crops, and urban landscapes using the MEGAN (Model of Emissions of Gases and Aerosols from Nature) 3.0 biogenic emissions model. BVOC emissions vary with temperature. CARB did not estimate biogenic nitric oxide emissions from soils; therefore, the biogenic emissions estimate is strictly BVOC.

5.4 Base Year Emissions Inventory

Anthropogenic Emissions Table by Source Category

Tables 5-1 and 5-2 show the anthropogenic emissions inventory of VOC and NO_X by source categories for the SFNA. The SFNA includes emissions from Sacramento and Yolo Counties, the eastern portion of Solano County, Placer and El Dorado Counties excluding the Lake Tahoe Air Basin, and the southern portion of Sutter County[16]. The emissions inventory for ozone planning purposes represents emissions for a summer seasonal average day in units of tons per day. Inventories were generated using CEPAM: 2019 SIP Baseline Emission Projections (CARB, 2022) and do not include emission reduction credits (ERCs).

16 Southern Sutter County emissions include:
1) all point sources located in the area,
2) 3.6% of the county total of area and aggregated point sources that are projected by population where, which is the percent of Sutter County population in the Sutter portion of the SFNA based on the 2010 Census. This ratio has slightly dropped to 3.3% after the 2020 Census.
3) 41% of the county total for emissions from agriculture, where 41% is the ag land ratio in the Sutter portion of the SFNA,
4) 34% of the county total for emissions from off-road equipment, where 34% is the percent of Sutter County land area in the Sutter portion of the SFNA,
5) 56% of the total railroad emissions, where 56% of the train tracks are located in the South Sutter Split,
6) 0% of the county total for emissions from oil and gas operations categories.

Table 5-1 Emissions of VOC (tons per day) SFNA

	2017	2023	2026	2029	2032
TOTAL EMISSIONS[a]	96.64	87.20	84.24	81.49	79.92
STATIONARY	22.55	22.48	23.00	23.28	23.93
AREA-WIDE	27.37	29.05	29.94	30.74	31.68
ON-ROAD MOTOR VEHICLES	19.38	12.88	11.48	10.67	9.69
OTHER MOBILE SOURCES	27.34	22.80	19.81	16.80	14.61
STATIONARY					
Cleaning and Surface Coatings	7.46	8.14	8.53	8.69	8.96
Fuel Combustion	0.59	0.56	0.55	0.54	0.53
Industrial Processes	4.49	4.60	4.83	5.03	5.32
Petroleum Production and Marketing	5.71	4.85	4.53	4.30	4.14
Waste Disposal	4.31	4.33	4.57	4.72	4.98
AREA-WIDE					
Consumer Products	15.22	16.24	17.03	17.73	18.57
Architectural Coatings	2.60	2.68	2.76	2.84	2.92
Pesticides/Fertilizers	1.23	1.11	1.10	1.08	1.07
Livestock Waste	3.70	3.66	3.65	3.64	3.64
Ag Burn/Other Managed Burn	1.08	1.59	1.58	1.58	1.58
Other	3.54	3.77	3.82	3.86	3.91
ON-ROAD					
Automobiles	6.45	3.98	3.50	3.25	2.97
Lt/Med Duty Trucks	9.97	6.59	5.74	5.19	4.52
Heavy Duty Gas Trucks	0.01	0.00	0.00	0.00	0.00
Heavy Duty Diesel Trucks	0.58	0.16	0.17	0.17	0.17
Motorcycles	2.28	2.11	2.04	2.03	2.01
Buses/Motor Homes	0.09	0.03	0.03	0.03	0.02
OTHER MOBILE					
Aircraft	0.52	0.55	0.56	0.58	0.59
Commercial Harbor Craft	0.07	0.06	0.05	0.05	0.05
Farm Equipment	1.36	0.88	0.74	0.62	0.53
Fuel Storage and Handling	1.41	1.23	1.17	1.14	1.13
Ocean Going Vessels	0.01	0.01	0.01	0.01	0.01
Off-Road Equipment	9.52	8.92	7.40	5.61	4.43
Off-Road Equipment (Perp)	0.16	0.11	0.10	0.10	0.10
Off-Road Recreational Vehicles	0.76	0.64	0.57	0.48	0.41
Recreational Boats	13.33	10.21	9.00	8.01	7.16
Trains	0.19	0.20	0.20	0.21	0.20

Source: (CARB, 2022), The table does not include ERCs identified in Section 5.6.

[a] TOTAL EMISSIONS are the rounded sum of reported emissions, as shown in Appendix A1.

Table 5-2 Emissions of NO_X (tons per day) SFNA

	2017	2023	2026	2029	2032
TOTAL EMISSIONS[a]	70.60	47.62	40.39	36.93	34.16
STATIONARY	6.49	6.29	6.18	6.09	5.97
AREA-WIDE	2.34	2.16	2.14	2.15	2.15
ON-ROAD MOTOR VEHICLES	35.85	19.35	13.89	11.64	9.90
OTHER MOBILE SOURCES	25.93	19.83	18.19	17.05	16.14
STATIONARY					
Cleaning and Surface Coatings	0.01	0.01	0.01	0.01	0.01
Fuel Combustion	5.81	5.61	5.48	5.39	5.25
Industrial Processes	0.55	0.55	0.56	0.56	0.58
Petroleum Production and Marketing	0.02	0.02	0.02	0.02	0.02
Waste Disposal	0.09	0.10	0.10	0.10	0.11
AREA-WIDE					
Residential Fuel Combustion	2.00	1.81	1.80	1.81	1.82
Ag Burn/Other Managed Burn	0.33	0.34	0.34	0.34	0.34
ON-ROAD					
Heavy Duty Diesel Trucks	11.42	6.80	4.18	3.56	3.15
Lt/Med Duty Trucks	18.89	9.46	7.14	5.75	4.62
Automobiles	3.88	1.95	1.59	1.44	1.36
Heavy Duty Gas Trucks	0.02	0.01	0.01	0.01	0.01
Buses/Motor Homes	1.19	0.73	0.59	0.49	0.38
Motorcycles	0.45	0.40	0.38	0.38	0.38
OTHER MOBILE					
Aircraft	1.78	1.98	2.08	2.18	2.29
Commercial Harbor Craft	0.78	0.68	0.67	0.65	0.62
Farm Equipment	6.86	3.72	3.06	2.52	2.09
Ocean Going Vessels	0.12	0.12	0.13	0.14	0.15
Off-Road Equipment	8.19	5.52	4.55	3.77	3.21
Off-Road Equipment (Perp)	1.92	1.03	0.83	0.72	0.70
Off-Road Recreational Vehicles	0.03	0.03	0.03	0.03	0.04
Recreational Boats	2.15	2.00	1.94	1.90	1.87
Trains	4.11	4.75	4.90	5.14	5.17

Source: (CARB, 2022), does not include NO_X ERCs identified in Section 5.6.
[a] TOTAL EMISSIONS are the rounded sum of reported emissions, as shown in Appendix A1.

2017 Emissions Pie Charts

The following pie charts (Figures 5-1 to 5-2) show the 2017 VOC and NO_X emission inventory categories as a percentage of the total inventory for the SFNA. In 2017, the VOC inventory includes 20% on-road mobile sources, 28% other mobile sources, 26% area-wide sources, and 23% stationary sources.

The NO_X inventory is predominately mobile source combustion emissions. In 2017, the NO_X inventory includes 51% on-road mobile sources, 37% other mobile sources, 9% stationary sources, and 3% area-wide sources.

2017 Top 10 Emission Categories

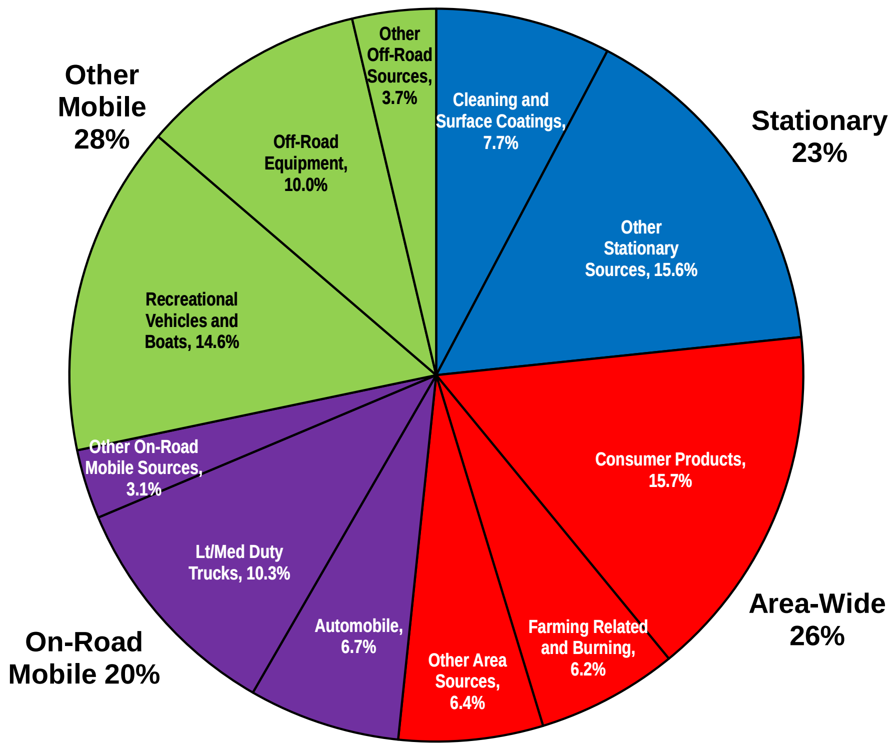
Figures 5-3 and 5-4 contain bar charts that display the 2017 top 10 emission inventory categories for VOC and NO_X, respectively. The largest three source categories for VOC are consumer products, recreational boats, and off-road equipment. The largest three source categories for NO_X are light-duty trucks, heavy duty diesel trucks, and off-road equipment.

State and federal laws limit local air district authority to regulate certain emissions sources, notably motor vehicles, off-road engines, pesticides, and consumer products. EPA retains almost exclusive regulatory authority for emissions from trains, aircraft, and ships. The largest source categories that air districts have regulatory authority over include architectural coatings, solvents and coatings, waste composting, petroleum marketing, stationary fuel combustion, and agricultural irrigation pumps.

Emissions Contribution by Agency Responsibility

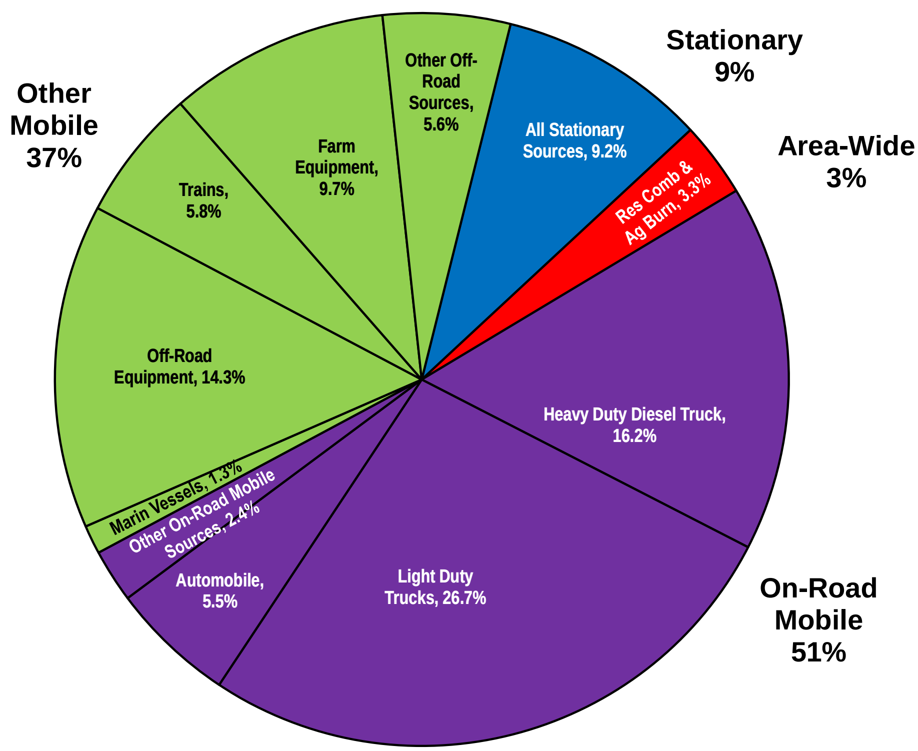
Figure 5-5 shows pie charts that identify the VOC and NO_X emissions contributions by primary agency responsibility (District, and CARB and EPA combined). In terms of emissions, local air districts have direct regulatory authority for only 34.6% of VOC emissions and 12.5% of NO_X emissions in the SFNA. CARB and EPA have the most regulatory responsibility over emissions, 65.4% of VOC and 87.5% of NO_X, due to their authority over mobile source emissions. To help the SFNA attain by the attainment deadline, significant emission reductions will need to come from mobile sources. Since a large portion of mobile source emissions is under CARB's authority, CARB has committed to new mobile source control measures that will help the SFNA meet its attainment goals. See Chapter 7 for more information on CARB's control measure commitments.

Figure 5-1 2017 VOC Inventory SFNA 96.64 tpd



Source: (CARB, 2022) does not include VOC ERCs identified in Section 5.6.

Figure 5-2 2017 NO_X Inventory SFNA 70.60 tpd



Source: (CARB, 2022) does not include NO_X ERCs identified in Section 5.6.

Figure 5-3 Top 10 Categories for VOC Planning Emissions – SFNA 2017

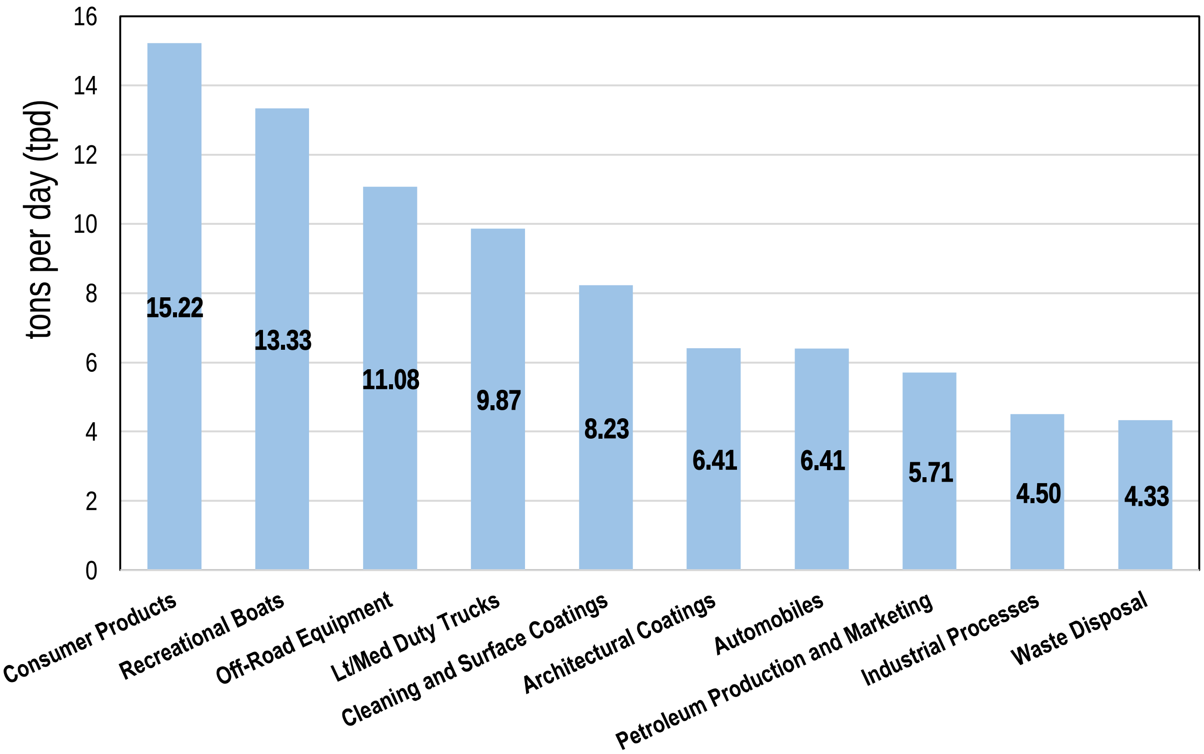


Figure 5-4 Top 10 Categories for NO_X Planning Emissions – SFNA 2017

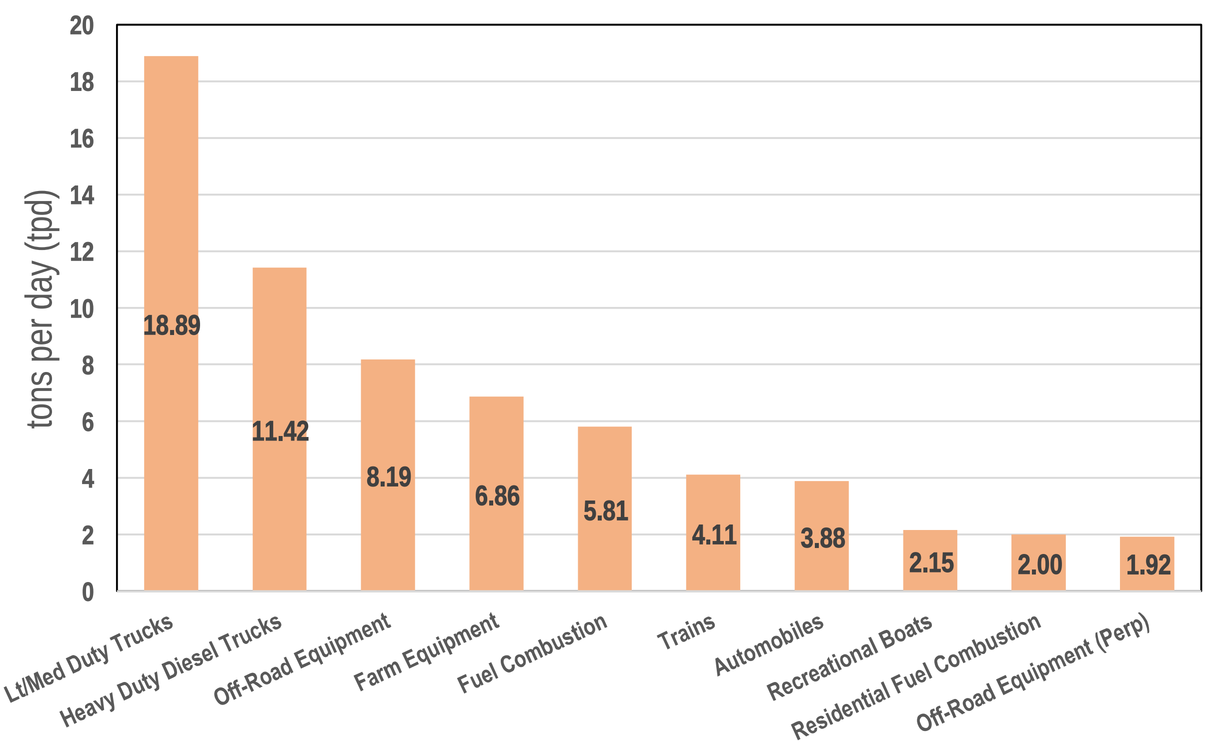
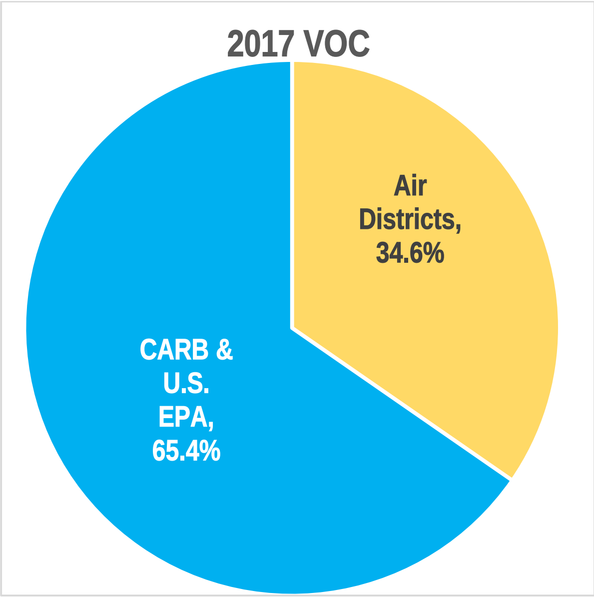
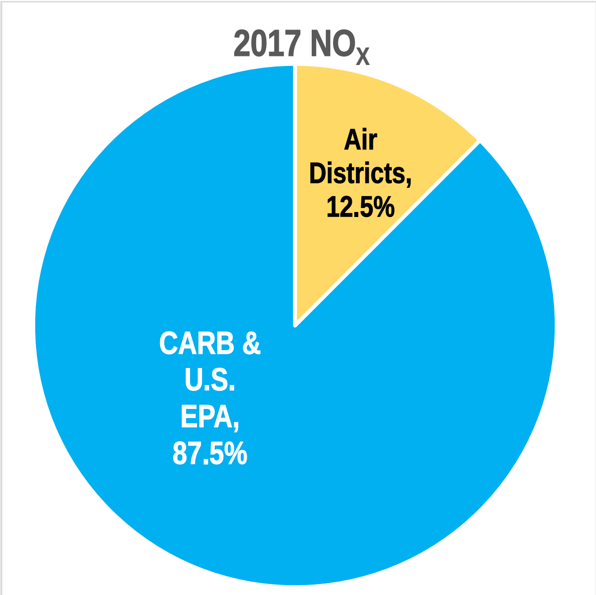


Figure 5-5 VOC and NO_X Emissions Contribution by Primary Agency Responsibility – SFNA



Total VOC = 96.64 tpd



Total NO_X = 70.60 tpd

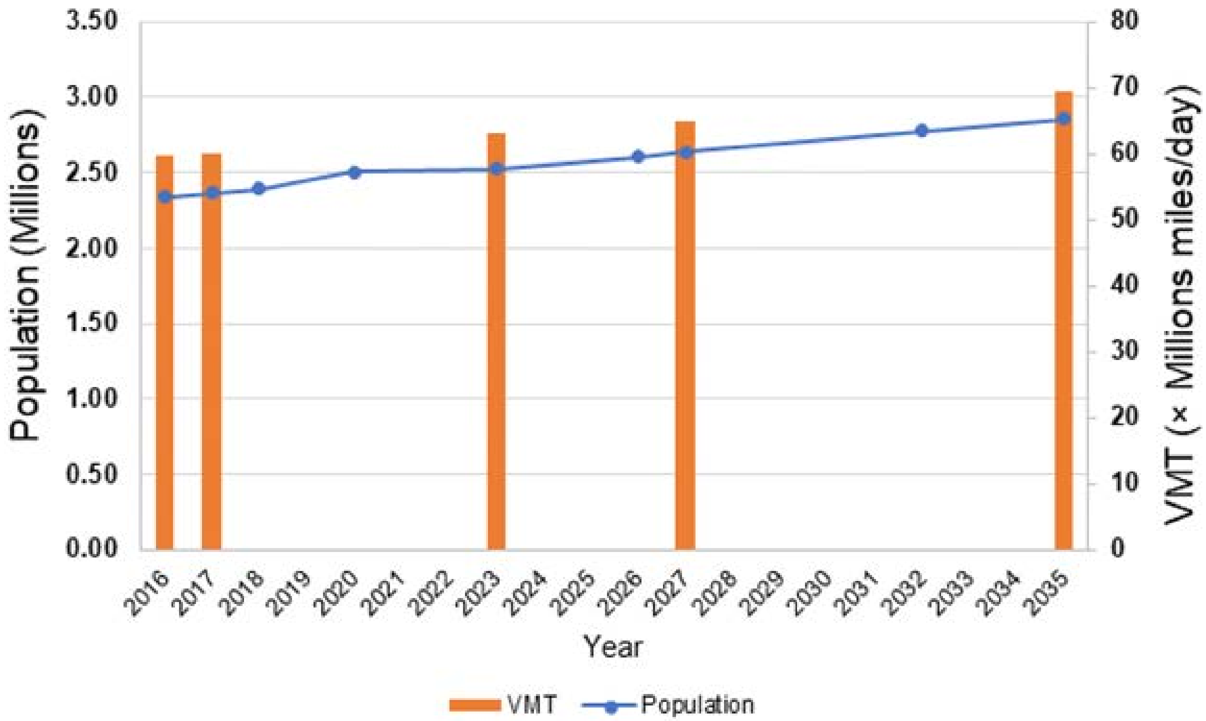
5.5 Emission Inventory Forecasts

The emission inventory forecasts take into account various growth parameters including forecasts for population, housing, employment, energy demand, motor vehicle travel, and other industrial and commercial outputs along with emission benefits from the federal, state, and local control measures. In order to forecast emissions for various future milestone and attainment analysis years, growth parameters and the post-2017 emission reduction effects of control measures are applied to the 2017 emissions inventory at the emission process level for stationary and area-wide sources.

Off-road motor vehicle emissions are forecasted separately by off-road category-specific models using growth rates that were based on category-specific economic indicators such as employment, expenditures, and fuel use. Future on-road emissions are determined by using VMT forecasts in SACOG's 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS) (SACOG, 2019).[17] Figure 5-6 shows the population and VMT growth for the Sacramento region. The SFNA population is expected to increase by 16% from 2.4 million to 2.9 million and an increase of vehicle miles traveled (VMT) by 12% from 61 to 68 million miles between 2017 base year and 2032 attainment. Existing control strategies continue to reduce future VOC and NO_X emissions from stationary and area sources, on-road motor vehicles, and some other mobile source categories (such as off-road equipment).

17 The 2020 MTP/SCS was adopted by the SACOG Board on November 18, 2019.

Figure 5-6 SFNA Population and VMT Historic and Forecast



Note:

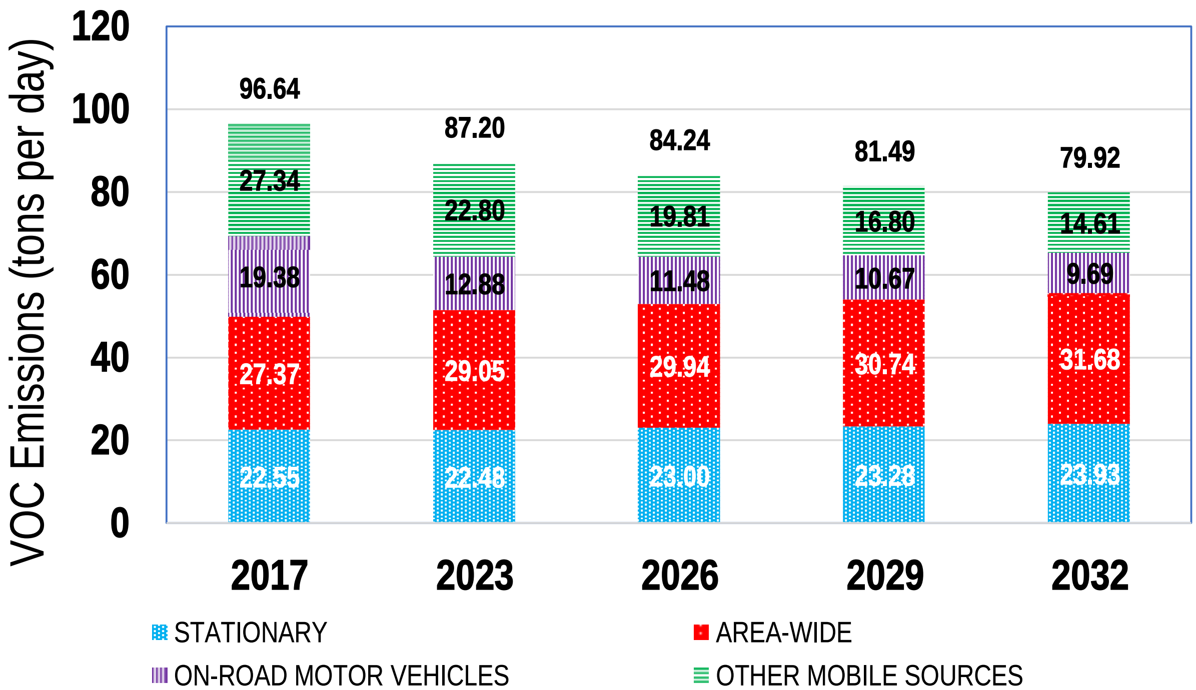
1. 2023 VMT data are interpolated from 2017 and 2027 data except Solano County
2. The population of Solano in Sacramento Valley is calculated based on the ratios developed using Census Data of 2010 and 2020 Census Block data.

Sources:

1. VMT of SACOG area from SACOG in 04/24/2023
2. VMT of Solano County (SV) for future years from SACOG 04/24/2023
3. VMT of Solano County (SV) for past years from the 2008 O3 NAAQS SIP Plan
4. Population of SACOG Counties from SACOG in 09/02/2021
5. Solano County Population data from CA Dept of Finance population data P2A. Download on 04/26/2023.
6. 2020 SFNA population is from Census 2020

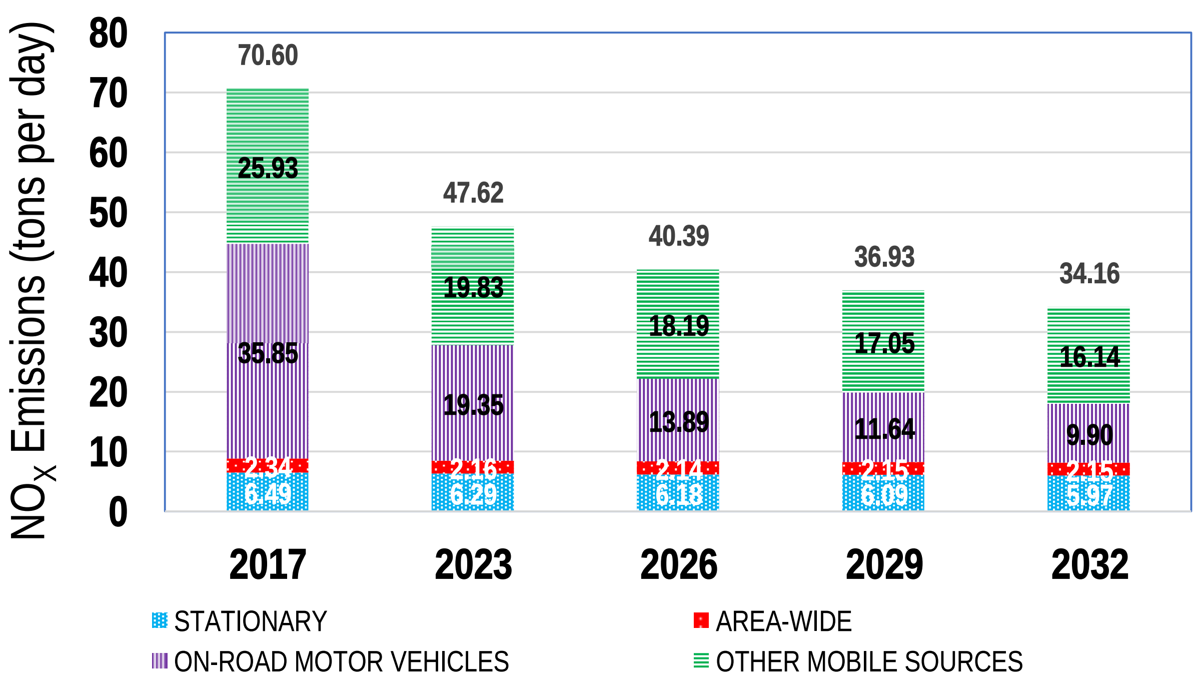
The following bar charts (Figures 5-7 and 5-8) show the VOC and NO_X emission inventory forecasts for stationary sources, area-wide sources, on-road motor vehicles, and other mobile sources for the SFNA. Bar charts are given for the 2017 base year and compared to the milestone RFP years of 2023, 2026, and 2029, and to the attainment year of 2032. The VOC and NO_X emission forecasts show significant declines in mobile source emissions, despite increasing population, vehicle activity, and economic development.

Figure 5-7 VOC Planning Inventory Forecasts – SFNA



Source: (CARB, 2022), does not include VOC ERCs identified in Section 5.6.

Figure 5-8 NO_X Planning Inventory Forecasts – SFNA



Source: (CARB, 2022), does not include NO_X ERCs identified in Section 5.6.

5.6 ERCs Added to Emission Inventory Forecasts

Certain pollutant emission reductions due to equipment shutdown or voluntary control may be converted to ERCs and registered with the air districts. These ERCs may then be used as “offsets” to compensate for an increase in emissions from a new or modified emission source regulated by the air districts. ERCs, in limited cases, may also be used as an alternative method to show compliance with specified rules. Thus, if a permitted source cannot meet the applicable emission standard requirements, usually because it is technically infeasible or not cost effective, the source may lease or purchase ERCs to achieve the required reductions.

Since ERCs represent potential emissions, they need to be accounted for in the emission inventories. One method is to assume that the use of ERCs will already be included within the projected rate of stationary source growth in the emissions inventory. However, if the use of available ERCs exceeds anticipated emissions growth, future emissions could be underestimated. Therefore, to ensure that the use of ERCs will be consistent with the future reasonable further progress and attainment goals, ERCs issued prior to the 2017 base year (as of January 1, 2018) are added to the forecasts (2023, 2026, 2029, and 2032) for VOC and NO_X planning emissions inventories.

5.6.1 Emissions Reduction Credits

For this attainment plan, the amount of unused banked ERCs that occurred prior to the 2017 baseline year for the Sacramento nonattainment area are 3.6 tons per day of VOC and 2.8 tons per day of NO_X (see Table 5-3 average of second and third quarters emissions which reflect the ozone season). The ERCs consist of emissions reduced from stationary sources. These ERCs were determined for each air district and adjusted based on their boundaries in the nonattainment area. Emissions were then added to the existing stationary and area sources to determine the future planning emissions inventory (for 2023, 2026, 2029, and 2032) and used in photochemical modeling.

5.6.2 Future Bankable Rice Burning ERCs

California legislation[18] in 1991 (known as the Connelly bill) required rice farmers to phase down rice field burning on an annual basis, beginning in 1992. A burn cap of 125,000 acres in the Sacramento Valley Air Basin was established, and growers with 400 acres or less were granted the option to burn their entire acreage once every four years. Since the rice burning reductions were mandated by state law, they would ordinarily not be “surplus” and eligible for banking. However, the Connelly bill included a special provision declaring that the reductions qualified for banking even though they are statutorily mandated, so long as they otherwise met the State and local banking rules.

18 Connelly-Areias-Chandler Rice Straw Burning Reduction Act of 1991 (California Health and Safety Code Section 41865).

Some rice straw burning reductions have been banked as ERCs. Other pre-2017 reductions in rice straw burning may be banked in the future under an ERC rule[19] once developed. The total amounts of potential bankable rice straw burning ERCs for the SFNA are estimated at 0.12 ton per day of VOC and 0.13 ton per day of NO_X and have not changed since the previous SIP was developed. The only district with unbanked rice straw burning ERCs is the SMAQMD as shown in Table 5-3. Other districts have already banked their rice straw burning emissions and the rice straw burning ERCs are included as part of the total for each district.

5.6.3 Summary of Emission Reduction Credits

ERCs issued for reductions that occurred prior to January 1, 2018, and potential future bankable rice burning ERCs are summarized in Table 5-3 for the SFNA. ERCs are based on tons per day (tpd) and will be added to the NO_X and VOC planning emission inventory forecasts in 2023, 2026, 2029, and 2032 used in attainment demonstration modeling and RFP demonstration.

Table 5-3 Emissions Reduction Credits for NO_X and VOC

	NO_X (tpd)				VOC (tpd)			
Quarters	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
El Dorado County AQMD[1]	---	---	---	---	---	---	---	---
Feather River AQMD	0.37	0.25	0.14	0.41	0.42	0.33	0.64	0.43
Placer APCD	0.58	0.55	0.53	0.56	0.45	0.41	0.40	0.40
Sac Metro AQMD	1.74	1.14	1.65	1.35	2.39	2.09	2.33	2.28
--- Future Bankable Rice Burning ERCs	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12
Yolo-Solano AQMD	0.69	0.72	0.36	0.87	0.63	0.54	0.28	0.73
SFNA Total	3.51	2.79	2.82	3.31	4.01	3.49	3.77	3.97

[1] There are no banked ERCs for El Dorado County AQMD as of 01/01/2018.

5.7 Emissions Inventory Documentation

More detailed documentation of the estimated 2017, 2023, 2026, 2029 and 2032 emission inventories for VOC and NO_X in each county and air basin combination in the SFNA is provided in Appendix A.

Emission inventories are constantly being updated to incorporate new and better information and methodologies. Many improvements, especially in the mobile source categories, and the addition of previously un-inventoried emission sources, have been made to the inventory. Detailed information on emission methodologies, changes, and forecasts can be found on CARB websites: http://www.arb.ca.gov/ei/ei.htm and https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory.

19 This rice burning ERC rule must be approved by EPA into the SIP for the rice ERCs to be used for compliance with federal air quality requirements.

5.8 Summary

This plan includes an emissions inventory for ozone precursor emissions: NO_X and VOC, in the baseline year (2017), milestone years (2023, 2026, and 2029), and attainment year (2032). Between 2017 and 2032, the emission inventories are expected to decrease by about 17% for VOC and by about 52% for NO_X despite an increase in vehicle miles traveled and SFNA population during the same period. These emissions decreases are due to the emission benefits from existing federal, state, and local air quality programs and newly committed state control measures. The planning emission inventory also includes NO_X and VOC ERCs in the milestone and attainment years to account for any potential future growth using ERCs in the SFNA. The summary of the NO_X and VOC planning inventories for the summer season, including ERCs in the SFNA, is shown in Tables 5-4 and 5-5.

Table 5-4 SFNA Summer Planning Emission Inventory for NO_X (tpd)

	2017	**2023**	**2026**	**2029**	**2032**
Emission inventory	70.60	47.62	40.39	36.93	34.16
NO_X ERCs		2.80	2.80	2.80	2.80
Total Planning Emission Inventory	70.60	50.42	43.19	39.73	36.96

Table 5-5 SFNA Summer Planning Emission Inventory for VOC (tpd)

	2017	**2023**	**2026**	**2029**	**2032**
Emission inventory	96.64	87.20	84.24	81.49	79.92
VOC ERCs		3.63	3.63	3.63	3.63
Total Planning Emission Inventory	96.64	90.83	87.87	85.12	83.55

5.9 References

CA Dept of Finance. *P2-A Total Population for California and Counites.* Sacramento, CA: State of California, Department of Finance. Web 26 April 2023. < https://dof.ca.gov/wp-content/uploads/sites/352/2023/07/P2A_County_Total.xlsx >

CARB *EMFAC.* Sacramento, CA: California Air Resources Board. [2017.] Web 25 May 2022. < https://arb.ca.gov/emfac/ >

---. *EMFAC2017 Web Database.* Sacramento, CA: California Air Resources Board. [2017.] Web 25 May 2022. < https://arb.ca.gov/emfac/2017/ >

---. CEPAM: External Adjustment Reporting Tool. Base Year: 2017. 28 April 2022. Web. 5 May 2022. < https://www.arb.ca.gov/app/emsinv/2019ozsip/fcmasterdetail_sip2019.php >

---. *Emission Inventory Documentation.* Sacramento, CA: California Air Resources Board. Web. 05 June 2023. < https://ww2.arb.ca.gov/emission-inventory-documentation >

---. *Mobile Source Emissions Inventory*. Sacramento, CA: California Air Resources Board. Web 05 June 2023. < https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory >

---. *MSEI - Modeling Tool.* Sacramento, CA: California Air Resources Board. Web 05 June 2023. < https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-modeling-tools >

EPA (83 FR 62998–63006) *Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements: Final Rule.* Federal Register, Volume 83, 06 December 2018, p. 62998 – 63006. Web 01 June 2023. < https://www.govinfo.gov/content/pkg/FR-2018-12-06/pdf/2018-25424.pdf >

---. (84 FR 41717 - 41720) *Official Release of EMFAC2017 Motor Vehicle Emission Factor Model for Use in the State of California: Notice of availability.* Federal Register, Volume 84, 15 August 2019, p. 41717 – 41720. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2019-08-15/pdf/2019-17476.pdf >

---. (87 FR 68483 - 68489) *Official Release of EMFAC2021 Motor Vehicle Emission Factor Model for Use in the State of California: Notice of availability.* Federal Register, Volume 87, 15 November 2022, p. 68483 – 68489. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2022-11-15/pdf/2022-24790.pdf >

---. 2017. *Emission Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations*. Research Triangle Park: United States Environmental Protection Agency,. May [2017.] Web. 06 June 2023. < https://www.epa.gov/sites/default/files/2017-07/documents/ei_guidance_may_2017_final_rev.pdf >

MTC. *Plan Bay Area 2050*. San Francisco, CA: Metropolitan Transportation Commission. October [2021.] Web 05 June 2023. < https://mtc.ca.gov/planning/long-range-planning/plan-bay-area-2050 >

SACOG. *2020 Metropolitan Transportation Plan/Sustainable Communities Strategy*. Sacramento, CA: Sacramento Area Council of Governments. 18 November [2019.] Web. 23 March 2020. < https://www.sacog.org/sites/main/files/file-attachments/2020_mtp-scs.pdf?1580330993 >

---. Email to Steven Lau (SMAQMD). 2 September 2021.

---. Email to Steven Lau (SMAQMD). 24 April 2023.

U.S. Census Bureau. “2020 Census Results” United States Census Bureau. Web 16 August 2023. < https://www.census.gov/programs-surveys/decennial-census/decade/2020/2020-census-results.html >

6 AIR QUALITY MODELING and ATTAINMENT DEMONSTRATION

6.1 Introductions

Clean Air Act (CAA) Section 182(c)(2)(A) requires that attainment demonstrations for “serious and higher” nonattainment areas be based on photochemical grid modeling or any other analytical method determined to be at least as effective by the United States Environmental Protection Agency (EPA). EPA provided guidance (EPA, 2018) on how to use an air quality model to generate results for demonstrating attainment of an ozone National Ambient Air Quality Standard (NAAQS). EPA’s modeling guidance does not name any specific photochemical grid models for attainment demonstration, but EPA recognizes two commonly used models, CMAQ[20] and CAMx[21]. The California Air Resources Board (CARB) selected the CMAQ model to demonstrate attainment of the 2015 ozone NAAQS for the Sacramento Federal Nonattainment Area (SFNA), using the single relative response factor (RRF) method (see Section 6.5 below) to predict the future design values (DVs). This chapter provides an overview of the modeling input data, modeling year selection, modeling results, and modeling uncertainties. The ultimate goal of the photochemical modeling is to determine whether the SFNA can attain the ozone standard by the severe attainment year of 2032.

6.2 Photochemical Modeling

Ground level ozone is formed by a series of complex chemical reactions, which involve nitrogen oxides (NO_X), volatile organic compounds (VOCs), and ultraviolet radiation. Ozone formation is also affected by meteorological characteristics (e.g. temperature, wind, vertical mixing, pressure, cloud cover, and humidity) and land surface features (e.g., land use, surface roughness, albedo[22], and terrain). It is the result of a large number of atmospheric interactions and different emissions sources, which combine together over vast spatial area. Computer modeling is used to simulate the formation of ozone through mathematical descriptions of atmospheric processes and photochemical reactions of pollutants over large regional air basins. CARB prepared separate technical documents to address the conceptual modeling, modeling protocol, model performance evaluation,

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20 CMAQ: **C**ommunity **M**ultiscale **A**ir **Q**uality Modeling System is an active open-source development project of the EPA that consists of a suite of programs for conducting air quality model simulations. CMAQ combines current knowledge in atmospheric science and air quality modeling, multi-processor computing techniques, and an open-source framework to deliver fast, technically sound estimates of ozone, particulates, toxics, and acid deposition. https://www.cmascenter.org/cmaq/

21 CAMx: **C**omprehensive **A**ir Quality **M**odel with E**x**tensions is an open-source photochemical grid model that comprises a “one-atmosphere” treatment of tropospheric air pollution over spatial scales ranging from neighborhoods to continents. https://www.camx.com/

22 Albedo is a measure of how much light that hits a surface is reflected without being absorbed.

attainment demonstration, and modeling emissions inventory. These technical documents are included in Appendix B – Photochemical Modeling.

6.3 Baseline and Future Year Model Runs

To evaluate when the SFNA will attain the 2015 8-hour ozone NAAQS, future ozone concentrations were determined based on the summer planning inventory of 2018 baseline year[23] and the 2032 attainment year.

Extensive air monitoring and emissions data was collected for the ozone season of 2018 to provide information for developing the base case model simulations. Data from 2018 was also evaluated to determine specific days and monitoring sites that were impacted from wildfires, and these high ozone concentrations were excluded from the modeling base year DV calculation. Air quality modeling simulations were conducted based on future year emissions data to determine if the SFNA would be in attainment of the 2015 ozone standard and how reductions of VOC and NO_X emissions in SFNA would decrease ambient ozone concentrations at different monitoring sites.

6.4 Emission Reduction Credits (ERCs) Added to Future Year Emissions

ERCs for the SFNA are discussed and quantified in Section 5.6. Since ERCs are potential future emissions, it is not currently known what emission sources they will be applied to and where the emission sources will be located. Due to the uncertainty of the type and location of future sources using ERCs, the VOC and NO_X ERCs (as of January 01, 2018) for the SFNA were added to the future year (2032) gridded modeling inventory as stationary and area-wide emissions. Existing inventories for stationary emissions are gridded for modeling by using the point source facility locations. Estimated area-wide emissions are gridded for modeling using related spatial surrogate parameters, such as population and land use types. The ERCs from each district were distributed to its stationary and area-wide emission inventory categories using an across-the-board percent increase calculated by adding the ERCs to total stationary and area-wide emissions inventories.

6.5 Forecasted Ozone Design Value

The results from the baseline and future year modeling run were evaluated at each ozone nonattainment monitor to determine the predicted future ozone DV. The method for calculating the predicted future ozone DVs is described by the following equation (EPA, 2018, p. 100):

[23] There is a deviation between the modeling baseline year and the emissions inventory baseline year. When preparing the baseline year modeling, CARB found that the overall model performance for 2018 is better than 2017. In consideration of model performance and uniformity for the State, CARB selected an alternative year of 2018 as the modeling baseline year.

DV_{future} = RRF x (DV_{base}) where,

DV_{future} = the estimated future DV at the monitor used to predict attainment of the 8-hour ozone NAAQS (rounded to tenths of a ppb)

RRF = the **relative response factor** is the ratio of the future year (FY) modeled average 8-hour daily maximum ozone (rounded to tenths of a ppb) to the reference year (RY) modeled average 8-hour daily maximum ozone (rounded to tenths of a ppb) for the monitor. Reference year model simulation is similar to base year model simulation except emissions from random events or from events that cannot be projected to the future are removed from the modeling emissions inventory. For example, wildfires emissions are excluded from reference year modeling. The top 10 days with reference year modeled maximum daily average 8-hr ozone greater than or equal to 60 ppb are selected to calculate the RRF. If less than 10 days satisfy the requirements, then it uses all the available days to calculate the FY_{AVG} and RY_{AVG}.

$$RRF = \frac{FY_{AVG}}{RY_{AVG}}$$

DV_{base} = the three-year average of the actual observed average base year DVs (2018, 2019, and 2020) at the monitor for 8-hour ozone (rounded to tenths of a ppb)[24]

6.5.1 Alternate Modeling Base Year Design Value

For the modeling base year 2018, the modeling DV is the average of DV_{2018}, DV_{2019}, and DV_{2020}. Because 2020 was an atypical year with large societal changes in response to a world-wide pandemic (COVID-19), an alternative method was used to calculate the baseline DV, which excluded 2020 data. In consultation with the EPA, CARB used an alternative way to calculate the 2018 modeling design value. The equation below describes the alternative modeling base year DV calculation:

$$DV_{Base,Alternative} = \frac{DV_{2018} + DV_{2019} + \frac{4th\ highest\ MDA8\ O_3\ (2018 + 2019)}{2}}{3}$$

$DV_{base,Alternative}$ = An alternative method calculating the base year modeling DV, which does not include the fourth highest ambient maximum daily average 8-hour (MDA8) ozone concentration of 2020.

[24] The discussion here and in the following sections uses three related terms: design value, peak design value, and weighted design value. The design value is the average of the 4th highest emission concentration measured at a monitoring station for each year in any consecutive 3-year period. The peak design value is the highest design value in a given year at all stations in the SFNA. The weighted design value is calculated by averaging the design value each year for a three-year period. The weighted design value is only used in photochemical grid modeling and is intended to account for year-to-year meteorological variability (Appendix B, Section B.1.2).

4th highest MDA8 O_3 = Annual fourth highest maximum daily average 8-hour ozone concentration for 2018 or 2019.

6.6 Attainment Demonstration

Attainment demonstration describes how a nonattainment area achieves the NAAQS by the attainment year. The future year corresponds to the analysis year for the severe nonattainment area attainment year of 2032. The future year emission forecasts incorporate growth assumptions and estimated reductions associated with all existing federal, state, regional, and local control measures. Proposed and adopted statewide measures in the 2022 State Strategy for the State Implementation Plan (SIP)(CARB, 2022) were also included in the future year modeling emissions inventory. No new federal and local control measures commitments besides the statewide strategies are needed to attain the standard by 2032. The details of the modeling emissions inventory are described in Appendix B.2.

The baseline design values were calculated using the method discussed in Section 6.5.1. High ozone concentrations (six days) caused by wildfires in 2018 were excluded from the baseline DV calculation at the Auburn monitoring site. Once these values were excluded, the highest calculated 8-hour weighted baseline DV was 84 parts per billion (ppb), which was measured at the Placerville monitoring site[25].

The RRFs at the SFNA monitoring sites were determined by the photochemical modeling. Applying the RRF to the baseline DV, the future ozone DV for each SFNA monitor was determined. The results for the future ozone DVs are presented in Table 6-1. Demonstrating attainment of the 2015 ozone NAAQS means that the future ozone DVs from all monitoring sites in the attainment year must be less than or equal to 70 ppb[26]. The future DVs were predicted to be less than 70 ppb at all SFNA ozone monitoring sites in 2032. The highest future DV for the region is forecasted to be 69.8 ppb at the Colfax monitoring site.

[25] The Auburn monitoring site had an original baseline design value of 87.3 but six high ozone concentrations from 2018 were removed from the baseline design value calculation because of fire impacts. After these six days from 2018 (7/31, 8/1, 8/2, 8/8, 8/9 and 8/10) were excluded the baseline design value was 81.7 at Auburn. The SFNA was heavily impacted by the smoke of Mendocino Complex Wildfire and Carr Wildfires. These wildfires brought large amount of ozone precursors pollutant into SFNA. The centers of both wildfires were less than 200 miles away from SFNA, started in late July 2018, and burned over 30 days. In August 2018, various air monitoring sites in SFNA recorded daily average 8-hour ozone concentrations over 0.090ppm or 90ppb. An extensive long high ozone episode is not common in SFNA after 2015.

[26] For attainment demonstration purposes, all the decimal points for the projected future ozone DVs are truncated consistent with 40 CFR Part 50 Appendix P. For example, 70.9 ppb is truncated to 70 ppb.

Table 6-1 Baseline (2018) and Future Design Value (2032) Ozone Concentrations

Region	Site	RRF	DV2018	DV2032	DV2032t[3]
Eastern	Colfax	0.8334	83.7	69.8	69
	Placerville	0.8283	84.0	69.6	69
	Auburn[1]	0.8356	81.7	68.3	68
	Cool	0.8353	81.7	68.2	68
Central	North Highlands	0.8674	74.7	64.8	64
	Folsom	0.8433	76.7	64.7	64
	Roseville	0.8408	76.3	64.2	64
	Del Paso Manor	0.8662	72.0	62.4	62
	Sloughhouse	0.8708	71.3	62.1	62
	Sac T Street	0.9053	66.3	60.0	60
Western	Elk Grove	0.9127	67.7	61.8	61
	Woodland	0.8750	66.7	58.4	58
	Vacaville	0.9100	64.0	58.2	58
	Davis-UCD	0.9063	62.3	56.5	56

[1] There were 6 days in 2018 (7/31/18, 8/1/18, 8/2/18, 8/8/18, 8/9/18, 8/10/18) which were excluded from Auburn monitoring site RRF calculation because of wildfires impact.

[2] Echo Summit monitoring site is a seasonal monitor site and only operates during the ozone season, i.e. April through October. The annual 4th highest ozone concentration will never satisfy the data completeness requirement. In addition, the calculated design value is usually below the 2015 Ozone NAAQS of 70 ppb. Therefore, the base year design value and RRF are not included in this table.

[3] DV2023t is the truncated value for DV2032.

6.7 Air Quality Modeling Uncertainties

EPA's modeling guidance document (EPA, 2018, p.169) states that, "models are simplistic approximations of complex phenomena. The modeling analyses used to assess whether emission reduction measures will bring an individual area into attainment for the NAAQS contain many elements that are uncertain. These uncertain aspects of the analyses can sometimes prevent definitive assessments of future attainment status." Uncertainty arises for a variety of reasons; for example, incomplete representation in the atmospheric physical and chemical processes may cause limitations in the model's scientific formulation. Modeling uncertainties can also result from meteorological conditions, emissions projections, and other input database limitations, such as land use, microclimate, background ozone concentrations, etc.

Other *factors* adding to air quality modeling uncertainties include:

1. How well the meteorological simulation represents the severity of future meteorological conditions conducive to high ozone formation,

2. How well the methodology for forecasting ozone design values corresponds to actual future monitored ozone design values, and
3. How well domain-wide emission reductions in the SFNA attainment analysis are achieved, especially during the time when pollutant transport is significant.

The impact of future climate change is not included in the photochemical modeling assumptions. Any effects from climate changes, like changes of ambient temperature or return frequency of heat wave, during the timeframe of this SIP (14 years, from 2018 to 2032) will likely be too insignificant to have an impact on the modeling results. If in the future, the ozone concentrations are impacted by natural events related to climate change like wildfires, EPA has a mechanism to excluded data impacted by wildfires or other natural events under its exceptional event rule[27].

EPA modeling guidance (EPA, 2018, p. 32) states that "there are significant uncertainties regarding the precise location and timing of climate change impacts on air quality." To mitigate potential air quality modeling uncertainties, the modeling guidance suggests using corroborative methods and analyses to support the air quality modeling results and attainment demonstration. In response to higher frequency and increased magnitudes of wildfires in recent years due to possible results of climate change, CARB considered the uncertainty of wildfires impacts. In the modeling, CARB conducted a simulation using the base year and an additional simulation for the base year that excluded wildfire emissions. This simulation without the wildfire impacts was labeled as the reference year. The relative response factor for the future DV projection is based on the comparison of future year using the reference year. Also, the base year DV excluded the days with obvious wildfires impacts when calculating the annual fourth highest ambient concentration at the peak monitoring sites at the Auburn monitoring site.

In addition, a weight-of-evidence (WOE) report developed by CARB and the SFNA air districts is included in this plan (Appendix F). The WOE report provides additional information outside of photochemical modeling to support the finding of the photochemical modeling results.

6.8 Summary

The photochemical modeling results show that attainment of the 2015 NAAQS can be achieved at the end of 2032 with a future design value of 69 ppb at the peak monitoring site.

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[27] Treatment of Data Influenced by Exceptional Events are described in 40 CFR Parts 50 and 51.

6.9 References

CARB. *2022 State Implementation Plan Strategy*. Sacramento, CA: California Air Resources Board. 20 September 2022. Web 7 November 2022 < https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf >

EPA. *Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze*. Washington, D.C.: United States Environmental Protection Agency. EPA 454/R-18-009. November, [2018.] Web. 05 June 2023. < https://www.epa.gov/sites/default/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf >

7 CONTROL MEASURES

7.1 Introduction to Control Measures

The photochemical modeling and results discussed in Chapter 6 indicate that the Sacramento Federal Nonattainment Area (SFNA) will attain the 2015 Ozone National Ambient Air Quality Standard (NAAQS) by the end of 2032. The SFNA will rely on existing federal, state, and local control programs along with the committed state control measures to reduce ozone precursor emissions. California Air Resources Board (CARB) will continue to implement existing control strategies and the commitments outlined in its 2022 State Implementation Plan (SIP) Strategy (CARB, 2022). The SFNA air districts and Sacramento Area Council of Governments (SACOG) will continue to implement existing local and regional strategies and transportation control measures (TCMs). This chapter provides a summary of the 2022 SIP Strategy and discussions on existing state, local and regional control programs as it relates to the SFNA. This chapter also summarizes the results of the reasonably available control measures (RACM) analysis, which will determine whether the implementation of all RACM can advance attainment by one year.

7.2 State Control Measure Commitments

SIPs must contain enforceable commitments to reduce emissions necessary to meet the federal air quality standard, as defined by the attainment demonstration. The 2022 State SIP Strategy listed new SIP measures and commitments and quantified their potential emissions reductions for the State, including the potential benefits to the SFNA. Adoption of the 2022 State SIP Strategy, including the schedule to adopt the measures, by the CARB formed the basis of the commitments for emission reductions by the applicable attainment deadlines for each nonattainment area. These commitments will be considered by the CARB Board alongside the respective nonattainment area's SIP. The commitments consist of two components:

1. A commitment to bring an item to the CARB Board for defined new measures or take other specified actions within CARB's authority; and
2. A commitment to achieve emission reductions by specific dates.

The commitments and associated emission reductions specified in 2022 State SIP Strategy and included as part of the air districts' SIP needed for attainment of the standard will become federally enforceable when the U.S. Environmental Protection Agency (EPA) takes formal action to approve the air districts' SIP. Furthermore, the specific state measures and actions would still be subject to CARB's formal approval process and would not be final until the CARB Board has adopted the measures.

7.2.1 State Commitment to Act on Measures

On September 22, 2022, the CARB adopted the 2022 State SIP Strategy, which included a list of measures and their corresponding adoption and implementation schedule. For each SIP measure from the 2022 State SIP Strategy shown in Table 7-1, CARB describes its commitments to address each measure, which includes the proposed actions that CARB will take to achieve the emission reductions. In the instance of measures that involve the development of a rule under CARB's regulatory authority, CARB commits to bring a publicly noticed item before the CARB Board that is either a proposed rule or a recommendation that the CARB Board direct staff to not pursue a rule. If the recommendation is not to pursue a measure, CARB would explain why such a rule is unlikely to achieve the relevant emission reductions in the relevant timeframe and would include a demonstration that the overall emissions reduction commitments will be achieved despite that rule not being pursued or through adoption of an alternative reduction measure. This public process and CARB hearing would provide additional opportunities for public and stakeholder input, ongoing technology review, and assessments of costs and environmental impacts.

The measures, as proposed by staff to the CARB Board or adopted by the Board, may provide more or less than the initial emissions reduction estimates. In addition, an action by the CARB Board may include any action within its discretion.

7.2.2 State Commitment to Achieve Emission Reductions

The following section describes the estimated emission reductions and commitments from the SIP measures identified and quantified for the SFNA. The emissions reduction commitments from State sources are analyzed in CARB's staff report for the Sacramento Metro nonattainment area 70 ppb 8-hour ozone SIP. CARB's staff report and this plan will be presented to the CARB Board for adoption. While the 2022 State SIP Strategy includes estimates of the emission reductions from each of the individual new measures, CARB's overall commitment is to achieve the total emission reductions necessary from State-regulated sources to attain the federal air quality standards, reflecting the combined reductions from the existing control strategies and new measures.

Therefore, if a particular measure does not get its expected emission reductions, the State's overall commitment to achieving the total emission reductions still remains intact. If the actual emission reductions exceed the projections reflected in the current emission inventory and the 2022 State SIP Strategy, CARB will submit an updated emissions inventory to EPA as part of a SIP revision. The SIP revision would outline the changes that have occurred and provide tracking to demonstrate that total emission reductions sufficient for attainment are being achieved through enforceable emission reduction measures. CARB's emission reduction commitments may be achieved through a combination of actions including but not limited to the implementation of control measures; the expenditure of local, State, or federal incentive funds; or other enforceable measures.

Table 7-1 Measures and Schedule

Measure	Agency	Action	Implementation Begins
On-Road Heavy-Duty			
Advanced Clean Fleets Regulation	CARB	2023	2024
Zero-Emissions Trucks Measure	CARB	2028	2030
On-Road Light-Duty			
On-Road Motorcycle New Emissions Standards	CARB	2022	2025
Clean Miles Standard	CARB	2021	2023
Off-Road Equipment			
Tier 5 Off-Road Vehicles and Equipment	CARB	2025	2029
Amendments to the In-Use Off-Road Diesel-Fueled Fleets Regulation	CARB	2022	2024
Transport Refrigeration Unit Regulation Part 2	CARB	2026	2028
Commercial Harbor Craft Amendments	CARB	2022	2023
Cargo Handling Equipment Amendments	CARB	2025	2026
Off-Road Zero-Emission Targeted Manufacturer Rule	CARB	2027	2031
Clean Off-Road Fleet Recognition Program	CARB	2025	2027
Spark-Ignition Marine Engine Standards	CARB	2029	2031
Other			
Consumer Products Standards	CARB	2027	2028
Zero-Emission Standard for Space and Water Heaters	CARB	2025	2030
Enhanced Regional Emission Analysis in State Implementation Plans[28]	CARB	2025	2023
Pesticides: 1,3-Dichloropropene Health Risk Mitigation	DPR[29]	2022	2024
Primarily-Federally and Internationally Regulated Sources – CARB Measures			
In-Use Locomotive Regulation	CARB	2023	2024
Future Measures for Aviation Emission Reductions	CARB	2027	2029

Air quality modeling indicated that Nitrogen Oxides (NO_X) emissions reductions are needed in the SFNA by 2032 in order to attain the standard by the attainment date. A significant fraction of the needed reductions will come from the existing control program. In addition, although most of the 2016 State SIP Strategy measure commitments have been adopted, there is one (Zero-Emission Forklift) that the CARB Board will be acting upon in 2023, and two that were recently adopted but are not yet accounted for in the baseline emissions inventory (Advanced Clean Cars II, Transport Refrigeration Unit Part 1), as outlined in Table 7-2 below.

[28] CARB finalization
[29] California Department of Pesticide Regulation

Table 7-2 Reductions from Remaining 2016 State SIP Strategy Measures

Measure	Action	Implementation Begins	2032 NO_X (tpd)	2032 ROG[30] (tpd)
Advanced Clean Cars II	2022	2026	0.4	0.4
Transport Refrigeration Unit Part I	2022	2023-2024	<0.1	<0.1
Zero-Emission Forklift	2023	2026	<0.1	<0.1
Total			0.5	0.4

Numbers may not add up due to rounding. Table 7-3 shows that, collectively, emissions reductions from CARB's current control program, reductions from the 2016 State SIP Strategy measures, and reductions estimated from the measures in the 2022 State SIP Strategy provide the emissions reductions needed from State sources to support attainment of the 70 parts per billion (ppb) 8-hour ozone standard in the SFNA. The measures in Table 7-4 reflect CARB commitments for State actions and the estimated emissions reductions for SFNA.

Table 7-3 SFNA NO_X Emission Reductions from CARB Programs

CARB Programs in the SFNA	2032 NO_X Emission Reductions (tons per day)[2]
Current Mobile Source Control Program[1]	31.5
Potential CARB Emissions Reductions	6.1
2016 State SIP Strategy Measures (Not yet in baseline inventory)	0.5
2022 State SIP Strategy Measures	5.6
Total Reductions	**37.5**

[1]Source: CARB 2019 CEPAM v1.04[31]
[2]Numbers may not add up due to rounding.

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31 California Emission Projection Analysis Model

Table 7-4 SFNA Expected Emissions Reductions from the 2022 State SIP Strategy Measures. (Unit: tons per day)

Measure	2032 NO_X (tpd)	2032 ROG (tpd)
On-Road Heavy-Duty		
Advanced Clean Fleets Regulation	0.8	<0.1
Zero-Emissions Trucks Measure	NYQ[1]	NYQ
Total On-Road Heavy-Duty Reductions	0.8	<0.1
On-Road Light-Duty		
On-Road Motorcycle New Emissions Standards	0.1	0.2
Clean Miles Standard	<0.1	<0.1
Total On-Road Light-Duty Reductions	0.1	0.2
Off-Road Equipment		
Tier 5 Off-Road Vehicles and Equipment	0.2	NYQ
Amendments to the In-Use Off-Road Diesel-Fueled Fleets Regulation	0.5	0.1
Transport Refrigeration Unit Regulation Part 2	0.4	<0.1
Commercial Harbor Craft Amendments	0.3	<0.1
Cargo Handling Equipment Amendments	<0.1	<0.1
Off-Road Zero-Emission Targeted Manufacturer Rule	NYQ	NYQ
Clean Off-Road Fleet Recognition Program	NYQ	NYQ
Spark-Ignition Marine Engine Standards	<0.1	0.1
Total Off-Road Equipment Reductions	1.5	0.3
Other		
Consumer Products Standards	-	NYQ
Zero-Emission Standard for Space and Water Heaters	NYQ	NYQ
Enhanced Regional Emission Analysis in State Implementation Plans	NYQ	NYQ
Pesticides: 1,3-Dichloropropene Health Risk Mitigation	-	NYQ
Total Other	NYQ	NYQ
Primarily-Federally and Internationally Regulated Sources – CARB Measures		
In-Use Locomotive Regulation	3.2	0.1
Future Measures for Aviation Emission Reductions	NYQ	NYQ
Total Primarily-Federally and Internationally Regulated Sources – CARB Measures Reductions	3.2	0.1
Aggregate Emissions Reductions[2]	**5.6**	**0.7**

1 Not yet quantified.
2 Numbers may not add up due to rounding.

As a part of the emissions reduction commitments for the SFNA, CARB commits to reduce emissions specifically from on-road mobile sources that will be used for transportation conformity. CARB continues to have a total emissions reduction commitment, which is a sum of emissions reductions from on- and off-road mobile sources, consumer products, and other State-regulated sources as outlined in Table 7-4. The on-road mobile source commitment in the 2022 State SIP Strategy will provide the enforceability needed to establish the motor vehicle emissions budgets (MVEB) that already account for the emissions reductions from the on-road mobile source measures. The emissions reductions shown in Table 7-5 from the proposed on-road mobile source commitment are a subset of the total emissions reductions from the state's emission reduction commitments.

Table 7-5 Emissions Reduction from On-Road Mobile Source Measures

On-Road Mobile Source Reductions	2032 NO_X (tpd)	2032 ROG (tpd)
Sacramento Metro	1.2	0.4

7.2.3 On-Road Heavy-Duty

7.2.3.1 Advanced Clean Fleets Regulation

This measure accelerates zero-emission vehicle (ZEV) adoption in the medium- and heavy-duty sectors by setting zero-emission requirements for fleets and 100 percent ZEV sales requirement in California for manufacturers of Class 2b through 8 vehicles. The Advanced Clean Fleets Regulation will focus on strategies to ensure that the cleanest vehicles are deployed by government, business, and other entities in California to meet their transportation needs. The requirements would be phased-in on varying schedules for different fleets including public, drayage trucks, and high priority private and federal fleets. Public fleets would be required to phase-in purchase requirement starting at 50 percent of new purchases in 2024 and 100 percent starting in 2027. All drayage trucks operating at seaports and intermodal railyards would be required to be zero-emission by 2035. Drayage trucks will also have new registration and reporting requirements, starting in 2023. High priority private and federal fleets would be required to phase-in zero-emission vehicles as a percentage of the total fleet. The fleet requirements are based on zero-emission suitability and are phased-in by vehicle body type. The Advanced Clean Fleets Regulation would also include a requirement that 100 percent of Class 2b and above vehicle manufacturer sales in California are zero-emissions starting in 2040.

7.2.3.2 Zero-Emission Trucks Measure

This measure would increase the number of ZEVs and require cleaner engines to achieve emissions reductions from fleets that are not affected by the proposed Advanced Clean Fleets measure. This would include potential zero-emissions zone concepts around warehouses and sensitive communities if CARB is given new authority to enact indirect source rules in combination with strategies to upgrade older trucks to newer and cleaner engines. This would be a transitional strategy to achieve zero-emissions medium- and heavy-duty vehicles everywhere feasible by 2045.

7.2.4 On-Road Light-Duty

7.2.4.1 On-Road Motorcycles New Emissions Standards

This measure would reduce emissions from new, on-road motorcycles by adopting more stringent exhaust and evaporative emissions standards along with limited on-board diagnostics requirements and zero-emissions sales thresholds with an associated credit program to help accelerate the development of zero emissions motorcycles. The new exhaust emissions standards include substantial harmonization with the more stringent European motorcycle emissions standards already in place. The new evaporative emissions standards are based on more aggressive CARB off-highway recreational vehicle emissions standards that exist today. This measure also proposes significant zero-emission motorcycle sales thresholds beginning in 2028 and increasing gradually through 2035.

7.2.4.2 Clean Miles Standard

The Clean Miles Standard was adopted by CARB on May 20, 2021. The primary goals of this measure are to reduce greenhouse gases (GHG) emissions from ride-hailing services offered by transportation network companies (TNCs) and promote electrification of the fleet by setting an electric vehicle mile target, while achieving criteria pollutant co-benefits. TNCs would be required to achieve zero grams carbon dioxide (CO_2) emissions per passenger mile traveled and 90 percent electric vehicle miles traveled (VMT) by 2030.

7.2.5 Off-Road Equipment

7.2.5.1 Tier 5 Off-Road Vehicles and Equipment

This measure would reduce NO_X and particulate matter (PM) emissions from new off-road compression-ignition (CI) engines by adopting more stringent exhaust standards for all power categories, including those that do not currently utilize exhaust aftertreatment such as diesel particulate filters and selective catalytic reduction. This measure would be more stringent than required by current EPA and European Stage V nonroad regulations and would require the use of best available control technologies.

For this measure, CARB staff would develop and propose standards for new off-road CI engines including the following: aftertreatment-based PM standards for engines less than 19 kilowatt (kW) (25 horsepower [hp]), aftertreatment-based-NO_X standards for engines greater than or equal to 19kW (25hp) and less than 56 kW (75 hp), and more stringent PM and NO_X standards for engines greater than or equal to 56 kW (75 hp). Other possible elements include enhancing in-use compliance, proposing more representative useful life periods, and developing a low load test cycle. It is expected that this comprehensive off-road Tier 5 regulation would rely heavily on technologies manufacturers are developing to meet the recently approved low NO_X standards and enhanced in-use requirements for on-road heavy-duty engines.

7.2.5.2 Amendments to the In-Use Off-Road Diesel-Fueled Fleets Regulation

Amendments to the In-Use Off-Road Diesel-Fueled Fleets Regulation were approved by CARB on November 17, 2022. This measure will further reduce emissions from the in-use off-road diesel equipment sector by adopting more stringent requirements to the In-Use Off-Road Diesel-Fueled Fleets Regulation. These amendments create additional requirements to the currently regulated fleets by targeting the oldest and dirtiest equipment that is allowed to operate indefinitely under the current regulation’s structure.

The amendments include an operational backstop to the current In-Use Off-Road Diesel-Fueled Fleets Regulation for most Tiers 0, 1, and 2 engines between 2024 and 2032. This will allow a 12-year phase out of these oldest engines. Along with the operational backstop, adding vehicle provisions in the current regulation will be extended to phase in a limitation on the adding of Tier 3 and Tier 4i vehicles to fleets. The amendments also include proposed new requirements for most fleets to use renewable diesel, proposed requirements for prime contractors and public works awarding bodies to increase the enforceability of the regulation, and optional flexibility provisions for fleet adoption of zero-emission vehicles.

7.2.5.3 Transport Refrigeration Unit Regulation Part 2 (Non-Truck TRUs)

This measure is the second part of a two-part rulemaking to transition diesel-powered transport refrigeration units (TRUs) to zero-emission technologies. This measure would require zero-emission equipment for non-truck TRUs (trailer TRUs, domestic shipping container TRUs, railcar TRUs, TRU generator sets, and direct-drive refrigeration units).

7.2.5.4 Commercial Harbor Craft Amendments

The Commercial Harbor Craft Amendments were approved by CARB on March 24, 2022. This measure proposes that starting in 2023 and phasing in through 2031, most commercial harbor crafts (CHCs) (except for commercial fishing vessels and categories listed below) would be required to meet the cleanest possible standard (Tier 3 or 4) and retrofit with diesel particulate filters (DPFs) based on a compliance schedule. The current regulated CHC categories are ferries, excursion, crew and supply, tug/tow boats, barges, and dredges. The amendments would impose in-use requirements on the rest of vessel categories except for commercial fishing vessels, including workboats, pilot vessels, commercial passenger fishing, and all barges over 400 feet in length or otherwise meeting the definition of an ocean-going vessel. The amendments would also remove the current exemption for engines less than 50 hp.

The measure also proposes that, starting in 2025, all new excursion vessels be required to be plug-in hybrid vessels that are capable of deriving 30 percent or more of combined propulsion and auxiliary power from a zero-emission tailpipe emission source. Starting in 2026, all new and in-use short run ferries would be required to be zero-emission; and starting in 2030 and 2032, all commercial fishing vessels would need to meet a Tier 2 standard at minimum.

7.2.5.5 Cargo Handling Equipment Amendments

This measure would start transitioning Cargo Handling Equipment (CHE) to full zero-emission in 2026, with over 90 percent penetration of ZE equipment by 2036. Based on the current state of zero-emission CHE technological developments, the transition to zero-emission would most likely be achieved largely through the electrification of CHE. This assumption about aggressive electrification is supported by the fact that currently some electric Rubber Tired Gantry (RTG) cranes, electric forklifts, and electric yard tractors are already commercially available. Other technologies are in early production or demonstration phases.

7.2.5.6 Off-Road Zero-Emission Targeted Manufacturer Rule

The Off-Road Zero-Emission Targeted Manufacturer Rule would accelerate the development and production of zero-emission off-road equipment and powertrains. Existing zero-emission regulations and regulations currently under development target a variety of sectors (e.g., forklifts, cargo handling equipment, off road fleets, Small Off-Road Engines (SORE), etc.). However, as technological advancements occur, more sectors including wheel loaders, excavators, and bulldozers could be accelerated. Fully addressing control of emissions from new farm and construction equipment under 175 hp that are preempted, will require partnership on needed Federal zero-emission standards for off-road equipment.

This measure would require manufacturers of off-road equipment and/or engines to produce for sale zero-emission equipment and/or powertrains as a percentage of their annual statewide sales volume. Sales/production mandate levels would be developed based on the projected feasibility of zero-emission technology to enter and grow in the various off-road equipment types currently operating in California. This measure is expected to increase the availability of zero-emission options in the off-road sector and support other potential measures that promote and/or require the purchase and use of such options. A targeted manufacturer regulation will need to take into account parameters such as the number of equipment and engine manufacturers producing off-road equipment for sale in California, along with sales volumes, to ensure that such an effort is cost effective and technologically feasible.

7.2.5.7 Clean Off-Road Fleet Recognition Program

This measure would create a non-monetary incentive to encourage off-road fleets to go above and beyond existing regulatory fleet rule compliance and adopt advanced technology equipment with a strong emphasis on zero-emission technology. The Clean

Off-Road Fleet Recognition Program would provide a standardized methodology for contracting entities, policymakers, state and local government, and other interested parties to establish contracting criteria or require participation in the program to achieve their individual policy goals.

The Clean Off-Road Fleet Recognition Program framework would encourage entities with fleets to incorporate advanced technology and zero-emission vehicles into their fleets, prior to or above and beyond regulatory mandates based on fleet size. The program would provide standardized criteria or a rating system for participation at various levels to reflect the penetration of advanced technology and zero-emission vehicles into a fleet. Levels could be scaled over time as zero-emission equipment becomes more readily available. CARB anticipates the next several years of technological advancements and demonstrations to drive the stringency of the rating system. Participation in the program would be voluntary for entities with fleets, however, designed in a manner that provides them motivation to go beyond business as usual. The program would offer value for entities with fleets to participate by potentially providing them increased access to jobs/contracts, public awareness, and marketing opportunities.

7.2.5.8 Spark-Ignition Marine Engine Standards

For this measure, CARB will develop and propose catalyst-based standards for outboard and personal watercraft engines less than or equal to 40 kW in power that will gradually reduce emission standards to approximately 70 percent below current levels. For outboard and personal watercraft engines under 40 kW, more stringent exhaust standards will be developed and proposed based on the incorporation of electronic fuel injection that will gradually reduce emission standards 40 percent below current levels. This measure would require a 5.0 grams per kW hour of hydrocarbon (HC) and NO_X (g/kW-hr HC+NO_X) standard for outboard engines and personal watercraft engines at or above 40 kW in power and a 10.0 g/kW-hr HC+NO_X standard for engines less than 40 kW.

In addition to requiring more stringent exhaust standards, CARB is considering actions consistent with Executive Order N-79-20 that would require a percentage of outboard and personal watercraft vessels to be propelled by zero-emission technologies for certain applications. Outboard engines less than 19 kW, which are typically not operated aggressively or for extended periods, could potentially be phased-out and gradually replaced with zero-emission technologies. Some personal watercraft applications could also potentially be replaced with zero-emission technologies.

7.2.6 Others

7.2.6.1 Consumer Products Standards

This measure will further reduce Volatile Organic Compounds (VOC) and equivalent VOC emissions from consumer products to expedite attainment of national ambient air quality standards for ozone. As with previous rulemakings, emission reductions will be achieved by setting regulatory standards applicable to the content of consumer products. To meet emission reduction targets for the measure, CARB staff will evaluate categories with relatively high contributions to ozone formation, whether currently regulated or unregulated. Staff will consider the merits of proposing VOC content standards as well as reactivity limits. Staff developing proposed amendments to the Consumer Products Regulation will also consider investigating concepts for expanding manufacturer compliance options, market-based approaches, and reviewing existing exemptions. Staff will work with stakeholders to explore mechanisms that would encourage the development, distribution, and sale of cleaner, very low, or zero-emitting products. In undertaking these efforts staff will prioritize strategies that achieve the maximum feasible reductions in ozone forming, toxic air contaminant, and GHG emissions. This measure complements a parallel measure in CARB's Climate Change Scoping Plan Update, approved by the CARB Board in December 2022, to phase down use of HFC-152a[32] and other GHGs in consumer products.

7.2.6.2 Zero-Emission Standard for Space and Water Heaters

For this measure, CARB would develop and propose zero GHG emission standards for space and water heaters sold in California; CARB could also work with air districts to further tighten district rules to drive zero-emission technologies. This measure would not mandate retrofits in existing buildings, but some buildings would require retrofits to be able to use the new technology that this measure would require. Beginning in 2030, 100 percent of sales of new space and water heaters (for either new construction or replacement of burned-out equipment in existing buildings) would need to meet zero-emission standards. It is expected that this regulation would rely heavily on heat pump technologies currently being sold to electrify new and existing homes.

7.2.6.3 Enhanced Regional Emissions Analysis in SIPs

The primary goal of this measure is to reduce criteria pollutant and GHG emissions that come from on-road mobile sources through reductions in VMT. In addition, lowering VMT will help alleviate traffic congestion, improve public health, reduce consumption of fossil fuels, and reduce infrastructure costs. CARB is exploring three options to reduce ROG and NO_X emissions through reductions in VMT. First, CARB will consider whether and how to change the process for developing MVEB by evaluating the existing MVEB development process to meet NAAQS. In addition, CARB will assess and improve the RACM analysis in the SIP by providing a comprehensive list of TCMs and emission quantification methodology. Finally, CARB will consider updating the guidelines for the California Motor Vehicle Registration Fee (MV Fees) Program and the Congestion

[32] HFC-152a is an abbreviation of hydrofluorocarbon-152a and its chemical formula is $C_2H_4F_2$. It is a colorless organofluorine compound and mainly used as a refrigerant and propellant for aerosol sprays and in gas duster products.

Mitigation and Air Quality Improvement (CMAQ) Program to fund a broader range of transportation and air quality projects that advance new approaches and technologies in reducing air pollution.

7.2.6.4 Pesticides: 1,3-Dichloropropene Health Risk Mitigation

Pesticides are regulated under both federal and state law. DPR is the agency responsible for regulating the sale and use of pesticides in California. DPR can generally reduce exposures to pesticides through the development and implementation of necessary restrictions on pesticide sales and use and by encouraging integrated pest management. Considered a VOC, 1,3-Dichloropropene (1,3-D) is a fumigant used to control nematodes, insects, and disease organisms in soil.

DPR is developing a regulation to address both cancer and acute risk to non-occupational bystanders from the use of 1,3-D. DPR released their regulatory package and noticed their rulemaking hearing for 1,3-D on November 15, 2022. The regulation will be developed in consultation with the County Agricultural Commissioners (CACs), the local air districts, CARB, the Office of Environmental Health Hazard Assessment (OEHHA), and the California Department of Food and Agriculture (CDFA). Once implemented, DPR's regulation would require applicators to use totally impermeable film (TIF) tarpaulins or other mitigation measures that provide a comparable degree of protection from exposure.

7.2.7 Primarily-Federally and Internationally Regulated Sources – CARB Measures

In addition to reducing emissions from the above sources, it is critical to achieve emissions reductions from sources that are primarily regulated at the federal and international level. It is imperative that the federal government and other relevant regulatory entities act decisively to reduce emissions from these primarily-federally and internationally regulated sources of air pollution. CARB and the air districts in California have taken actions to not only petition federal agencies for action, but also to directly reduce emissions using programmatic mechanisms within our respective authorities. CARB continues to explore additional actions, many of which may require a waiver or authorization under the Clean Air Act (CAA), as described below.

7.2.7.1 In-Use Locomotive Regulation

This measure would use mechanisms available under CARB's regulatory authority to accelerate the adoption of advanced, cleaner technologies, and include zero emission technologies, for locomotive operations. The In-Use Locomotive Regulation would apply to all locomotives operating in the State of California with engines that have a total rated power of greater than 1,006 horsepower, excluding locomotive engines used in training of mechanics, equipment designed to operate both on roads and rails, and military locomotives. The measure reduces emissions by increasing use of cleaner diesel locomotives and zero emission locomotives through a spending account, in-use operational requirements, and by an idling limit. By July 1, 2024, a spending account would be established for each locomotive operator. Funds in the account would only be used toward Tier 4 or cleaner locomotives until 2030, and at any time toward zero-emission locomotives, zero-emission pilot or demonstration projects, or zero-emission infrastructure.

For the in-use operational requirements, beginning January 1, 2030, only locomotives built after January 1, 2007, may operate in California. Each year after January 1, 2030, only locomotives less than 23 years old may operate in California. Additionally, under the in-use operational requirements, starting January 1, 2030, all switch, industrial, and passenger locomotives operating in California with an original engine build date 2030 or newer will be required to be zero emission. Starting January 1, 2035, all freight line haul locomotives operating in California with an original engine build date 2035 or newer must be zero emission. Locomotives equipped with automatic engine stop/start systems are to idle no more than 30 minutes unless an exemption applies. Also, locomotive operators would report locomotive engine emissions levels and activity on an annual basis.

7.2.7.2 Future Measures for Aviation Emissions Reductions

Future measures for aviation would reduce emissions from airport and aircraft related activities. The identified emission sources for the aviation sector are main aircraft engines, auxiliary power units (APU), and airport ground transportation. Emission reductions can be achieved by pursuing incentive and regulatory measures.

CARB would evaluate federal, state, and local authority in setting operational efficiency practices to achieve emission reductions. Operational practices include landing, takeoff, taxiing, and running the APU, and contribute to on-ground and near-ground emissions. Near ground emissions are emissions between ground level up to 3,000 feet. Operational practices such as de-rated take-off and reduced power taxiing have the potential to achieve emission reductions.

CARB would similarly work with EPA, Air Districts, airports, and industry stakeholders in a collaborative effort to develop regulations, voluntary measures, and incentive programs. CARB would evaluate the incentive amounts that would be required to encourage aircrafts to voluntarily use cleaner engines and fuels. Incentives to encourage the use of cleaner engines and fuels for aircraft in California would involve identification of funding sources and implementation mechanisms such as development of new programs.

7.3 Existing Statewide Mobile Source Program

Given the severity of California’s air quality challenges and the need for ongoing emission reductions, CARB has implemented the most comprehensive mobile source emissions control programs in the nation. These programs have achieved significant emission reductions across all mobile source sectors that go far beyond national programs or programs in other states. These efforts extended back to the first mobile source regulations adopted in the 1960s, and predated the CAA of 1970, which established the basic national framework for controlling air pollution. In recognition of the pioneering nature of CARB's efforts, the CAA 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 CAA Section 209(b). Appendix C.I provides a detailed discussion of all the new statewide control measures and incentive programs. These current control measures and incentive programs are essential emissions strategies for the SFNA SIP to achieve attainment by 2032.

7.4 Existing Local Control Program

The California Health and Safety Code §40000 delegates authority to local air districts for control of air pollution from all stationary and some area-wide sources. Local air districts can adopt and implement rules for controlling the emissions from these sources. The SFNA air districts have been regulating air pollution sources since the 1970s. Existing rules and their emission benefits have helped and will continue to help make progress toward achieving the region's clean air goals. Tables 7-6 and 7-7 summarize the existing control measures from each SFNA air district, and Appendix C.II briefly describes the existing VOC and NO_X measures.

The benefits from these existing measures are already reflected in the baseline year 2017 and attainment year 2032 emissions inventory (see Chapter 5). The photochemical modeling results show that the SFNA will rely on existing federal, state, and local control programs along with committed state control measures to attain the standard by the attainment deadline. No new local control measures are committed in this plan for attainment purposes.

Table 7-6 Summary of existing local control measures for VOC

VOC Source Category	El Dorado AQMD	Feather River AQMD	Placer County APCD	Sacra-mento Metro AQMD	Yolo-Solano AQMD
Adhesives	X		X	X	X
Architectural Coatings	X	X	X	X	X
Asphalt Paving Material	X		X	X	X
Bakeries				X	
Bulk Terminal	X	X	X	X	X
Confined Animal Facility	X	X	X	X	X
Drying Cleaning	X			X	X
Fugitive Emissions	X			X	X
Gasoline Dispensing Facility	X	X	X	X	X
Graphic Arts	X		X	X	X
Landfill Gas		X		X	X
Polyester Resin Operations	X		X	X	X
Semiconductor Manufacturing			X		
Surface Coating Operations	X	X	X	X	X
Surface Preparation and Cleanup	X	X	X	X	X
Synthetic Organic Chemical Manufacturing Industry				X	X

Table 7-7 Summary of existing local control measures for NO_X

NO_X Source Category	El Dorado AQMD	Feather River AQMD	Placer County APCD	Sacra-mento Metro AQMD	Yolo-Solano AQMD
Boilers & Steam Generators	X	X	X	X	X
Gas Turbines			X	X	X
Internal Combustion Engines	X	X	X	X	X
Residential & Small Water Heaters	X	X	X	X	X
Central Furnace/Miscellaneous Combustion Unit				X	X

7.5 Local New Source Review (NSR) Program

In addition to the local existing VOC and NO_X control measures described in Section 7.4, the SFNA air districts have established local new source review programs that require new or modified stationary sources to implement the most stringent emission limit and/or offset their emissions impacts. The program requirements are established in the New Source Review rules adopted for each SFNA district shown below. These rules set the requirements for reviewing permit applications for new and modified sources for Best Available Control Technology (BACT)[33], emission offsets, emission calculation procedures, and other administrative permitting requirements.

Table 7-8 SFNA Air Districts' New Source Review Program

SFNA Air District	New Source Review Program (Initial Adoption Date)
El Dorado AQMD	Rule 523 – New Source Review (4/26/1994)
Feather River AQMD	Rule 10.1 – New Source Review (2/8/1993)
Placer County APCD	Rule 502 – New Source Review (11/12/1974)
Sacramento Metro AQMD	Rule 202 – New Source Review (9/20/1976)
Yolo-Solano AQMD	Rule 3.4 – New Source Review (12/11/1996)

7.6 TCMs

TCMs are strategies used to reduce motor vehicle emissions. TCMs may reduce vehicle trips, vehicle use, vehicle miles traveled, vehicle idling, or traffic congestion. SACOG is the Metropolitan Planning Organization (MPO) for the greater Sacramento region (includes Sacramento, Yolo, Placer, El Dorado, Sutter, and Yuba Counties). SACOG provides transportation planning and funding for the region and has worked with local governments and the SFNA air districts to develop and implement TCMs. For example, one of the TCMs developed for the previous attainment plans for the SFNA is the Spare The Air program, a program that has achieved a high level of public awareness.

Implemented TCMs are included in the measured baseline activity in the SACOG transportation model. This baseline activity data was used to forecast future projections for the motor vehicle inventory.

There are transportation planning implications associated with including TCMs in a SIP. Each time the MPO makes a conformity determination to accompany a new Metropolitan Transportation Plan (MTP), a new Metropolitan Transportation Improvement Program (MTIP), or an amendment to either document, it must demonstrate that all TCMs are still on track to be implemented in a timely fashion. If a TCM does not stay on schedule, the MPO must show that all State and local agencies with influence over approvals or funding for TCMs are giving maximum priority to approve or fund TCMs over other projects within their control. The MPO and other responsible agencies would have to either ensure that the TCM is able to get back on schedule or substitute for another TCM. The MPO may

[33] Best Available Control Technology (BACT) is the requirement that certain air pollution sources install equipment or employ administrative practices that will result in the lowest achievable emission rate. The lowest achievable emission rate is defined by the California state law as: 1) The most stringent emission limitation contained the State Implementation Plan for the particular class or category of source, unless the owner of the source demonstrates that the limitation is not achievable, or 2) The most stringent emission limitation that is achieved in practice by that class or category or source.

not be able to demonstrate conformity on a new or amended MTP or MTIP if a TCM is failing.

In addition, the Transportation Conformity Rule (40 CFR 93.103) states that “When assisting or approving any action with air quality-related consequences, Federal Highway Authority (FHWA) and Federal Transit Administration shall give priority to the implementation of those transportation portions of an applicable implementation plan prepared to attain and maintain the NAAQS.”

Based on suggestions received from interagency consultation and discussions with transportation and air quality stakeholders via the Regional Planning Partnership (RPP), SACOG formally refines the types of projects to be included as TCMs during the SIP and/or MTIP and MTIP Guidelines development process. During the regular update cycle for the MTP and MTIP, SACOG, in coordination with the RPP, will refine and revise TCM descriptions and definitions to clarify the general TCM process as well as resolve specific implementation issues. SACOG works with the project implementing agencies, air quality stakeholders, and any other interested parties, primarily through the RPP, to facilitate the TCM process and implement TCMs appropriately.

SACOG is responsible for ensuring that TCM strategies are funded in a manner consistent with the implementation schedule established in the MTIP at the time a project is identified as a TCM commitment. The transportation conformity process is designed to ensure timely implementation of TCM strategies. If the implementation of a TCM strategy is delayed, or if a TCM strategy is only partially implemented, the emission reduction shortfall must be made up by either substituting a new TCM strategy or by enhancing other control measures. The criterion for this process is discussed in the Guidance for implementing the CAA Section 176 (c)(8) Transportation Control Measure Substitution and Addition Provision (EPA, 2009).

SACOG conducted an evaluation of transportation control measures (SACOG, 2022), which consisted of: 1) strategies identified through a comprehensive review of implemented TCMs in California, as well as other states; and 2) statewide and mobile source emission reduction strategies. Since no new local or regional measures are needed for achieving or accelerating attainment, SACOG did not commit to any TCMs, except the continuation of the Spare The Air Program from the last ozone attainment plan.

7.6.1 Spare the Air program

The Spare the Air program is included as a TCM commitment in this attainment plan. This program is a public education program with an episodic ozone reduction element during the summer ozone season, plus general awareness throughout the rest of the year. This program was originally created in 1995 to engage the general public in voluntarily helping to solve the problem of ozone air pollution. The program is designed to protect public health by informing residents when air quality is unhealthy and achieving voluntary emission reductions. This is done by encouraging residents to reduce vehicle trips, reduce their commute time, take public transportation, and spend less time in their cars.

This program is implemented by the SMAQMD and benefits all the air districts within the SFNA. Information conveyed through Spare The Air, such as alerts, further encourages people to use alternative modes by promoting public transits and alternative modes of transportation. The Spare the Air program is included in the 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS) as an air quality improvement program to reduce vehicle miles traveled on bad air quality days and as a strategy contained under Policy 8[34] (SACOG, 2019). This 2020 MTP/SCS was adopted by the SACOG Board on November 18, 2019.

The Spare The Air program is a non-regulatory transportation control measure. The air districts receive approximately $600,000 per year from a Congestion Mitigation & Air Quality Improvement (CMAQ) grant. The funding is provided by the Federal Highway Administration but appropriated through SACOG. SACOG secured funding for Spare The Air program as a TCM from 2025 thru 2032, which is the SFNA's attainment year for the 2015 ozone NAAQS.

7.7 RACM Analysis

EPA's final 2015 NAAQS SIP Requirement Rule (83 FR 62998) requires that the attainment demonstration include a demonstration that it has adopted all RACM necessary to demonstrate attainment "as expeditiously as practicable" and to meet any Reasonable Further Progress (RFP) requirements. EPA interprets "as expeditiously as practicable" to mean measures that, when considered cumulatively, could advance attainment by a year. The evaluation of RACM was completed by CARB for source categories under the State's control, by the SFNA air districts for local stationary and some area-wide sources, and by SACOG for TCMs.

CARB evaluated RACM for different source categories under the State's control, including mobile sources, consumer products, and pesticides. Evaluation of mobile sources category included the analyses of light- and medium-duty vehicles, heavy-duty vehicles, off-road vehicles and engines, marine sources, and mobile source fuels. CARB found that with the current mobile source control program and new commitments in the 2022 State SIP Strategy, there are no additional RACMs. For consumer products and pesticides, California's Consumer Products Program with the most stringent VOC requirement and Department of Pesticide Regulation's pesticide regulations represent all measures that are technologically and reasonably available. There are no additional RACMs for consumer products or pesticides. RACM analysis for State sources is discussed in detail in Appendix D.1.

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[34] This policy state that it is necessary to support and invest in strategies to reduce vehicle emissions that can be shown as cost effective to help achieve and maintain clean air and better public health.

The analysis of stationary and some area-wide source control measures included an initial 210 local measures that potentially could be implemented by the SFNA air districts, as shown in Appendix D.2. For each measure, the emissions inventory, potential reductions, and cost effectiveness were estimated. Ninety-six measures were removed from further consideration because either there were no emission sources, or the cost effectiveness of the measure was excessive and beyond reasonable. These measures included limited NO_X reductions from already well-controlled emission sources, such as boilers, IC engines, flares, miscellaneous combustion devices, and open burning. The VOC and NO_X emissions of the remaining measures were summed.

For TCMs, out of the approximately 200 measures identified as candidate RACM, none were found to meet the criteria for RACM implementation. Based on a comprehensive review of TCM projects in other nonattainment areas, it was determined that the TCMs being implemented in the Sacramento region represent all TCM RACM. None of the candidate measures reviewed, and determined to be infeasible, meet the criteria for RACM implementation. These measures were found to be economically infeasible, or the agency had no authority to implement the measures (Seitz, 1999). SACOG's TCMs RACM analysis is included in Appendix D.3.

To determine if the SFNA can advance attainment by one year, the amount needed to advance attainment is determined by comparing the emissions inventories for 2031 and 2032. The emissions differences between those years are 0.815 tpd of NO_X and 0.427 tpd of VOC. However, advancement may also be achieved by a greater reduction in NO_X emissions and a smaller reduction in VOC emissions, and vice versa. Therefore, the amounts needed to advance attainment were put on a common basis of "NO_X equivalents" to perform the analysis. A sensitivity analysis performed by CARB for the 2019, 2020, and 2021 peak design value site, Auburn, showed that NO_X emissions reductions are 41.9 times more effective in reducing ozone concentrations than VOC emissions reductions. See Appendix D.4 for the results of the sensitivity analysis performed by CARB. The difference in NO_X equivalents between 2031 and 2032 is $0.815 + 0.427/41.9 \approx 0.825$ tpd.

The potential RACM measures, in total, could achieve 0.457 tpd of NO_X reductions and 3.04 tpd in VOC reductions. The reduction in NO_X equivalents is $0.457 + 3.04/41.9 \approx 0.530$ tpd. This is less than the 0.825 tpd amount required to advance attainment by a year. Therefore, the conclusion of this analysis is there are no RACM measures, when considered cumulatively, that can advance attainment by one year.

7.8 Summary

The SFNA relies on existing federal, state, and local programs that have been reducing and will continue to reduce ozone precursor emissions to attain the 2015 ozone standard by the end of 2032. In addition to the existing programs, CARB has committed to adopting and implementing statewide control measures. These state strategies include on-road light-duty and heavy-duty vehicles regulations and emissions standards, off-road equipment control strategies, consumer products, emissions standards for space and water heaters, enhanced emissions analysis, and pesticides. For regional measures, SACOG will continue the current Spare The Air Program TCM and fund the program through 2032. Aside from the continuation of the TCM, no new local or regional control measures were needed for attainment purposes, including meeting the requirements for demonstrating RFP. CARB, the SFNA air districts and SACOG also conducted a RACM analysis that showed the collection of all reasonably available control measures would not advance attainment by one year.

7.9 References

CARB. *2022 State Implementation Plan Strategy*. Sacramento, CA: California Air Resources Board. 20 September 2022. Web 7 November 2022 < https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf >

EPA. (83 FR 62998–63006) *Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements: Final Rule.* Federal Register, Volume 83, 6 December 2018, p. 62998 – 63006. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2018-12-06/pdf/2018-25424.pdf >

---. *Guidance for implementing the Clean Air Act Section 176 (c)(8) Transportation Control Measure Substitution and Addition Provision, EPA-420-B-09-002*. Washington, D.C.: U.S. Environmental Protection Agency Transportation and Regional Programs Division Office of Transportation and Air Quality. January [2009.] Web. 05 June 2023. < http://www.scag.ca.gov/Documents/Section176-Guide-Jan08.pdf >

---. *Procedures for Determining Regional Transportation Related Emissions*, 40 CFR §93.103. Web 05 June 2023 < https://www.govinfo.gov/content/pkg/CFR-1996-title40-vol9/html/CFR-1996-title40-vol9-sec93-130.htm >

Seitz, John. *Guidance on the Reasonably Available Control Measures (RACM) Requirement and Attainment Demonstration Submissions for Ozone Nonattainment Area.* U.S. EPA, Office of Air Quality Planning and Standards. 30 November [1999.] Web. 13 April 2017. < https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19991130_seitz_racm_guide_ozone.pdf >

SACOG. *2020 Metropolitan Transportation Plan/Sustainable Communities Strategy. Sacramento, CA: Sacramento Area Council of Governments.* 18 November [2019.] Web. 23 March 2020. < https://www.sacog.org/sites/main/files/file-attachments/2020_mtp-scs.pdf?1580330993 >

---. *Reasonably Available Control Measure Analysis for the 2015 Ozone Standard.* Sacramento, CA: Sacramento Area Council of Governments. 22 September [2022.] Web. 05 June 2023 < https://www.sacog.org/sites/main/files/file-attachments/092822-rpp-racm_analysis_2015_ozone.pdf?1664226931 >

8 CONTINGENCY MEASURES

8.1 Opportunities for Contingency Measures

Contingency measures are required by the Clean Air Act (CAA) Sections 172 and 182 to be implemented quickly if triggered when an area fails to make reasonable further progress (RFP) or attain the National Ambient Air Quality Standards (NAAQS) by the required date. Over the last few years, multiple court decisions by the United States Court of Appeals for the Ninth Circuit (Ninth Circuit) and in other parts of the country have effectively disallowed the State Implementation Plan (SIP-)approved approach which the California Air Resources Board (CARB), the local air districts and the rest of the country have historically used to meet contingency measure requirements. The U.S Environmental Protection Agency (EPA) released new draft guidance on March 17, 2023 (EPA, 2023)(88 FR 17571) to provide states direction in response to the court decisions. Unfortunately, the draft guidance does not comprehensively address all of the issues related to contingency measures and will not be final for months. Timely, comprehensive, and practical final guidance is needed for CARB, local air districts, and other air agencies across California and the country, to ensure that the significant resources devoted to creating, adopting, and implementing a contingency measure result in a measure or measures that meets federal requirements and can be approved into the SIP. To meet our commitment to satisfy the contingency planning requirements, while recognizing the impracticality of doing so before final guidance is adopted, contingency measure commitments are included in this SIP, as well as a commitment to review the final EPA contingency measure guidance and adopt additional measures necessary to satisfy the final guidance provisions.

California faces the most difficult air quality challenges in the nation and, accordingly, leads the country with the most stringent air pollution control programs. Historically, EPA guidance required contingency measures to achieve approximately one year's worth of emission reductions in the context of RFP. The new draft guidance proposes to change the calculation of one year's worth of emissions reductions such that it connects more directly to attainment inventories (termed now as "one year's worth of progress") and thereby reduces the amount needed for contingency measures. However, CARB's and local air districts' control programs are advanced, and primarily-federally regulated sources contribute over half of the mobile source Nitrogen Oxides (NO_X) emissions. Thus, opportunities for a triggered contingency measure that can be implemented by the State and local air districts and can result in one year's worth of progress in the required time frame are not readily available. Further, if any State measure that could achieve this level of emission reductions existed, it would be adopted to improve air quality and support attainment of the NAAQS and would not be withheld for contingency purposes. While EPA finalizes its draft guidance, California has continued to work towards meeting contingency measure requirements, conducting an in-depth analysis of all CARB regulations to identify potential contingency measures. Based on the evaluation of possible measures to address contingency measure requirements, CARB has identified the proposed California Smog Check Contingency Measure[35], which, if adopted by the CARB Board, will be submitted to EPA for incorporation into the SIP. CARB is currently developing this statewide contingency measure to help fulfill contingency measure requirements for the Sacramento Metro and other nonattainment areas, with a target for Board consideration in October 2023. At the local levels, the SFNA air districts commit to amend their architectural rules by May/June 2024. If adopted by the air districts' boards, the measures will be forwarded to CARB for review and then, the EPA to be included into the SIP. The air districts also commit to perform a detailed and thorough analysis of all available control measures and to re-evaluate the contingency measure requirements upon EPA's issuance of the final guidance.

8.2 Background

The CAA specifies that SIPs must 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…." The CAA is silent though on the specific level of emission reductions that must flow from contingency measures. In the absence of specific requirements for the amount of emission reductions required, in 1992, EPA conveyed that the contingency measures should, at a minimum, ensure that an appropriate level of emissions reduction progress continues to be made if attainment of RFP is not achieved and additional planning by the State is needed (57 FR 13510, 13512 (April 16, 1992)). Further, EPA ozone guidance states that "contingency measures should represent one year's worth of progress amounting to reductions of 3 percent of the baseline emissions inventory for the nonattainment area". EPA, though, has accepted contingency measures that equal less than one year's worth of RFP when the circumstances fit under "EPA's long-standing recommendation that states should consider 'the potential nature and extent of any attainment shortfall for the area' and that contingency measures 'should represent a portion of the actual emissions reductions necessary to bring about attainment in the area[36].'"

Historically, EPA allowed contingency measure requirements to be met via excess emission reductions from ongoing implementation of adopted emission reduction programs, a method that CARB and local air districts have used to meet contingency measure requirements and EPA has approved in the past. In 2016, in Bahr v. EPA[37] (Bahr), the Ninth Circuit determined EPA erred in approving a contingency measure that relied on an already-implemented measure for a nonattainment area in Arizona, thereby

[35] https://ww2.arb.ca.gov/resources/documents/california-smog-check-contingency-measure
[36] See 78 FR. 37741- 37750 (Jun. 24, 2013), approval finalized with 78 FR 64402 (Oct. 29, 2013).
[37] Bahr v. U.S. Environmental Protection Agency, (9th Cir. 2016) 836 F.3d 1218.

rejecting EPA's longstanding interpretation of section 172(c)(9). EPA staff interpreted this decision to mean that contingency measures must include a future action triggered by a failure to attain or failure to make RFP. This decision was applicable to the states covered by the Ninth Circuit. In the rest of the country, EPA still allowed contingency measures using their pre-Bahr stance. In January 2021, in Sierra Club v. Environmental Protection Agency[38], the United States Court of Appeals for the D.C. Circuit, ruled that already implemented measures do not qualify as contingency measures for the rest of the country (Sierra Club).

In response to Bahr and as part of the 75 ppb 8-hour ozone SIPs due in 2016, CARB developed the statewide Enhanced Enforcement Contingency Measure (Enforcement Contingency Measure) as a part of the 2018 Updates to the California State Implementation Plan to address the need for a triggered action as a part of the contingency measure requirement. CARB worked closely with EPA regional staff in developing the contingency measure package that included the triggered Enforcement Contingency Measure, a district triggered measure and emission reductions from implementation of CARB's mobile source emissions program. However, as part of the San Joaquin Valley 2016 Ozone Plan for 2008 8-hour Ozone Standard SIP action, EPA wrote in their final approval that the Enforcement Contingency Measures did not satisfy requirements to be approved as a "standalone contingency measure" and approved it only as a "SIP strengthening" measure. EPA did approve the district triggered measure and the implementation of the mobile reductions along with a CARB emission reduction commitment as meeting the contingency measure requirement for this SIP.

Subsequently, the Association of Irritated Residents filed a lawsuit against EPA for their approval of various elements within the San Joaquin Valley 2016 Ozone Plan for 2008 8-hour Ozone Standard, including the contingency measure. The Ninth Circuit issued its decision in Association of Irritated Residents v. EPA[39] (AIR) that EPA's approval of the contingency element was arbitrary and capricious and rejected the triggered contingency measure that achieves much less than one year's worth of RFP. Most importantly, the Ninth Circuit said that, in line with EPA's longstanding interpretation of what is required of a contingency measure and the purpose it serves, together with Bahr, all reductions needed to satisfy the CAA's contingency measure requirements need to come from the contingency measure itself and the amount of reductions needed for contingency should not be reduced by the fact of surplus emission reductions from ongoing programs absent EPA formally changing its historic stance on the amount of reductions required. EPA staff has interpreted AIR to mean that triggered contingency measures must achieve the entirety of the required one year's worth of emission reductions on their own. In addition,

38 Sierra Club v. Environmental Protection Agency, (D.C. Cir. 2021) 985 F.3d 1055.
39 Association of Irritated Residents v. U.S. Environmental Protection Agency, (9th Cir. 2021) 10 F.4th 937

surplus emission reductions from ongoing programs cannot reduce the amount of reductions needed for contingency.

In response to Bahr and Sierra Club, in 2021, EPA convened a nation-wide internal task force to develop guidance to support states in their development of contingency measures. The draft guidance released in March 2023 is currently undergoing a public review process. The draft guidance proposes a new method for how to calculate one year's worth of progress for the targeted amount of reductions needed for contingency and provides new clarification on the reasoned justification that would be needed for measures to be approved with a lesser amount of reductions. Per the draft guidance, the reasoned justification would need to include an infeasibility analysis detailing why there are insufficient measures to meet one year's worth of progress.

Since Bahr, CARB and air districts across California have worked closely with our EPA regional office in developing contingency measures with little success. CARB and local air districts will continue to work closely with our regional EPA partners and is committed to meeting the CAA requirements for contingency measures. EPA needs to finalize national guidance on this complex issue to ensure states can effectively develop approvable contingency measures consistent with the new guidance.

8.3 CARB's Opportunities for Contingency Measures

Much has changed since EPA's 1992 guidance on contingency measures. Control programs across the country have matured as have health-based standards. Ozone standards have been strengthened in 1997, 2008 and 2015 with attainment dates going out to 2037. California has the only three extreme ozone nonattainment areas in the country. Thus, control measures are needed for meeting the NAAQS as expeditiously as possible rather than being held in reserve.

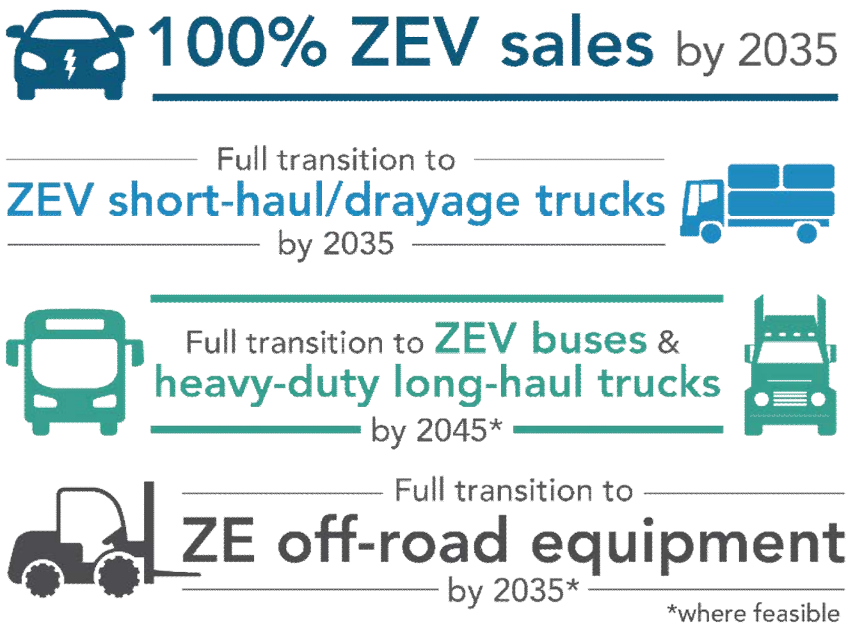
To address contingency measure requirements given the courts' decisions and draft EPA guidance, CARB and local air districts would need to develop a measure or measures that, when triggered by a failure to attain the NAAQS or failure to meet RFP, will achieve one year's worth of progress for the given nonattainment area unless it is determined that it is infeasible to achieve one year's worth of emission reductions. Several factors indicate that, once the final guidance is approved, California may be able to support an infeasibility finding. Given CARB's wide array of mobile source control programs, the relatively limited portion of emissions primarily regulated by the local air districts, and the fact that primarily-federally regulated sources are expected to account for approximately 54 percent of statewide nitrogen oxides (NO_X) emissions by 2032, finding triggered measures that will achieve the required reductions is nearly impossible. That said, even discounting the amount to reflect the proportion of sources that are primarily federally regulated, additional control measures that can be identified by CARB that would achieve the required emissions reductions needed for a contingency measure are scarce.

Adding to the complexity of identifying available control measures, not only does the suite of contingency measures need to achieve a large amount of reductions, but they will also need to achieve these reductions in the year following the year in which the failure to attain or meet RFP has been identified. Although the newly released draft guidance proposes allowing for up to two years to achieve those reductions, control measures achieving the level of reductions required often take more than two years to implement and will likely not result in immediate reductions. In California's 2022 State SIP Strategy, CARB's three largest NO_X reduction measures, In-Use Locomotive Regulation, Advanced Clean Fleets, and Transportation Refrigeration Unit II, rely on accelerated turnover of older engines/trucks and a shift to zero-emission equipment. The buildup of infrastructure and equipment options limits the availability to have significant emission reductions in a short amount of time. Options for a technically and economically feasible triggered measure that can be implemented and achieve the necessary reductions in the time frame required are scarce in California and may not be possible.

CARB has over 50 years of experience reducing emissions from mobile sources like cars and trucks, as well as other sources of pollution under State authority. The Reasonably Available Control Measures for State Sources analysis illustrates the reach of CARB's current programs and regulations, many of which set the standard nationally for other states to follow. Few sources CARB has primary regulatory authority over remain without a control measure, and all control measures that are in place support the attainment of the NAAQS. There is a lack of additional control measures that would be able to achieve the necessary reductions for a contingency measure. Due to the unique air quality challenges California faces, should such additional measures exist, CARB would pursue those measures to support expeditious attainment of the NAAQS and would not reserve such measures for contingency purposes. Nonetheless, CARB continues to explore options for potential statewide contingency measures utilizing its authorities and applying EPA's draft guidance.

A central difficulty in considering a statewide contingency measure under CARB's authority, is that CARB is already fully committed to driving sources of air pollution in California to zero emission everywhere feasible and as expeditiously as possible. In 2020, Governor Newsom signed Executive Order N-79-20 (Figure 8-1) that established a first-in-the-nation goal for 100 percent of California sales of new passenger cars and trucks to be zero-emission by 2035. The Governor's order set a goal to transition 100 percent of the drayage truck fleet to zero emission by 2035, all off-road equipment where feasible to zero-emission by 2035, and the remainder of the medium and heavy-duty vehicles to zero emission where feasible by 2045.

Figure 8-1 Governor Newsom Executive Order N-79-20



California is committed to achieving these goals and CARB is pursuing an aggressive control program in conjunction with other state and local agencies to turn the Executive Order into reality. Thus, CARB's programs not only go beyond emissions standards and programs set at the federal level, but many include zero-emissions requirements that drive mobile sources to zero-emissions, as listed in Table 8-1 below, or otherwise, achieve zero-emissions through incentives and voluntary programs. CARB is also exploring and developing a variety of new measures to drive more source categories to zero-emissions and reduce emissions even further, as detailed in CARB's 2022 State SIP Strategy. With most source categories being driven to zero-emissions as expeditiously as possible, opportunities for having triggered measures that could reduce emissions by the amount required for contingency measures are scarce.

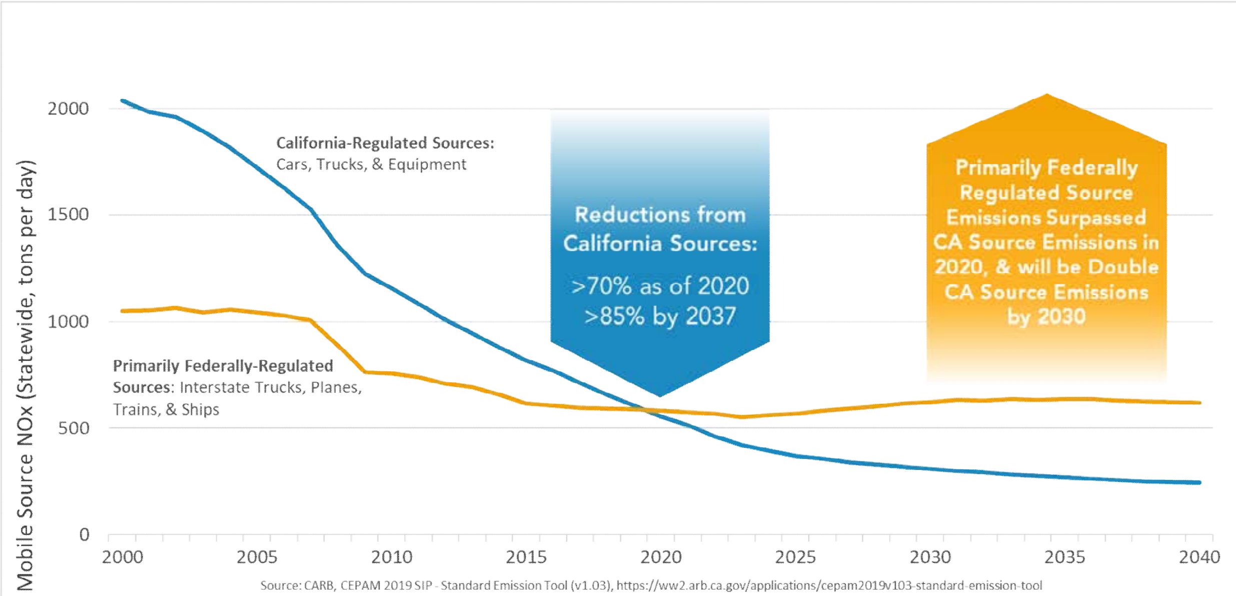
Table 8-1 Emissions Sources and Respective CARB Programs with a Zero-Emissions Requirement/Component

Emission Source	Regulatory Programs
Light-Duty Passenger Vehicles and Light-Duty Trucks	• Advanced Clean Cars Program (I and II), including the Zero Emission Vehicle Regulation • Clean Miles Standard
Motorcycles	• On-Road Motorcycle Regulation*
Medium Duty-Trucks	• Advanced Clean Cars Program (I and II), including the Zero Emission Vehicle Regulation • Zero-Emission Powertrain Certification Regulation • Advanced Clean Trucks Regulation • Advanced Clean Fleets Regulation
Heavy-Duty Trucks	• Zero-Emission Powertrain Certification Regulation • Advanced Clean Trucks Regulation • Advanced Clean Fleets Regulation
Heavy-Duty Urban Buses	• Innovative Clean Transit • Advanced Clean Fleets Regulation
Other Buses, Other Buses – Motor Coach	• Zero-Emission Airport Shuttle Regulation • Advanced Clean Fleets Regulation
Commercial Harbor Craft	• Commercial Harbor Craft Regulation
Recreational Boats	• Spark-Ignition Marine Engine Standards*
Transport Refrigeration Units	• Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (Parts I and II*)
Industrial Equipment	• Zero-Emission Forklifts* • Off-Road Zero-Emission Targeted Manufacturer Rule*
Construction and Mining	• Off-Road Zero-Emission Targeted Manufacturer Rule*
Airport Ground Support Equipment	• Zero-Emission Forklifts*
Port Operations and Rail Operations	• Cargo Handling Equipment Regulation • Off-Road Zero-Emission Targeted Manufacturer Rule*
Lawn and Garden	• Small Off-Road Engine Regulation • Off-Road Zero-Emission Targeted Manufacturer Rule*
Ocean-Going Vessels	• At Berth Regulation
Locomotives	• In-Use Locomotive Regulation

*Indicates program or regulation that is in development

There are few sources of air pollution remaining in California that are not already being aggressively controlled by CARB or the local air districts, and as mentioned previously, those sources that are not as well controlled are primarily-federally regulated sources. This includes interstate trucks, ships, locomotives, aircraft, and certain categories of off-road equipment, constituting a large source of potential emissions reductions. Since these are primarily regulated at the federal and, in some cases, international level, options to implement a contingency measure with reductions approximately equivalent to one year's worth of progress are limited.

Figure 8-2 Statewide Emissions trendline for California and Federally regulated sources



Additionally, CARB is currently working across the agency on efforts to advance racial equity and alleviate the environmental burdens priority communities in California experience. For contingency, like with all of CARB's programs, any measure considered must be evaluated to understand whether there could be any disparate impacts on priority communities. Given the existing disproportionate impacts overburdened communities already face, CARB must ensure that any new measure adopted does not have a disproportionate impact or place any further burden on these communities.

8.4 CARB Measure Analysis

Despite these challenges, CARB has analyzed control measures for all sources under CARB authority to identify potential contingency measure options. CARB currently has programs in place or under development for most of these sources, and staff have evaluated a variety of regulatory mechanisms within existing and new programs for potential contingency triggers.

8.4.1 Criteria for Contingency Feasibility

CARB has evaluated potential options for a contingency measure within each of CARB's regulations (Appendix E.1 Table E-1) using criteria to determine its feasibility given the contingency measure requirements under the CAA, recent court decisions and EPA draft guidance. First, each measure was evaluated on whether it could be implemented within 60 days of being triggered and achieve the necessary reductions within 1-2 years of being triggered. Second, the technological feasibility of each option was considered to assess whether the measure would be technically feasible to implement. Measure requirements may be unavailable or cost prohibitive to implement, especially in the time frame required for contingency measures.

8.4.2 Challenges for CARB Measures

Based on CARB's feasibility analysis, there are a few common components of CARB regulations that limit the options for contingency measures. CARB regulations that require fleet turnover or new engine standards require a long lead time for implementation. Engine manufacturers would need lead time to design, plan, certify, manufacture, and deploy cleaner engines to meet a new or accelerated engine standard, while fleet regulations necessitate that manufacturing is mature so that there is enough supply available to meet that demand. Fleet regulations also require vehicle and equipment owners and operators to plan, purchase and deploy new, often zero-emission, equipment which may require changes to their business operations and the installation of new infrastructure. Thus, measures that require fleet turnover or new engine standards are not appropriate to be used as a triggered contingency measure.

CARB regulations are also technological forcing, which makes it difficult to amend regulations or pull compliance timelines forward with only 1-2 years notice as industry needs time to plan, develop, and implement these new technologies. It would be infeasible to require industry to turn over their fleets within one year if the technology is not readily available at a reasonable cost. Further, because they are technology forcing, many CARB regulations require an interim technology or implementation review and assessment to ensure that the requirements are achievable; as a part of these reviews, CARB routinely considers whether regulations can be accelerated or strengthened. CARB regulations are the most stringent air quality control requirements in the country, so there are few opportunities to require additional stringency. CARB is driving sources under its authority to zero-emission everywhere feasible to ensure attainment of air quality standards across the State, and to support near-source toxics reductions and climate targets. However, the zero-emissions targets also eliminate opportunities for contingency based on more stringent standards.

8.4.3 Smog Check Contingency Measure

Nonetheless, CARB continues to explore options for potential statewide contingency measures utilizing its authorities and applying EPA's draft guidance. After an in-depth evaluation of all sources under CARB authority, CARB identified the proposed Smog Check Contingency Measure as a viable option to meet contingency measure requirements. The proposed Smog Check Contingency Measure, if triggered, would change the exemption from the existing eight or less model-years old to seven or less model-years old in the applicable nonattainment area. The Smog Check Contingency Measure can be triggered a second time for a nonattainment area where the smog check exemption would apply to vehicles six or less model-years old. CARB is currently developing the proposed Smog Check Contingency Measure and plans to bring the measure to the Board for consideration in October 2023.

8.5 Districts' Opportunities for Contingency Measures

The SFNA air districts continue to work to improve air quality in the Sacramento region and work towards meeting multiple active federal ozone health standards, including the 2015 ozone NAAQS. The improvements in lowering ambient ozone concentrations in the SFNA are, in part, a result of adopting and implementing many rules and regulations that limit ozone precursor emissions from stationary and areawide sources under the local air districts' authorities. Because of the robust existing local control programs, finding technologically feasible and effective measures for reducing ambient ozone concentrations for contingency purposes poses some challenges. As discussed in this chapter, EPA's draft guidance for contingency measures calls for control measures that can be triggered within 60 days and achieve one year's worth of emission reductions within 2 years. These requirements for contingency measures limit the available local opportunities. While EPA's draft guidance allows air agencies to justify using less than one year's worth of emission reduction provided, they conduct a feasibility analysis of the available control measures, the SFNA air districts will wait until final guidance from EPA to perform this thorough and detailed analysis. The SFNA air districts, along with CARB and other air agencies across the country, have raised concerns and provided comments to EPA on the draft guidance (Ayala et al., 2023). With these concerns and comments, there's an uncertainty as to which measures can be considered feasible for contingency purposes because EPA's draft contingency measure guidance is undergoing review and will not be final for months.

While waiting for final EPA guidance, the SFNA air districts will move forward with one control measure that has been evaluated by CARB and the SFNA air districts and is ready to be implemented if EPA finds the SFNA fails to meet RFP or fails to attain the NAAQS by the attainment date.

The SFNA air districts commit to amend their architectural coating rules to include triggering provisions that lower the volatile organic compounds (VOC) limits for several coating categories, delete the coating categories for non-flats, stains floor, and some other specialty coatings, and establish new VOC content limits for colorants to be consistent with the Architectural Coatings Suggested Control Measure adopted by CARB on May 21, 2019 (CARB, 2019). These proposed changes will go into effect within 60 days if EPA makes a finding that the SFNA has failed to meet RFP or has failed to attain the NAAQS by the attainment deadline. Additional details of the contingency measure commitments can be found in Appendix E.2. Table 8-2 reflects the estimated reductions for different future years and proposed adoption date for these contingency measures for the SFNA districts. Each air district will take its amended rule to its respective air district board for adoption prior to submitting the amended rule to CARB and EPA.

Table 8-2 Contingency Measure Commitments

District Rule	Estimated VOC Reductions (tpd) in SFNA			Proposed Adoption Date
	2028	**2031**	**2035**	
FRAQMD Rule 3.15	< 0.001	< 0.001	< 0.001	June 2024
EDAQMD Rule 215	0.003	0.003	0.003	May 2024
SMAQMD Rule 442	0.119	0.122	0.126	May 2024
PCAPCD Rule 218	0.004	0.004	0.004	May 2024
YSAQMD Rule 2.14	0.027	0.028	0.029	May 2024
Total Reductions	**0.154**	**0.158**	**0.162**	

Note: EPA's draft guidance on contingency measure allows the emission benefits to be realized within two years if the area fails to meet RFP (2026 and 2029) or fails to attain the NAAQS by the attainment date (August 2033), which corresponds to 2028, 2031, and 2035.

In addition, the SFNA air districts commit to evaluate potential local control measures in accordance with EPA's guidance on contingency measures once it is finalized and will continue to work with CARB and EPA to evaluate the available options for contingency measures.

8.6 Summary

At this time, CARB is including a zero-emission component in most of its regulations, both those already adopted and those that are in development, and the vast majority of these regulations are statewide in scope. Beyond the wide array of sources CARB has been regulating over the last few decades, and especially considering those CARB is driving to zero-emission, there are few sources of emissions left for CARB to implement additional controls upon under its authorities for ozone contingency purposes in the SFNA. The few source categories that do not have control measures are primarily-federally and internationally regulated.

Given the courts' decisions over the last few years, CARB and the local air districts will need to implement contingency measures that, when triggered, would achieve one year's worth of progress, or at least the relevant portion equivalent to the contribution of sources primarily regulated at the State and local level, unless a reasoned justification for achieving a lesser amount of emission reductions can be provided. Considering the air quality challenges California faces, if a measure achieving such reductions were feasible, CARB would implement the measure to support expeditious attainment of the NAAQS as the CAA requires rather than withhold it for contingency measure purposes. Further, should there be a measure achieving the required emission reductions, the measure would likely take more than 1-2 years to implement during which time the expected emission benefits would be reduced due to natural turnover of equipment. Despite the challenges, CARB has identified the proposed Smog Check Contingency Measure as its most viable option given the requirements. CARB staff plans to bring the proposed Smog

Check Contingency Measure to the CARB Board for consideration in October 2023, and if adopted, it will be submitted to EPA for incorporation into the California SIP.

For sources under local air districts' authorities, the SFNA air districts have been implementing many control measures through their robust stationary source regulatory programs. Preliminary review of currently available, technological feasible, and effective local measures indicates limited opportunities for contingency measures that meet the requirements of EPA's draft guidance. As the air districts wait for EPA's final guidance on contingency measures, the SFNA air districts, at this stage, commit to amend their architectural coatings rules to include triggering provisions that make more restrictive requirements go into effect if EPA finds that the SFNA has failed to meet RFP or has failed to attain the NAAQS by the attainment deadline. Each air district will take its amended rule to its respective air district board for adoption prior to submitting the amended rule to CARB and EPA. The SFNA air districts further commit to perform a detailed and thorough analysis of all available control measures and to re-evaluate the contingency measure requirements upon EPA's issuance of the final guidance. If additional contingency measures are needed, the SFNA air districts will amend the SIP to include them.

8.7 References

Ayala, Alberto (SMAQMD), et al. Letter to Michael S. Regan, EPA Administrator. "*Air Districts of the Sacramento Federal Ozone Nonattainment Area (SFNA) Comments on the Draft Guidance on the Preparation of State Implementation Plan Provisions That Address the Nonattainment Area Contingency Measures Requirements for Ozone and Particulate Matter, Docket ID No. EPA-HQ-OAR-2023-0063.*" 24 April 2023. [Print.]

CARB. *2019 CARB SCM for Architectural Coatings.* Sacramento, CA: California Air Resources Board. May [2019.] Web 07 June 2023. < https://ww2.arb.ca.gov/sites/default/files/2020-05/10602_scm_final.pdf >

---. *2022 State Implementation Plan Strategy*. Sacramento, CA: California Air Resources Board. 20 September 2022. Web 7 November 2022 < https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf >

EPA. (57 FR 13498 – 13570) *State Implementation Plans; General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990: Proposed Rule.* Federal Register, Volume 57, 16 April 1992, p. 13498 – 13570. Web 07 June 2023. < https://archives.federalregister.gov/issue_slice/1992/4/16/13412-13570.pdf >

---. *Draft: Guidance on the Preparation of State Implementation Plan Provisions that Address the Nonattainment Area Contingency Measure Requirements for Ozone and Particulate Matter.* U.S. Environmental Protection Agency Office of Air Quality Planning and Standards Air Quality Policy Division. 16 March, [2023.] Web 07 June

2023. < https://www.epa.gov/system/files/documents/2023-03/CMTF%202022%20guidance%203-17-23.pdf >

Newsom, Gavin. Executive Order N-79-20: Zero-Emission by 2035. 19 January 2021. Web 06 June 2023. < https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf >

9 TRANSPORT ANALYSIS

9.1 Introduction to Pollutant Transport

The air quality in the Sacramento Federal Nonattainment area (SFNA) can be impacted by pollutant transport from the San Francisco Bay Area and the San Joaquin Valley. Delta breezes carry air pollutants from coastal Bay Area and San Joaquin Valley emission sources downwind to the inland areas of the Sacramento region, and these pollutants may contribute to ozone formation during the same day or the following days. The California Air Resources Board (CARB) has determined that the relative impact on air quality in the SFNA from the Bay Area and San Joaquin Valley pollutant transport can be considered overwhelming, significant, or inconsequential on various days depending on meteorological conditions (CARB, 2001, pp. 25, 37). Various studies in the past two decades also reaffirmed that a strong sea breeze within the deep marine boundary layer from the San Francisco Bay Area enhanced pollutant transport into the Sacramento Delta Region and that the air flow pattern in the Sacramento Valley (Schultz eddy) causes pollutants to recirculate and become trapped within the Sacramento region. The delta breeze also transports emissions towards the eastern portion of the Sacramento region, where the highest ozone concentrations have been observed during the past 15 years (also see Appendix F: Weight of Evidence for more information).

Various photochemical modeling sensitivity simulations confirmed that emissions reduction outside the SFNA would reduce the ambient ozone concentration at the SFNA peak monitors. The actual impacts from the upwind area are very difficult to quantify. The influence of air pollutant transport on ozone concentrations can involve many different, complex methodologies with varying limitations and uncertainties. Surface wind flow data from ambient monitors and wind flow patterns can reveal where pollutants are coming from, but the amount of ozone formation will depend on other factors, like temperature and vertical convection. Thus, impacts cannot be quantified on just the pollutant transport alone. Photochemical grid modeling can quantify a more precise transport contribution to downwind ozone areas and account for pre-existing conditions, but they may only be representative of a specific ozone season and subject to various modeling performance uncertainties.

9.2 EPA Rules and Regulations on Intrastate Transport

The 2015 Ozone National Ambient Air Quality Standard (NAAQS) State Implementation Plan (SIP) Requirement Rule (83 FR 62998) states that air agencies must consider the intrastate transport impacts of emissions from sources outside of the ozone nonattainment area but within the state. United States Environmental Protection Agency (EPA) notes that these upwind sources may have significant impact on downwind nonattainment areas, and the 2015 Ozone NAAQS SIP Requirement Rule requires control measures for these emission sources outside of the nonattainment area if it will help the area attain the NAAQS by the attainment date.

9.3 Attainment Assumptions of Domain-wide Reductions

Transported pollutants from upwind areas can contribute to the ozone problem further downwind across geographic areas. CARB, as the state air agency, is responsible for submitting SIPs for California in which it must address intrastate transport for California's nonattainment areas. As discussed in Chapter 7, CARB has committed to adopting and implementing statewide mobile source control measure in its 2022 State SIP Strategy (CARB, 2022). These commitments to reduce mobile sources emissions in California will help reduce intrastate transport for California's nonattainment areas, including the SFNA.

CARB's photochemical modeling simulations include the northern and central regions of California in the modeling domain (see Appendix B.1 Modeling Protocol & Attainment Demonstration). Within each domain, the model includes emission reductions from statewide and upwind regions' existing programs and new statewide control measures. The use of domain-wide emissions and emissions benefits from air quality programs in the air quality modeling accounts for air pollutant transport impacts across northern California, including in the SFNA. These existing local and state emission reduction programs and new state control measures have been reducing and will continue to reduce ozone precursors from intrastate transport and help reduce ambient ozone concentrations.

9.4 Summary

CARB continues to adopt, enforce, and implement the state control measures as described in Chapter 7. Since the mobile source emission inventory is the largest emission source of ozone precursor emissions in the state, reducing mobile source emissions will help reduce intrastate transports. These statewide control measures, especially the mobile source measures, will continue to bring emission reduction benefits to all nonattainment areas in California, including the SFNA. Other upwind air districts will also continue their efforts to implement air quality programs to reduce emissions. The total emission reductions from existing federal, state, regional, and local programs along with new state commitments will ensure the Sacramento region will meet the 2032 attainment deadline.

9.5 References

CARB. *Ozone Transport: 2001 Review.* Sacramento, CA: California Air Resources Board, April [2001.]

---. *2022 State Implementation Plan Strategy*. Sacramento, CA: California Air Resources Board. 20 September 2022. Web 7 November 2022 < https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf >

EPA. (83 FR 62998–63006) *Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements: Final Rule.* Federal Register, Volume 83, 06 December 2018, p. 62998 – 63006. Web 01 June 2023. < https://www.govinfo.gov/content/pkg/FR-2018-12-06/pdf/2018-25424.pdf >

10 TRANSPORTATION CONFORMITY AND MOTOR VEHICLE EMISSIONS BUDGETS

10.1 Introduction to Transportation Conformity

Transportation conformity is the federal regulatory procedure for linking and coordinating air quality and transportation planning. Transportation conformity analysis and findings are required under federal Clean Air Act (CAA) Section 176 to ensure that transportation activities do not impede an area's ability to attain the air quality standards. The CAA requires that transportation plans, programs, and projects that obtain federal funds or require approval be consistent with, or conform to, applicable state implementation plans (SIPs) before they can be approved. This coordination between air quality and transportation plans ensures that transportation activities will not: (1) cause or contribute to new air quality violations, (2) increase the frequency or severity of any existing violation, or (3) delay the timely attainment of National Ambient Air Quality Standards (NAAQS).

Transportation planning is the responsibility of local metropolitan planning organizations (MPOs). For the Sacramento Federal Nonattainment Area (SFNA), transportation projects, programs and plans are approved by two MPOs: Sacramento Area Council of Governments (SACOG) and Metropolitan Transportation Commission (MTC). SACOG's jurisdiction includes Sacramento, Sutter, Yolo counties and portions of Placer and El Dorado counties (excluding the portion in the Tahoe Basin). MTC has jurisdiction over nine Bay Area counties, including SFNA portion of Solano County. CAA Section 176(c) states that a MPO cannot approve any federally funded project, program, or plan, which does not conform to a SIP approved by the United States Environmental Protection Agency (EPA).

To conform to the SIP, SACOG and MTC must demonstrate that projected regional motor vehicle emissions from transportation activities will be less than or equal to the motor vehicle emissions budgets (MVEB), which are the on-road mobile source portion of the total emissions inventory used to demonstrate RFP and attainment of the 2015 ozone NAAQS. Transportation projects, programs or plans cannot be federally funded or approved if the total emissions in the transportation activities exceed the MVEB. This chapter discusses transportation conformity and the establishment of the proposed MVEB.

10.2 Conformity Rule

Implementation of the CAA Section 176(c) requirements is outlined in the Conformity Rule (40 CFR §93.100 - §93.165). The Conformity Rule:

- Establishes criteria and procedures for determining whether the long-range metropolitan transportation plan (MTP) and the metropolitan transportation improvement program (MTIP); a short-term listing of surface transportation projects that receive federal funds, are subject to a federally required action, are regionally significant, or conform to the SIP.

- Ensures that transportation plans and projects are consistent with the applicable SIP. This means that transportation emissions are less than or equal to the MVEB.
- Ensures that transportation plans, programs, and other individual projects do not cause new air quality violations, exacerbate existing ones, or delay attainment of air quality standards.

MPOs are required to update their MTP every 4 years and their MTIP is updated every 2 years on a separate schedule; both are amended as necessary. Before adopting the MTP/MTIP and associated amendments, MPOs must prepare a regional conformity analysis based on the projects in the proposed MTP/MTIP and programs as specified in the federal Conformity Rule. Those emissions are compared to the MVEBs in the latest EPA-approved SIP. The MPO must determine if the emissions from the proposed projects in the MTP/MTIP are less than the emissions budgets in the approved SIP. The Conformity Rule (40 CFR 93.105) also includes the interagency consultation procedures for the development and approval of the MVEB (See Section 10.3.1).

10.3 Proposed MVEB

The MVEB are based on Conformity Analysis: Amendment #2 to the SACOG's 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS) and the 2023 Metropolitan Transportation Improvement Program, which was adopted by SACOG's Board of Directors on September 15, 2022 (SACOG, 2019 and SACOG, 2022). The MTP/SCS included the latest planning assumptions, which were projections of population, housing units, and employment growth in the Sacramento Region, as well as land use allocations, and transportation system improvements. These growth projections were further applied to SACOG's Activity-Based Travel Simulation Model (SACSIM) (Bradley et al, 2007), and the model forecasted the regional vehicle miles traveled (VMT) and the average weekday travel patterns for several future years. These data were used as inputs into California Air Resources Board's (CARB's) EMFAC2017 model[40] to estimate the MVEB. Emissions for SFNA portion of Solano County were estimated in the EMFAC2017 model separately based on data provided by MTC.

The MVEB are used to ensure that transportation planning activities conform to the SIP and are set for each Reasonable Further Progress (RFP) milestone year (2023, 2026, and 2029) and the attainment year (2032). MVEB are established for both ozone pollutants precursors: volatile organic compounds (VOC) and nitrogen oxides (NO_X). Reductions of both precursors are needed to demonstrate attainment of the ozone

40 EMFAC2017 is a California specific on-road emissions inventory model, which calculates the on-road mobile emission rates. Effective August 15, 2019, the EPA approved the EMFAC2017 emissions model for SIP and conformity purposes (84 FR 41717).

standard. Table 10-1 shows the transportation conformity motor vehicle emissions budgets for VOC and NO_X in the SFNA. Emissions are based on an average summer day consistent with the ozone attainment and progress demonstrations, using the following method:

1) Calculate the on-road motor vehicle emissions totals for the appropriate pollutants (VOC and NO_X) from the EMFAC2017 model.
2) Subtract emissions from: a) reductions from recently adopted regulations using off-model adjustments; and b) reductions from developing regulations using off-model adjustments.
3) Sum each pollutant (VOC and NO_X) and round each total up to the nearest tenth of ton.

Table 10-1 Transportation Conformity Budgets for the 2015 8-hour Ozone standard in the SFNA, tons per average summer day

Sacramento Totals (Tons/Day)	2023		2026		2029		2032	
	VOC	NO_X	VOC	NO_X	VOC	NO_X	VOC	NO_X
Vehicular Exhaust (on road emissions)	12.9	19.5	11.5	17.4	10.7	16.4	9.7	15.7
Reductions from recently adopted regulations using off-model adjustments[a]	0.0001	0.1717	0.0045	3.597	0.018	4.897	0.0436	5.9087
Reductions from developing regulations using off-model adjustments[b]	-	-	-	-	-	-	0.41	1.16
Total[c]	12.88	19.35	11.48	13.84	10.67	11.53	9.28	8.60
Motor Vehicle Emission Budgets[d,e]	**12.9**	**19.4**	**11.5**	**13.9**	**10.7**	**11.6**	**9.3**	**8.6**

Source: EMFAC2017 v1.03

a This reflects the adjustment factor for Heavy-Duty Vehicle Warranty Phase 1, Innovative Clean Transit (ICT), Heavy-Duty Vehicle Inspection Program (HDVIP)/Periodic Smoke Inspection Program (PSIP), Advanced Clean Trucks (ACT), and Heavy-Duty Omnibus regulations.

b This reflects the on-road commitments for Advanced Clean Cars II (ACCII) and Advanced Clean Fleets (ACF) from the 2022 State SIP Strategy.

c Values may not add up due to rounding.

d Motor vehicle emission budgets calculated are rounded up to the nearest tenth of a tpd.

e The budgets are calculated with EMFAC2017 v1.03 using SACOG 2020 MTP/SCS Amendment #2 activity data and MTC activity data for SFNA portion of Solano County. Since there is an update for the activity data, small differences between the budgets and planning inventory (Chapter 5) for the mobile source emissions are observed. These differences do not impact the RFP or attainment demonstrations.

10.3.1 Interagency Consultation

The conformity rule requires an interagency consultation (40 CFR 93.105) for developing and implementing any provisions related to transportation conformity, including the MVEB. The purpose of the interagency consultation process is to align the air quality and transportation plans as it relates to conformity with all agencies involved and to resolve any issues before making conformity determinations. This process includes consultation among the MPOs, local, State, and federal departments of transportation, and local and State air quality planning agencies.

The proposed MVEB have been developed through SACOG's Regional Planning Partnership (RPP), which serves as the forum for interagency consultation procedure required by 40 CFR 93.105, and these forums are open to the public. Agencies represented on the RPP include the SFNA air districts, SACOG, California Department of Transportation (Caltrans), EPA Region IX, Department of Transportation – Federal Highway Administration, Federal Transit Administration, local transportation agencies, and CARB.

The MVEB in Table 10-1 were presented at the SACOG RPP meeting on February 22, 2023. No changes were made to the MVEB, and the RPP approved by consensus that the MVEB be included in the 2015 Ozone NAAQS SIP.

10.4 MVEB Approval and Use

The MVEB, included as part of this plan, will be submitted to EPA for approval. Before the EPA approves the MVEB, EPA will conduct an adequacy review to determine if the MVEB are adequate for conformity purposes. The EPA can make an adequacy finding on the new MVEB prior to approving other elements of this plan. This adequacy review process is subject to public participation and review requirements (40 CFR 93.118(f)).

The EPA will only find the MVEB to be adequate if the criteria are satisfied under 40 CFR 93.118(e)(4). This includes endorsement of the attainment plan by CARB after a public hearing (40 CFR 93.118(e)(4)(i)). The new emissions budgets developed as part of the 2015 ozone NAAQS Plan cannot supersede the MVEB already in an approved SIP (for the 2008 ozone NAAQS) for the years addressed by the previously approved implementation plan. Once the MVEB in this plan are approved by EPA, the MPOs in the SFNA must use the approved budgets to determine ozone conformity (40 CFR 93.109(c)(1)).

10.5 References

Bradley, M.A., et al. *Development and application of the SACSIM activity-based model system*. Submitted for presentation at the 11th World Conference on Transport Research, Berkeley, California. June [2007.]

---. 40 CFR (§93.100 - §93.152), *Determining Conformity of Federal Actions to State or Federal Implementation Plans. Subpart A—Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Title 23 U.S.C. or the Federal Transit Laws.* Title 40 Code of Federal Regulations, Sec. 93. Revised as of 24 November 1993. Available at: < https://www.ecfr.gov/cgi-bin/text-idx?SID=8b2b0a46e78f13f33a2f0dbfa1b65288&mc=true&node=pt40.22.93&rgn=div5 >; Accessed: 07 June 2023.

SACOG. *2020 Metropolitan Transportation Plan/Sustainable Communities Strategy*. *Sacramento, CA: Sacramento Area Council of Governments.* 18 November [2019.] Web. 23 March 2020. < https://www.sacog.org/sites/main/files/file-attachments/2020_mtp-scs.pdf?1580330993 >

---. *Conformity Analysis. SACOG 2023-26 Metropolitan Transportation and Improvement Program (MTIP), Amendment #2 to the Metropolitan Transportation Plan – Sustainable Communities Strategy (MTP).* Sacramento, CA: Sacramento Area Council of Governments. 15 September 2022. Web 07 June 2023. < https://www.sacog.org/sites/main/files/file-attachments/final_2023-26_mtip_air_quality_conformity_analysis_0.pdf >

11 GENERAL CONFORMITY

11.1 Introduction to General Conformity

General conformity is the federal regulatory process that ensures major federal actions[41] or projects will not interfere with air quality planning goals. Clean Air Act (CAA) Section 176(c)(1) states that "no department, agency, or instrumentality of the Federal Government shall engage in, support in any way for provide financial assistance for, license or permit, or approve, any activity which does not conform to an implementation plan after it has been approved or promulgated."

The 2015 National Ambient Air Quality Standard (NAAQS) State Implementation Plan (SIP) Requirements Rule (83 FR 62998) requires that federal agencies use the emissions inventory from an approved SIP's attainment or maintenance demonstration to support a conformity determination. Upon approval of this SIP, general conformity determinations will be based on the emissions inventory used to develop this plan[42].

The general conformity regulations and thresholds did not change as part of the 2015 NAAQS SIP Requirements Rule. The existing general conformity thresholds (also known as *de minimis* threshold levels) for an ozone severe nonattainment area of 25 tons per year of volatile organic compounds (VOC) or nitrogen oxides (NO_X) contained in 40 CFR 93.153(b)(1) will continue to apply for this plan. In practicality, this means that the emissions from any new major projects like transportation, construction, or other work where the federal government provides funding will need to be less than 25 tons per year for VOC or NO_X. Otherwise, the project must perform a general conformity demonstration.

This chapter summarizes general conformity requirements and emissions criteria for demonstrating general conformity.

11.2 General Conformity Requirements

The United States Environmental Protection Agency (EPA) established the conformity regulations for general federal actions (40 CFR 51.851 and 40 CFR 93 subpart B) under CAA section 176(c). The General Conformity Rule sets the requirements a federal agency must meet to make a conformity determination. General conformity does not allow federal agencies and departments to support or approve an action that does any of the following (40 CFR 93.153(g)(1)):

- Causes or contributes to new violations of any NAAQS in an area;
- Interferes with provisions in the applicable SIP for maintenance of any standard;

41 Federal actions are defined as any activity engaged in by a department, agency, or instrumentality of the Federal government, or any activity that they support, fund, license, permit, or approve, other than activities related to transportation plans, programs, and projects that are applicable to transportation conformity requirements. (40 CFR 93.152)

42 Otherwise, general conformity determination will be based on the last EPA SIP-approved plan.

- Increases the frequency or severity of an existing violation of any NAAQS; or
- Delays timely attainment of any NAAQS or any required interim emission reductions or other milestone.

11.3 Types of Federal Actions Subject to General Conformity Requirements

Examples of general federal actions that may require a conformity determination include, but are not limited to, the following: leasing of federal land, private construction on federal land, reuse of military bases, airport construction and expansions, construction of federal office buildings, highway construction and expansion, and construction or modifications of dams or levees. These actions are further discussed in 40 CFR 93.153.

General conformity requirements apply if direct or indirect emissions from a federal action have the potential to exceed the *de minimis* threshold levels established for each criterion or precursor pollutant in a nonattainment area or maintenance area. The thresholds are shown in 40 CFR 93.153(b)(1)(2). For a severe nonattainment area, the threshold level is 25 tons per year of VOC or NO_X.

Direct emissions of a criteria pollutant or its precursors are emissions that are caused or created by the federal action and occur at the same time and place as the action. Indirect emissions are reasonably foreseeable emissions that occur within the same nonattainment area as the project but are further removed from the federal action in time and/or distance and can be practicably controlled by the federal agency due to a continuing program responsibility (40 CFR 93.152). A federal agency can indirectly control emissions by placing conditions on federal approval or federal funding.

There are certain federal actions listed in 40 CFR 93.153 (c)(2)(i-xxii) that would result in no emissions increase, or an increase in emissions that is clearly *de minimis*. These actions include but are not limited to continuing and recurring activities such as permit renewals where activities conducted will be similar in scope and operation to the activities currently being conducted, and rulemaking and policy development and issuance.

11.4 Emissions Criteria for Demonstrating General Conformity

To meet the conformity determination emissions criteria, the total of direct and indirect emissions from a federal action must meet all relevant requirements and milestones contained in the applicable SIP (40 CFR 93.158(c)), and must meet other specified requirements, such as:

- For any criteria pollutant or precursor, the total of direct and indirect emissions from the action must be specifically identified and accounted for in the applicable SIP's attainment or maintenance demonstration (40 CFR 93.158(a)(1)); or
- For precursors of ozone, nitrogen dioxide, volatile organic compounds, or particulate matter, the total of direct and indirect emissions from the action must be fully offset

within the same nonattainment (or maintenance) area through a revision to the applicable SIP or a similarly enforceable emissions control measure in the SIP (40 CFR 93.158(a)(2)); or

- For ozone, the California Air Resources Board (CARB) or the local air district(s) must make a determination that either:
  - o the total of direct and indirect emissions from the action will result in a level of emissions that, together with all other emissions in the nonattainment (or maintenance) area, will not exceed the emissions budget specified in the applicable SIP (40 CFR 93.158(a)(5)(i)(A)); or
  - o the total of direct and indirect emissions from the action will result in a level of emissions that, together with all other emissions in the nonattainment (or maintenance) area, will exceed the emissions budget specified in the applicable SIP but the State Governor or designee for SIP actions makes a written commitment to EPA to take specific future actions[43] (40 CFR 93.158(a)(5)(i)(B)).

No additional emissions will be included in this plan for projects that would trigger general conformity thresholds. If general conformity is triggered, the project would be required to reduce or offset emissions to show that there is no emissions increase.

11.5 References

EPA. (83 FR 62998–63006) *Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements: Final Rule.* Federal Register, Volume 83, 06 December 2018, p. 62998 – 63006. Web 01 June 2023. < https://www.govinfo.gov/content/pkg/FR-2018-12-06/pdf/2018-25424.pdf >

[43] This includes the following: 1) A specific schedule for adoption and submittal of a revision; 2) Identification of specific measures for incorporation into the SIP; 3) A demonstration that all existing applicable SIP requirements are being implemented in the area; 4) A determination that the responsible Federal agencies have required all reasonable mitigation measures associated with their action; and 5) Written documentation including all air quality analyses supporting the conformity determination.

12 REASONABLE FURTHER PROGRESS (RFP) DEMONSTRATIONS

12.1 Introduction to RFP

Clean Air Act (CAA) Sections 172(c)(2), 182(b)(1), and 182(c)(2)(B) specifies the reasonable further progress (RFP) requirements for reducing emissions in ozone nonattainment areas. The purpose of the RFP demonstration is to ensure the area achieves a certain level of annual incremental reductions in emissions. The federal 2015 8-hour ozone National Ambient Air Quality Standard (NAAQS) State Implementation Plan (SIP) Requirements Rule requires that areas classified as “serious and above” must submit an RFP demonstration for the SIP (83 FR 63004).

12.2 RFP Demonstration Methodology

The methodology for demonstrating RFP is:

1) Prepare the base year and forecasted emissions inventories
2) Include available emission reduction credits (ERCs) in the future years
3) Assess creditable control measure reductions that are not included in the emission inventory
4) Calculate RFP emission reduction targets from the required precent reduction
5) Compare the emission reductions to RFP emission targets, and
6) Use nitrogen oxides (NO_X) substitution for volatile organic compounds (VOC) reduction shortfalls, if needed.

Step-by-step calculations are outlined in Section 12.3. The key elements to the RFP demonstration are described below:

12.2.1 Base Year and Forecasted Emissions Inventories

CAA Section 182(b)(1)(B) defines the baseline emissions as the total amount of actual VOC or NO_X emissions from all anthropogenic sources in the nonattainment area. For this RFP demonstration, the baseline emissions are from the 2017 base year VOC and NO_X inventories. These baseline emissions were used to calculate the required percent reduction targets in the future years. The forecasted VOC and NO_X emission inventory for the milestone years (2023, 2026, and 2029) and attainment year (2032) are used to quantify the emission reductions that are expected to be achieved since the 2017 base year. The future year emission forecasts are derived by projecting the baseline emissions using socio-economic growth indicators[44] and the effects of adopted control measures. See Chapter 5 for more information about the emission inventories.

[44] Socio-economic growth indicators include, but not limited to population, housing units, employment, vehicle miles traveled, and land use changes.

12.2.2 Available ERCs

ERCs that were created prior to the 2017 baseline year for the Sacramento Federal Nonattainment Area (SFNA) are added to the emission forecasts to ensure they will not interfere with RFP if they are used in the future. ERCs may be used as "offsets" to compensate for an increase in emissions from a new or modified major source regulated by the air districts or meet general conformity requirements. The amount of available ERCs are 3.63 tons per day of VOC and 2.8 tons per day of NO_X. See Section 5.6 of Chapter 5 for more information.

12.2.3 Creditable Control Measure Reductions

In the federal 2015 8-hour ozone NAAQS SIP Requirements Rule (83 FR 63004), all emission reductions from SIP-approved rules or federally promulgated measures that occur after the base year are creditable for purposes of the RFP, provided the reductions meet the requirements for creditability, i.e., that they are enforceable, permanent, quantifiable, and surplus. The emissions reductions from existing control regulations adopted and implemented after the 2017 base year and submitted to U.S. Environmental Protection Agency (EPA) for approval are applied to meet the RFP requirements. Most of these emission reductions were already accounted for in the forecasted emission inventories.

12.2.4 RFP Emission Reduction Targets

The RFP emission reduction targets are determined by the required percent reduction specified in the federal 2015 8-hour ozone NAAQS SIP Requirements Rule (83 FR 63004). It requires a nonattainment area to show a VOC emission reduction of at least 18% from the base year emissions inventory averaged over the first six years of the planning period, and additional 3% per year from base year emissions, averaged over consecutive 3-year period thereafter until attainment of the standard. For this plan, the SFNA must show 45% reduction of emissions between 2017 and 2032 (an 18% reduction from 2017 to 2023 and a 27% reduction between 2023 and 2032).

12.2.5 NO_X Substitution for VOC Reduction Shortfalls

CAA Section 182(c)(2)(C) allows for the substitution of NO_X emission reductions in place of VOC reductions to meet the RFP requirements. According to EPA's NO_X Substitution Guidance (EPA, 1993), the substitution of NO_X reductions for VOC reductions must be done on a percentage basis, rather than a straight ton-for-ton exchange[45].

45 According to the guidance, substitution of NO_X reduction for VOC on a ton-for-ton basis could yield calculated NO_X reduction requirements, which exceed the available NO_X inventory in cases where the base VOC inventory greatly exceeds the NO_X inventory. In addition, the percentage basis is consistent with the RFP "percent" reduction requirements.

Thus, if there is a certain percent VOC reduction shortfall, an equal percentage reduction in NO_X emissions can be substituted to provide the equivalent reductions necessary for meeting the RFP goals toward attainment. For example, the 11.7% apparent shortfall in VOC in the 2023 milestone year can be met by substituting 11.7% NO_X reductions.

CAA Section 182(c)(2)(C) also states that NO_X may be substituted for VOC if the substitution will achieve ozone reductions equivalent to those that would be achieved using VOCs. EPA's NO_X Substitution Guidance (EPA, 1993) states that any combination of VOC and NO_X reductions is "equivalent" so long as the reductions are consistent with those identified as necessary to attain the NAAQS in the modeling demonstration and provide for steady progress in leading to the emission reductions identified as necessary to attain the NAAQS by the specified attainment year. Therefore, the cumulative amount of NO_X substitution reductions used toward the RFP requirement cannot be greater than the total NO_X reductions dictated by the modeled attainment demonstration. This attainment consistency requirement is meant to prevent the substitution of NO_X reductions that would not lead to progress toward attaining the ozone standard.

The current air quality modeling analysis performed by the California Air Resources Board shows attainment in 2032 with reductions from existing and already adopted VOC and NO_X control measures and committed statewide control measures. Furthermore, CARB conducted a sensitivity modeling analysis to determine how the changes of each ozone anthropogenic precursor in the baseline year will change the ozone DV at a particular monitoring site. This analysis was conducted by reducing NO_X or VOC by 45% from the baseline emissions in the SFNA. The sensitivity analysis results showed that both VOC and NO_X reductions provide ozone benefits in the Sacramento region, but NO_X reductions generally provide greater ozone benefits than VOC reductions. More details of the sensitivity analysis are available in Appendix B.1.3.6.

Therefore, a substantial use of NO_X substitution would be consistent with current analyses of ozone attainment strategies in the SFNA.

12.3 RFP Demonstrations

Tables 12-1 and 12-2 summarize the RFP calculations and whether the SFNA can demonstrate RFP. The first step in RFP demonstration shown in Table 12-1 is to determine whether the SFNA VOC reduction alone can meet the RFP requirements. The total VOC emissions were used, which included the VOC emission inventory for the milestone and attainment year, available ERCs, and consideration of other creditable control measure reductions that were not included in the emissions inventory (Row D). For this RFP demonstration, only the available ERCs are included. The total VOC emissions are compared to the RFP target VOC levels. The RFP target VOC levels for the milestone and attainment years (Row F) are calculated by applying the required RFP precent reduction (Row E) to base year total emissions (Row D Base Year). If the milestone and attainment years VOC emissions are less than the corresponding target VOC levels (indicated as a zero or negative amount), the RFP is met for that milestone or attainment year; otherwise, the difference (indicated as a positive amount) is the shortfall in VOC reduction. The VOC reduction shortfalls were compared with the baseline emissions and converted to percent shortfalls (Row H). The NO_X percent change in reduction in next table will be compared to the VOC percent shortfall to determine if the SFNA can demonstrate RFP. The row description shows the details for each calculation step.

Table 12-1 VOC Calculation for RFP Demonstration

Row	Calculation Steps	2017	2023	2026	2029	2032
A	VOC Emissions (tons /day)	96.64	87.20	84.24	81.49	79.92
B	VOC ERCs (tons/day)		3.63	3.63	3.63	3.63
C	Motor Vehicle Emissions Budgets (MVEB) Rounding Margin		0.02	0.02	0.03	0.00
D	Total VOC Emissions (tons/day)	96.64	90.86	87.89	85.15	83.55
E	Required Percent Change Since Previous Milestone Year (%)	--	18	27	36	45
F	RFP Target VOC Level (tons/day)	--	79.24	70.55	61.85	53.15
G	Cumulative Milestone Year Shortfall (tons/day)	--	11.61	17.34	23.30	30.40
H	Cumulative Shortfall in VOC (%)	--	12.0	17.9	24.1	31.5

Row Description

A VOC emission inventory used for RFP demonstration; Baseline, milestone, and attainment year Emission Inventory (Chapter 5), which includes the benefits of existing rules and accounts for projected growth in the future years

B VOC ERCs are the VOC ERCs weighted averaged between Quarters 2 and 3 and added to the future years. See Chapter 5.6 for a detailed discussion on ERCs

C In order to demonstrate consistency between the RFP demonstration and the MVEB, a line item adjustment is made in the RFP demonstration to account for the differences in the on road mobile source emissions projections in the CEPAM inventory and the MVEB, which is rounded up to the nearest tenth of a ton

D Total VOC Emissions are the VOC emission inventory plus the VOC ERCs (Row A + Row B + Row C)

E RFP requires 18% reduction 6 years after base year; future milestone years are every 3 years until the attainment year; and RFP requires reductions of 3% per year at each milestone year (e.g., for every 3 years, required 9% reduction)

F RFP Target VOC Level = [(2017 Base Year Row D) x (1 – Row E/100)]; e.g., for 2032, 96.64 tpd x (1 – 45/100)= 53.15 tpd

G [(Row D) – (Row F)] or (Baseline – Target); zero or negative number meets target level and positive number is a shortfall of target level; e.g., for 2032, 83.55 tpd - 53.15 tpd = 30.40 tpd

H [(Row G) / (Row D Base Year) x 100]; e.g., for 2032, cumulative shortfall is 30.40 tpd /96.64 tpd = 31.5%

Table 12-1 shows that VOC reductions are not sufficient to meet the RFP requirements as the milestone and attainment year VOC emission levels are above the target VOC levels. As discussed in Section 12.2.3, the CAA Section 182(c)(2)(C) allows for NO_X reductions to substitute for emission reductions needed to demonstrate RFP. Therefore, projected milestone and attainment year NO_X emission reductions are used to substitute the VOC reduction shortfall and to meet the target VOC levels.

Table 12-2 shows the steps for NO_X reduction substitution. Similar to Table 12-1, the total SFNA NO_X emissions were calculated, which included the NO_X emission inventories and the available NO_X ERCs (Row L). The milestone and attainment years NO_X emissions were compared to the 2017 baseline NO_X emissions. The differences in NO_X emissions between the milestone and attainment years and the baseline emissions are reductions in NO_X emissions since 2017 (Row M) and are reflected as percentage reductions (Row N). The percent of NO_X emissions reduction was compared to the percent of VOC reduction shortfall (Row O). If the percent of NO_X emissions reduction is greater than the percent of VOC reduction shortfall (if Row P is a positive number), then it indicates that there is a surplus of emission reductions, and RFP is met.

Table 12-2 NO_X Substitution Calculation for RFP Demonstration

Row	Calculation Steps	2017	2023	2026	2029	2032
I	NO_X Emissions (tons/day)	70.6	47.62	40.39	36.93	34.16
J	NO_X ERCs (tons/day)		2.80	2.80	2.80	2.80
K	MVEB Rounding Margin		0.05	0.01	0.00	0.00
L	Total NO_X Emissions (tons/day)	70.6	50.42	43.19	39.73	36.96
M	Reductions in NO_X Emissions since Base Year (tons/day)	--	20.18	27.41	30.87	33.64
N	Percent Reductions in NO_X Emissions since Base Year (%)	--	28.6	38.8	43.7	47.6
O	Cumulative Shortfall in VOC (%) (Row G in Table 12-1)	--	12.0	17.9	24.1	31.5
P	Percent Surplus Reduction (%)	--	16.6	20.9	19.6	16.2
Q	**RFP Met?**	**--**	**YES**	**YES**	**YES**	**YES**

Row Description

I NO_X emission inventory used for RFP demonstration; Baseline, milestone, and attainment year emission inventory (Chapter 5), which includes the benefits of existing rules and accounts for projected growth in the future years

J NO_X ERCs are the NO_X ERCs averaged between quarters 2 and 3 and added to the future years. See Chapter 5.6 for a detailed discussion on ERCs

K Same as Row C

L Total NO_X Emissions are the NO_X emission inventory plus the NO_X ERCs (Row I + Row J + Row K)

M Reductions achieved since 2017 base year: [(Row L Base Year) – (Row L Milestone Year or Attainment Year)]; e.g., for 2032: 70.60 tpd – 34.16 tpd = 33.64 tpd

N Percent reductions achieved since 2017 base year: [(Row M) / (Row L Base Year)] x 100; e.g., for 2032: (33.64/70.6) x 100 = 47.6

O Cumulative VOC shortfall from Row H in Table 12-1

P Surplus reductions achieved [(Row N) – (Row O)]; e.g., for 2032: 47.6 % – 31.5% = 16.2%

Q Positive numbers in Row P represent surplus for each milestone year or attainment year, thus indicating that the SFNA meets the RFP.

The demonstration evaluated RFP to 2032, which is the 2015 ozone standard attainment year for the SFNA. For each of the milestone years, the required progress is met based on the reductions from the existing control program using a combination of VOC and NO_X substitution reductions within the SFNA. The SFNA meets the RFP targets for the milestone years (2023, 2026, 2029) and attainment year (2032) for this plan.

12.4 References

EPA. *NO_X Substitution Guidance*. Research Triangle Park, NC: United States Environmental Protection Agency Office of Air Quality Planning and Standards, December [1993.] Web 08 June 2023. < https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19931201_oaqps_nox_substitution_guidance.pdf >

---. (83 FR 62998–63036) *Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements: Final Rule.* Federal Register, Volume 83, 06 December 2018, p. 62998 – 63006. Web 01 June 2023. < https://www.govinfo.gov/content/pkg/FR-2018-12-06/pdf/2018-25424.pdf >

13 SUMMARY AND CONCLUSIONS

13.1 2015 8-hour Ozone Designation and Classification

The United State Environmental Protection Agency (EPA) lowered the health-based 8-hour ozone National Ambient Air Quality Standards (NAAQS) in 2015 from 75 parts per billion (ppb) to 70 ppb. The Sacramento Federal Nonattainment Area (SFNA), which includes all of Sacramento and Yolo counties and portions of Placer, El Dorado, Solano, and Sutter counties, was classified as a serious nonattainment for this standard. Attainment of the 2015 ozone standard by the serious attainment date was not practical, and the SFNA air districts have requested to be reclassified to Severe-15. This plan was developed for the Severe-15 classification, which gives the SFNA an attainment deadline of no later than August 3, 2033.Attainment of the 2015 ozone standard will be shown by the data from the last full year prior to the attainment deadline, referred to as the attainment year, or 2032.

13.2 Ozone Trends

Ambient air quality data are collected at multiple monitoring sites throughout the SFNA. As of the end of 2022, the air quality monitoring network in the SFNA included 15 active ozone monitoring stations that are operated by local air districts or the California Air Resources Board (CARB). Ozone data and trends from 2000 to 2021 were used for the analysis in this plan to assess the progress the SFNA has made in improving air quality and determine if the region can attain the standard by the attainment date. This analysis evaluated the number of days exceeding the 8-hour ozone standard and compared the design values to the 2015 ozone standard.

The number of days exceeding the 8-hour 2015 ozone standard recorded at the peak monitoring sites fluctuated from year to year due to meteorological variability and changes in precursor emission patterns. Most exceedances of the 2015 ozone standard occurred at the following monitoring sites - Cool, Folsom, Placerville, Lincoln, and Auburn. From 2000 to 2021, the number of exceedance days declined from the peak of 66 days in 2000 to 34 days in 2021 (Figure 13-1). In addition, the SFNA peak design value, three-year average of the fourth highest concentrations, was calculated to be 107 ppb in 2000 and decreased to 82 ppb in 2021 (Figure 13-2), a 25 ppb reduction. Although the reductions in ozone concentration occurred at varying rates depending on the site, a downward trend was observed at all SFNA monitoring stations. It ranged per site from a declining rate of 0.40 ppb per year to as high as 1.53 ppb per year. These analyses were conducted with all data, despite wildfire impacts during several years.

This downward trend in the number of days exceeding the 8-hour ozone standard and the design value indicate that the SFNA will continue to progress towards attainment barring any substantial impacts from wildfires.

Figure 13-1 3 2015 O_3 NAAQS Exceedance Days Count Trend at the highest count monitor in SFNA

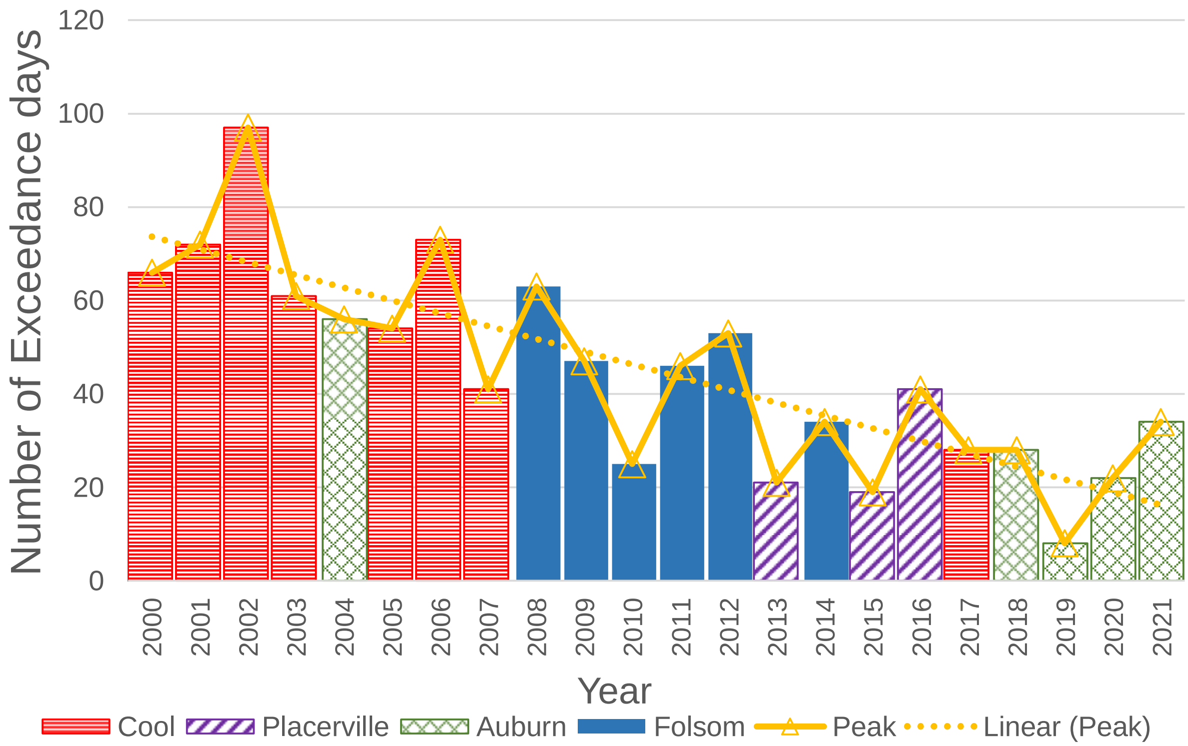
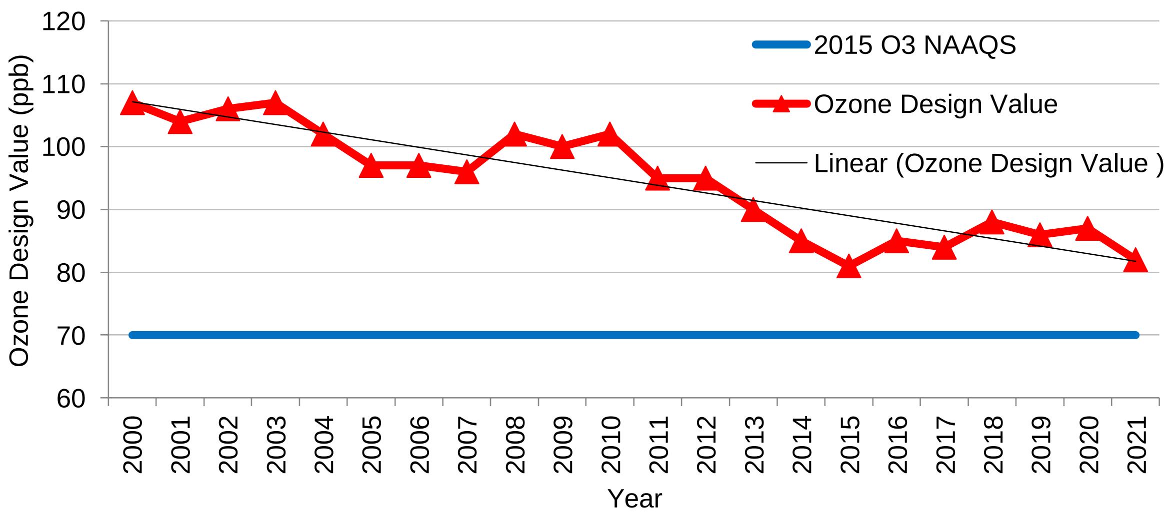


Figure 13-2 Peak 8-Hour Ozone Design Value Trends in the SFNA (2000 – 2021)

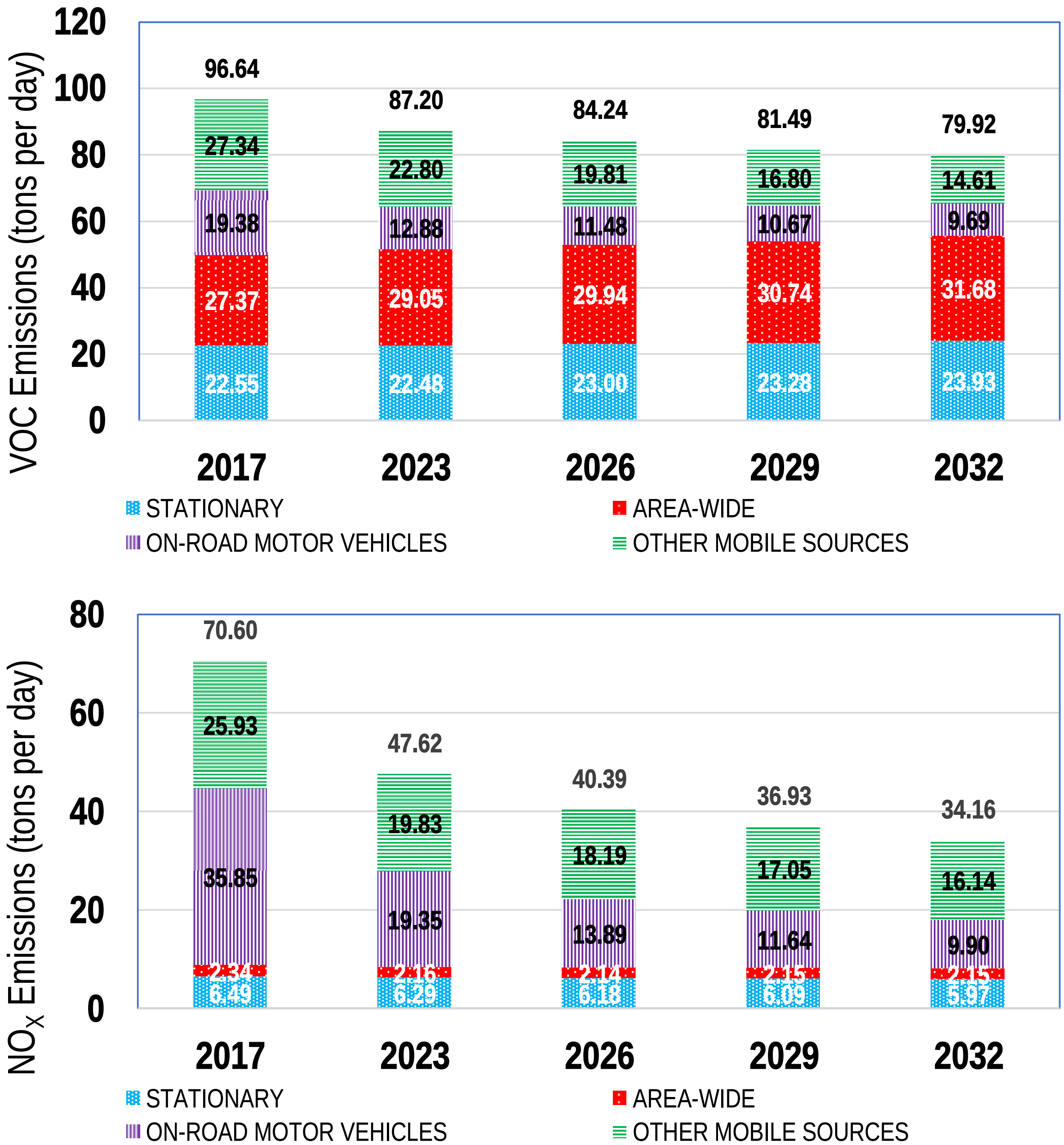


Sources: 1990-2020 Design Values were extracted from AQS Report (AMP 480) and downloaded on December 22, 2021. 2021 DV is calculated based on the combination of the AQS data and preliminary AQMIS data downloaded on 02/16/2022.
Notes: The SFNA was impacted by wildfires in summer 2018 which causes unusual high 4th highest ozone concentration for 2018. The peak design value calculation in this chart included the days impacted by wildfires and demonstrated a declining trend, despite smoke impacts.

13.3 VOC and NO_X Emissions Inventory

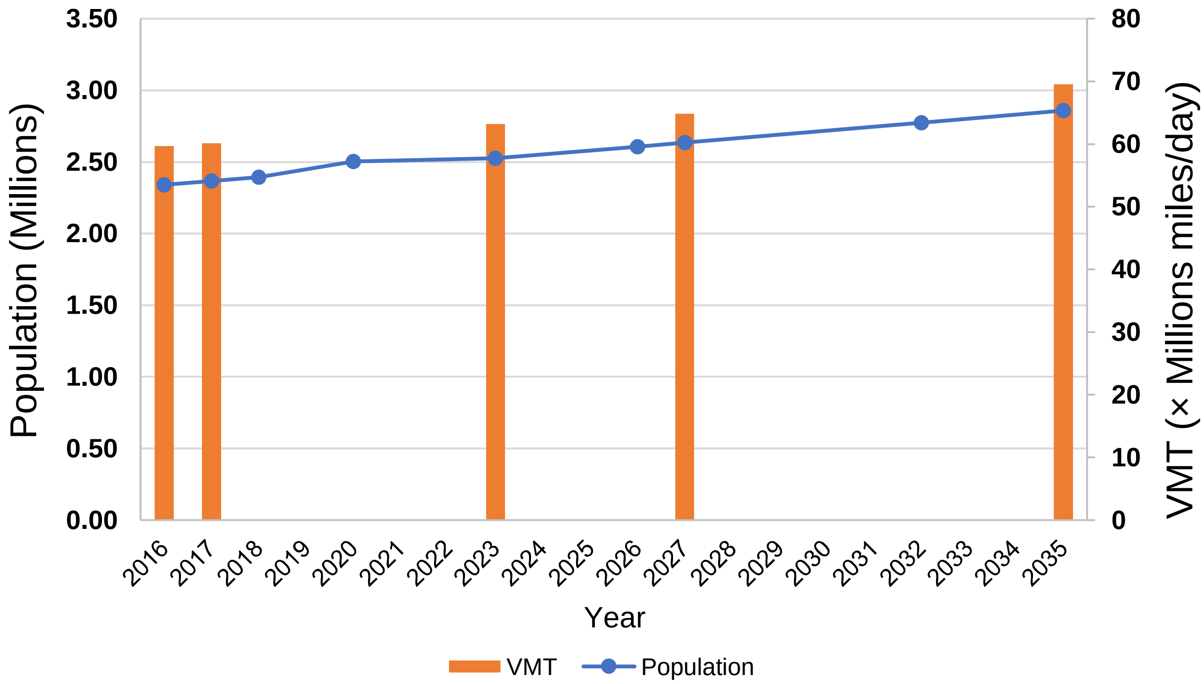
This plan provides the emissions inventories for 2017 (baseline), 2023, 2026, 2029 (milestone years), and 2032 (attainment year), which are summarized in Figure 13-3. The 2017 base year anthropogenic planning emissions inventory for the SFNA was estimated to be 97 of Volatile Organic Compounds (VOC) and 71 tons per day (tpd) of Nitrogen Oxides (NO_X). In 2032, the forecasted emissions inventory will be 80 tpd and 34 tpd of VOC and NO_X, respectively. Between 2017 and 2032, the emissions inventory is expected to decrease by about 17% for VOC and by about 52% for NO_X due to implementation of existing and future controls despite the increases in vehicle miles traveled (VMT) and population in the SFNA during the same period (Figure 13-4).

Figure 13-3 SFNA VOC and NO_X Planning Inventory Forecasts



Source: (CARB, 2022), does not include NO_X Emissions Reduction Credits (ERCs) identified in Section 5.6.

Figure 13-4 SFNA Population Growth and VMT Forecast



Sources:

1. VMT of Sacramento Area Council of Governments (SACOG) area from SACOG in 04/24/2023
2. VMT of Solano County – Sacramento Valley (SV) for future years from SACOG 04/24/2023
3. VMT of Solano County (SV) for past years from the 2008 O3 NAAQS SIP Plan
4. Population of SACOG Counties from SACOG in 09/02/2021
5. Solano County Population data from CA Dept of Finance population data P2A. Download on 04/26/2023.
6. 2020 SFNA population is from Census 2020

The planning emissions inventories also include NO_X and VOC ERCs in the milestone and attainment years as shown in Table 13-1. This inclusion accounts for any potential future growth that uses ERCs to offset the emissions in the SFNA.

Table 13-1 SFNA Summer Planning Emissions Inventory (tons per day)

Year	VOC Emissions Inventory	VOC ERCs	Total VOC Planning Emissions Inventory	NO_X Emissions Inventory	NO_X ERCs	Total NO_X Planning Emissions Inventory
2017	96.64		96.64	70.60		70.60
2023	87.20	3.63	90.83	47.62	2.80	50.42
2026	84.24		87.87	40.39		43.19
2029	81.49		85.12	36.93		39.73
2032	79.92		83.55	34.16		36.96

13.4 Attainment Modeling and Analysis

Photochemical modeling (Appendix B) was conducted to simulate base case episodes of high ozone formation. The photochemical model used the 2018 baseline year emissions inventories and 2032 future year emissions forecasts to determine if the SFNA could attain the 2015 ozone standard by the attainment date with existing control programs and new statewide control measures.

The modeling results showed a relative decline in future ozone concentrations and predicted attainment at all ozone monitors by 2032[46] as shown in Table 13-2. It showed that the peak design value of 69.8 ppb was at the Colfax monitoring station in 2032. In addition, the modeling results indicated that both VOC and NO_X reductions provide ozone benefits in the SFNA, but that NO_X reductions are much more effective than VOC reductions. The modeling results were also supported by a Weight of Evidence analysis.

Table 13-2 Baseline (2018) and Future Design Value (DV) (2032) Ozone Concentrations

Region	Site	DV2018	DV2032	DV2032t*
Eastern	Colfax	83.7	69.8	69
	Placerville	84.0	69.6	69
	Auburn[1]	81.7	68.3	68
	Cool	81.7	68.2	68
Central	North Highlands	74.7	64.8	64
	Folsom	76.7	64.7	64
	Roseville	76.3	64.2	64
	Del Paso Manor	72.0	62.4	62
	Sloughhouse	71.3	62.1	62
	Sac T Street	66.3	60.0	60
Western	Elk Grove	67.7	61.8	61
	Woodland	66.7	58.4	58
	Vacaville	64.0	58.2	58
	Davis-UCD	62.3	56.5	56

* DV2023t is the truncated value for DV2032.

13.5 Control Measures

The photochemical modeling showed that the SFNA can attain the standard by 2032 by relying on existing control programs and new commitments for statewide control

46 The statutory attainment date for a "Severe-15" nonattainment area is August 3, 2033 (83 FR 25776). To demonstrate attainment by this date, data is used from 2030, 2031 and 2032 to determine the design value.

measures. Federal, state, regional, and local air management programs will continue to do their part by reducing ozone precursor emissions. One of the existing programs is the transportation control measure, the Spare the Air Program, which was approved and is funded by SACOG and will continue through 2032. For new control measure commitments, CARB is working on measures for on-road heavy-duty and light-duty vehicle, off-road equipment, and other non-mobile sources like consumer products, space and water heaters, and pesticides (Table 13-3).

Table 13-3 Statewide Control Measures and Schedule

Measure	Agency	Action	Implementation Begins
On-Road Heavy-Duty			
Advanced Clean Fleets Regulation	CARB	2023	2024
Zero-Emissions Trucks Measure	CARB	2028	2030
On-Road Light-Duty			
On-Road Motorcycle New Emissions Standards	CARB	2022	2025
Clean Miles Standard	CARB	2021	2023
Off-Road Equipment			
Tier 5 Off-Road Vehicles and Equipment	CARB	2025	2029
Amendments to the In-Use Off-Road Diesel-Fueled Fleets Regulation	CARB	2022	2024
Transport Refrigeration Unit Regulation Part 2	CARB	2026	2028
Commercial Harbor Craft Amendments	CARB	2022	2023
Cargo Handling Equipment Amendments	CARB	2025	2026
Off-Road Zero-Emission Targeted Manufacturer Rule	CARB	2027	2031
Clean Off-Road Fleet Recognition Program	CARB	2025	2027
Spark-Ignition Marine Engine Standards	CARB	2029	2031
Other			
Consumer Products Standards	CARB	2027	2028
Zero-Emission Standard for Space and Water Heaters	CARB	2025	2030
Enhanced Regional Emission Analysis in State Implementation Plans[47]	CARB	2025	2023
Pesticides: 1,3-Dichloropropene Health Risk Mitigation	DPR[48]	2022	2024
Primarily-Federally and Internationally Regulated Sources – CARB Measures			
In-Use Locomotive Regulation	CARB	2023	2024
Future Measures for Aviation Emission Reductions	CARB	2027	2029

CARB, the SFNA air districts and SACOG conducted a Reasonably Available Control Measures (RACM) analysis as required by CAA Sections 172(a)(2)(A) and 181(a) to see if the SFNA can meet the air quality standards “as expeditiously as practicable.” This is

[47] CARB finalization
[48] California Department of Pesticide Regulation

interpreted to mean whether other measures would enable the SFNA to advance attainment by an additional year and have an attainment year of 2031 instead of 2032. Results from the RACM analysis showed that the collection of all reasonably available control measures could not advance attainment by one year.

13.6 Contingency Measures

The SFNA air districts and CARB are committed to meeting the contingency measures requirements required by the CAA. EPA has drafted updates to its guidance to help local and state agencies identify and develop contingency measures, and this draft guidance is undergoing a public review. As the final EPA guidance is awaiting finalization, CARB is proposing amendments to the Smog Check program as a statewide contingency measure. At the local levels, the SFNA air districts commit to amend the architectural coatings rules to include contingency provisions and more restrictive requirements that will go into effect if EPA finds that the SFNA has failed to meet RFP or failed to attain the NAAQS by the attainment deadline. Each air district will take its amended rule to its respective air district board for adoption prior to submitting the amended rule to CARB and EPA. The SFNA air districts also commit to re-evaluate the contingency measure requirements upon EPA's issuance of the final guidance on contingency measures. If additional contingency measures are needed, the SFNA air districts will amend the SIP to include them.

13.7 Ozone Transport

The air quality in the SFNA can be impacted by pollutant transport from the San Francisco Bay Area and the San Joaquin Valley. CARB's photochemical modeling included both transported emissions and emission reductions from statewide and upwind regions' control measures. These statewide control measures, especially the mobile source measures, will continue to bring emission reduction benefits to all nonattainment areas in California, including the SFNA. Other upwind air districts will also continue their efforts to implement air quality programs to reduce emissions. The total emission reductions from existing federal, state, regional, and local programs along with new state commitments will ensure the Sacramento region will meet the 2032 attainment deadline.

13.8 Transportation Conformity

Conformity with the SIP requires that transportation activities not cause new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS. This plan establishes the motor vehicle emissions budgets (MVEB) for demonstrating conformity with the SIP. When the MVEB are approved by EPA, the local Metropolitan Planning Organizations must ensure that the aggregate transportation emissions in the SFNA stay below or equal to these levels when approving new metropolitan transportation plans and transportation improvement programs. Table 13-4 summarizes the proposed MVEB for the 2023, 2026, and 2029 milestone years, and the 2032 attainment year.

Table 13-4 SFNA Proposed New MVEB

Sacramento Totals (Tons/Day)	2023		2026		2029		2032	
	VOC	NO_X	VOC	NO_X	VOC	NO_X	VOC	NO_X
MVEB	12.9	19.4	11.5	13.9	10.7	11.6	9.3	8.6

13.9 General Conformity

There were no changes to the general conformity regulations made as part of the 2015 NAAQS implementation rule. The existing de minimis emissions levels of 25 tons per year of VOC or NO_X as specified in 40 CFR 93.153(b)(1) continues to apply in the SFNA. If general conformity is triggered, the project would be required to reduce emissions to show that there is no emissions increase, or that those emissions are already accounted for in this plan.

13.10 Reasonable Further Progress Demonstration

The SFNA is required to demonstrate reasonable further progress (RFP), which is 3% reduction of VOC per year until the attainment date or a total of 45% VOC reduction from baseline in 2032. The RFP demonstration is performed for 2023, 2026, 2029 (milestone years), and 2032 (attainment year).

In the SFNA, NO_X emission reductions are more effective in reducing ozone concentrations. Because of this, the SFNA is allowed to use NO_X substitution to help show RFP. The NO_X substitution is used on a percentage basis to cover any VOC percentage shortfalls for the RFP demonstration. Using both VOC and NO_X substitution reductions, the SFNA has the emission reductions to meet RFP for the milestone and attainment years.

The SFNA is also required to develop a progress report (also known as milestone compliance demonstration) to evaluate whether actual emission reductions meet the RFP targets. These reports will be required to be submitted no later than 90 days after the date of the milestone years (2023, 2026, and 2029). The first milestone report will be due on March 31, 2024.

13.11 Overall Conclusion

The Sacramento Regional 2015 NAAQS 8-Hour Ozone Attainment and Reasonable Further Progress Plan satisfies the federal ozone planning requirements for Sacramento Federal Nonattainment Area for the severe classification. This plan includes ozone trends, emissions inventories, photochemical modeling, attainment demonstration, ozone transport, transportation and general conformity, MVEB, and RFP demonstration. This plan relies on existing federal, state, regional and local control programs and includes commitments for new statewide control and contingency measures and local contingency measures to attain the 2015 ozone standard by the end of 2032. The attainment of the standard is supported by photochemical modeling and the weight of evidence, which show that all future design values of the SFNA ozone monitors are below 70 ppb.

13.12 References

CA Dept of Finance. *P2-A Total Population for California and Counites.* Sacramento, CA: State of California, Department of Finance. Web 26 April 2023. < https://dof.ca.gov/wp-content/uploads/sites/352/2023/07/P2A_County_Total.xlsx >

CARB. CEPAM: External Adjustment Reporting Tool. Base Year: 2017. 28 April 2022. Web. 5 May 2022. < https://www.arb.ca.gov/app/emsinv/2019ozsip/fcmasterdetail_sip2019.php >

EPA. (83 FR 25776–25848) *Additional Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards: Final Rule.* Federal Register, Volume 83, 4 June 2018, p. 25776 – 25848. Web 05 June 2023. < https://www.govinfo.gov/content/pkg/FR-2018-06-04/pdf/2018-11838.pdf >

SACOG. Email to Steven Lau (SMAQMD). 2 September 2021.

---. Email to Steven Lau (SMAQMD). 24 April 2023.

U.S. Census Bureau. “2020 Census Results” United States Census Bureau. Web 16 August 2023. < https://www.census.gov/programs-surveys/decennial-census/decade/2020/2020-census-results.html >

APPENDIX A
Emissions Inventory

Table of Contents

Table of Figures

A Emissions Inventory

The 2017, 2023, 2026, 2029, and 2032 emissions inventories are presented in various format and details in this appendix.

A.1 Emissions Inventory Spreadsheets

A.1.1 Estimated Emissions Forecast Summary

Appendix A-1-1 is a spreadsheet, which is available in a separate file. The spreadsheet included estimated Volatile Organic Compound (VOC) and Nitrogen Oxides (NO_X) forecast by common sources categories (i.e., Stationary, Area, and Mobile) and by detailed Emission Inventory Code (EIC) categories for Sacramento Federal Ozone Nonattainment Area (SFNA) in California Emission Projection Analysis Model (CEPAM): External Adjustment Reporting Tool – 2019 Sacramento SIP Ozone Nonattainment Ver 1.04.

Spreadsheet Name: App A-1-1.xlsx

Worksheet Tab Name	Worksheet Description
README	Table of Contents and the screen capture of the CEPAM downloading time
NOX	Nitrogen Oxides Emissions Inventory Summary from CEPAM 2019 V.1.04
VOC	Volatile Organic Compounds Emissions Inventory Summary from CEPAM 2019 Version 1.04
NOX ems details	Detailed NO_X emission forecast summary by EIC for SFNA in CEPAM 2019 V1.04
VOC ems details	Detailed VOC emission forecast summary by EIC for SFNA in CEPAM 2019 V1.04

A.2 CARB SFNA 70 ppb 8-Hour Ozone NAAQS Emissions Inventory Write-Up CEPAM2019 v1.04 (July 2022)

A.2.1 Emissions Inventory Background

Emissions inventories are required by the Clean Air Act (CAA) and the Ozone SIP Requirements Rule for the 2015 ozone National Ambient Air Quality Standards (NAAQS), also called the Ozone Implementation Rule.[1] Specifically, they are required for those areas that exceed the health-based NAAQS. These areas are designated as nonattainment based on monitored exceedances of these standards. These nonattainment areas must develop an emissions inventory as the basis of a State Implementation Plan (SIP) that demonstrates how they will attain the standards by specified dates. This document describes the emissions inventory included in the SFNA 70 ppb Ozone SIP.

A.2.2 Emissions Inventory Overview

Emissions inventories are estimates of the amount and type of pollutants emitted into the atmosphere by facilities, mobile sources, and areawide sources. 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 California Air Resources Board (CARB) and in conjunction with five local air districts (Districts) – the Sacramento Metropolitan Air Quality Management District (AQMD), El Dorado County AQMD, Feather River AQMD, Placer County Air Pollution Control District, and Yolo-Solano AQMD – have developed a comprehensive current emissions inventory consistent with the requirements set forth in Section 182(a)-(f) of the federal Clean Air Act[2]. CARB and district staff conducted a thorough review of the inventory to ensure that the emission estimates reflect accurate emissions reports for point sources and that estimates for mobile and areawide sources are based on the most recent approved 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.

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1 Implementation of the 2015 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; (40 CFR part 51 Subpart CC; see also https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-51#subpart-CC).

2 Section 182(a)-(f) of the Act. *https://www.govinfo.gov/content/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partD-subpart2-sec7511a.htm*

The United States Environmental Protection Agency (EPA) regulations require that the emissions inventory for an Ozone SIP contain emissions data for the two precursors to ozone formation: NOx and VOC[3]. 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 EPA's list of VOCs.

A.2.2.1 Inventory Base Year

40 CFR 51.1315(a) requires that the inventory year be selected consistent with the baseline year for the reasonable further progress (RFP) plan as required by 40 CFR 51.1310(b)[4], which states that the base year emissions inventory shall be the emissions inventory for the most recent calendar year of which a complete triennial inventory is required to be submitted to EPA under the provisions of subpart A of 40 CFR part 51, Air Emissions Reporting Requirements, 40 CFR 51.1– 50. States may also use an alternative baseline emissions inventory provided that the year selected corresponds with the year of the effective date of designation as nonattainment for that NAAQS[5].

CARB selected the base year 2017 because it is the most recent triennial inventory year conducted for the National Emissions Inventory (NEI) pursuant to the Air Emissions Reporting Requirements (AERR) rule.

A.2.2.2 Forecasted Inventories

In addition to base year emissions, emissions projections are needed for a variety of reasons, including redesignation maintenance plans, the attainment projected inventory for a nonattainment area (NAA), and air quality modeling for attainment plans[6].

For stationary and area sources, forecasted inventories are a projection of the base year inventory that reflects expected growth trends for each source category and emissions reductions due to adopted control measures. CARB develops emission forecasts by applying growth and control profiles to the base year inventory. The stationary and area source emissions inventory for the SFNA 70 ppb Ozone SIP is modeled by the California CEPAM External Adjustment Reporting Tool, 2019 Emission Projections, Version 1.04.

Growth profiles for point and areawide sources are derived from surrogates, such as economic activity, fuel usage, population, and housing units, 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

[3] Section 182(a)(1) of the Act. https://www.govinfo.gov/content/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partD-subpart2-sec7511a.htm

[4] 40 CFR 51.1315(a). https://www.govinfo.gov/content/pkg/CFR-2021-title40-vol2/pdf/CFR-2021-title40-vol2-sec51-1315.pdf.

[5] 40 CFR 51.1310(b). https://www.govinfo.gov/content/pkg/CFR-2020-title40-vol2/pdf/CFR-2020-title40-vol2-sec51-1310.pdf.

[6] 40 CFR 51.114. https://www.govinfo.gov/content/pkg/CFR-2000-title40-vol2/pdf/CFR-2000-title40-vol2-sec51-114.pdf.

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 on-road mobile source emissions are generated by CARB's EMFAC2017 model, which predicts activity rates and vehicle fleet turnover by vehicle model year, along with activity inputs from the metropolitan planning organization (MPO). Off-road mobile sources are forecasted with category-specific model or, where not available, CARB's OFFROAD2007. CEPAM integrates the emission projections derived from these mobile source models to develop a comprehensive forecasted emission inventory. As with stationary sources, the mobile source models include control algorithms that account for adopted regulatory actions.

A.2.2.3 Temporal Resolution

40 CFR 51.1315(c) requires emissions values included in the base year inventory to be actual ozone season day emissions as defined by 40 CFR 51.1300(q)[7]. Since ozone concentrations tend to be highest during the summer months, the emissions inventory used in the SIP is based on the summer season (May through October).

A.2.2.4 Geographic Scope

The SFNA is comprised of the Sacramento Metropolitan AQMD and the Yolo-Solano AQMD, El Dorado and Placer Counties except the portion within the Lake Tahoe Air Basin, and the Southern portion of Sutter County. Since the Southern portion of Sutter County is split into a region not defined by county, air basin, or district boundaries, the air districts identified the facilities that fall in the sub-area; for on-road sources, a special EMFAC2017 run was executed based on MPO activity specific to this sub-region, and the area and off-road source emissions in South Sutter County were estimated using category-specific factors based on the spatial distribution of population and other activity parameters within the sub-region—these fractions were developed by the air districts. The special split allocation method of each subcategory within South Sutter County is shown in Table A-1 below.

7 40 CFR 51.1315(c). https://www.govinfo.gov/content/pkg/CFR-2021-title40-vol2/pdf/CFR-2021-title40-vol2-sec51-1315.pdf.

Table A-1 Allocation Method for South Sutter County Sub-Area

EICSUM	SOURCE CATEGORY	ALLOCATION METHOD
30	OIL AND GAS PRODUCTION (COMBUSTION)	OIL AND GAS ACTIVITY
50	MANUFACTURING AND INDUSTRIAL	HUMAN POPULATION
52	FOOD AND AGRICULTURAL PROCESSING	AG LAND RATIO
60	SERVICE AND COMMERCIAL	HUMAN POPULATION
99	OTHER (FUEL COMBUSTION)	HUMAN POPULATION
220	DEGREASING	HUMAN POPULATION
230	COATINGS AND RELATED PROCESS SOLVENTS	HUMAN POPULATION
250	ADHESIVES AND SEALANTS	HUMAN POPULATION
299	OTHER (CLEANING AND SURFACE COATINGS)	HUMAN POPULATION
310	OIL AND GAS PRODUCTION	OIL AND GAS ACTIVITY
330	PETROLEUM MARKETING	HUMAN POPULATION
420	FOOD AND AGRICULTURE	AG LAND RATIO
510	CONSUMER PRODUCTS	HUMAN POPULATION
520	ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	HUMAN POPULATION
530	PESTICIDES/FERTILIZERS	AG LAND RATIO
540	ASPHALT PAVING / ROOFING	HUMAN POPULATION
610	RESIDENTIAL FUEL COMBUSTION	HUMAN POPULATION
620	FARMING OPERATIONS	AG LAND RATIO
660	FIRES	AG LAND RATIO
670	WASTE BURNING AND DISPOSAL	AG LAND RATIO
710	LIGHT DUTY PASSENGER (LDA)	EMFAC2017 run specific to South Sutter
722	LIGHT DUTY TRUCKS - 1 (LDT1)	EMFAC2017 run specific to South Sutter
723	LIGHT DUTY TRUCKS - 2 (LDT2)	EMFAC2017 run specific to South Sutter
724	MEDIUM DUTY TRUCKS (MDV)	EMFAC2017 run specific to South Sutter
732	LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1)	EMFAC2017 run specific to South Sutter
733	LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2)	EMFAC2017 run specific to South Sutter

EICSUM	SOURCE CATEGORY	ALLOCATION METHOD
734	MEDIUM HEAVY DUTY GAS TRUCKS (MHDV)	EMFAC2017 run specific to South Sutter
742	LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1)	EMFAC2017 run specific to South Sutter
743	LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2)	EMFAC2017 run specific to South Sutter
744	MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV)	EMFAC2017 run specific to South Sutter
746	HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV)	EMFAC2017 run specific to South Sutter
750	MOTORCYCLES (MCY)	EMFAC2017 run specific to South Sutter
772	SCHOOL BUSES - DIESEL (SBD)	EMFAC2017 run specific to South Sutter
778	OTHER BUSES - MOTOR COACH - DIESEL (OBC)	EMFAC2017 run specific to South Sutter
780	MOTOR HOMES (MH)	EMFAC2017 run specific to South Sutter
810	AIRCRAFT	AG LAND RATIO (EMPHASIS: CROP DUSTING)
820	TRAINS	TRACK MILES
840	RECREATIONAL BOATS	PHYSICAL LAND MASS RATIO
850	OFF-ROAD RECREATIONAL VEHICLES	PHYSICAL LAND MASS RATIO
860	OFF-ROAD EQUIPMENT	HUMAN POPULATION
870	FARM EQUIPMENT	AG LAND RATIO
890	FUEL STORAGE AND HANDLING	HUMAN POPULATION

A.2.2.5 Quality Assurance and Quality Control

CARB has established a quality assurance and quality control (QA/QC) process to ensure the integrity and accuracy of the emission 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 air districts, which 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. Area-wide source emissions estimates are developed by both CARB and air district staff, and the methodologies are reviewed by both agencies before their inclusion in the emissions inventory. Mobile categories are verified with CARB mobile source staff for consistency with the on-road and off-road emission models. Additionally, CEIDARS is designed with automatic system checks to prevent errors, such as double counting of emission sources. At the final stage, CEPAM is thoroughly reviewed to validate the accuracy of growth and control application, and the output emissions are compared against prior approved versions of CEPAM to identify data anomalies.

A.2.3 Emission Inventory Components

A summary of the components that make up SFNA's 70 ppb Ozone SIP emissions inventory is presented in the following sections. These include mobile (on- and off-road) sources, stationary point sources, and areawide sources. Natural sources are not included.

A.2.3.1 Mobile Source Emissions

CARB develops the emission inventory for the mobile sources using various modeling methods. These models account for the effects of various adopted regulations, technology types, fleet turnover, and seasonal conditions on emissions. Mobile sources in the emission inventory are composed of both on-road and off-road sources, described in the sections below.

A.2.3.1.1 On-Road Mobile Source Emissions

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 local MPO.

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 Department of Motor Vehicles (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 at:

https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-road-documentation

A.2.3.1.1.1 EMFAC2017 SAFE Vehicles Rules Off-Model Adjustment Removal

On September 27, 2019, EPA and National Highway Traffic Safety Administration (NHTSA) published the "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program" (SAFE-1).[8] SAFE-1 revoked California's authority to set its own greenhouse gas emissions standards and set zero-emission vehicle mandates in California. On April 28, 2021, EPA reconsidered the 2019 SAFE-1 by finding that the actions taken as a part of SAFE-1 were decided in error and are now entirely rescinded[9].

Therefore, any previously applied off-model adjustments as a result of SAFE-1 were removed from this inventory, resulting in a minor reduction in emissions.

A.2.3.1.1.2 EMFAC2017 ACT Off-Model Adjustment

The Advanced Clean Trucks (ACT) regulation was approved on June 25, 2020, and has two main components, a manufacturers zero-emission vehicle (ZEV) sales requirement and a one-time reporting requirement for large entities and fleets. The first component requires manufacturers to sell ZEVs as a percentage of annual truck and bus sales in California for vehicle model years 2024 and newer.

The ACT regulation impacts some of the underlying assumptions in CARB's EMFAC2017 model, which was used to assess emissions from on-road mobile sources. Therefore, CARB developed off-model adjustment factors in order to reflect the regulation. Adjustment factors were based on calculations in *EMFAC2021*, which models a percentage of California-certified ZEV sales for each EMFAC category and model year. More information on inventory modelling methods can be found in the ACT Initial Statement of Reasons (ISOR) *Appendix F*[10]. These adjustment factors were calculated based on emission estimates using *EMFAC2021* under two scenarios: (1) controlled scenario -estimated emissions with adopted regulations (EMFAC2021 default) and (2) uncontrolled scenario - estimated emissions without accounting for the benefits of adopted regulations, including ACT and other regulations Heavy-Duty Omnibus, Opacity, and ICT (described below). These adjustments, provided in the form of multipliers, were applied to emissions outputs from the EMFAC2017 model by the CEPAM external adjustment module to account for the impact of the ACT regulation. The ACT off-model adjustment factors were only applied to the medium-and heavy-duty truck sectors.

Additional information on ACT is available at:

https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks

Additional information on EMFAC2021 technical details is available at:

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8 84 FR 51310. *https://www.govinfo.gov/content/pkg/FR-2019-09-27/pdf/2019-20672.pdf*.
9 87 FR 14332. *https://www.govinfo.gov/content/pkg/FR-2022-03-14/pdf/2022-05227.pdf*.
10 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/appf.pdf

https://ww2.arb.ca.gov/sites/default/files/2021-08/emfac2021_technical_documentation_april2021.pdf

A.2.3.1.1.3 EMFAC2017 Heavy-Duty Omnibus Off-Model Adjustment

On August 27, 2020, CARB adopted the Heavy-Duty (HD) Omnibus regulation, which would establish NO_X engine emission standards 90 percent lower than today's technology. The Omnibus Regulation will dramatically reduce NOx emissions by comprehensively overhauling exhaust emission standards, test procedures, and other emissions-related requirements for California-certified heavy-duty engines with engine model years 2024 and newer.

The HD Omnibus regulation impacts some of the underlying assumptions in CARB's EMFAC2017 model, which was used to assess emissions from on-road mobile sources. Therefore, CARB developed off-model adjustment factors based on *EMFAC2021* (described above) in order to reflect the regulation. These adjustments, provided in the form of multipliers, were applied to emissions outputs from the EMFAC2017 model by the CEPAM external adjustment module to account for the impact of the HD Omnibus regulation. The adjustment factors reflect the impact of all components of the HD Omnibus regulation on in-use (i.e. real-world) NO_X emissions and deterioration-related emissions. More details on the inventory analysis for this regulation can be found in *Appendix D*[11] of the HD Omnibus staff report.

The HD Omnibus off-model adjustment factors were only applied to on-road heavy-duty vehicles.

Additional information on the HD Omnibus regulation is available at:

https://ww2.arb.ca.gov/our-work/programs/heavy-duty-low-nox

A.2.3.1.1.4 EMFAC2017 Innovative Clean Transit Off-Model Adjustment

The Innovative Clean Transit (ICT) regulation was adopted by CARB in 2019 and targets reductions in transit fleets by requiring transit agencies to gradually transition their buses to zero-emission technologies. ICT has helped to advance heavy-duty ZEV deployment, with buses acting as a beachhead in the heavy-duty sector. Based on the size of the transit agencies, they are categorized as small and large agencies. Starting calendar year 2023, large agencies follow the phase-in schedule to have a certain percentage of their new purchases as zero emission buses (ZEB). For the small agencies, the start calendar year will be 2025. By 2030, all the agencies need to have 100% of their new purchases as ZEB.

The ICT regulation impacts some of the underlying assumptions in CARB's EMFAC2017 model, which was used to assess emissions from on-road mobile sources. Therefore,

11 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/appd.pdf

CARB developed off-model adjustment factors based on EMFAC2021 (described above) in order to reflect the regulation. These adjustments, provided in the form of multipliers, were applied to emissions outputs from the EMFAC2017 model by the CEPAM external adjustment module to account for the impact of ICT. More details on the inventory analysis for this regulation can be found in *Appendix L*[12] of the ICT staff report. The ICT off-model adjustment factors were only applied to the urban buses (UBUS) category.

Additional information on the ICT regulation is available at:

https://ww2.arb.ca.gov/our-work/programs/innovative-clean-transit/ict-regulation

A.2.3.1.1.5 EMFAC2017 Heavy-Duty Inspection and Maintenance Off-Model Adjustment

On Dec. 9th, 2021, CARB adopted Heavy-Duty Inspection and Maintenance (HD I/M) program, which controls emissions effectively from non-gasoline on-road heavy-duty vehicles with a gross vehicle weight rating (GVWR) greater than 14,000 pounds. Starting from calendar year 2023, the program drastically reduces NO_X and $PM_{2.5}$ emissions by enforcing periodic testing and inspections for heavy-duty trucks operating in California.

The Heavy-Duty Inspection and Maintenance (HD I/M) regulation impacts some of the underlying assumptions in CARB's EMFAC2017 model, which was used to assess emissions from on-road mobile sources. Therefore, CARB developed off-model adjustment factors based on off-model analysis with EMFAC2021 in order to reflect the regulation. More information on this analysis is provided in *Appendix D*[13] of the HD I/M staff report. Since this regulation was adopted after the release of EMFAC2021, these adjustment factors were calculated based on emission estimates under two scenarios: (1) EMFAC2021 with HD I/M analysis incorporated and (2) EMFAC2021 default, which does not include HD I/M. These adjustments, provided in the form of multipliers, were applied to emissions outputs from the EMFAC2017 model by the CEPAM external adjustment module to account for the impact of HD I/M. These off-model adjustment factors were applied to all diesel heavy-duty diesel categories.

A.2.3.1.2 Off-Road Mobile Source Emissions

Emissions from off-road sources are 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 by CARB to specific off-road categories.

12 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/ict2018/appl.pdf
13 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2021/hdim2021/appd.pdf

A.2.3.1.2.1 Recreational Marine Vessels

Pleasure craft or recreational marine vessel (RMV) is a broad category of marine vessel that includes gasoline-powered spark-ignition marine watercraft (SIMW) and diesel-powered marine watercraft. It includes outboards, sterndrives, personal watercraft, jet boats, and sailboats with auxiliary engines. This emissions inventory was last updated in 2014 to support the evaporative control measures. The population, activity, and emission factors were revised using new surveys, DMV registration information, and emissions testing.

Staff used economic data from a 2014 UCLA Economic Forecast to estimate the near-term annual sales of RMV (2014 to 2019). To forecast long-term annual sales (2020 and later), staff used an estimate of California's annual population growth as a surrogate.

Additional information is available at:

https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad

A.2.3.1.2.2 Recreational Vehicles

Off-highway recreational vehicles include off-highway motorcycles (OHMC), all-terrain vehicles (ATV), off-road sport vehicles, off-road utility vehicles, sand cars, golf carts, and snowmobiles. A new model was developed in 2018 to update emissions from recreational vehicles. Input factors such as population, activity, and emission factors were re-assessed using new surveys, DMV registration information, and emissions testing. OHMC population growth is determined from two factors: incoming population as estimated by future annual sales and the scrapped vehicle population as estimated by the survival rate.

Additional information is available at:

https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad

A.2.3.1.2.3 Fuel Storage and Handling

Emissions from portable fuel containers (gas cans) were estimated based on past surveys and CARB in-house testing. This inventory uses a composite growth rate that depends on occupied household (or business units), percent of households (or businesses) with gas cans, and average number of gas cans per household (or business) units.

Additional information is available at:

https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad

A.2.3.1.2.4 Small Off-Road Engines (SORE)

SORE are spark-ignition engines rated at or below 19 kilowatts (i.e., 25 horsepower). Typical engines in this category are used in lawn and garden equipment as well as other outdoor power equipment and cover a broad range of equipment. The majority of this equipment belongs to the Lawn & Garden (e.g., lawnmower, leaf blower, trimmer) and Light Commercial (e.g., compressor, pressure washer, generator) categories of CARB's SORE emissions inventory model.

The newly developed, stand-alone SORE2020 Model reflects the recovering California economy from the 2008 economic recession and incorporates emission results from CARB's recent in-house testing as well as CARB's most recent Certification Database. CARB also has conducted an extensive survey of SORE operating within California through the Social Science Research Center (SSRC) at the California State University, Fullerton (CSUF). Data collected through this survey provides the most up-to-date information regarding the population and activity of SORE equipment in California. The final SORE emissions included the adopted SORE rule in December 2021 as well as the 15-day changes after the Board hearing which allowed the pressure washers (greater than 5 hp) extra time for meeting the regulation. The SORE annual sales were forecasted using historic growth of the number of California households (DOF[14] household forecasts, 2000 – 2008 and 2009 - 2018).

Additional information on SORE baseline emissions (without the adopted rule and 15-day changes) is available at:

https://ww2.arb.ca.gov/sites/default/files/2020-09/SORE2020_Technical_Documentation_2020_09_09_Final_Cleaned_ADA.pdf

A.2.3.1.2.5 Ocean Going Vessels

Ocean going vessels (OGVs) were updated in 2021 based on Automatic Identification System (AIS) (transponder) data. This data, along with vessel information supplied by South Coast AQMD and IHS Fairplay provides vessel visit counts, speed, engine size, and other vessel characteristics. The inventory adopts EPA's methodology for emissions based on vessel speed, engine model year and horsepower. The inventory includes transit, maneuvering, anchorage, and at-berth emissions, updating the 2019 at-berth-only inventory. The comprehensive national model Freight Analysis Framework (FAF) was used to develop growth rates for forecasting.

Additional information on CARB's general OGV update is available at: *https://ww2.arb.ca.gov/sites/default/files/2022-03/CARB_2021_OGV_Documentation_ADA.pdf*

[14] California Department of Finance

A.2.3.1.2.6 Commercial Harbor Craft

Commercial Harbor Crafts (CHC) are grouped into 18 vessel types: articulated tug barge (ATB), bunker barge, towed petrochemical barge, other barge, dredge, commercial passenger fishing, commercial fishing, crew and supply, catamaran ferry, monohull ferry, short run ferry, excursion, ATB tug, push and tow tug, escort/ship assist tug, pilot boat, research boat, and work boat.

The CHC inventory was updated in 2021 and includes vessels used around harbors such as tug and tow boats, fishing vessels, research vessels, barges, and similar. The inventory was updated based on CARB's reporting data for these vessels, as well as inventories from the Ports of Los Angeles and Long Beach and Oakland and Richmond. This supplied vessel characteristics, and the population was scaled up to match U.S. Coast Guard data on the annual number of vessels in California waters. Activity and load factors were based on a mix of reporting data and port-specific inventories. Emission factors were based on certification data for harbor craft engines. Population and activity growth factors were estimated based on historical trends in the past decade.

Additional information on this methodology is available at:

https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2021/chc2021/apph.pdf

A.2.3.1.2.7 Locomotives

All locomotive inventories were updated in 2020 and include linehaul (large national companies), switchers (used in railyards), passenger, and Class 3 locomotives (smaller regional companies). Data for each sector was supplied by rail operations, including Union Pacific and Burlington Northern, and Santa Fe Railway (BNSF) for linehaul and switcher operations. Data for other categories was supplied by the locomotive owners. Emission factors for all categories were based on EPA emission factors for locomotives. The inventory reflects the 2005 memorandum of understanding (MOU) with Union Pacific and BNSF. Growth rates were primarily developed from the FAF.

More information is available at:

https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-road

A.2.3.1.2.8 Diesel Agricultural Equipment

The agricultural equipment inventory covers all off-road vehicles used on farms or first processing facilities (of all fuel types). It was updated in 2021 using a 2019 survey of California farmers and rental facilities, and the 2017 U.S. Department of Agriculture (USDA) agricultural census. Emission factors are based on the 2017 off-road diesel emission factor update. The inventory reflects incentive programs for agricultural equipment that were implemented earlier than August 2019. Agricultural growth rates were developed using historical data from the County Agricultural Commissioners' reports.

Additional information is available at:

https://ww2.arb.ca.gov/sites/default/files/2021-08/AG2021_Technical_Documentation_0.pdf

A.2.3.1.2.9 In-Use Off-Road Equipment

This category covers off-road diesel vehicles over 25 horsepower in construction, mining, industrial, and oiling drilling categories. The inventory was updated in 2022 based on the DOORS registration program. Activity was updated based on a 2021 survey of registered equipment owners, and emission factors were based on the 2017 off-road diesel emission factor update. The inventory reflects the In-Use Off-Road Equipment Regulations, as amended in 2011.

The updated methodology is currently in the process of being posted online. When it is completed, the methodology will be available at:

https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-road

A.2.3.1.2.10 Cargo Handling Equipment

The Cargo Handling Equipment (CHE) inventory covers equipment (of all fuels) used at California ports and intermodal railyards, such as cranes, forklifts, container handling equipment, and more. The inventory population and activity were updated in 2021 based on the port inventories for the Ports of Los Angeles and Long Beach and Richmond, and the CARB reporting data for other ports and railyards, which had a more comprehensive inventory than available through reporting. Load factors were based on the previous inventory in 2007, and emission factors were based on the 2017 off-road diesel emission factor update. The inventory reflects the CHE Airborne Toxic Control Measures (ATCM), adopted in 2005 and completed in 2017.

The updated methodology is currently in the process of being posted online. When it is completed, the methodology will be available at:

https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-road

A.2.3.1.2.11 Transportation Refrigeration Units - Diesel

The Transportation Refrigeration Units (TRU) inventory was updated in 2020 based on the TRU reporting program at CARB. The activity was developed based on 2010 surveys of facilities served by TRUs and 2017 to 2019 telematics data purchased from TRU manufacturers. Emission factors were developed specifically for TRUs based on TRU engine certification data reported to EPA as of 2018. The inventory reflects the TRU

ATCM and 2021 amendments. The forecasting was based on IBISWorld reports forecast for related industries, and turnover forecasting was based on the past 20 years equipment population trends.

Additional information is available at:

https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/tru2021/apph.pdf

A.2.3.1.2.12 Portable Equipment

Portable equipment inventory includes non-mobile diesel, such as generators, pumps, air compressors, chippers, and other miscellaneous equipment over 50 horsepower. This inventory was developed in 2017 based on CARB's registration program, 2017 survey of registered owners for activity and fuel, and the 2017 off-road diesel emission factor update. The inventory also reflects the Portable ATCM and 2017 amendments.

Because registration in the Portable Engine Registration Program (PERP) is voluntary, the PERP registration data was used as the basis for equipment population, with an adjustment factor used to represent the remaining portable equipment in the state. Estimates of future emissions beyond the base year were made by adjusting base year estimates for population growth, activity growth, and the purchases of new equipment (i.e. natural and accelerated turnover).

Additional information is available at:

https://ww3.arb.ca.gov/msei/ordiesel/perp2017report.pdf

A.2.3.1.2.13 Large Spark Ignition/Forklifts

The large spark ignition (LSI) inventory includes gasoline and propane forklifts, sweeper/scrubbers, and tow tractors. The inventory was updated in 2020 based on the LSI/forklift registration in the DOORS reporting system at CARB, and the sales data was provided by the Industrial Truck Association (ITA). Activity was based on a survey of equipment owners in the DOORS system, and emission factors were based on EPA's latest guidance for gasoline and propane engines. The inventory reflects the LSI regulation requirements and 2016 amendments.

The updated methodology is currently in the process of being posted online. When it is completed, the methodology will be available at:

https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-road

A.2.3.1.2.14 Forestry Equipment

The new 2021 forestry diesel equipment emissions inventory was developed to replace the previous emissions inventory for diesel forestry equipment based on OFFROAD2007. This inventory includes equipment used in forestry and in milling. This includes foresting operations, such as feller/bunchers and dragline operations, equipment used to build roads to reach forested areas, and forklifts or loaders used in milling operations. The inventory was based on a 2019 survey of forestry operations and mills (for calendar year 2017), as well as the 2019 California Department of Tax and Fee Administration data on the annual timber harvest, with emission factors from the 2017 off-road diesel emission factor update. This sector does not include any emission reduction measures or strategies. The model projects forestry equipment population and emissions in future years by predicting the retirement and purchasing habits of forestry equipment. The model attempts to predict a business-as-usual (BAU) behavior based on the 2017 survey data.

Additional information is available at:

https://ww2.arb.ca.gov/sites/default/files/2021-10/2021_Forestry_Inventory_Technical_Document_FINAL_09302021.pdf

A.2.4 Stationary Point Sources

The stationary source inventory is composed of point sources and area-wide sources. The data elements in the inventory are consistent with the data elements required by the AERR. The inventory reflects actual emissions from industrial point sources reported to the air districts by the facility operators through calendar year 2017.

Stationary point sources also include smaller point sources, such as gasoline dispensing facilities and laundering, that are not inventoried individually, but are estimated as a group and reported as a single source category. Emissions from these sources are estimated using various models and methodologies. Estimation methods include source testing, direct measurement by continuous emissions monitoring systems, or engineering calculations. Emissions for these categories are estimated by both CARB and the air districts.

Estimates for the categories below were developed by CARB and have been reviewed by CARB staff to reflect the most up-to-date information.

A.2.4.1.1.1 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 OFFROAD2007 model.

Additional information on this methodology is available at:

https://ww3.arb.ca.gov/ei/areasrc/arbfuelcombother.htm

A.2.4.1.1.2 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 at: *https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full1-1.pdf*

A.2.4.1.1.3 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 based on the DOF population forecasts, 2020.

Additional information on this methodology is available at: *https://ww3.arb.ca.gov/ei/areasrc/arbcleanlaund.htm*

A.2.4.1.1.4 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. Emissions were grown based on CARB/REMI[15] industry-specific economic output, version 2.4.5.

Additional information on this methodology is available at: *https://ww3.arb.ca.gov/ei/areasrc/arbcleandegreas.htm*

A.2.4.1.1.5 Coatings and Thinners

This category includes emissions from coatings and related process solvents. Auto refinishing emissions estimates are based on a CARB methodology using production data and a composite emission factor derived from a 2002 survey. These estimates were grown based on CARB's on-road mobile sources model (EMFAC2017). 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

15 Regional Economic Models, Inc

emission factor developed by CARB. These estimates were grown based on REMI county economic forecasts, version 2.4.5.

Additional information on these methodologies is available at: *https://ww3.arb.ca.gov/ei/areasrc/arbcleancoatreproc.htm*

A.2.4.1.1.6 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. Estimates were grown based on REMI county economic forecasts, version 2.4.5.

Additional information on this methodology is available at: *https://ww2.arb.ca.gov/carb-cleaning-and-surface-coating-methodologies-adhesives-and-sealants*

A.2.4.1.1.7 Gasoline Dispensing Facilities (GDFs)

This category uses the 2015 CARB methodology to estimate emissions from fuel transfer and storage operations at GDFs. 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 also 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 2014. Emissions were grown based on EMFAC2017.

Additional information on this category is available at:

https://ww2.arb.ca.gov/arb-petroleum-production-and-marketing-methodologies-petroleum-marketing

A.2.4.1.1.8 Gasoline Cargo Tank

This category uses the 2002 CARB methodology to estimate emissions from gasoline cargo tanks. These emissions do not include the emissions from loading and unloading of gasoline cargo tank product; they are included in the gasoline terminal inventory and gasoline service station inventory. Pressure-related fugitive emissions are volatile organic vapors leaking from three points: fittings, valves, and other connecting points in the vapor collection system on a cargo tank. 1997 total gasoline sales were obtained from the California Department of Transportation. The emission factors are derived from the data in the report, "Emissions from Gasoline Cargo Tanks, First Edition," published by the Air and Waste Management Association in 2002.

The initial emission estimates for 1997 were grown to 2012 using a growth parameter developed by Pechan based on gasoline and oil expenditures data. Emissions were grown according to fuel consumption from CARB's EMFAC 2017 mobile sources emission factors model.

Additional information on this methodology is available at:

https://ww2.arb.ca.gov/arb-petroleum-production-and-marketing-methodologies-petroleum-marketing

A.2.4.1.1.9 Oil and Gas Production

The oil and natural gas production inventory is estimated by the 2015 CARB methodology. This category is related to fugitive emissions from production-related fuel consumption, fugitive losses (sumps, pits, pumps, compressors, well heads, separators, valves, and fittings), vapor recovery and flares, tank and truck working and breathing losses, wastewater treatment, tertiary production, and wet and dry gas stripping. Emissions were calculated using EPA's Oil and Natural Gas Tool v1.4 with default emissions factors from ENVIRON Int'l Corp's 2012 report, "2011 Oil and Gas Emission Inventory Enhancement Project for CenSARA[16] States," and activity data taken from California's Division of Oil, Gas, and Geothermal Resources (DOGGR) (which was renamed to Geologic Energy Management Division (CalGEM) in 2020). CARB also incorporated data from the 2007 Oil and Gas Industry Survey (e.g., typical component counts) and feedback from individual air districts (e.g., minimum controls required to operate in a certain district, with associated control factors) to improve these parameters and further adjust the tool's output. Emissions were grown to 2017 based on CalGEM historical statewide production. Growth in future years an assumed 2.9% annual decline, which reflects the statewide CalGEM trend from 2000 through 2016.

Additional information on this methodology is available at:

https://ww2.arb.ca.gov/resources/documents/oil-and-gas-industry-survey

https://ww3.arb.ca.gov/ei/areasrc/oilandgaseifinalreport.pdf

A.2.4.1.1.10 Wine Fermentation and Aging

This category includes emissions from the fermentation and aging of wine. Wine fermentation volumes in California are reported by the U.S. Alcohol and Tobacco Tax and Trade Bureau. CARB staff derived the emission factors from a computer model developed by Williams and Boulton. Emissions were initially estimated for 2002 and grown to later years using beverage manufacturing (Alcoholic & Non-Alcoholic) economic output.

An emission factor for brandy was derived by Hugh Cook of the Wine Institute. Emissions were initially estimated for 1992 then grown to 2012 using economic output for food

[16] Central States Air Resource Agencies

manufacturing. Emissions were grown from 2012 to 2017 using beverage manufacturing economic output per REMI. Growth for future years is based on REMI forecast version 2.4.5.

Additional information on this methodology is available at: *http://www.arb.ca.gov/ei/areasrc/arbindprofandag.htm*

A.2.5 Area-Wide Sources

Area-wide sources include categories where emissions take place over a wide geographic area, such as consumer products. Emissions from these sources are estimated using various models and methodologies. Estimation methods include source testing, direct measurement by continuous emissions monitoring systems, or engineering calculations. Emissions for these categories are estimated by both CARB and the air districts.

Estimates for the categories below were developed by CARB and had been reviewed by CARB staff to reflect the most up-to-date information:

A.2.5.1.1.1 Consumer Products and Aerosol Coatings

The Consumer Product emission estimates utilized sales and formulation data from the CARB's mandatory survey of all consumer products sold in California for calendar years 2013 through 2015 (2015 Consumer Product Survey). The aerosol coatings estimates utilized sales and formulation data from a survey conducted by CARB in 2010. Based on the survey data, CARB staff determined the total product sales and total VOC emissions for the various product categories. Growth for personal care products is based on real disposable personal income projections per REMI version 2.4.5. No growth is assumed for aerosol coatings. Growth for all other consumer products is based on DOF population projections, 2020.

Additional information on CARB's consumer products surveys is available at:

https://ww2.arb.ca.gov/our-work/programs/consumer-products-program/consumer-commercial-product-surveys

A.2.5.1.1.2 Architectural Coatings

Architectural coatings are coatings applied to stationary structures and their accessories. They include house paints, stains, industrial maintenance coatings, traffic coatings, and many other products. Industrial maintenance coatings are high performance architectural coatings formulated for application to substrates, including floors, exposed to extreme environmental conditions (e.g., immersion in water, chronic exposure to corrosive agents, frequent exposure to temperatures above 121°C, repeated heavy abrasion). The architectural coatings category reflects emission estimates based on a 2014 comprehensive CARB survey for the 2013 calendar year. The emission estimates include benefits of the 2007 CARB Suggested Control Measures. These emissions are grown based on DOF households forecast, 2020.

Additional information about CARB's architectural coatings program is available at:

https://ww2.arb.ca.gov/carb-solvent-evaporation-methodologies-architectural-coatings-and-cleaningthinning-solvents

A.2.5.1.1.3 Pesticides

The California Department of Pesticide Regulation (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 through the 2018 calendar year. Agricultural pesticide emission forecasts for 2019 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 households growth projections, 2020.

Additional information about CARB's pesticides program is available at:

https://ww2.arb.ca.gov/carb-solvent-evaporation-methodologies-agricultural-and-non-agricultural-pesticides

A.2.5.1.1.4 Residential Wood Combustion

Residential Wood Combustion estimates are based on the 2011 CARB methodology. It reflects survey data on types of wood burning devices and wood consumption rates, updates to the 2002 EPA NEI emission factors, and improved calculation approaches.

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 at:

https://ww2.arb.ca.gov/carb-miscellaneous-process-methodologies-residential-fuel-combustion

A.2.5.1.1.5 Residential Natural Gas Combustion

CARB staff updated the methodology to reflect 2017 fuel use from the California Energy Consumption Database. Residential natural gas consumption by county was obtained from the 2019 California Energy Commission (CEC) California Energy Consumption Database. the heat content of natural gas to reflect 2017 values per the U.S. Energy Information Administration (EIA) State Energy Consumption, Price, and Expenditure Estimates. The emissions estimates reflect the most recent emissions factors from EPA's AP-42 for residential natural gas combustion. Growth is based on CEC projections for natural gas consumption, 2019.

Additional information on this methodology is available at:

https://ww2.arb.ca.gov/carb-miscellaneous-process-methodologies-residential-fuel-combustion

A.2.5.1.1.6 Residential Distillate Oil and Liquefied Petroleum Gas

The residential distillate oil/liquefied petroleum gas (LPG) category includes emissions occurring in the residential sector. Distillate oil for heating is generally used in older homes and remote areas where natural gas lines are not available.

Activity is based on the number of housing units, population, and LPG and distillate oil capacities. The 1991 Fuels Report Working Paper published by the CEC was used to determine energy demand by fuel type in terms of the number of houses heated by a specific fuel in a particular area. Heating degree days (HDD) are used to estimate how many heating days are likely to occur in a particular area.

This category uses emission factors from EPA's AP-42. The emissions were initially calculated in 1993 then grown to 2012 using housing unit data from the DOF, 2013. Emissions were grown from 2012 to 2017 using a ‘no growth’ profile developed by Pechan (2012). Emissions post-2017 were grown based on EIA – SEDS[17], and no growth was assumed.

Additional information on this methodology is available at:

https://ww2.arb.ca.gov/carb-miscellaneous-process-methodologies-residential-fuel-combustion

A.2.5.1.1.7 Farming Operations

CARB staff updated the non-cattle Livestock Husbandry methodology to reflect livestock population data based on the USDA’s 2017 Census of Agriculture. Cattle emissions are primarily based on the 2012 Census of Agriculture. 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, 2012. No growth is assumed for dairy and feedlots.

Additional information on CARB’s methodology is available at:

https://ww2.arb.ca.gov/carb-miscellaneous-process-methodologies-farming-operations

A.2.5.1.1.8 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.

[17] State Energy Data System

Estimates for automobile fires are calculated using the weight of the car and components and composite emission factors derived from AP-42 emission factors. Structural fire growth is based on DOF households forecasts, 2020, and automobile fire growth is based on DOF population forecasts, 2020.

Additional information on this methodology is available at:

https://ww2.arb.ca.gov/carb-miscellaneous-process-methodologies-fires

A.2.5.1.1.9 Managed Burning & Disposal – Forest Management

Forest Management Managed Burning and Disposal category provides emission estimates from prescribed burning performed in natural vegetation types such as forests and woodlands.

Burn project perimeters and ignition dates are provided by the 2019 California Department of Forestry and Fire Protection (FRAP) geodatabase. Forest management prescribed burning emissions are estimated using the First Order Fire Effects Model (FOFEM 6.0) and a custom geoprocessing tool (Emission Estimation System, EES) developed for CARB by researchers at UC Berkeley. Future year estimates are based on a 10-year average, held flat in the forecast.

Additional information on this methodology is available at: *https://ww2.arb.ca.gov/district-miscellaneous-process-methodologies-managed-burning-and-disposal*

A.2.5.1.1.10 Managed Burning & Disposal – Agricultural Burning

The Agricultural Burning Managed Burning and Disposal category includes the open burning of agricultural residues (such as crop stubble and orchard pruning), weed abatement (such as ditch and canal bank burning), and other materials. CARB updated the emissions inventory to reflect burn data reported by air 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.

Additional information on this methodology is available at:

https://ww2.arb.ca.gov/district-miscellaneous-process-methodologies-managed-burning-and-disposal

A.2.6 Point and Area-Wide 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-2. The emissions inventory also 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-3.

Table A-2 Growth Surrogates for Point and Areawide Sources

Source Category	Subcategory	Growth Surrogate
Electric Utilities	Natural Gas	CEC Integrated Energy Policy Report forecast, 2019
	Other Fuels	EIA Annual Energy Outlook, 2019
Cogeneration	All	CEC forecast, 2019
Oil and Gas Production (Combustion)	All	DOGGR statewide total oil production. Assumed 2.9% annual decline reflecting CalGEM historical trend, 2000 through 2016
Petroleum Refining (Combustion)	All	No growth assumption
Manufacturing and Industrial	Natural Gas	CEC forecast, 2019
	Other Fuels	EIA forecast, 2018
Food and Agricultural Processing	Ag Irrigation I. C. Engines	FMMP irrigated farmland acreage, 2008
	Natural Gas	CEC forecast, 2019
	Others	REMI economic forecast, version 2.4.5; EIA forecast, 2018
Service and Commercial	Natural Gas	CEC forecast, 2019
	Other Fuels	EIA forecast, 2018
Other (Fuel Combustion)	Diesel	Modeled estimate, 2003
	Other Fuels	EIA forecast, 2018
Waste Disposal	All	DOF population forecast, 2020
Laundering	Dry Cleaning	DOF population forecast, 2020
Degreasing	All	CARB/REMI economic forecast, version 2.4.5
Coatings & Thinners	Auto Refinishing	Vehicles from CARB EMFAC2017 model
	Others	REMI economic forecast, version 2.4.5
Printing	All	REMI economic forecast, version 2.4.5
Adhesives & Sealants	All	REMI economic forecast, version 2.4.5
Oil and Gas Production	All	Assumed 2.9% annual decline reflecting CalGEM historical trend, 2000 through 2016
Petroleum Refining	All	No growth assumption
Petroleum Marketing	Natural Gas Transmission	CEC forecast, 2019
	Gas Dispensing Facilities and Cargo Tanks	Fuel use from CARB EMFAC2017 model
	Other Point Sources	REMI economic forecast, version 2.4.5
Chemical	All	REMI economic forecast, version 2.4.5
Mineral Processes	All	REMI version 2.4.5; EIA forecast, 2018
Metal Processes	All	REMI economic forecast, version 2.4.5
Other Industrial Processes	All	REMI economic forecast, version 2.4.5
Consumer Products	Personal Care Products	Real Disposable Personal Income per REMI, version 2.4.5

Source Category	Subcategory	Growth Surrogate
	Other Consumer Products	DOF population forecast, 2020
	Aerosol Coatings	No growth
Architectural Coatings & Related Process Solvents	All	DOF households forecast, 2020
Pesticides & Fertilizers	Agricultural Pesticides	CARB projection of farmland acres per FMMP, 2016
	Structural Pesticides	DOF households forecast, 2020
Asphalt Paving & Roofing	All	DOF construction jobs forecast, 2020; CARB projection
Residential Fuel Combustion	Natural Gas	CEC forecast, 2019
	Other Fuels	EIA – SEDS – No growth
Farming Operations	Dairy / Feedlots	No growth
	Other Livestock	CARB projection of livestock population per Census of Agriculture, 2012
Fires	Structural	DOF households forecast, 2020
	Automobile	DOF population forecast, 2020
Managed Burning and Disposal	Forest Management	10-year average, held flat
	Agricultural Burning, Weed Abatement	FMMP farmland acreage projection, 2016
	Non-Agricultural Open Burning	Rural counties: DOF population forecast, 2020. Urban counties: no growth.
Cooking	All	DOF population forecast, 2020

Table A-3 District and CARB Control Rules and Regulations Included in the Inventory

Agency	Rule/Reg No.	Rule Title	Source Categories Impacted
EDCAQMD	225&235	Solvent Cleaning and Degreasing Operations, Surface Cleaning	Degreasing; coating and related processes; surface cleaning
EDCAQMD	229	Boilers, Steam Generators and Process Heaters	Fuel combustion - boilers, process heaters and steam generators
EDCAQMD	230	Automotive Refinishing Operations	Coatings and related process solvents - auto refinishing
EDCAQMD	231	Graphic Arts Operations	Printing
EDCAQMD	236	Adhesives	Adhesives and sealants
EDCAQMD	237	Wood Products Coatings	Coatings and related process solvents - wood furniture and fabricated products
EDCAQMD	238	Gasoline Transfer and Dispensing	Petroleum marketing - fuel dispensing tanks
EDCAQMD	239	Residential Water Heaters	Residential fuel combustion - water heating

Agency	Rule/Reg No.	Rule Title	Source Categories Impacted
EDCAQMD	240	Polyester Resin Operations	Fiberglass and fiberglass products manufacturing
FRAQMD	3-17	Wood Heating Devices	Residential fuel combustion - wood stoves and fireplaces
PCAPCD	216&240	Organic Solvent & Surface Cleaning and Degreasing	Organic solvent & surface cleaning and degreasing
PCAPCD	223	Metal Can Coating	Prining, petroleum marketing
PCAPCD	231	Boilers, Steam Generators and Process Heaters	Fuel combustion - boilers, process heaters and steam generators
PCAPCD	233	Biomass Boilers	Wood/bark boilers
PCAPCD	234	Automotive Refinishing Operations	Coatings and related process solvents - auto refinishing
PCAPCD	235	Adhesives	Adhesives and sealants
PCAPCD	236&238	Wood Products Coatings & Factory Coating of Flat Wood Paneling	Coatings and related process solvents - wood furniture and fabricated products
PCAPCD	237	Municipal Landfills	Landfills - waste disposal
PCAPCD	239	Graphic Arts Operations	Printing
PCAPCD	245	Metal Parts and Products Coating Operations	Coatings and related process solvents
PCAPCD	246	Natural Gas-Fired Water Heaters	Residential fuel combustion - water heating
SMAQMD	411	Boilers, Process Heaters, and Steam Generators	Fuel combustion - boilers, process heaters and steam generators
SMAQMD	412	Stationary Internal Combustion Engines	Stationary internal combustion engines
SMAQMD	413	Stationary Gas Turbines	Internal combustion turbines
SMAQMD	414/414A	Natural Gas-Fired Water Heaters	Residential fuel combustion - water heating
SMAQMD	417	Wood Burning Appliances	Residential wood combustion - wood stoves and fireplaces
SMAQMD	419	NOx from Miscellaneous Combustion Units	Miscellaneous combustion such as incineration and asphaltic concrete production
SMAQMD	421	Mandatory Episodic Curtailment of Wood and Other Solid Fuel Burning	Residential wood combustion

Agency	Rule/Reg No.	Rule Title	Source Categories Impacted
SMAQMD	442	Architectural Coatings	Thinning solvents
SMAQMD	443	Leaks From Synthetic Organic Chemical and Polymer Operations	Oil and gas production; chemical
SMAQMD	448	Gasoline Transfer Into Stationary Storage Containers	Petroleum marketing - fuel dispensing tanks
SMAQMD	450	Graphic Arts Operations	Printing
SMAQMD	451	Surface Coating of Miscellaneous Metal Parts & Products Coatings	Coatings and related process solvents - metal parts and products
SMAQMD	456	Aerospace Coating Operations	Coatings and related process solvents - aircraft and aerospace
SMAQMD	458	Large Commercial Bread Bakeries	Bakeries
SMAQMD	459	Auto, Truck & Heavy Equipment Refinishing Operations	Coatings and related process solvents - auto refinishing
SMAQMD	460	Adhesives & Sealants	Adhesives and sealants
SMAQMD	463	Wood Products Coatings	Coatings and related process solvents - wood furniture and fabricated products
SMAQMD	464	Organic Chemical Manufacturing Operations	Chemical manufacturing
SMAQMD	465	Polyester Resin Operations	Fiberglass and fiberglass products manufacturing
SMAQMD	466N454	Solvent Cleaning and Degreasing Operations	Degreasing; coating and related processes; printing
SMAQMD	485	Municipal Landfill Gas	Landfills - waste disposal
SMAQMD	496	Large Confined Animal Facilities	Livestock operations
SMAQMD	RWC_CHANGE	Wood Stove and Fireplace Changeout Incentive Program	Residential wood combustion
YSAQMD	2.21	Organic Liquid Storage and Transfer	Petroleum marketing - organic liquid storage and transfer
YSAQMD	2.22	Gasoline Dispensing Facilities	Petroleum marketing - fuel dispensing tanks
YSAQMD	2.23	Fugitive Hydrocarbon Emissions	Oil and gas production - fugitive losses
YSAQMD	2.25	Metal Parts and Products Coating Operations	Coating and related process solvents

Agency	Rule/Reg No.	Rule Title	Source Categories Impacted
YSAQMD	2.26	Motor Vehicle and Mobile Equipment Coating Operation	Coating and related process solvents
YSAQMD	2.27	Boilers, Steam Generators and Process Heaters	Fuel combustion - boilers, process heaters and steam generators
YSAQMD	2.29	Graphic Arts Printing Operations	Printing
YSAQMD	2.3	Polyester Resin Operations	Fiberglass and fiberglass products manufacturing
YSAQMD	2.31	Solvent Cleaning and Degreasing Operations, Surface Cleaning	Degreasing; coating and related processes; surface cleaning
YSAQMD	2.33	Adhesives Operations	Adhesives and sealants
YSAQMD	2.37	Natural Gas-Fired Water Heaters	Residential fuel combustion - water heating
YSAQMD	2.38	Municipal Landfills	Landfills - waste disposal
YSAQMD	2.39	Wood Products Coating Operations	Coatings and related process solvents - wood furniture and fabricated products
YSAQMD	2.44	Central Furnaces	Residential fuel combustion - space heating
CARB	ARCH_SCM	Architectural Coatings 2000 Suggested Control Measures (SCM)	Architectural coatings
CARB	AC_SCM2007	Architectural Coatings 2007 SCM	Architectural coatings
CARB	ARB_R003 & ARB_R003_A	Consumer Product Regulations & Amendments	Consumer products
CARB	ARB_R007	Aerosol Coating Regulations	Aerosol coatings
CARB	GDF_HOSREG	Gasoline Dispensing Facility Hose Emission Regulation	Petroleum marketing
CARB	ORVR	Fueling Emissions from ORVR Vehicles	Petroleum marketing
CARB	AG_IC_ENG	Ag IC Engine Emission Scalers	Agricultural irrigation internal combustion engines
CARB	NONAGICENG	Non-Ag IC Engine Scalers	Non-agricultural internal combustion reciprocating engines

A.2.7 External Adjustments

External adjustments were made in CEPAM to account for military growth and other unaccounted regulatory factors. The external adjustments reflected in the CEPAM2019v1.04 SFNA SIP inventory are listed below in Table A-4.

Table A-4 External Adjustment IDs and Descriptions

Adjustment ID	Adjustment Description
HD_I/M	HD I/M Regulation adopted by CARB Dec 2021
NonAg_ICE	Update non-ag internal comb. engines to reflect 2003 ATCM and 2010 rule amend
TRUCK_REGS	Advanced clean trucks Omnibus Low NOx_Opacity ICT_UBUS adjustments

APPENDIX B
Photochemical Modeling

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B Photochemical Modeling

B.1 Modeling Protocol and Attainment Demonstration

Modeling Protocol & Attainment Demonstration for the Sacramento Regional 2015 NAAQS 8-Hour Ozone Attainment and Reasonable Further Progress Plan

CALIFORNIA
AIR RESOURCES BOARD

Prepared by
California Air Resources Board
Sacramento Metropolitan Air Quality Management District

Prepared for
United States Environmental Protection Agency Region IX

March 2023

Acronyms

ACM2 – Asymmetric Convective Model version 2

ADAM – Aerometric Data Analysis and Management

AQMIS – Air Quality and Meteorological Information System

ARB – Air Resources Board

BCs – Boundary Conditions

Calex – Research at the Nexus of Air Quality and Climate Change conducted in 2010

CAM-Chem – Community Atmosphere Model with Chemistry

CARB – California Air Resources Board

CARES – Carbonaceous Aerosols and Radiative Effects Study in 2010

CEPAM – California Emissions Projection Analysis Model

CESM2 – Community Earth System Model version 2

CMAQ Model – Community Multi-scale Air Quality Model

CTM – Chemical Transport Model

DV – Design Value

ICs – Initial Conditions

IOA – Index of Agreement

LAI – Leaf Area Index

MB – Mean Bias

MCIP – Meteorology-Chemistry Interface Processor

MCAB – Mountain Counties Air Basin

MDA8 – Maximum Daily Average 8-hour Ozone

ME – Mean Error

MEGAN – Model of Emissions of Gases and Aerosols

MFB – Mean Fractional Bias

MFE – Mean Fractional Error

MODIS – Moderate Resolution Imaging Spectroradiometer

NAAQS – National Ambient Air Quality Standards

NASA – National Aeronautics and Space Administration

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

OGV – Ocean Going Vessels

R – Correlation coefficient

R^2 – R-squared/Coefficient of determination

RH – Relative Humidity

RMSE – Root Mean Square Error

ROG – Reactive Organic Gases

RRF – Relative Response Factor

SAPRC – Statewide Air Pollution Research Center

SIP – State Implementation Plan

SJV – San Joaquin Valley

SJVAB – San Joaquin Valley Air Basin

SFNA – Sacramento Federal 8-hour ozone Non-attainment Area

SVAB – Sacramento Valley Air Basin

U.S. EPA – United States Environmental Protection Agency

VOCs – Volatile Organic Compounds

WRF Model – Weather and Research Forecast Model

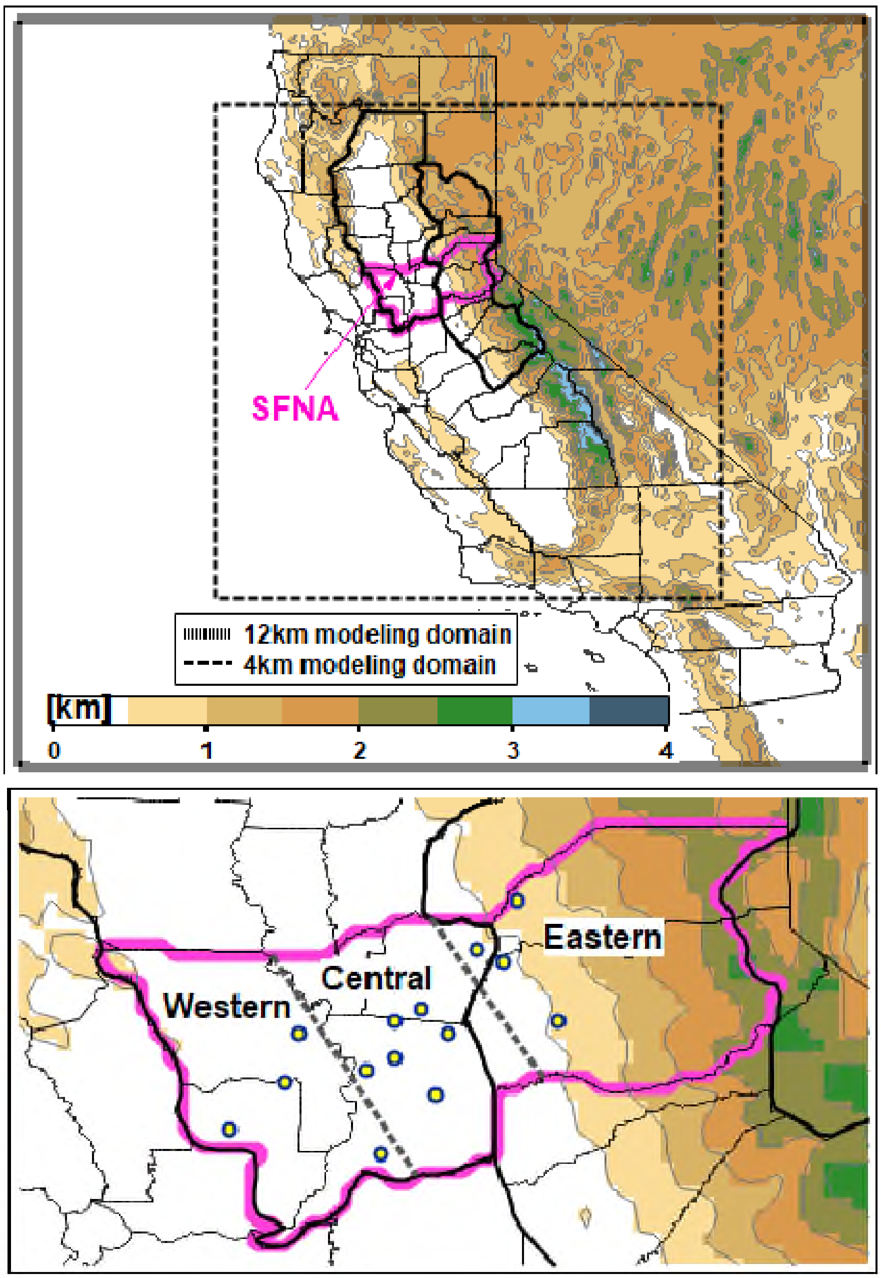
B.1.1 Introduction

The Sacramento Federal 8-hour ozone Nonattainment Area (SFNA) is located in the northern part of California's Central Valley (Figure B-1), which is a 500-mile long northwest-southeast oriented valley encompassing two of the worst polluted air basins in the nation, the San Joaquin Valley and Sacramento Valley air basins. The SFNA is home to more than 2 million residents with an area of 5600 square miles and is geographically located in two different air basins including the southern portion of the Sacramento Valley Air Basin (SVAB) and the north central portion of the Mountain Counties Air Basin (MCAB) (Figure B-1). The SFNA area occupies the southern portion of the Sacramento Valley, extending to the inland side of the California Coastal Range on the westernmost edge, and continues to the border of the Lake Tahoe air basin to the east, encompassing portions of the Sierra Nevada Mountain Range. It extends southward to the Sacramento Delta Region and northward to include the southern portion of Sutter County. In total, the SFNA comprises all of Sacramento and Yolo counties, the eastern portion of Solano County, the southern portion of Sutter County, and the portions of El Dorado and Placer counties that are not part of the Lake Tahoe Air Basin.

Due to its inland location, the climate of the Sacramento region is more extreme than that of most coastal regions, such as the San Francisco Bay Area. The winters are generally cool and wet, while the summers are hot and dry and both seasons can experience periods of high pressure and stagnation which are conducive to pollutant buildup. These climate conditions result in seasonal patterns where ozone levels are highest during the summer, while $PM_{2.5}$ concentrations are highest during the winter. The lack of summertime precipitation, coupled with the large extent of forested land surrounding the Central Valley, also creates conditions highly conducive to wildfires during the summer months.

The worst ozone air quality in the SFNA typically occurs during summer months, where the interaction between geography, climate, and a mix of natural (biogenic) and anthropogenic emissions poses significant challenges to air quality progress. A combination of stable wind fields and recirculation patterns generated by daytime upslope and nighttime downslope flows from the mountains located to the west (Coast Range) and east (Sierra Nevada), tend to confine and trap emissions and the pollutants near the surface. The anthropogenic NO_X and ROG emissions from the urban Sacramento area and biogenic ROG emissions from the Sierra foothills coupled with the hot and dry summertime weather conditions facilitate rapid ozone production in the region. During ozone episodes within the SFNA, the most important transport pattern is toward the northeast and the foothills within the Sacramento area itself. Due to the general daytime flow pattern from west to east, as well as the time needed for photochemical processes to occur, the highest ozone mixing ratios in the Sacramento region generally occur in the afternoon in the downwind, eastern portion of the region.

Figure B-1. Map of California (top) along with the location of SFNA in magenta. The shaded and gray line contours denote the gradients in topography (km). The outer box of the top panel is the California statewide 12 km modeling domain, while the inner box shows the 4 km modeling domain covering Central California. The insert on the bottom shows a zoomed-in view of the spatial extent (magenta lines), approximate regional boundaries of the Western, Central and Eastern sub-regions (dashed black lines) and the location of ozone monitoring sites (circle markers) in the SFNA.

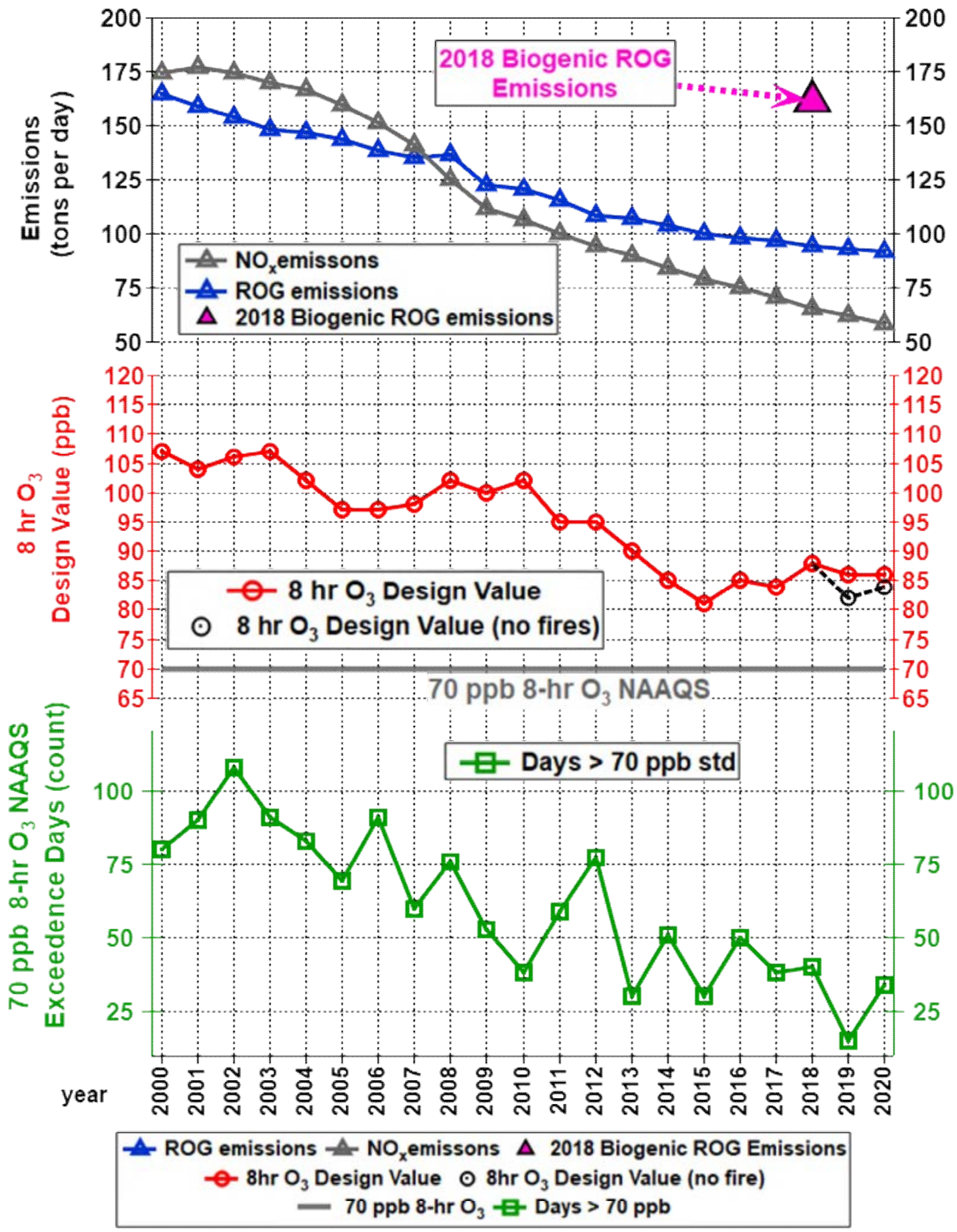


The air quality planning in the SFNA is led by the Sacramento Metropolitan Air Quality Management District (www.AirQuality.org). Four other air districts also participate in the planning and management in the area. The Yolo-Solano Air Quality Management District (AQMD) (www.ysaqmd.org) has jurisdiction over Yolo County and the SFNA portion of Solano County. Feather River AQMD (www.fraqmd.org) has jurisdiction over Sutter and Yuba counties, including the south Sutter County portion of the SFNA. Placer County Air Pollution Control District (APCD) (www.placer.ca.gov/apcd) has jurisdiction over Placer County, as does El Dorado County AQMD (www.edcgov.us/AirQualityManagement) over its county.

For purposes of model evaluation and analysis, the SFNA is divided into three sub regions that are characterized by distinct geography, meteorology, emissions characteristics, transport patterns, and air quality: 1) Western SFNA comprising Yolo, Solano and the southwest portion of Sacramento counties, which lies upwind of the Sacramento urban emission sources and is impacted by pollutant transport from the surrounding Bay Area and SJV located on the west/southwest, 2) Central SFNA including the inland urban core, and the metropolitan areas of Sacramento county and the westernmost portion of Placer county, and 3) Eastern SFNA comprising Placer and El Dorado counties in the Sierra Nevada foothills area that is located downwind of urban Sacramento. The geographical extent of the sub-regions in SFNA and their approximate regional boundaries are shown in the bottom panel of Figure B-1.

Anthropogenic sources of the oxides of nitrogen (NO_X) and reactive organic gases (ROG) are the major precursors that lead to ozone formation in the SFNA. Biogenic hydrocarbons are also important contributors to ozone precursors in the region and are projected to play an even more important role in the future as emission controls reduce anthropogenic ROG. Summer emission trends from 2000 to 2020 in the SFNA are shown in Figure B-2 for anthropogenic NO_X and ROG, along with summer biogenic ROG emissions in the SFNA averaged from May to October 2018 (magenta triangle marker). Figure B-2 clearly shows a large decrease in both local anthropogenic NO_X (from ~175 tpd to ~58 tpd) and ROG (from ~165 tpd to ~91.5 tpd) emissions from 2000 to 2020. In 2018, biogenic ROG emissions (~163 tpd) are estimated to be ~1.7 times higher than the corresponding anthropogenic emissions (~94 tpd) in the SFNA.

Figure B-2. Trend in summer emissions of NO_X and ROG (tons per day), Maximum Daily Average 8-hour Ozone Design Value (ppb) and 70 ppb 8-hour Ozone NAAQS exceedance days between 2000 and 2020 in the SFNA. Note that O_3 design site may vary from year to year. Anthropogenic Emissions estimates are from the California Emission Projection Model (CEPAM) 2019 Ozone SIP Baseline Projection Version 1.04 with 2017 base year. 2018 biogenic ROG emissions are from MEGAN 3.0 biogenic model calculations.



Over the same 2000 to 2020 time period, the ozone design value within the SFNA declined steadily (Figure B-2, middle panel), but did also exhibit a fair amount of variability due to year-to-year variability in meteorology and the associated changes in biogenic emissions. Overall, the region-wide design values (DVs) have declined from 107 ppb in 2000 to 86 ppb in 2020. However, these DVs are still substantially higher than the current 70 ppb standard. Exceedance days in the region (Figure B-2, bottom panel) have substantially decreased over time from 80 days in 2000 to 34 days in 2020, indicating significant improvements in ozone air quality across the entire region. In recent years, the prevalence of forest fires during the summer ozone season significantly impacted the air quality in the SFNA. High ozone concentrations were observed at several SFNA sites on days impacted by forest fires. Weight of Evidence of this SIP document focused on the days with ozone values that significantly affected the design values at Auburn site, which is one of the two high ozone sites in the SFNA. Excluding the fire impact days (7/31/2018, 8/1/2018,8/2/2018, 8/8/2018, 8/9/2018 and 8/10/2018) at Auburn site, ozone DVs would be 82 ppb in 2019 and 84 ppb in 2020 denoted by black circle markers in middle panel of Figure B-2.

The SFNA is designated as serious nonattainment for the 2015 70 ppb O_3 standard with a 2026 attainment deadline. However, it is very unlikely that SFNA would have a design value of 0.070 ppm or lower by 2026. Therefore, as part of this State Implementation Plan (SIP), SFNA is seeking to voluntarily reclassify as a severe nonattainment area with a 2032 attainment deadline. This document serves as the modeling protocol and attainment demonstration for the 2015 standard in the SFNA. The modeling analysis uses 2018 as the base year for the attainment demonstration. The year 2018 was chosen based on preliminary analysis that showed 2018 exhibiting superior model performance for O_3 in Northern California compared to adjacent years.

B.1.2 Methodology

United States Environmental Protection Agency (EPA) modeling guidance (EPA, 2018) outlines the approach for utilizing regional chemical transport models (CTMs) to predict future attainment of the 2015 (70 ppb) 8-hour ozone standard. 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 then 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 2018 is the average of the observed 4th highest 8-hour O_3 mixing ratio from 2016, 2017, and 2018 (Table B-1). The EPA recommends using an average of three DVs to better account for the year-to-year variability in ozone levels due to meteorology. This average DV is called the weighted DV (in the context of this SIP document, the weighted DV will also be referred to as the reference year DV or DV_R). Since 2018 represents the reference year for projecting DVs to the future, site-specific DVs should be calculated for the three-year periods ending in 2018, 2019, and 2020, and then these three DVs are averaged. However, 2020 was an atypical year with large societal changes in response to the COVID19 pandemic and is not suitable for use in the DV_R calculation. To remove the impact from 2020 observations, we utilize an alternative methodology for calculating the average DVs by excluding year 2020. In this method, the 8-hour O_3 DV for 2020 was replaced by the two-year average of the 4^{th} highest 8-hour O_3 concentrations from 2018 and 2019. Table B-1 illustrates the observational data from each year that goes into the average DV_R and Equation 1 shows how the DV_R is calculated.

Table B-1 Data from each year that are utilized in the Design Value calculation for a specific year (DV Year), and the yearly weighting of data for the average Design Value calculation (or DVR).

DV Year	Years Averaged for the Design Value (4th highest observed 8-hr O_3)			
2018	2016	2017	2018	
2019		2017	2018	2019
2020			2018	2019

$$DV_R = \frac{DV_{2018} + DV_{2019} + \frac{4th\ highest\ MDA8\ O_3\ (2018 + 2019)}{2}}{3} \quad (1)$$

Table B-2 lists the design values for the sites within the three sub-regions of the SFNA that were used in the model attainment demonstration. Note that the average DVs are listed in descending order for sites within each sub-region except that at the Auburn-Atwood site, which has two average DVs due to one excluding wildfire impacted days in the DV calculation. The ozone data collected at the Colfax and Auburn sites in Placer County between January 2015 to May 2019 were deemed invalid after a technical systems audit by EPA. The audit revealed that the calibration procedures did not follow EPA regulation and guidance. Since Colfax and Auburn are two of the high ozone sites in the SFNA, it is important to examine their air quality trends to ensure these two sites will also attain the 70 ppb ozone standard by 2032. Therefore, this attainment demonstration also utilized the invalidated monitoring data in the analyses. The Placerville-Gold monitoring site, located in the Eastern SFNA, has the highest average DV in the SFNA with an average DV of 84.0 ppb if only DVs excluding wildfire days at Auburn-Atwood are considered.

Table B-2. Year-specific 8-hour ozone design values for 2018, 2019 and 2020, and the average baseline design value (DVR, represented as the average of three design values) for 2018 at the monitoring sites in the SFNA. The 2020 DV is the two-year average of the 4th highest 8-hour O_3 concentrations from 2018 and 2019.

Sub-region	Site	2018 DV (ppb)	2019 DV (ppb)	2020 DV (ppb)	2018-2020 Average DV (ppb)
Eastern SFNA	Placerville-Gold	88	81	83	84.0
Eastern SFNA	Colfax-CityHall	85	82	84	83.7
Eastern SFNA	Cool-Hwy193	84	80	81	81.7
Eastern SFNA	Auburn-Atwood, fire days excluded	83	81	81	81.7
Eastern SFNA	Auburn-Atwood, all days	88	86	88	87.3
Central SFNA	Folsom-Natoma	82	75	73	76.7
Central SFNA	Roseville-NSunrise	81	75	73	76.3
Central SFNA	N_Highlands-Blackfoot	78	74	72	74.7
Central SFNA	Sacramento-DelPas	75	71	70	72.0
Central SFNA	Sloughhouse	75	70	69	71.3
Central SFNA	Sacramento-TStreet	67	67	65	66.3
Western SFNA	Elk_Grove-Bruceville	67	68	68	67.7
Western SFNA	Woodland-Gibson	68	66	66	66.7
Western SFNA	Vacaville-Ulatis	65	64	63	64.0
Western SFNA	Davis-UCD	62	62	63	62.3

Projecting the reference DVs to the future requires three photochemical model simulations, described below:

1. Base Year Simulation

The base year simulation for 2018 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 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 2018, the only difference between the base and reference year simulations was that wildfires were excluded from the reference year simulation.

3. Future Year Simulation

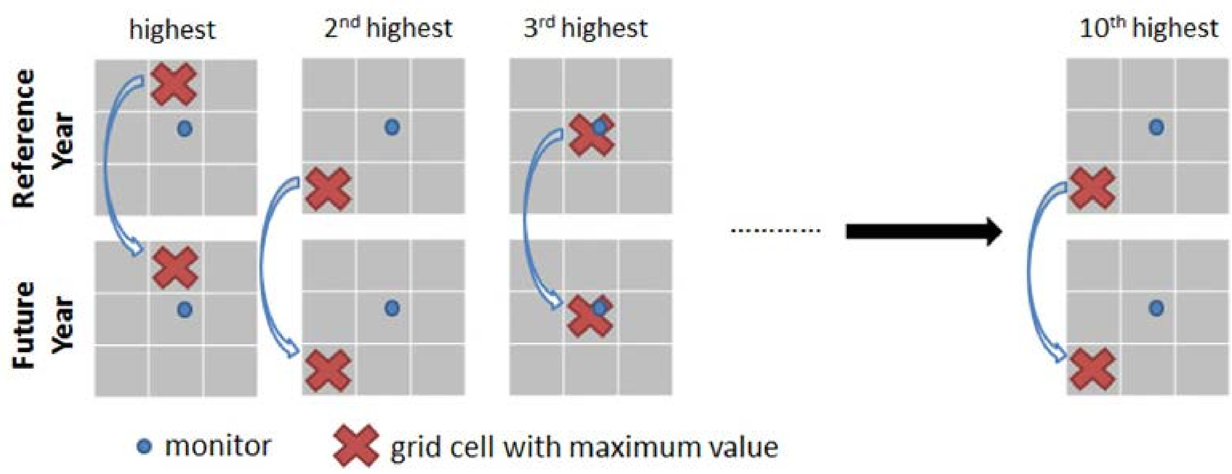
The future year simulation (2032) was identical to the reference year simulation, except that the projected future year anthropogenic emission levels were used rather than the reference year emission levels. All other model inputs (e.g., meteorology, chemical boundary conditions, biogenic emissions, 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 the modeled future year ozone to the corresponding modeled reference year ozone (Equation 2).

$$\text{RRF} = \frac{\frac{1}{N}\sum_{d=1}^{N}(MDA8\ O_3)_{future}^{d}}{\frac{1}{N}\sum_{d=1}^{N}(MDA8\ O_3)_{reference}^{d}} \quad (2)$$

here, MDA8 O_3 refers to the maximum daily average 8-hour ozone, d refers to the 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 B-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 ratios in any ozone season (i.e., the 4th 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 EPA modeling guidance (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 B-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 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.

$$DV_F = DV_R \times RRF \quad (3)$$

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 2. 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.

B.1.2.1 Meteorological Modeling

California’s proximity to the ocean, complex terrain, and diverse climate represents a unique challenge for reproducing meteorological fields that adequately represent the synoptic and mesoscale features of the regional meteorology. In summertime, the majority of the storm tracks are far to the north of the state and a semi-permanent Pacific high pressure system typically sits off the California coast. Interactions between this eastern Pacific subtropical high pressure system and the thermal low pressure further inland over the Central Valley or South Coast lead to conditions conducive to pollution buildup over large portions of the state (Bao et al., 2008; Fosberg et al., 1966).

The state-of-the-science Weather Research and Forecasting (WRF) prognostic model (Skamarock, Klemp and Dudhia) version 4.2.1 was employed in the modeling. Its domain consisted of three nested Lambert projection grids of 36 km (D01), 12 km (D02), and 4 km (D03) uniform horizontal grid spacing as shown in Figure B-4. The 4 km innermost domain has 427x427 grid points and spans 1748 km in the east-west and the north-south directions. All three domains utilized 30 vertical sigma layers with the lowest layer extending to 30 m above the surface (Table B-3). The North America Regional Reanalysis (NARR) fields, enhanced with surface and upper-air observations, were used for initial and boundary conditions as well as Four Dimension Data Assimilation (FDDA) on the outermost (36 km) domain. The horizontal spatial resolution of the NARR data is 32 km. The major physics options for each domain are listed in Table B-4, which include the Yon-Sei University (YSU) planetary boundary layer (PBL) scheme, Kain-Fritsch cumulus parameterization for the outer two domains, and 5-layer thermal diffusion land-surface option.

Figure B-4. WRF modeling domains (D01 36 km; D02 12 km; and D03 4 km).

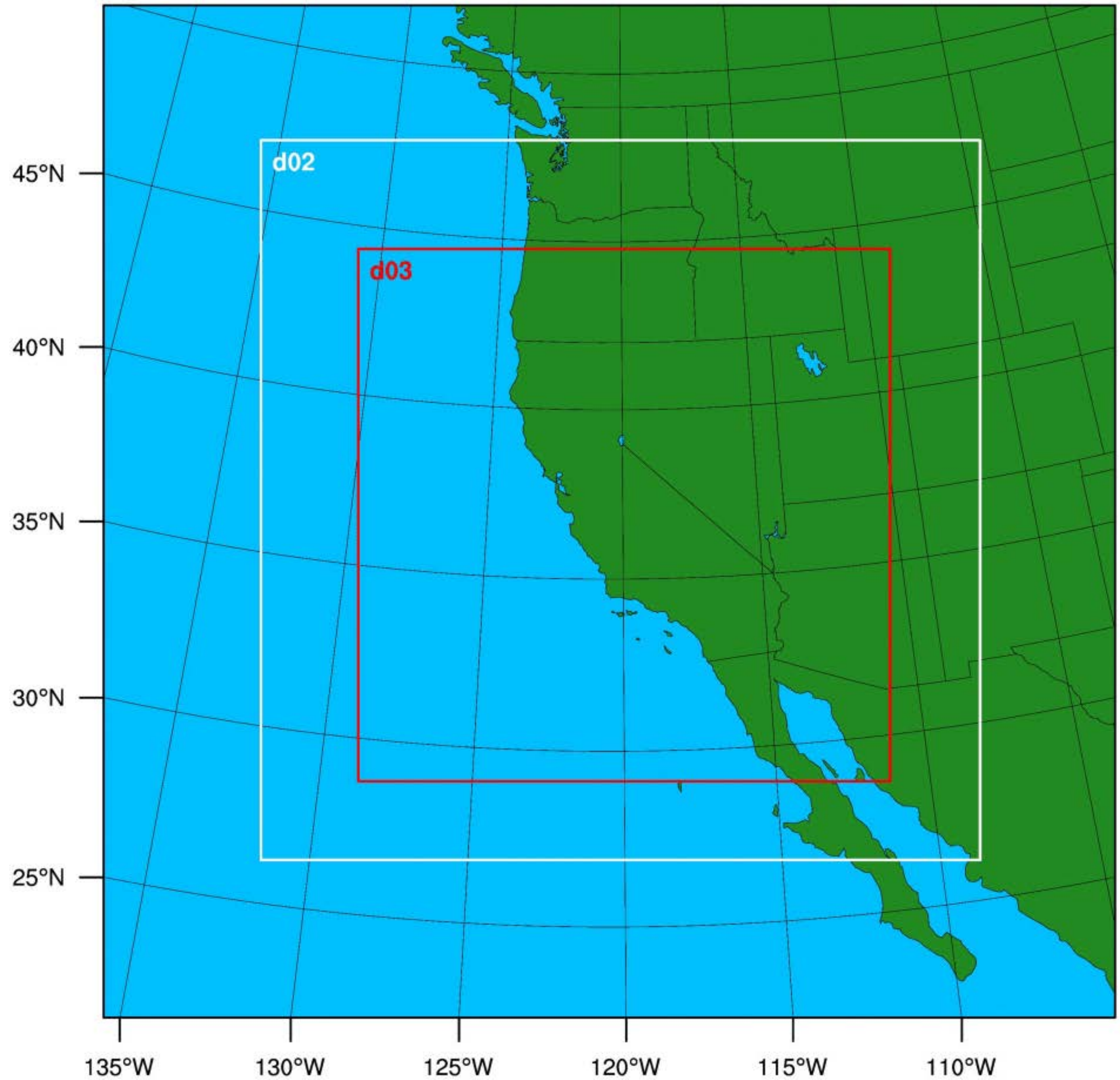


Table B-3. WRF vertical layer structure.

Layer Number	Height (m)	Layer Thickness (m)	Layer Number	Height (m)	Layer Thickness (m)
30	16082	1192	15	2262	403
29	14890	1134	14	1859	334
28	13756	1081	13	1525	279

Layer Number	Height (m)	Layer Thickness (m)	Layer Number	Height (m)	Layer Thickness (m)
27	12675	1032	12	1246	233
26	11643	996	11	1013	194
25	10647	970	10	819	162
24	9677	959	9	657	135
23	8719	961	8	522	113
22	7757	978	7	409	94
21	6779	993	6	315	79
20	5786	967	5	236	66
19	4819	815	4	170	55
18	4004	685	3	115	46
17	3319	575	2	69	38
16	2744	482	1	31	31

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 two inner domains to allow the 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 Meteorology-Chemistry Interface Processor (MCIP) version 5.1 was used to process the 12 km (D02) and 4 km (D03) WRF output for use in the CTM simulations.

Table B-4. WRF Physics options.

Physics Option	D01 (36 km)	D02 (12 km)	D03 (4 km)
Microphysics	WSM 6-class	WSM 6-class	WSM 6-class
Longwave Radiation	RRTM	RRTM	RRTM
Shortwave Radiation	Dudhia	Dudhia	Dudhia
Surface Layer	Revised MM5 Monin-Obukhov	Revised MM5 Monin-Obukhov	Revised MM5 Monin-Obukhov
Land Surface	5-layer Thermal Diffusion	5-layer Thermal Diffusion	5-layer Thermal Diffusion
Planetary Boundary Layer	YSU	YSU	YSU
Cumulus Parameterization	Kain-Fritsch Scheme	Kain-Fritsch Scheme	No

B.1.2.2 Emissions

The anthropogenic emissions inventory used in this modeling was based on the California Emissions Projection Analysis Model (CEPAM) v1.03 augmented with updates consistent with CEPAM v1.04 for select source categories. These sources are described in *http://outapp.arb.ca.gov/cefs/2019ozsip/CEPAM2019_key_updates_chron.pdf* under version "March 29, 2022 Release of Version 1.04 Planning Projections", except for emissions from Ocean Going Vessels (OGV). For a detailed description of the anthropogenic 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 Appendix B.2.

Table B-5 summarizes the 2018 and 2032 SFNA anthropogenic emissions. Overall, anthropogenic NO_X emissions in CEPAM v1.04 were projected to decrease by ~48% between 2018 and 2032 from 65.6 tpd to 34.2 tpd with the bulk of the reductions coming from on-road mobile sources. In contrast, anthropogenic ROG was projected to decrease by ~15% from 94.1 tpd to 79.9 tpd with the bulk of those reductions coming from all mobile sources including on-road and other mobile sources. The right two columns in Table B-5 show the 2032 emissions after incorporating additional CARB commitments from the State SIP Strategy that will increase the overall reduction in NO_X and ROG emissions to ~57% and 16.5%, respectively, between 2018 and 2032. In addition, the emission inventory for 2032 includes an additional 2.81 tpd and 3.63 tpd of NO_X and ROG emissions, respectively, from Emission Reduction Credits (ERCs). Details on these rules/adjustments can be found in the Modeling Emissions Inventory Appendix B.2.

Table B-5. SFNA Summer Planning Emissions for 2018 and 2032 (tons/day).

	CEPAM v1.04						With CARB Commitments			
Source Category	2018 NO_X (tpd)	2032 NO_X (tpd)	NO_X diff	2018 ROG (tpd)	2032 ROG (tpd)	ROG diff	2032 NO_X (tpd)	NO_X diff	2032 ROG (tpd)	ROG diff
Stationary	6.6	6.0	-9.7%	22.7	23.9	5.5%	6.0	-9.7%	23.9	5.5%
Area	2.3	2.2	-4.4%	27.3	31.7	16.2%	2.2	-4.4%	31.7	16.2%
On-road Mobile	32.9	9.9	-69.9%	17.9	9.7	-45.8%	8.6	-73.7%	9.1	-49.3%
Other Mobile	23.9	16.1	-32.4%	26.3	14.6	-44.4%	11.3	-52.5%	13.9	-47.1%
Total	65.6	34.2	-47.9%	94.1	79.9	-15.1%	28.1	-57.2%	78.6	-16.5%

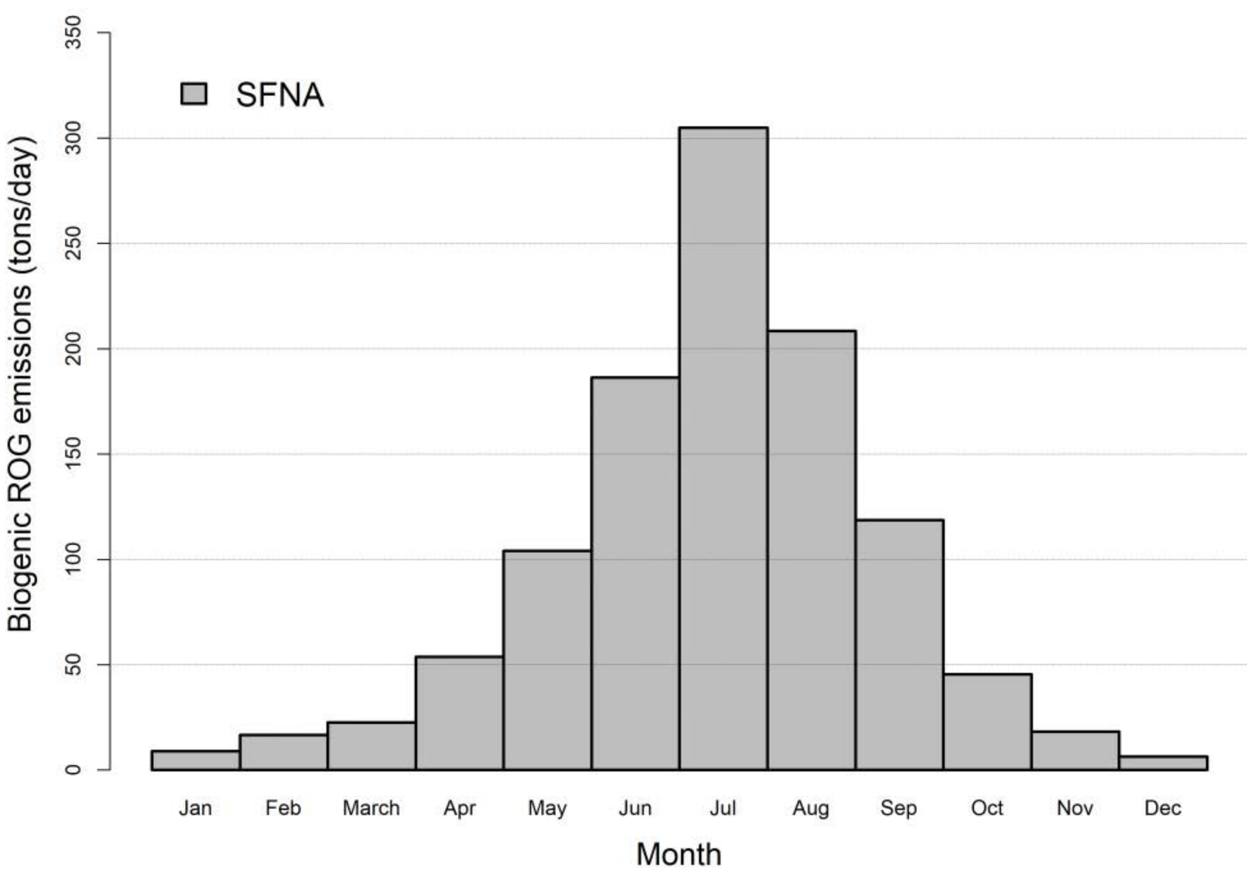
* Note that rounding errors may result in emissions totals that do not exactly match the sum of the individual categories.

Biogenic emissions were generated using the Model of Emissions of Gases and Aerosols from Nature (MEGAN3.0) biogenic emissions model (*https://bai.ess.uci.edu/megan*). 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, eco-type, and emissions were utilized. Leaf Area Index (LAI) for non-urban grid cells was based on the 8-day 500 m resolution Moderate Resolution Imaging Spectroradiometer (MODIS) Terra/Aqua combined product

(MCD15A2H) for 2018 (*https://earthdata.nasa.gov/*). 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 for each grid cell (*https://archive.usgs.gov/archive/sites/landcover.usgs.gov/green_veg.html*). 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 urban tree plot data, processed through the i-Tree v6 software (*https://www.itreetools.org/tools/i-tree-eco*). Hourly meteorology for MEGAN was provided by the 4 km WRF simulation described above, with all stress factor adjustments turned off.

Monthly biogenic ROG totals for 2018 within the SFNA are shown in Figure B-5 (note that the same biogenic emissions were used in the 2018 and 2032 modeling). Throughout the summer, biogenic ROG emissions ranged from ~100 tpd in May to 308 tpd in July and ~215 tpd in August, with the difference in emissions primarily due to monthly differences in temperature, insolation, and leaf area from month-to-month.

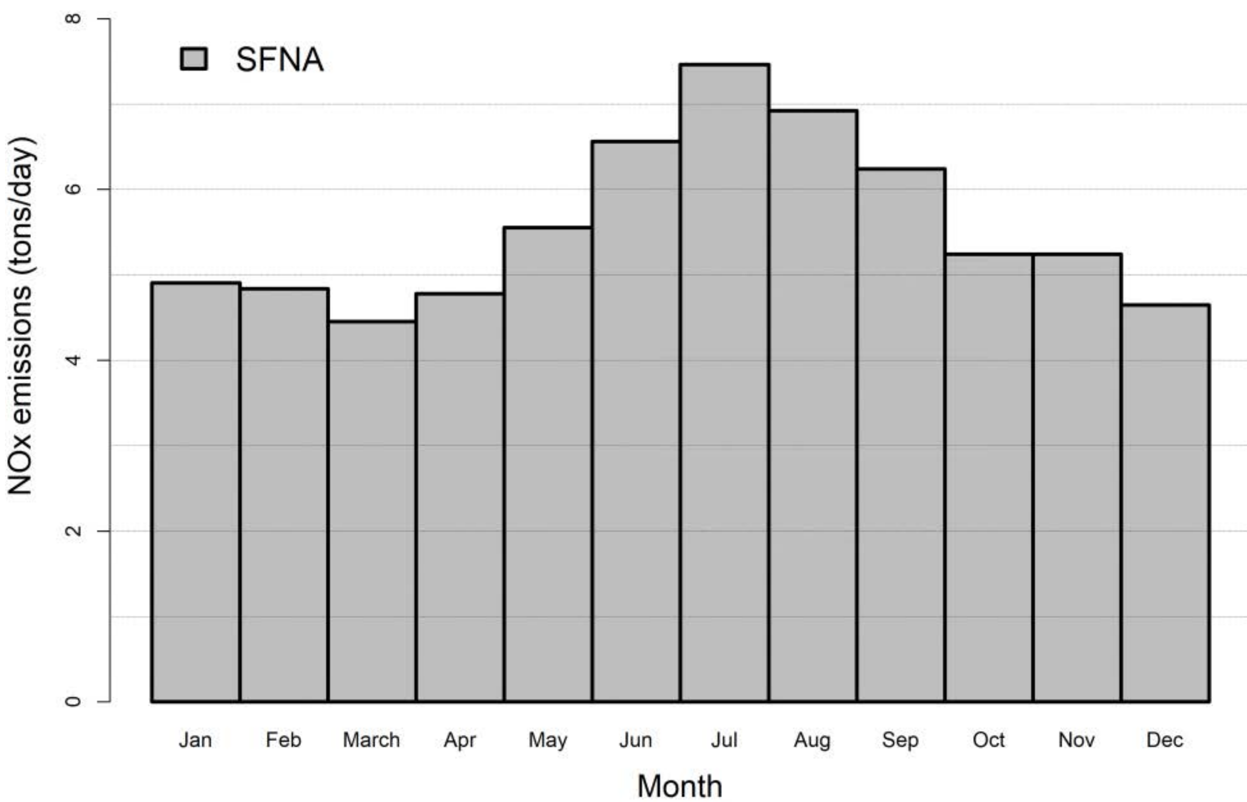
Figure B-5. Monthly average biogenic ROG emissions for 2018 in the SFNA.



In addition to biogenic ROG emissions, the MEGAN model also estimates NO_X emissions from soils using the Yienger and Levy scheme (Yienger and Levy, 1995) that accounts for natural emissions from soils as well as enhanced emissions from managed crop lands.

Figure B-6 shows the monthly average soil NO_X emissions for 2018 from MEGAN. Soil NO_X emissions are highest during summer months where the emissions peak at 7.5 tpd in July.

Figure B-6. Monthly average soil NO_X emissions for 2018 in the SFNA



B.1.2.3 Air Quality Modeling

Figure B-1 shows the Community Multiscale Air Quality (CMAQ) modeling domains used in this work. The larger domain covering all of California has a horizontal grid size resolution of 12 km with 107x97 lateral grid cells for each vertical layer and extends from the Pacific Ocean in the west to Eastern Nevada in the east and runs from the U.S.-Mexico border in the south to the California-Oregon border in the north. The smaller nested domain (dashed black outline) covering the SFNA including the San Joaquin Valley (SJV), Sacramento Valley (SV), Mountain Counties (MC) air basin, has a finer scale 4 km grid resolution and includes 192x192 lateral grid cells.

The 12 km and 4 km domains are based on a Lambert Conformal Conic projection with reference longitude at -120.5°W, reference latitude at 37°N, and two standard parallels at 30°N and 60°N, which is consistent with the WRF domain settings. The CMAQ vertical layer structure is based on the WRF sigma-pressure coordinates, and the exact layer structure used can be found in Table B-3. The original 30 vertical layers from WRF were used for the CMAQ simulations, extending from the surface to 100 mb such that the majority of the vertical layers fall within the planetary boundary layer.

The CTM utilized in the modeling is the CMAQ model version 5.2.1 (EPA, 2018). CMAQ is the EPA's open-source regional air quality model, which 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).

Table B-6 lists the CMAQ configuration and settings used in the modeling. The SAPRC07tic chemical mechanism (Carter, 2010a,b) was chosen to represent the gas-phase photochemistry in the atmosphere, along with the aero6 aerosol module for simulating aerosol dynamics and chemistry. Photolysis rates were calculated in-line to better represent changes in photolysis rates due to meteorological conditions and gaseous and particulate pollutant levels in the atmosphere.

Table B-6. CMAQ configuration and settings.

Process	Scheme
Advection	Yamo module for horizontal and WRF module for vertical
Horizontal diffusion	Multi-scale
Vertical diffusion	ACM2 (Asymmetric Convective Model version 2)
Gas-phase chemical mechanism	SAPRC version 07tc gas-phase mechanism with extended isoprene chemistry
Chemical solver	EBI (Euler Backward Iterative solver)
Aerosol module	Aero6 (the sixth generation CMAQ aerosol mechanism)
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 (calculating photolysis rates inline)

Global chemical transport Community Atmosphere Model with Chemistry (CAM-Chem) coupled to the Community Earth System Model (CESM2) (Emmons, 2020; Lamarque et al., 2012) was developed by the National Center for Atmospheric Research (NCAR) and used for simulations of global tropospheric and stratospheric atmospheric compositions. CAM-Chem modeling outputs have been widely used to provide chemical boundary conditions for various regional air quality models (Yan et al., 2021; He et al., 2018; Shahrokhishahraki et al., 2022; Wang et al., 2022). In this work, chemical boundary conditions for the outer 12-km domain were extracted from the CAM-Chem output based on the vertical and horizontal grid structure in CMAQ, processed into CMAQ model ready format and mapped to CMAQ chemical species. The CAM-chem data for 2018 was obtained from the National Center for Atmospheric Research (https://www.acom.ucar.edu/cam-chem/cam-chem.shtml) (Buchholz, 2019) and processed using the mozart2camx preprocessor version 3.2.3 (https://www.camx.com/download/support-software/). The same CAM-chem derived BCs for the 12 km outer domain were used for both base year, reference year and future year simulations. The inner 4 km domain simulations utilized BCs that were based on the output from the corresponding 12 km domain simulations.

The extended ozone season (April – October) was simulated through parallel individual monthly simulations for the base year, reference year and future year. For each month, the CMAQ simulations included a seven-day spin-up period (i.e., the last seven days of the previous month) for the outer 12 km domain where initial conditions were set to the default initial conditions included with the CMAQ release. The 4 km inner domain simulations utilized a three-day spin-up period, where the initial conditions for the start day were based on output from the corresponding day of the 12 km domain simulation. These spin-up periods were chosen based on previous testing, which showed that influence from the initial conditions was negligible after the seven- and three-day spin-up periods for the 12 km and 4 km simulations, respectively.

B.1.3 Results

B.1.3.1 Meteorological Model Evaluation

Simulated surface wind speed, temperature, and relative humidity from the 4 km domain were validated against hourly observations from 37 surface stations in the region (Figure B-7). Considering the geographical and meteorological differences, the area covered by these sites was divided into two regions: the lower elevation (Valley) and higher elevation mountain (Mountain) areas. Among the 37 surface sites used in this analysis, 21 of them are located in the valley zone with the remaining 16 sites located in the mountain region. The observational data for the surface stations were obtained from the CARB archived meteorological database available at http://www.arb.ca.gov/aqmis2/aqmis2.php. Table B-7 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). 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 is shown in Table B-8.

The average hourly wind speed bias for April-October 2018 is 0.61 m/s and 0.69 m/s for valley and mountain stations, respectively; while the average mean error is 0.73 m/s and 0.75 m/s for valley and mountain stations, respectively. The index of agreement for the wind speed in this period is 0.79 (0.69) for valley (mountain) stations. Temperature is biased low with an average bias of -1.05 K for valley stations and -1.62 for mountain stations, while the IOA for temperature is 0.97 for both valley and mountain stations. Consistent with the negative temperature bias, relative humidity has a positive bias of 12.61% and 13.19% for valley and mountain stations, respectively. The distribution of daily mean bias and mean error for wind speed, temperature and relative humidity are shown in Figure B-8. The spatial distributions of the mean bias and mean error of modeled surface wind, temperature and relative humidity are shown in Figure B-9. Observed vs. modeled scatter plots of hourly wind speed, temperature, and relative humidity are shown in Figure B-10. These results are comparable to other WRF modeling efforts in California investigating ozone formation in the Central California (e.g., Hu et al., 2012) and modeling analysis for the CalNex, CARES and Discover-AQ field studies (e.g. Fast et al., 2012; Baker et al., 2013; Kelly et al., 2014; Angevine et al., 2012; Chen et al., 2020). Detailed hourly time-series of surface temperature, relative humidity, wind speed, and wind direction can be found in the supplemental materials.

Table B-7. Meteorological site location and parameter measured.

Site Number (Figure B-7)	Site ID	Site Name	Region	Parameter(s) Measured
1	3290	Lincoln (RAWS)	Valley	Wind, T, RH
2	3397	Brooks	Valley	Wind, T, RH
3	5370	Sacramento International Airport	Valley	T, RH
4	3187	Folsom-Natoma Street	Valley	Wind, T, RH
5	5012	McClellan Air Force Base	Valley	T
6	6180	Woodland-CIMIS	Valley	Wind, T, RH
7	5776	Fair Oaks #2	Valley	Wind, T, RH
8	2731	Sacramento-Del Paso Manor	Valley	Wind, T, RH
9	5799	Bryte	Valley	Wind, T, RH
10	3011	Sacramento-T Street	Valley	Wind, T, RH
11	5319	Sacramento Mather Airport	Valley	T, RH
12	5710	Davis #2	Valley	Wind, T, RH
13	2143	Davis-UCD Campus	Valley	Wind, T, RH
14	2432	Sacramento-Executive Airport	Valley	T, RH
15	5784	Winters	Valley	Wind, T, RH
16	3209	Sloughhouse	Valley	Wind
17	5767	Dixon	Valley	Wind, T, RH
18	5384	Nut Tree Airport	Valley	T, RH
19	7232	Hastings Tract East	Valley	Wind, T, RH
20	5785	Twitchell Island	Valley	Wind, T, RH
21	3297	Briones	Valley	Wind, T, RH
22	6001	Lincoln Municipal Airport	Mountain	T

Site Number (Figure B-7)	Site ID	Site Name	Region	Parameter(s) Measured
23	5290	Blue Canyon Nyack Airport	Mountain	T, RH
24	3288	Hell Hole	Mountain	Wind, T, RH
25	2948	South Lake Tahoe-Sandy Way	Mountain	Wind, T, RH
26	3289	Bald Mountain Location	Mountain	Wind, T, RH
27	2527	South Lake Tahoe-Airport Met	Mountain	T, RH
28	3196	Cool-Highway 193	Mountain	Wind, T, RH
29	5832	Auburn #3	Mountain	Wind, T, RH
30	3291	Pilot Hill Station	Mountain	Wind, T, RH
31	3487	Echo Summit	Mountain	Wind, T, RH
32	2956	Roseville-N Sunrise Blvd	Mountain	Wind, T, RH
33	5714	Camino #2	Mountain	Wind, T, RH
34	3017	Placerville-Gold Nugget Way	Mountain	Wind, T, RH
35	3292	Owens Camp	Mountain	Wind, T, RH
36	6025	Diamond Springs-CIMIS	Mountain	Wind, T, RH
37	3293	Ben Bolt	Mountain	Wind, T, RH

Figure B-7. Meteorological monitoring sites utilized in the model evaluation for SFNA. Numbers reflect the sites listed in Table B-7.

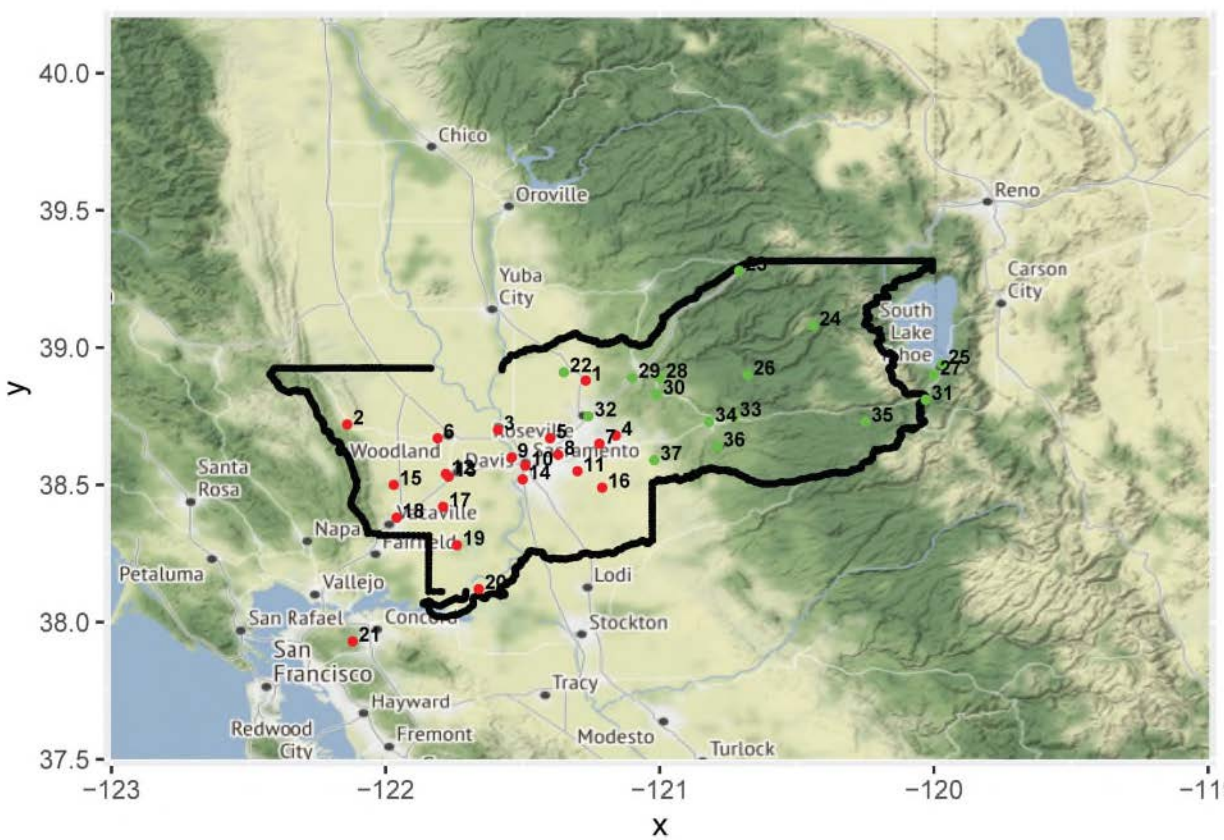


Table B-8. Hourly surface wind speed, temperature and relative humidity statistics for April through October 2018. IOA denotes index of agreement.

Parameter	Region	Obs. Mean	Mod. Mean	Mean Bias	Mean Error	IOA
Wind Speed (m/s)	Valley	2.29	2.91	0.61	0.73	0.79
Wind Speed (m/s)	Mountain	1.62	2.31	0.69	0.75	0.69
Temperature (K)	Valley	293.56	292.51	-1.05	1.84	0.97
Temperature (K)	Mountain	291.25	289.64	-1.62	1.87	0.97
Relative Humidity (%)	Valley	55.66	67.42	11.76	12.61	0.86
Relative Humidity (%)	Mountain	48.23	59.9	11.67	13.19	0.81

Figure B-8. Distribution of daily mean bias (left) and mean error (right) for Valley and Mountain sites from April – October 2018. Results are shown for wind speed (top), temperature (middle), and RH (bottom).

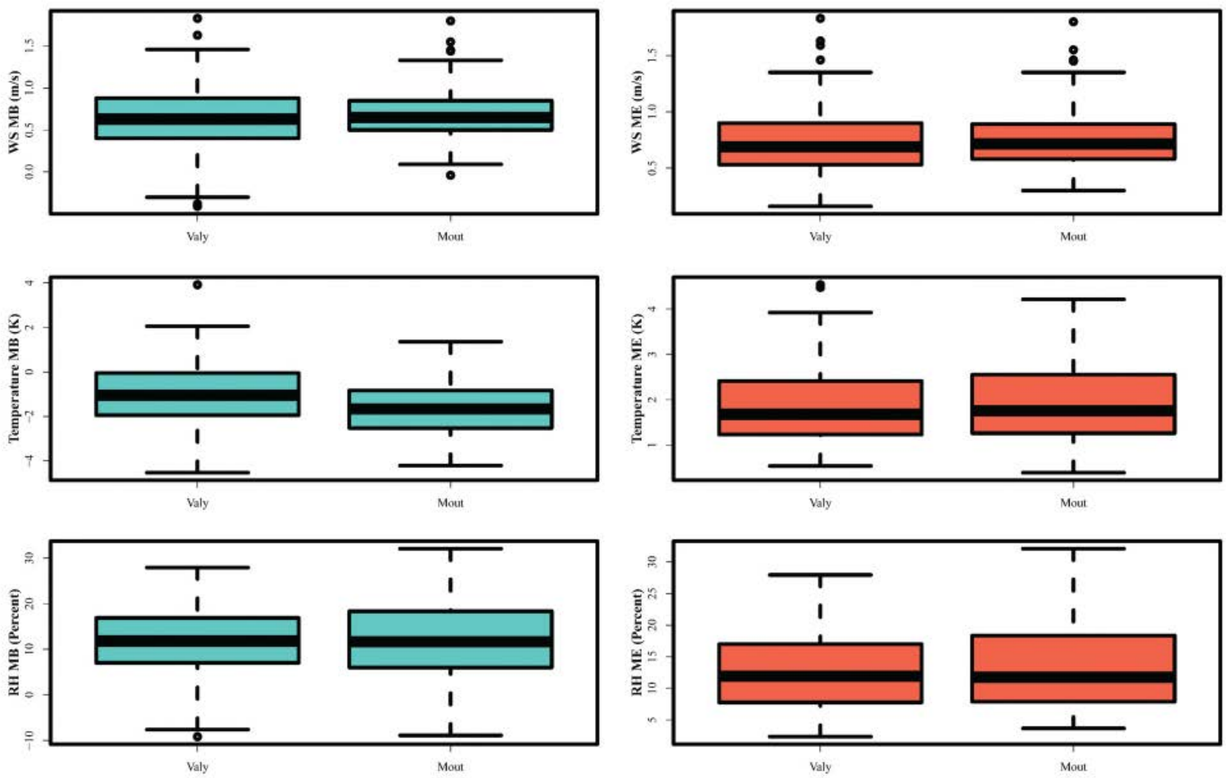


Figure B-9. Spatial distribution of mean bias (left) and mean error (right) for April-October 2018. Results are shown for wind speed (top), temperature (middle), and RH (bottom).

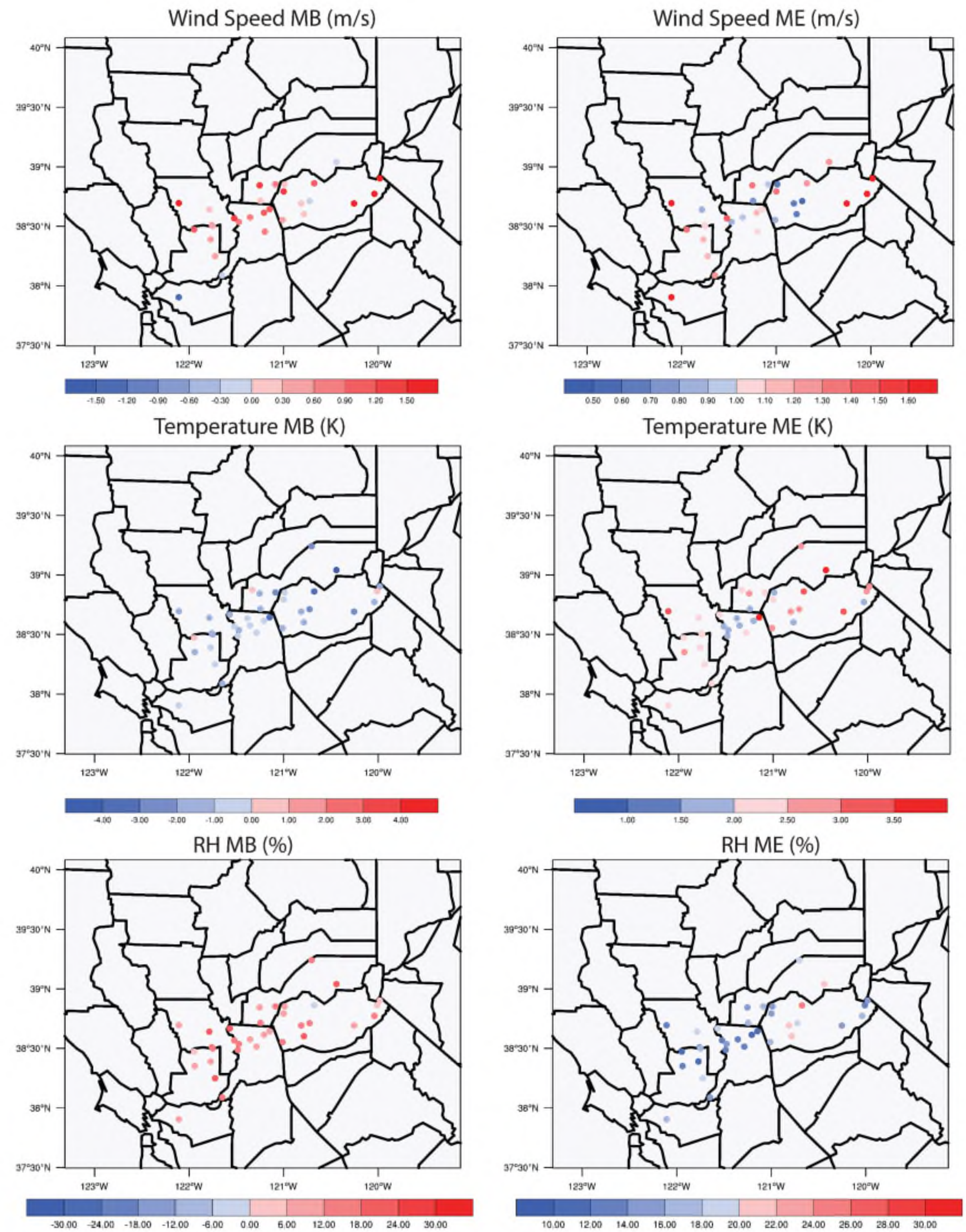
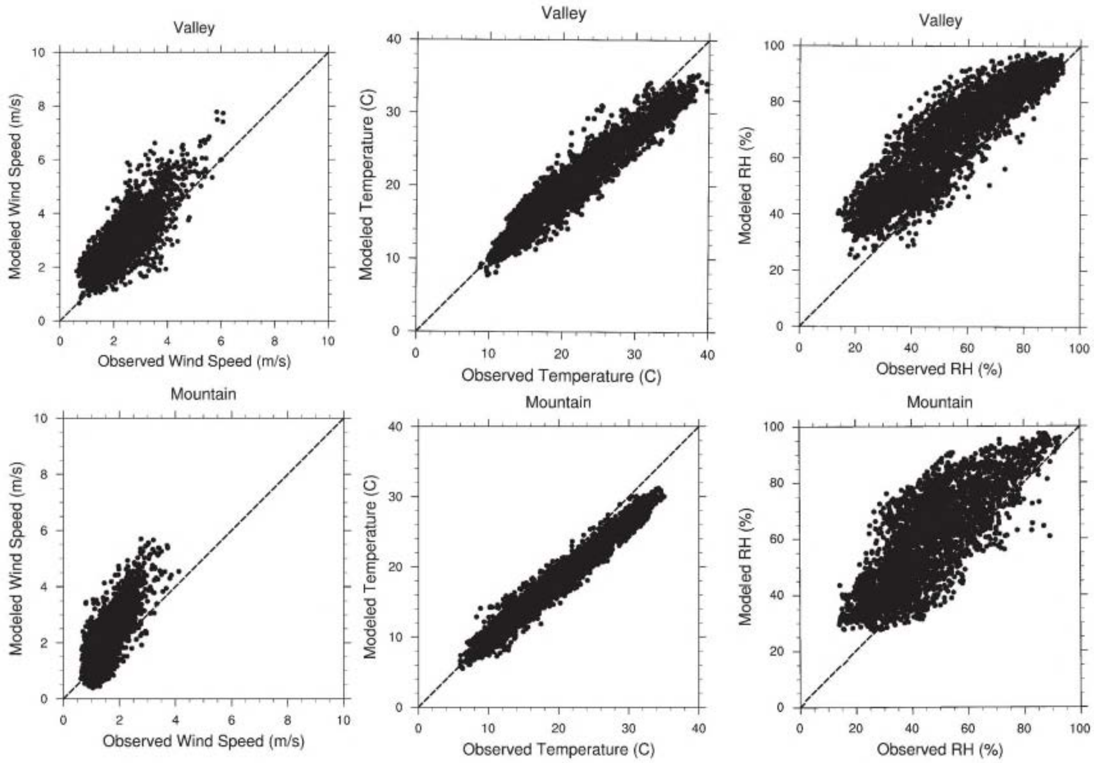


Figure B-10. Comparison of modeled and observed hourly wind speed (left), 2-meter temperature (center), and relative humidity (right) for valley stations (top) and mountain stations (bottom) for April – October 2018.



B.1.3.2 Phenomenological Evaluation

Conducting a detailed phenomenological evaluation for all modeled days can be resource intensive given that the entire ozone season (April – October) was modeled for the attainment demonstration. However, some insight and confidence that the model is able to reproduce the meteorological conditions leading to elevated ozone can be gained by investigating the meteorological conditions during peak ozone days within the SFNA in more detail.

As described in B.1.2, the Placerville-Gold monitoring site located in Sacramento Valley has the highest average DV in SFNA (Table B-2). Meteorological conditions that produced peak ozone levels in the area occurred on August 2, 2018, with a daily maximum 8-hour ozone mixing ratio of 99 ppb observed at the Placerville-Gold monitoring site. The upper-air weather charts showed that a 500 mb high pressure system was observed over California. The pressure gradient of this system was weak and the daytime temperature at the Placerville-Gold monitoring site reached 93 ˚F. Figure B-11 shows the surface wind fields in the early afternoon (13:00 PST) and the evening (20:00 PST) on the highest ozone day (August 2, 2018) at the Placerville-Gold site with the observed and modeled values denoted by red and black arrows, respectively. Overall, modeled winds compare relatively well with the observed values. The model was able to capture many of the important features of the wind fields in the SFNA. For most summer days, marine air penetrates inland through the Carquinez Strait, and then the marine air flow splits into northward flows up in the Sacramento Valley and southward flows down in the SJV due to the blocking effect of the Sierra mountain range. The daytime southwesterly wind in the Sacramento Valley was well reproduced by the model on August 2, 2018. The changes of the up-slope wind in the early afternoon and down-slope wind in the evening are also reproduced reasonably well in the model over the western slope of the Sierras.

Since RRF calculations in the model attainment test described previously are based on the top 10 peak ozone days, the modeled and measured winds in the region were examined in further detail for the top 10 ozone days observed at the Placerville-Gold monitor in 2018. The ten highest maximum daily average 8-hour ozone mixing ratios observed at the Placerville-Gold site in 2018 occurred on August 2, August 9, August 10, August 8, August 5, August 1, September 21, July 31, August 25, July 28, respectively. Figure B-12 shows the mean wind field (vector average) for the top 10 ozone days at 05:00 PST and 13:00 PST, respectively. Overall, the surface wind distribution indicates that the model is in general agreement with the observations and is able to capture important features of the observed meteorological fields, such as the daytime southwesterly winds in the valley associated with the marine air penetration as well as the daytime up-slope and nighttime down-slope wind over the western side of the Sierras, on those days when elevated ozone levels occurred.

Figure B-11 Surface wind field at 13:00 PST (top) and 20:00 PST (bottom) on August 02, 2018. The modeled wind field is shown with black wind vectors, while observations are shown in red.

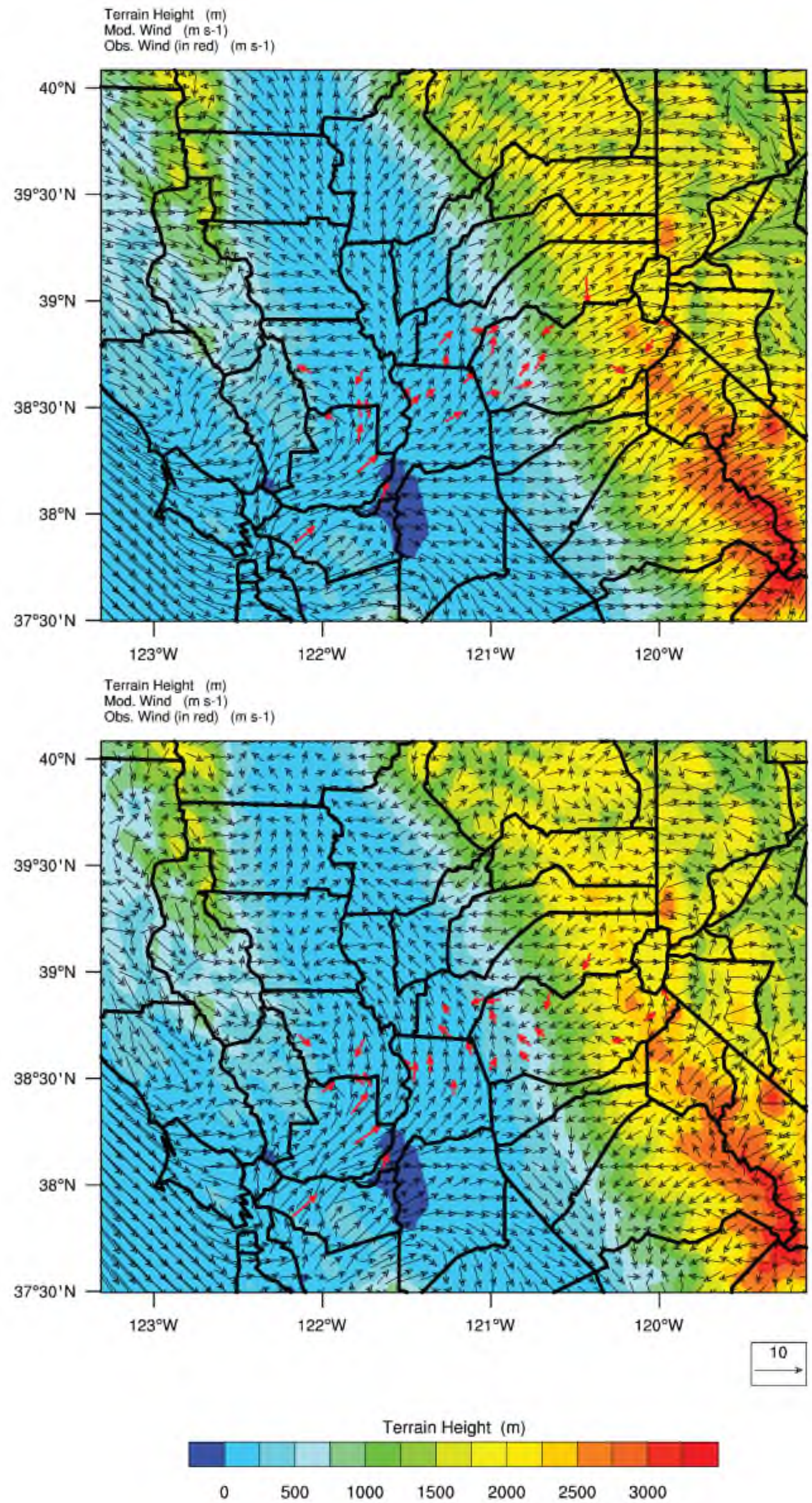
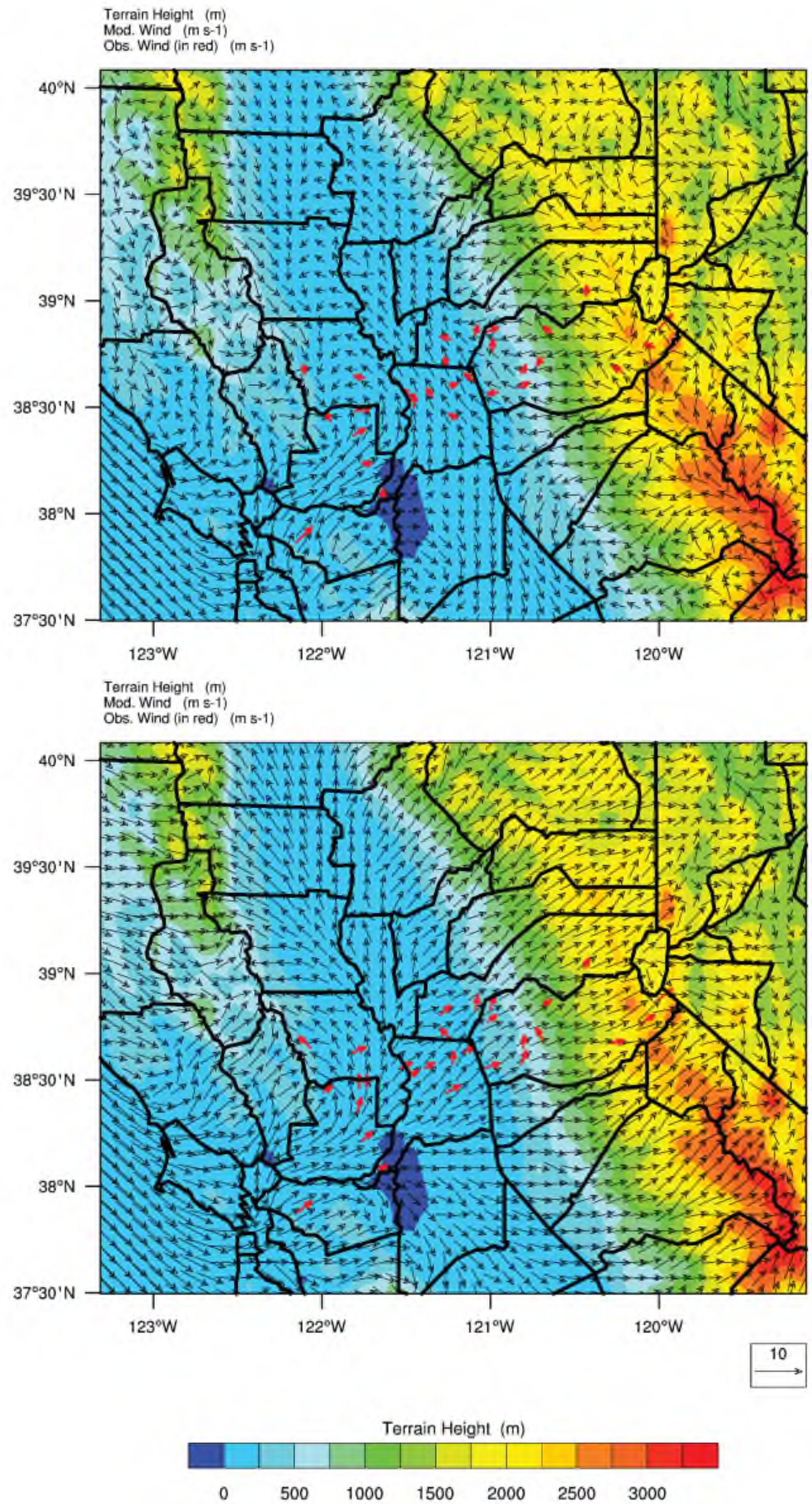


Figure B-12. Average wind field at 5:00 PST (top) and 13:00 PST (bottom) for the top 10 observed ozone days at Placerville-Gold monitor in 2018. Modeled wind field is shown with black wind vectors, while observations are shown in red.



In addition, it is useful to examine the direction of predominant wind flow, through wind rose plots, on peak ozone days to ensure the same transport patterns from source to receptor observed in the atmosphere are also captured in the model. Figure B-13 shows the observed and simulated wind speed frequency and direction at the Placerville-Gold site for the top 10 ozone days in 2018. The Placerville-Gold site is located at the foothills of the western slope of the Sierras. From Figure B-13, it is clear that the dominant observed wind flow pattern on peak ozone days shows daytime up-slope wind (wind from the west/south-west and wind from the west) and nighttime down-slope wind (wind from the north/north-east and wind from the east). The model predicted higher occurrences of winds from the west, and lower occurrences of winds from the west/south-west compared to observations. It is more difficult for the model to reproduce wind fields at mountain sites due to limitations in representing unresolved topographical features and their affects on land surface process and the momentum flux. Despite a little discrepancy (~30 deg) in the dominant wind direction, the model was generally able to reproduce the wind directions and wind speeds at Placerville-Gold for the top 10 ozone days in 2018.

Figure B-13. Observed (left) and modeled (right) wind roses at the Placerville-Gold site for the top 10 observed ozone days in 2018.

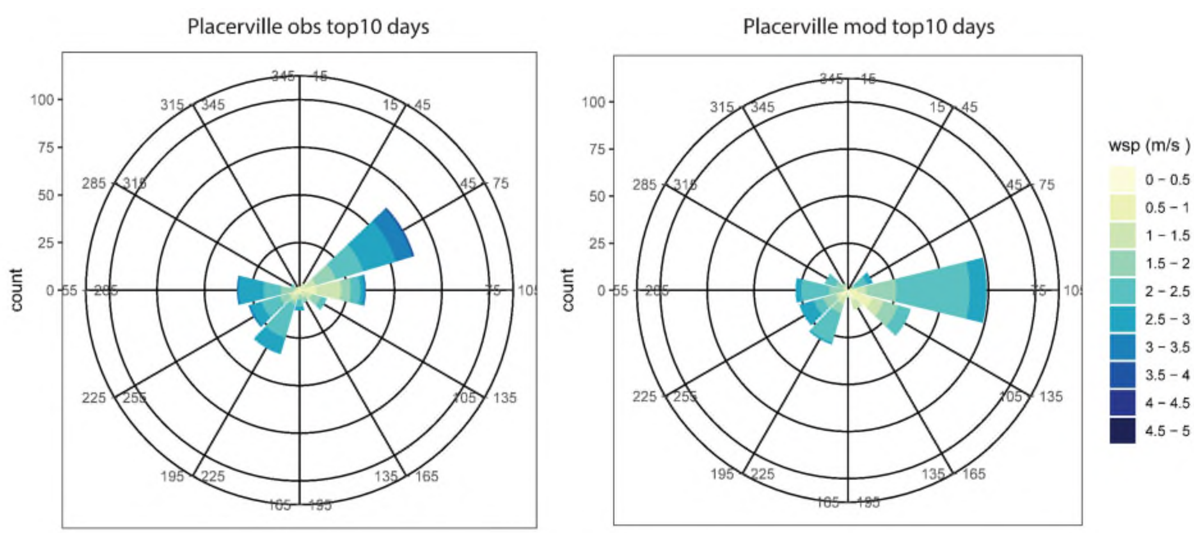
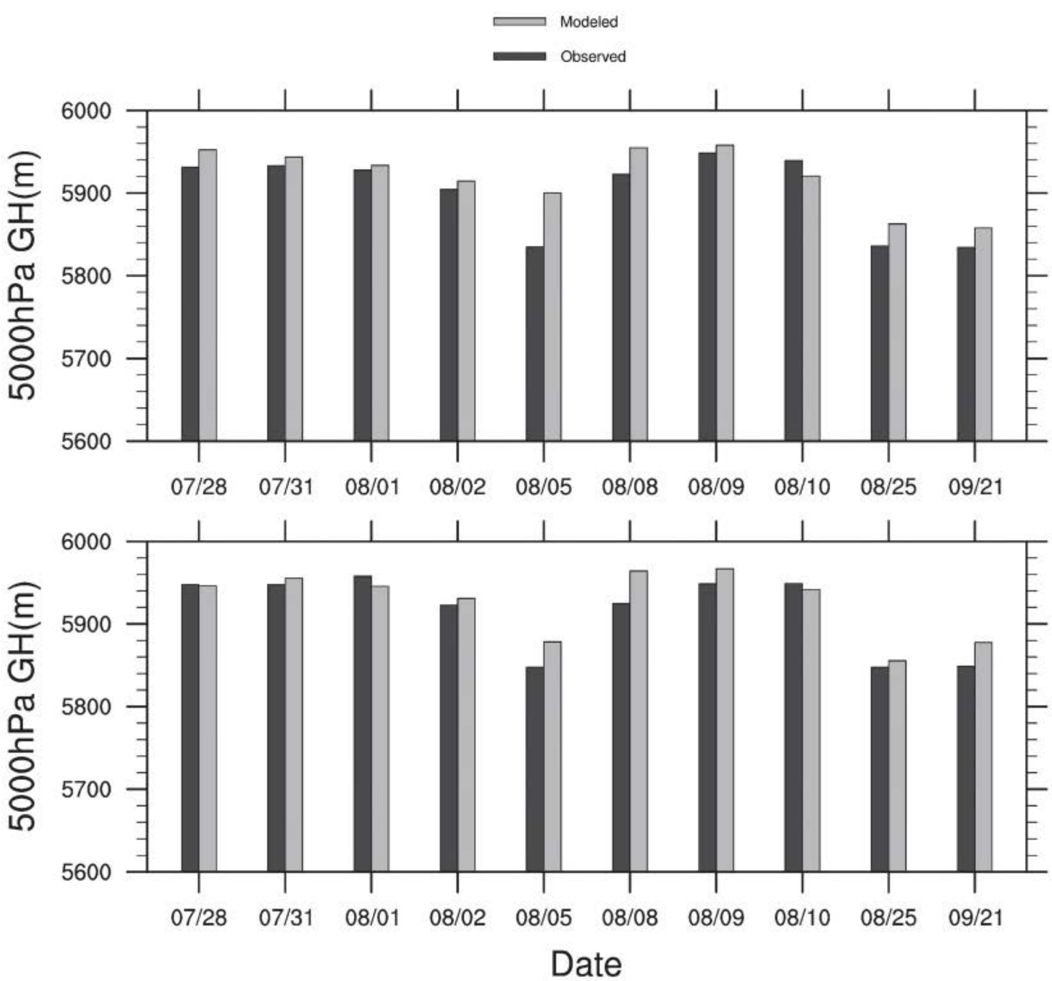


Figure B-14 shows the 500 hPa geopotential height at 12:00 UTC and 00:00 UTC for the top 10 ozone days in 2018 at the Placerville-Gold site. These times were chosen to coincide with timing of the upper-air observations. In this figure, the North American Regional Reanalysis (NARR) data is used to represent the observations. The NARR dataset is a product of observational data assimilated into some of the NOAA model products for the purpose of producing a snapshot of the weather over North America at any given time. The 500 hPa geopotential height is a useful metric to evaluate, because most weather systems follow the winds at this level. It can be seen from Figure B-14 that on average the 500 hPa geopotential height is ~5800 m above sea level and the modeled 500 hPa geopotential height closely matches the observed values.

Although a phenomenological evaluation of only a subset of peak ozone days does not necessarily mean the model performs equally well on all days, the fact that the model can adequately reproduce wind flows consistent with the ozone conceptual model, combined with reasonable performance statistics over the ozone season (Table B-8), provides added confidence in the meteorological fields utilized for this attainment demonstration modeling.

Figure B-14. Modeled and observed at 12:00 UTC (top) and 00:00 UTC (bottom) 500 hPa geopotential height for the top 10 observed ozone days at the Placerville-Gold site in 2018.



B.1.3.3 Air Quality Model Evaluation

Observed ozone data from CARB's Air Quality and Meteorological Information System (AQMIS) database (www.arb.ca.gov/airqualitytoday/) and Aerometric Data Analysis and Management (ADAM) database (www.arb.ca.gov/adam/) were used to evaluate the accuracy of the 4 km CMAQ modeling for all ozone monitors listed in Table B-2. The EPA modeling guidance (EPA, 2018) recommends using the grid cell value where the monitor is located, to pair observations with simulated values in operational evaluation of model predictions. Since the future year design value calculations are based on simulated values near the monitor (i.e., the maximum simulated ozone within a 3x3 array of grid cells with the grid cell containing the monitor located at the center of the array), model performance was evaluated by comparing observations against the simulated values 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). While different cutoff criteria have be used in different model evaluation studies (Emery et al., 2017), EPA suggests the days with simulated values > 60 ppb should receive higher priority in evaluation to give more attention to the model outputs that could potentially impact the outcome of the attainment test. Model performance is further summarized separately for the three sub-regions in the SFNA due to their distinct geographical, meteorological and air quality patterns.

As recommended by EPA modeling guidance, a number of statistical metrics have been 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 (R^2). In addition, the following plots were used in evaluating the modeling with all available data: time-series plots comparing the predictions and observations, scatter plots for comparing the magnitude of the simulated and observed concentrations, as well as frequency distributions.

The model performance evaluation is presented for the entire SFNA region and also disaggregated for the three sub regions. Performance statistics for modeling scenarios with data above 60 ppb are reported separately for different ozone metrics including maximum daily average 8-hour (MDA8) ozone, maximum daily average 1-hour (MDA1) ozone, and hourly ozone (all hours of the day) for the monitored grid cell as well as the 3x3 maximum. Performance statistics for MDA8 ozone are shown in Table B-9 and Table B-10. Overall, when simulated data extracted at the grid cell is used for comparison with observations (as shown in Table B-9), the model shows a negative bias of -3.36 ppb in MDA8 O_3 greater than 60 ppb in the entire region, with the smallest bias occurring in the central SFNA (0.40 ppb) and the largest bias occurring in the eastern SFNA (-5.85 ppb). However, when the 3x3 maximum is used instead, positive bias in the model results increases to 2.65 ppb in central SFNA and the bias in eastern SFNA reduces to -4.14 ppb. Mean error shows a consistent trend with the error getting smaller from 7.98 ppb to 7.84 ppb for the entire SFNA when the 3x3 maximum is considered. Similar statistics for maximum daily average 1-hour ozone (monitor grid cell and 3x3 maximum) and hourly ozone can be found in Table B-11and Table B-12, respectively.

Model performance statistics with the range of values shown in Table B-9 to Table B-13 are consistent with previous studies in California and studies elsewhere in the U.S. Hu et al. (2012) simulated an ozone episode in central California (July 27 – August 2, 2000) using the SAPRC07 chemical mechanism and found a model bias of -10.8 ppb for maximum daily average 8-hour ozone with 60 ppb cutoff (compared to -3.36 ppb for the entire SFNA of this work). Hu et al. also showed a model bias of -12.7 ppb for maximum daily average 1-hour ozone in Central California with 60 ppb cutoff (compared to -2.64 ppb in this work).

Similarly, Shearer et al. (2012) compared model performance in Central California during two episodes in 2000 (July 24 – 26 and July 31 – August 2) for two different chemical mechanisms and found that normalized bias for maximum daily average 8-hour ozone ranged from -7% to -14% with hourly peak ozone showing a range of -7% to -18%. These values are greater than the statistics found in this work, which were calculated as -4.86% for MDA8 ozone and -3.66% for MDA1 ozone. Jin et al. (2010) conducted a longer term simulation over Central California (summer 2000) and found a RMSE for MDA8 ozone of 14 ppb, which is greater than the 11.08 ppb found in this work. Jin et al. (2010) also showed an overall negative bias of -2 ppb, which is in the similar range of -3.36 ppb (-1.47 ppb with 3x3 maximum values) found in this work. Zhu et al. (2019) shows hourly O_3 NMB of 8.2% and NME of 11.3% for July and August 2012 with 20 ppb cutoff, both are similar to the NMB and NME shown in Table B-13.

Table B-9. Maximum daily average 8-hour ozone performance statistics by modeling subregions and entire SFNA region for the 2018 ozone season (April - October). Maximum daily average 8-hour ozone (>60ppb) with simulated data extracted at grid cell where the monitor is located.

Parameter	Western SFNA	Central SFNA	Eastern SFNA	Entire SFNA
Number of data points	44	208	329	581
Mean obs (ppb)	64.68	67.26	70.77	69.05
Mean Bias (ppb)	-2.46	0.40	-5.85	-3.36
Mean Error (ppb)	6.09	6.53	9.16	7.98
RMSE (ppb)	7.76	8.15	12.91	11.08
Mean Fractional Bias (%)	-3.95	0.42	-8.45	-4.93
Mean Fractional Error (%)	9.54	9.66	13.28	11.70
Normalized Mean Bias (%)	-3.81	0.59	-8.26	-4.86
Normalized Mean Error (%)	9.42	9.71	12.94	11.56
R-squared	0.05	0.12	0.09	0.08

Table B-10. Maximum daily average 8-hour ozone performance statistics by modeling subregions and entire SFNA region for the 2018 ozone season (April - October). Maximum daily average 8-hour ozone (>60ppb) with simulated data extracted from the 3x3 grid cell array maximum centered at the monitor.

Parameter	Western SFNA	Central SFNA	Eastern SFNA	Entire SFNA
Number of data points	44	208	329	581
Mean obs (ppb)	64.68	67.26	70.77	69.05
Mean Bias (ppb)	-1.04	2.65	-4.14	-1.47
Mean Error (ppb)	5.81	7.03	8.63	7.84
RMSE (ppb)	7.49	8.58	12.00	10.59
Mean Fractional Bias (%)	-1.71	3.69	-5.88	-2.14
Mean Fractional Error (%)	9.01	10.21	12.36	11.33
Normalized Mean Bias (%)	-1.61	3.93	-5.84	-2.13
Normalized Mean Error (%)	8.98	10.45	12.19	11.36
R-squared	0.06	0.14	0.12	0.10

Table B-11. Maximum daily average 1-hour ozone performance statistics by modeling subregions and entire SFNA region for the 2018 ozone season (April - October). Maximum daily average 1-hour ozone (>60ppb) with simulated data extracted at grid cell where the monitor is located.

Parameter	Western SFNA	Central SFNA	Eastern SFNA	Entire SFNA
Number of data points	192	431	437	1060
Mean obs (ppb)	68.07	71.69	74.29	72.10
Mean Bias (ppb)	-1.44	-0.49	-5.29	-2.64
Mean Error (ppb)	7.66	8.57	9.78	8.90
RMSE (ppb)	9.59	10.96	13.53	11.87
Mean Fractional Bias (%)	-2.55	-0.78	-7.34	-3.81
Mean Fractional Error (%)	11.43	11.89	13.48	12.46
Normalized Mean Bias (%)	-2.12	-0.68	-7.12	-3.66
Normalized Mean Error (%)	11.25	11.95	13.17	12.35
R-squared	0.12	0.20	0.20	0.19

Table B-12. Maximum daily average 1-hour ozone performance statistics by modeling subregions and entire SFNA region for the 2018 ozone season (April - October). Maximum daily average 1-hour ozone (>60ppb) with simulated data extracted from the 3x3 grid cell array maximum centered at the monitor.

Parameter	Western SFNA	Central SFNA	Eastern SFNA	Entire SFNA
Number of data points	192	431	437	1060
Mean obs (ppb)	68.07	71.69	74.29	72.10
Mean Bias (ppb)	0.71	2.81	-2.77	0.13
Mean Error (ppb)	7.72	9.15	9.41	9.00
RMSE (ppb)	9.63	11.64	12.66	11.75
Mean Fractional Bias (%)	0.62	3.64	-3.84	0.01
Mean Fractional Error (%)	11.27	12.35	12.73	12.31
Normalized Mean Bias (%)	1.04	3.92	-3.73	0.18
Normalized Mean Error (%)	11.34	12.76	12.67	12.48
R-squared	0.12	0.21	0.23	0.20

Table B-13. Hourly ozone performance statistics by modeling subregions and entire SFNA region for the 2018 ozone season (April - October). Hourly ozone (>60ppb) with simulated data extracted at grid cell where the monitor is located. Note that only statistics for the grid cell in which the monitor is located were calculated for hourly ozone.

Parameter	Western SFNA	Central SFNA	Eastern SFNA	Entire SFNA
Number of data points	648	1940	3435	6023
Mean obs (ppb)	66.70	69.20	70.69	69.78
Mean Bias (ppb)	-3.84	-1.85	-9.61	-6.49
Mean Error (ppb)	8.58	8.63	12.53	10.85
RMSE (ppb)	11.06	11.12	16.43	14.39
Mean Fractional Bias (%)	-6.57	-3.15	-15.30	-10.45
Mean Fractional Error (%)	13.52	12.70	19.43	16.62
Normalized Mean Bias (%)	-5.76	-2.68	-13.59	-9.30
Normalized Mean Error (%)	12.87	12.47	17.72	15.54
R-squared	0.04	0.12	0.09	0.08

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). Figure B-15 illustrates the range of various statistical performance metrics presented in Simon et al. (2012), where we have overlayed the same statistical metrics calculated from the modeling used for this attainment demonstration. The box-and-whisker plots (colored in black) displayed in Figure B-15 were reproduced using data extracted from Figure 4 of Simon et al. (2012). The red dot and blue triangle in each of the panels in Figure B-15 denote the model performance statistics from the current modeling work, calculated using the simulated monitor grid cell and the 3x3 maximum, respectively.

Figure B-15. Comparison of various statistical metrics from the 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). Red circular markers show statistics calculated from modeled ozone at the monitor location, while blue triangular markers show statistics calculated from the maximum ozone in the 3x3 array of grid cells surrounding the monitor. Statistics for hourly ozone were only calculated from data over 60 ppb.

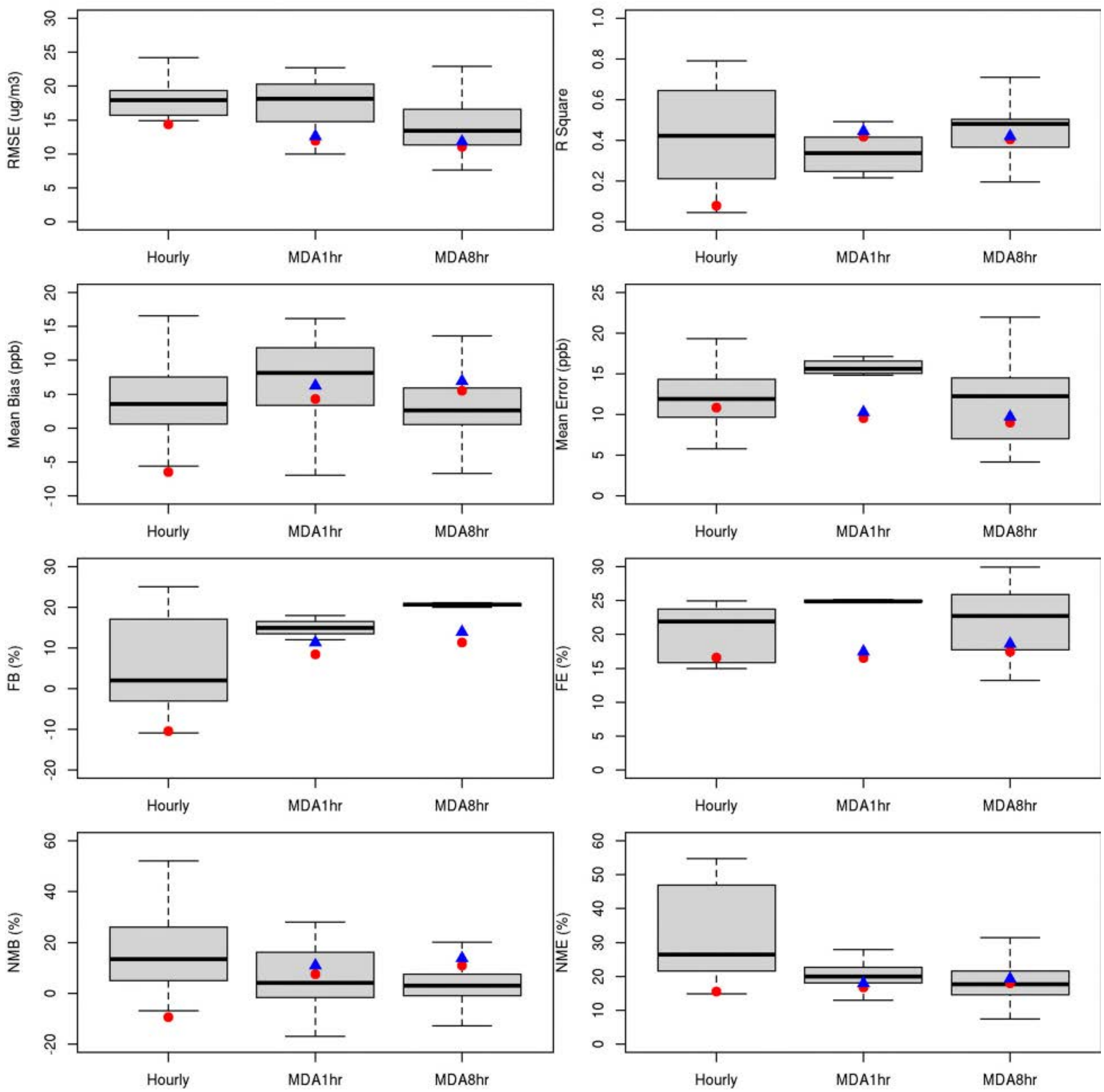
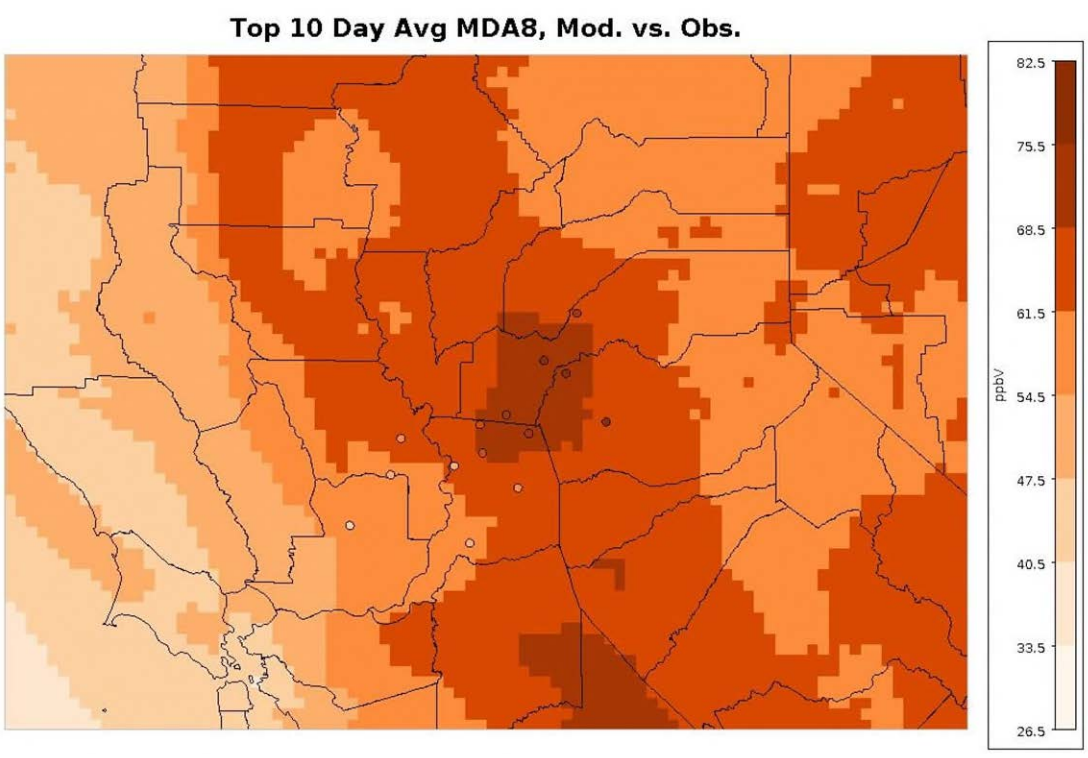


Figure B-15 clearly shows that the model performance statistical metrics for hourly, maximum daily average 8-hour and maximum daily 1-hour ozone from this work are consistent with previous modeling studies reported in the scientific literature, and in most cases are better than those statistics. In particular, the Simon et al. (2012) study found that mean bias for maximum daily average 8-hour ozone ranged from approximately -7 ppb to 13 ppb, while mean error ranged from around 4 ppb to 22 ppb, and RMSE varied from approximately 8 ppb to 23 ppb; all of which are similar in magnitude to the statistics presented in Table B-9 and Table B-10.

Spatial distributions of modeled and observed average maximum daily average 8-hour ozone for the top 10 O_3 days at the Placerville-Gold site are displayed in Figure B-16. The model is able to capture the observed spatial gradient of ozone in the modeling domain with reasonable agreement between the model and observation. Additional analysis including frequency analysis, time series plots and scatter plots of the hourly, maximum daily average 1-hr and maximum daily average 8-hour ozone at sites in the SFNA can be found in the supplemental materials. The model performance shown in these plots is consistent with the statistical analysis above. Observed and modeled daily average NO_X scatter plot for the SFNA is also shown in Figure S 60 in the supplemental materials which demonstrates decent agreement between modeled and observed NO_X concentrations.

Figure B-16. Average MDA8 ozone for the top 10 ozone days excluding fire days that impacted Auburn in 2018 from the model simulations overlaid with observation data (marked as circle) where the top 10 days from the observations were chosen based on the Placerville-Gold site.



B.1.3.4 Air Quality Model Diagnostic Evaluation

In addition to the statistical evaluation presented above, since the modeling is utilized in a relative sense, it is also useful to consider whether the model is able to reproduce observable relationships between changes in emissions and ozone. One approach to this would be to conduct a retrospective analysis where additional years are modeled (e.g., 2000 or 2005) and then investigate the ability of the modeling system to reproduce the observed changes in ozone over time. Since this approach is extremely time consuming and resource intensive, it is generally not feasible to perform such an analysis under the constraints of a typical SIP modeling application. An alternative approach for investigating the ozone response to changes in emissions is through the so called “weekend effect”.

The “weekend effect” is a well-known phenomenon in some major urbanized areas where emissions of NO_X are substantially lower on weekends than on weekdays, but measured levels of ozone are higher on weekends than on weekdays. This is due to the complex and non-linear relationship between NO_X and ROG precursors and ozone (e.g., Sillman, 1999).

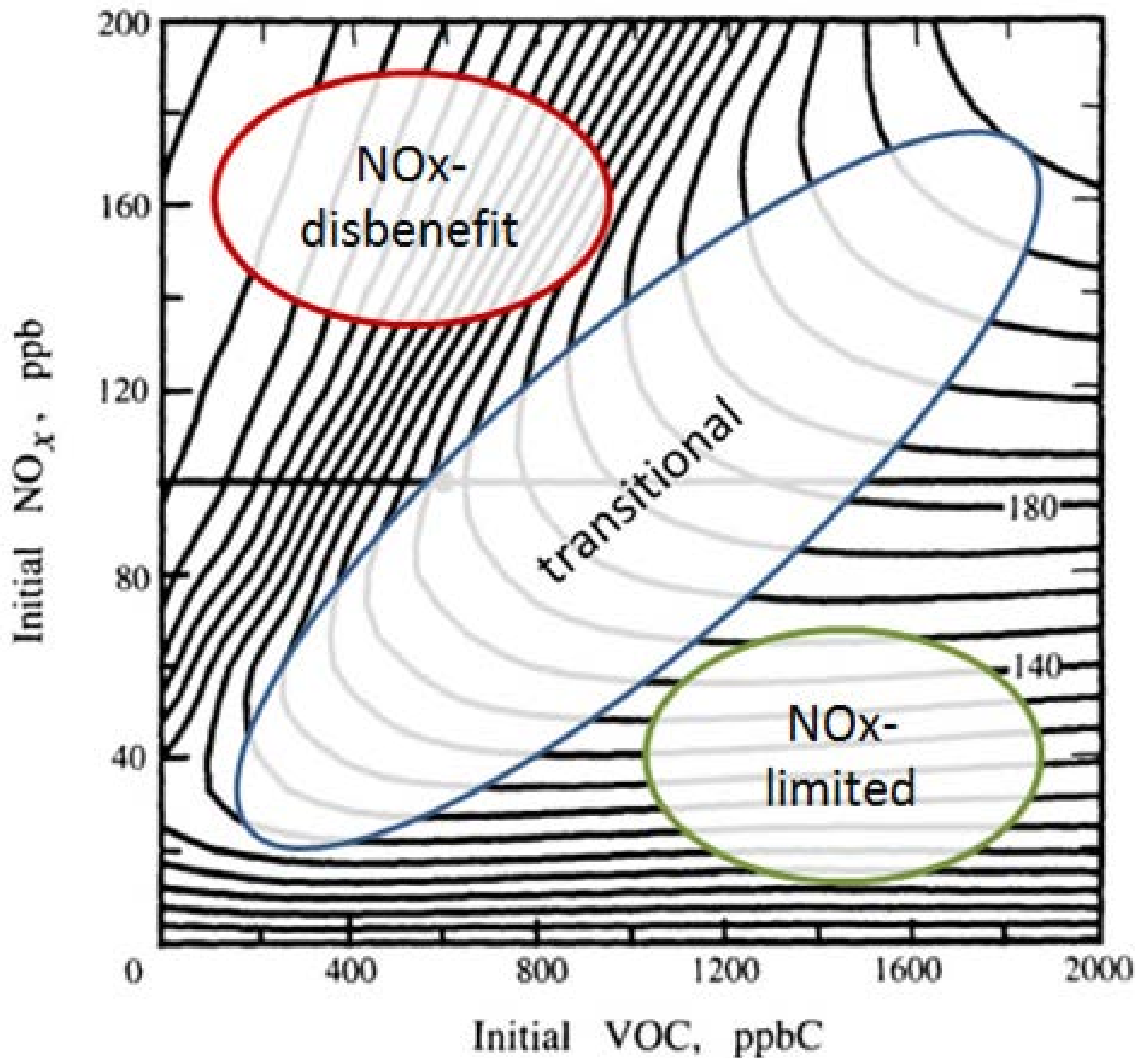
In general terms, under ambient conditions of high-NO_X and low-ROG (NO_X-disbenefit region in Figure B-17) ozone formation tends to exhibit a disbenefit to reductions in NO_X emissions (i.e., ozone increases with decreases in NO_X) and a benefit to reductions in ROG emissions (i.e., ozone decreases with decreases in ROG). In contrast, under ambient conditions of low-NO_X and high-ROG (NO_X-limited region in Figure B-17), ozone formation shows a benefit to reductions in NO_X emissions, while reducing ROG emissions results in only minor decreases in ozone. These two distinct “ozone chemical regimes” are illustrated in Figure B-17 along with a transitional regime that can exhibit characteristics of both the NO_X-disbenefit and NO_X-limited regimes. Note that Figure B-17 is shown for illustrative purposes only and does not represent the actual ozone sensitivity within the SFNA for a given combination of NO_X and ROG (VOC) emissions.

In this context, the prevalence of a weekend effect in a region suggests that the region is in a NO_X-disbenefit regime (Heuss et al., 2003). A lack of a weekend effect (i.e., no pronounced high O_3 occurrences during weekends) would suggest that the region is in a transition regime and moving between exhibiting a NO_X-disbenefit and being NO_X-limited. A reverse weekend effect (i.e., lower O_3 during weekends) would suggest that the region is NO_X-limited.

Investigating the “weekend effect” and how it has changed over time is a useful real-world metric for evaluating the ozone chemistry regime in the SFNA and how well it is represented in the modeling. The trend in day-of-week dependence of SFNA’s sub-regions was analyzed using the ozone observations between 2000 and 2020 and the average site-specific weekday (Wednesday and Thursday) and weekend (Sunday) observed summertime (June through September) average MDA8 ozone values by year

(2000 to 2020) are compared (Figure B-18). Different definitions of weekday and weekend days were also investigated and did not show appreciable differences from the Wednesday/Thursday and Sunday definitions.

Figure B-17. Illustration of a typical ozone isopleth plot, where each line represents ozone mixing ratio, in 10 ppb increments, as a function of initial NO_X and VOC (or ROG) mixing ratio (adapted from Seinfeld and Pandis. 1998, Figure 5.15). General chemical regimes for ozone formation are shown as NO_X-disbenefit (red circle), transitional (blue circle), and NO_X-limited (green circle).



In Figure B-18, it can be seen that ozone levels are highest in the eastern (bottom left panel) and central (middle left panel) regions of the SFNA consistent with their location downwind to and within the urban core of the SFNA. The lowest ozone levels are seen in the western SFNA region, which is located upwind of the urban Sacramento emissions source. A key observation in left panels of Figure B-18 is that the summertime average weekday and weekend MDA8 ozone levels have steadily declined between 2000 and 2020.

Along with the declining ozone, there was a shift in the relative difference between weekday and weekend ozone from 2000 to 2020. In the early 2000’s, the central region of the SFNA exhibited a roughly equal number sites with weekend ozone greater than weekday ozone as sites with weekday ozone greater than weekend ozone, which suggests that the region may have been in a transitional chemistry regime for ozone formation. By the mid-2000’s, the majority of sites were showing weekday ozone greater than weekend ozone, which is consistent with a shift into NO_X-limited chemistry. However, some of the sites had shifted back towards a more equal distribution between weekday and weekend ozone in recent years, likely due to variability in the biogenic emissions and meteorology that can shift the ozone chemistry between NO_X-limited and NO_X-disbenefit regimes in the Sacramento area (LaFranchi et al., 2011; Wu, et al, 2022).

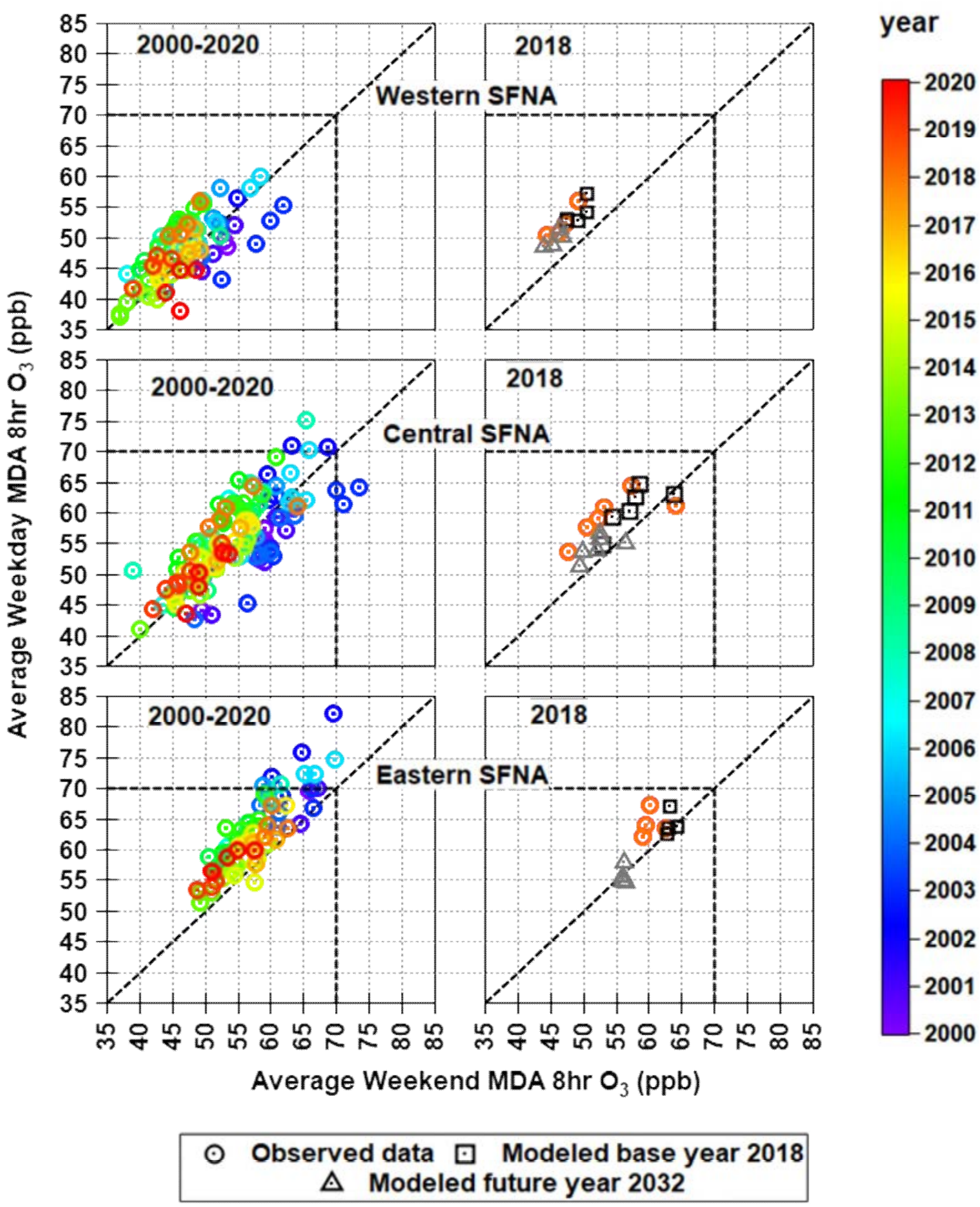
The Western SFNA region clearly experienced a greater NO_X-disbenefit in the early 2000’s and then moved into a transitional chemical regime in the mid-2000’s and transitioned into the NO_X-limited regime around the 2010/2011 timeframe. There was a shift back towards a more equal distribution between weekday and weekend ozone in some years after 2010, similar to the Central sub-region. However, this shift occurred at very low ozone levels (below 50 ppb) that are well below the 70 ppb 8-hour ozone standard.

In contrast to the central and western regions described above, the eastern portion of SFNA has been in a NO_X-limited regime since before 2000, which can be seen from the greater weekday ozone when compared to the weekend ozone. This region is in close proximity to large biogenic ROG emission sources and farther away from the anthropogenic NO_X sources in the urban Sacramento Metropolitan Area (SMA), which are conditions (i.e., low NO_X and high ROG) that place the region in a NO_X-limited regime.

The right panels of Figure B-18 show that all three sub-regions had almost fully transitioned to the NO_X-limited regime by 2018 except for some sites in the Central and Eastern regions, which continue to oscillate (middle and bottom right panels) falling above, close to or below the 1:1 dashed line depending on the year, and likely due to the year-to-year variability in meteorology and associated changes in biogenic ROG emissions. The simulated baseline 2018 weekday/weekend values (black open square markers shown in right panels of Figure B-18) from the attainment demonstration modeling fall above the 1:1 dashed line in the Western, Central and Eastern SFNA and are generally consistent with observed findings that show a shift into NO_X-limited chemistry in the SFNA.

The predicted future 2032 values (light gray open triangle markers in right panels of Figure B-18) clearly show that weekday and weekend ozone decline significantly (all values are below 60 ppb) and all three sub-regions show a shift to a NO_X-limited regime with values falling closer to but above the 1:1 dashed line, which is generally consistent with a study from UC Berkeley researchers that predicted the future cumulative NO_X controls over time will likely transition the entire SFNA (including the urban core) to a NO_X limited regime (LaFranchi et al., 2011).

Figure B-18. Site-specific average weekday and weekend maximum daily average 8-hour ozone for each year from 2000 to 2020 in the Western (top), Central (middle), and Eastern (bottom) sub-regions of SFNA. The colored circle markers denote observed values while the open black square, and gray triangle markers denote the simulated baseline 2018 and future year 2032 values. Points falling below the 1:1 dashed line represent a NO_X-disbenefit regime, those on the 1:1 dashed line represent a transitional regime, and those above the 1:1 dashed line represent a NO_X-limited regime.



B.1.3.5 Future Design Values in 2032

The RRFs and the 2032 future ozone design values for the monitoring sites in the western, central, and eastern regions of the SFNA were calculated using the procedures outlined in the Methodology section of this document and are summarized in Table B-14. Note that the results shown in the table are ordered by each sub-region in descending order of the average reference year 2018 DVs except for the Auburn-Atwood site.

The results in Table B-14 show that all monitoring sites in the SFNA have a future DV less than 70 ppb based on the 2032 emissions inventory when fire days are excluded in the Auburn-Atwood site DV calculation. The Colfax-CityHall site in the eastern SFNA has the highest predicted future design value of 69.8 ppb and truncated value of 69 ppb in 2032. Therefore, the attainment demonstration modeling predicts that the entire SFNA will attain the 70 ppb 8-hour O_3 standard by 2032 with the commitments outlined in the SIP.

Table B-14. Summary of key parameters related to the future year 2032 ozone design value (DV) calculation.

Sub-region	Site	RRF	2018 Average DV (ppb)	2032 DV (ppb)	2032 Truncated DV (ppb)
Eastern SFNA	Placerville-Gold	0.8283	84.0	69.6	69
Eastern SFNA	Colfax-CityHall	0.8334	83.7	69.8	69
Eastern SFNA	Cool-Hwy193	0.8353	81.7	68.2	68
Eastern SFNA	Auburn-Atwood,fire days excluded	0.8356	81.7	68.3	68
Eastern SFNA	Auburn-Atwood, all days	0.8356	87.3	72.9	72
Central SFNA	Folsom-Natoma	0.8433	76.7	64.7	64
Central SFNA	Roseville-NSunrise	0.8408	76.3	64.2	64
Central SFNA	N_Highlands-Blackfoot	0.8674	74.7	64.8	64
Central SFNA	Sacramento-DelPas	0.8662	72.0	62.4	62
Central SFNA	Sloughhouse	0.8708	71.3	62.1	62
Central SFNA	Sacramento-TStreet	0.9053	66.3	60.0	60
Western SFNA	Elk_Grove-Bruceville	0.9127	67.7	61.8	61
Western SFNA	Woodland-Gibson	0.8750	66.7	58.4	58
Western SFNA	Vacaville-Ulatis	0.9100	64.0	58.2	58
Western SFNA	Davis-UCD	0.9063	62.3	56.5	56

B.1.3.6 NO_X/VOC Sensitivity Analysis for Reasonable Further Progress (RFP)

For the Clean Air Act 182(c)(2)(B) Reasonable Further Progress (RFP) requirement for areas classified as Serious nonattainment and above, EPA guidance allows for NO_X substitution to demonstrate the annual 3 percent reduction of ozone precursors if it can be demonstrated that substitution of NO_X emission reductions (for ROG reductions) yield equivalent decreases in ozone. Additional EPA guidance states that certain conditions are needed to use NO_X substitution in an RFP demonstration (EPA 1993). First, an equivalency demonstration must show that cumulative RFP emission reductions are consistent with the NO_X and ROG emission reductions determined in the ozone attainment demonstration. Second, the reductions in NO_X and ROG emissions should be consistent with the continuous RFP emission reduction requirement.

For the equivalency demonstration, ROG and NO_X emissions within the nonattainment area boundary were reduced by 45% (3% for each of the 15 years between the designation year of 2017 and attainment year of 2032) independently from the baseline modeling year of 2018. These sensitivity simulations were used to develop RRFs and design values following the same methodology utilized in the attainment demonstration, where the sensitivity simulation was treated analogous to the future year. Table B-15 summarizes the design values calculated for the 45% NO_X and ROG sensitivity simulations. At all sites except for Davis-UCD in the SFNA, the ratios of the change in ozone design value to the NO_X emissions change ($\Delta O_3/\Delta NO_X$) are greater than those of the ROG emissions change ($\Delta O_3/\Delta ROG$). Davis-UCD site has the lowest 2018 average DV (62.3 ppb) in the SFNA. When ozone concentrations are this low, the ozone-NO_X-VOC sensitivity becomes more meteorology dependent. In fact, for the sites with 2018 average DV greater than 65 ppb, most of $\Delta O_3/\Delta NO_X$ can be an order of magnitude larger than $\Delta O_3/\Delta ROG$. Since the ozone improvement from NO_X reductions is greater than that for ROG reductions, the use of NO_X substitution will result in improved ozone air quality.

Table B-15. Summary of the ozone improvement from the 45% emissions reductions at the monitoring sites in the SFNA.

Sub-region	Site	2018 Average DV (ppb)	DV After 45% NO_X Reductions (ppb)	$\Delta O_3/\Delta NO_X$ (ppb/tpd)	DV After 45% ROG Reductions (ppb)	$\Delta O_3/\Delta ROG$ (ppb/tpd)
Eastern SFNA	Placerville-Gold	84.0	76.1	0.2675	83.2	0.0189
Eastern SFNA	Colfax-CityHall	83.7	76.4	0.2472	83.2	0.0118
Eastern SFNA	Cool-Hwy193	81.7	74.8	0.2336	81.0	0.0165
Eastern SFNA	Auburn-Atwood	87.3	80.0	0.2472	85.8	0.0354
Central SFNA	Folsom-Natoma	76.7	70.8	0.1998	75.3	0.0330
Central SFNA	Roseville-NSunrise	76.3	70.8	0.1862	75.2	0.0260
Central SFNA	N_Highlands-Blackfoot	74.7	71.1	0.1219	73.2	0.0354
Central SFNA	Sacramento-DelPas	72.0	68.6	0.1151	70.7	0.0307
Central SFNA	Sloughhouse	71.3	67.6	0.1253	70.0	0.0307
Central SFNA	Sacramento-TStreet	66.3	65.2	0.0372	65.2	0.0260
Western SFNA	Elk_Grove-Bruceville	67.7	66.4	0.0440	67.5	0.0047
Western SFNA	Woodland-Gibson	66.7	63.7	0.1016	65.9	0.0189
Western SFNA	Vacaville-Ulatis	64.0	63.4	0.0203	63.7	0.0071
Western SFNA	Davis-UCD	62.3	61.9	0.0135	61.4	0.0212

B.1.3.7 Unmonitored Area Analysis

The unmonitored area analysis is used to ensure that no regions outside of the existing monitoring network would exceed the NAAQS if a monitor was present (EPA, 2018). 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.

This analysis can be done using SMAT-CE (Software for the Modeled Attainment Test – Community Edition, https://www.epa.gov/scram/photochemical-modeling-tools).

However, this software is not open source and comes as a precompiled software package. To maintain transparency and flexibility in the analysis, in-house R codes developed at CARB, were utilized in this analysis.

The unmonitored area analysis was conducted using the 8-hr O_3 weighted DVs from all the available sites that fall within the 4 km inner modeling domain along with the reference year 2018 and future years 2032 4 km CMAQ model output. The steps in the unmonitored area analysis are described below:

Step 1: At each grid cell, the top 10 modeled maximum daily average 8-hour ozone mixing ratios from the reference year simulation were averaged, and a gradient in this top 10 day average between each grid cell and grid cells which contain a monitor was calculated.

Step 2: A single set of spatially interpolated 8-hour ozone DV fields was generated based on the observed 5-year weighted base year 8-hour ozone DVs from the available monitors. The interpolation is done using normalized inverse distance squared weightings from each monitor within the Voronoi regions that boarder that of the grid cell (calculated with the R tripack library), and adjusted based on the gradients between the grid cell and the corresponding monitor from Step 1.

Step 3: At each grid cell, the RRFs are calculated based on the reference- and future-year modeling following the same approach outlined in the Methodology section of this document, except that the +/- 20% limitation on the simulated and observed maximum daily average 8-hour ozone was not applied because observed data do not exist for grid cells in unmonitored areas.

Step 4: The future year gridded 8-hour ozone DVs were calculated by multiplying the gradient-adjusted interpolated 8-hour ozone DVs from Step 2 with the gridded RRFs from Step 3

Step 5: The future-year gridded 8-hour ozone DVs (from Step 4) were examined to determine if there are any peak values higher than those at the monitors, which could potentially cause violations of the applicable 8-hour ozone NAAQS.

Under the Voronoi diagram method, each monitoring site was assigned to a Voronoi region based on location and the distance to each grid cell (Sen 2016), and the interpolations were done between each grid cell and all the monitors in surrounding Voronoi regions. Voronoi diagram with inverse distance weighting method has been used in various 2-D data analysis areas, including air quality measurements interpolations (Atsuyuki, et al., 2009; Deligiorgi and Philippopoulos 2011).

Figure B-19 shows the spatial distribution of gridded DVs in 2032 for the SFNA based on the unmonitored area analysis (described above). The black star markers denote the monitoring sites, which had valid reference year 2018 DVs and were used in the analysis. Gridded DVs are below the 70 ppb standard in all areas within the nonattainment region, except at sparsely populated elevated locations over the Sierra Nevada Mountains.

Figure B-19. Spatial distribution of the future 2032 DVs based on the unmonitored area analysis in the SFNA.

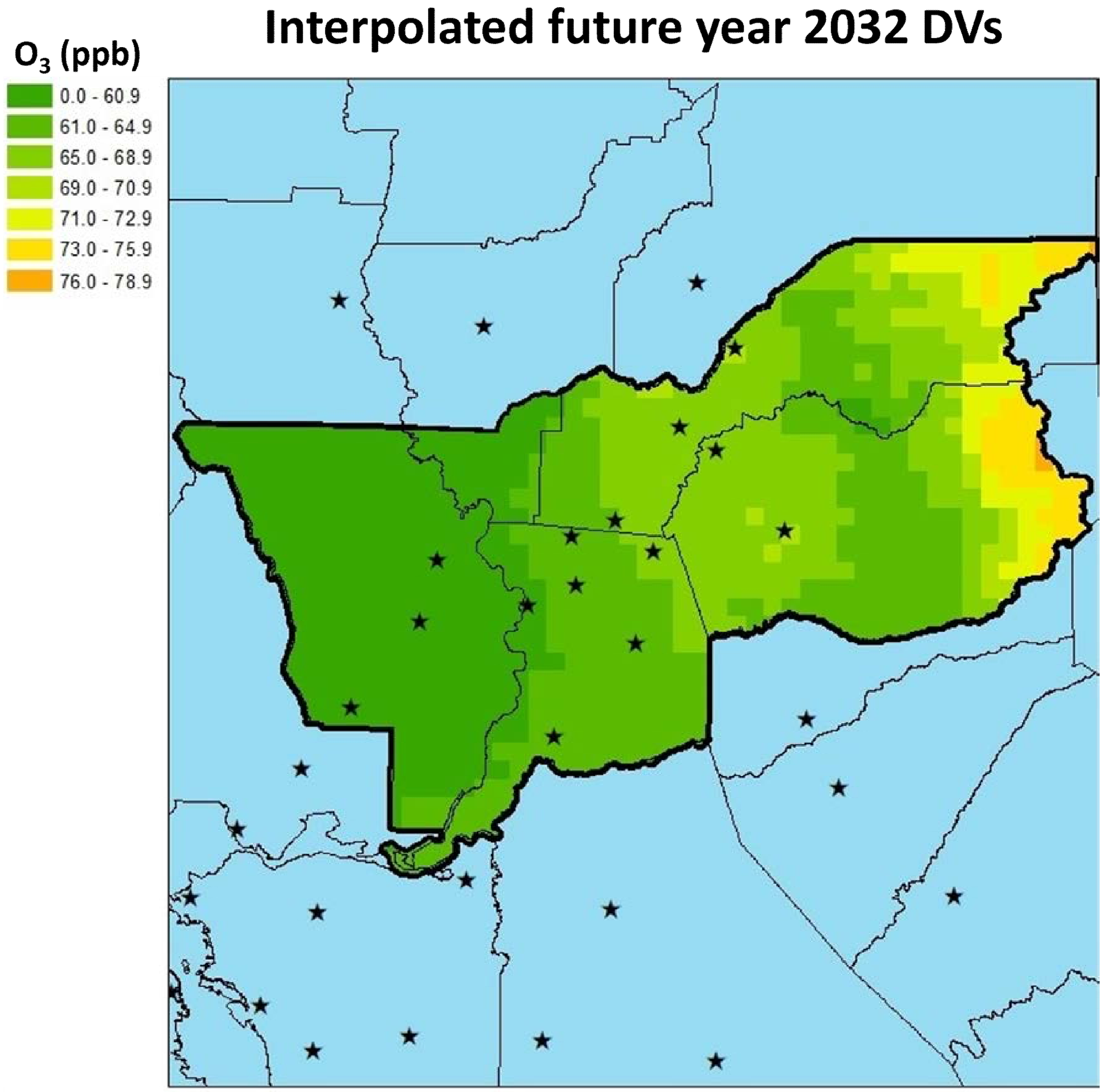
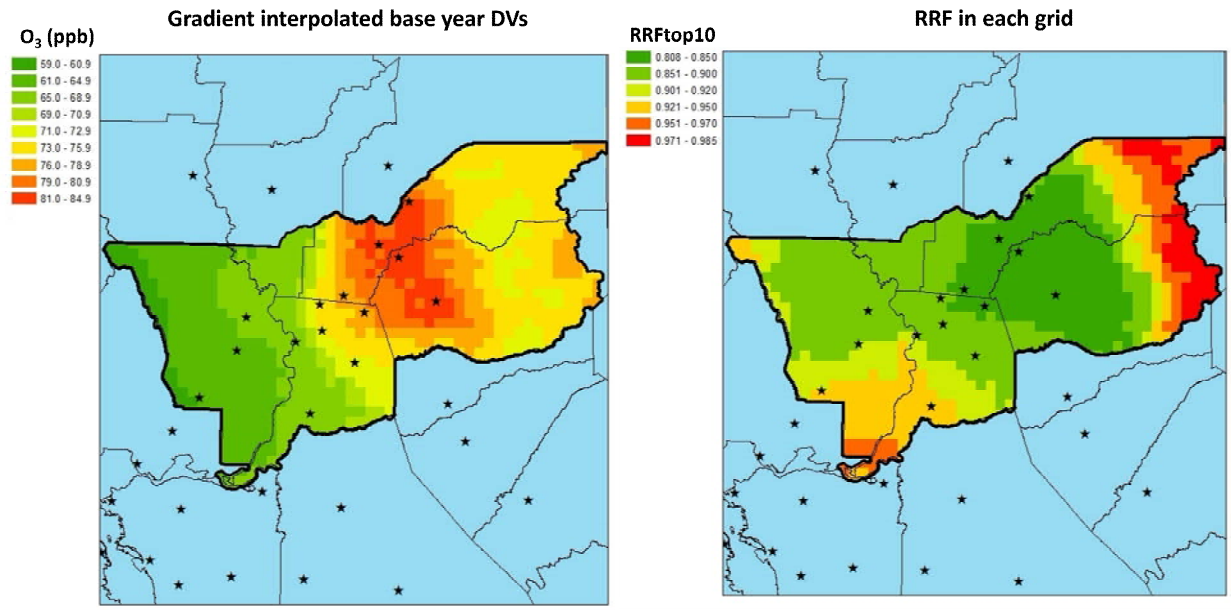


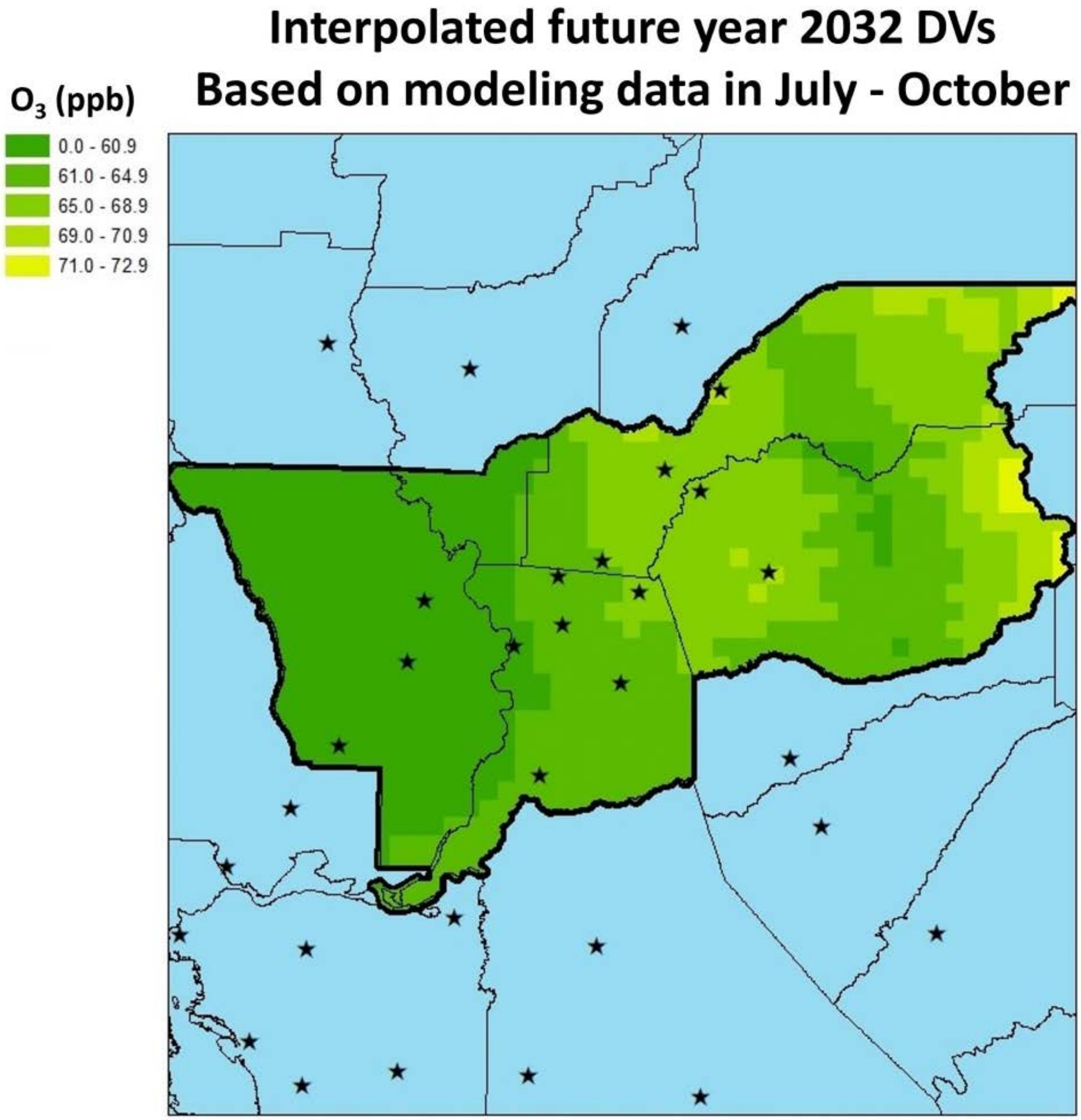
Figure B-20 shows the spatially interpolated base year DV from Step 2 above (left panel), and the RRF value at each model grid from Step 3 above (right panel). The RRF calculation is based on the top 10 days from the 2018 reference year model simulations for each grid cell. In 2018, the interpolated DVs exhibit high levels of ozone in the middle foothills region that is downwind of the Sacramento Metro region. In contrast, RRF values over the mountain regions are generally close to 1.0 while the RRF values in the foothills are mostly below 0.9, which indicates that the remote mountain regions in the east part are not responsive to the emission reductions within SFNA.

Figure B-20. Spatially interpolated 2018 base year DVs with gradient adjustment based on the unmonitored area analysis (left), and the RRF calculated for each grid (right).



Further analysis of the modeling results shows there is a disconnect between the timing of the ozone peaks in the foothills and over the elevated mountain regions. Within the mountain regions, high O_3 concentrations occur in the springtime from April to June, while the high O_3 concentrations in the foothills region occur during the peak summer ozone season from July to September. Figure S 61 shows an east-west cross sectional curtain plot of monthly average 8-hour O_3 in May 2018 and 2032 at row 127 of the model domain, which crosses through the Cool-Hwy193 monitor site. From the figure, it is clearly seen that O_3 concentrations over the top of the mountains are significantly impacted by transport from aloft, including the impact of stratospheric intrusion of O_3, which is strongest during the spring season. Figure S 62 shows a similar curtain plot, but for August, which clearly shows that even during the peak ozone summer season, ozone pollution in the foothills does not strongly affect ozone levels at elevations above 2500 m. When spring months are excluded from the unmonitored area analysis (only data from July to October is used), the interpolated O_3 DVs in the mountain regions for 2032 are reduced significantly and the unmonitored peaks disappear (Figure B-21), while the DVs within other regions only exhibit very minor changes.

Figure B-21. Spatial distribution of the future 2032 DVs based on the unmonitored area analysis in the SFNA using modeling data of July - October.



Our modeling based analysis shows that the high ozone levels within the Sierra Nevada Mountains predicted by the unmonitored area analysis are likely due to the impacts from higher ozone aloft and stratospheric influences in springtime, and are not influenced by pollution emitted and formed within the region during the peak ozone season summer months. This means that reducing anthropogenic emissions in the SFNA would not likely affect ozone levels within elevated regions of the Sierra Nevada Mountains. These unmonitored peaks are consistent with our understanding of the physical processes in the atmosphere and the role of stratospheric ozone influences in the spring (e.g., Jeanne et al., 2013, Lin et al., 2012, Ricardo et al., 2010).

The Echo Summit monitor, situated in the eastern part of SFNA with an elevation of 2250m, is considered a seasonal site, and does not meet the regulatory requirements set by the EPA and, as a result, was not included in the aforementioned analysis. To gain a better understanding of O_3 levels in the unmonitored area, additional analysis was conducted on the O_3 trend at the non-regulatory Echo Summit monitor using the available data from the site. Figure S 63 illustrates the time series of MDA8 O_3 levels at Echo Summit from April to October between 2016 and 2020. It is evident that the majority of MDA8 O_3 values at Echo Summit fall below or near 70 ppb. There were a few instances of higher MDA8 O_3 levels observed in 2018 and 2020, which can be attributed to the impact of wildfires. By utilizing the available data and following the methodology outlined in Section B.1.2, a base year O_3 DV of 67.7 ppb was derived for Echo Summit. This value is notably lower than the interpolated DV of 75.6 ppb shown in Figure B-20 from the unmonitored area analysis. These findings suggest that the peak in the unmonitored eastern region of SFNA is likely an artifact of the methodology used in the analysis of unmonitored areas. This discrepancy can be attributed to the sparse monitoring network and complex topography characteristics of the region. Taking into account the available data from the Echo Summit monitor, it is reasonable to conclude that this particular area is likely already in attainment of the 70 ppb O_3 standard.

B.1.4 References

AMSS. 2020. *Spatial Surrogate Methodology Document SNP2020-10-01.* Sacramento: INTERNAL DRAFT CARB.

AMSS. 2021. *Spatial Surrogate Methodology Document SNP2021-10-01.* Sacramento: INTERNAL DRAFT CARB.

Angevine, W. M., L. Eddington, K. Durkee, C. Fairall, L. Bianco, and J. Brioude. 2012. "Meteorological model evaluation for CalNex 2010." *Monthly Weather Review* (140): 3885-3906.

Atsuyuki, O., B. Boots, K. Sugihara, and S. N. Chiu. 2009. *Spatial tessellations: concepts and applications of Voronoi diagrams.* Second. John Wiley & Sons.

Baker, K. R., C. Misenis, M. D. Obland, R. A. Ferrare, A. J. Scarino, and J. T. Kelly. 2013. "Evaluation of surface and upper air fine scale WRF meteorological modeling of the May and June 2010 CalNex period in California." *Atmospheric Environment* (80): 299-309.

Bao, J.W., S.A. Michelson, P.O.G. Persson, I.V. Djalalova, and J.M. Wilczak. 2008. "Observed and WRF-simulated low-level winds in a high-ozone episode during the Central California ozone study." *Journal of Applied Meteorology and Climatology* 47: 2372-2394.

Beaver, S., and A. Palazoglu. 2009. "Influence of synoptic and mesoscale meteorology on ozone pollution potential for San Joaquin Valley of California." *Atmospheric Environment* 43 (10).

Blanchard, C.L., S. Tanenbaum, E.M. Fujita, D. Campbell, and J. Wilkinson. 2008. *Understanding Relationships between Changes in Ambient Ozone and Precursor Concentrations and Changes in VOC and NOx Emissions from 1990 to 2004 in Central California.* Report prepared for the California Air Resources Board, Envair, DRI and Alpine Geophysics.

Buchholz, R. R., L. K. Emmons, S. Tilmes, and & The CESM2 Development Team. 2019. "CESM2.1/CAM-chem Instantaneous Output for Boundary Conditions." UCAR/NCAR - Atmospheric Chemistry Observations and Modeling Laboratory. https://doi.org/10.5065/NMP7-EP60.

Cai, C., J. C. Avise, A. Kaduwela, J. DaMassa, C. Warneke, J. B. Gilman, W. Kuster, et al. 2019. "Simulating the Weekly Cycle of NOx-VOC-HOx-O3Photochemical System in the South Coast ofCalifornia During CalNex-2010 Campaign." *Journal of Geophysical Research: Atmospheres* 3532–3555.

Cai, C., S. Kulkarni, Z. Zhao, A. Kaduwela, J. C. Avise, and J. A. DaMassa. 2016. "Simulating Reactive Nitrogen, Carbon Monoxide, and Ozone in California During ARCTAS-CARB 2008 with High Wildfire Activity." *Atmospheric Environment* 28-44.

Caltrans. 2020. *Statewide Modeling.* https://dot.ca.gov/programs/transportation-planning/multi-modal-system-planning/statewide-modeling.

CARB. 1990. *Assessment and Mitigation of the Impacts of Transported Pollutants on Ozone Concentrations within California, Staff Report prepared by the Technical Support Division and the Office of Air Quality Planning and Liaison of the California Air Resources Board.* available at https://www.arb.ca.gov/aqd/transport/assessments/1990.pdf.

CARB. 2020. *2017 Baseline Inventory and Vehicle Miles Traveled Offset Demonstration for the 2015 70 ppb 8-hour Ozone Standard available at https://ww2.arb.ca.gov/resources/documents/2017-baseline-inventory-and-vehicle-miles-traveled-offset-demonstration-2015-70.* Accessed Jan 2022.

CARB. 2018. "2018 Western Nevada County Planning Area Ozone Attainment Plan available at https://ww3.arb.ca.gov/planning/sip/planarea/wnc/carb_staff_report.pdf." Staff Report. Accessed Jan 2022.

—. 2020. *Advanced Clean Trucks.* 02 07. https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks.

—. 2021. *Heavy-Duty Inspection and Maintenance Regulation.* https://ww2.arb.ca.gov/rulemaking/2021/hdim2021.

—. 2020. "Heavy-Duty Low NOx." February 07. https://ww2.arb.ca.gov/our-work/programs/heavy-duty-low-nox.

CARB. 2021. *Report on Updates to the California Integrated Transportation Network (ITN).* INTERNAL DRAFT.

Carter, W.P.L. 2010b. "Development of a condensed SAPRC-07 chemical mechanism." *Atmospheric Environment* 5336-5345.

Carter, W.P.L. 2010a. "Development of the SAPRC-07 chemical mechanism." *Atmospheric Environment* 5324-5335.

Chen, J., D. Yin, Z. Zhao, A. P. Kaduwela, J. C. Avise, J. A. DaMassa, A. Beyersdorf, and S. Burton et al. 2020. "Modeling air quality in the San Joaquin Valley of California during the 2013 DISCOVER-AQ field campaign." *Atmospheric Environment* (5): 100067.

Clinton, N., P. Gong, and K. Scott. 2006. "Quantification of pollutants emitted from very large wildland fires in Southern California." *Atmospheric Environment* Volume 40, pp. 3686-3695.

Deligiorgi, D., and K. Philippopoulos. 2011. "Spatial Interpolation Methodologies in Urban Air Pollution Modeling: Application for the Greater Area of Metropolitan Athens, Greece." In *Advanced Air Pollution*. doi:10.5772/17734.

EasternKern. 2017. "2017 Ozone Attainment Plan, available at: http://www.kernair.org/Documents/Announcements/Attainment/2017%20Ozone%20Plan_EKAPCD_Adopted_7-27-17.pdf."

EKAPCD. 2003. "East Kern County Ozone Attainment Demonstration, Maintenance Plan, and Redesignation Request." available at https://www.arb.ca.gov/planning/sip/planarea/easternkern/2003kernplan.pdf.

Emery, C., Z. Liu, A. M. Russell, T. Odman, G. Yarwood, and N. Kumar. 2017. "Recommendations on statistics and benchmarks to assess photochemical model performance." *Journal of the Air & Waste Management Association* 582-598.

Emmons, L. K., R. H. Schwantes, J. J. Orlando, G. Tyndall, D. Kinnison, and J.-F. Lamarque et al. 2020. "The Chemistry Mechanism in the Community Earth System Model version 2 (CESM2)." *Journal of Advances in Modeling Earth Systems.* https://doi.org/10.1029/2019MS001882.

EPA. 2014. *Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and RegionalHaze.* Modeling guidance, Research Triangle Park, United States Environmental Protection Agency, North Carollina: U.S. EPA. Accessed July 10, 2015. http://www.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf.

—. 2016. *https://www3.epa.gov/ttn/emc/cem.html.* Accessed August 16, 2016. https://www3.epa.gov/ttn/emc/cem.html.

—. 2018. *Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze.* 11 29. https://www.epa.gov/scram/sip-modeling-guidance-documents.

EPA. 1993. "NOx Substitution Guidance, available at https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19931201_oaqps_nox_substitution_guidance.pdf."

EPA. 2008. "Technical Support Document for 2008 Ozone NAAQS Designation." https://19january2017snapshot.epa.gov/www3/region9/air/ozone/pdf/R9_CA_NevadaCounty_FINAL.pdf.

EPA, U.S. 2017. "Ozone Designations - 2015 Standards accessible at https://www.epa.gov/sites/default/files/2018-05/documents/ca_tsd_combined_final_0.pdf." Accessed Jan 2022. https://www.epa.gov/sites/default/files/2018-05/documents/ca_tsd_combined_final_0.pdf.

ERG. 2019. "2014 Northern Baja California Emissions Inventory Project."

Fast, J. D., W. I. Gustafson Jr, L. K. Berg, W. J. Shaw, M. Pekour, and M. Shrivastava et al. 2012. "Transport and mixing patterns over Central California during the carbonaceous aerosol and radiative effects study (CARES)." *Atmospheric Chemistry and Physics* (12): 1759-1783.

Fosberg, M.A., and M.J. Schroeder. 1966. "Marine air penetration in Central California." *Journal of Applied Meteorology* (5): 573-589.

Fujita, E. M., R. E. Keislar, D. L. Freeman, J. Watson, A. J. Ranzieri, S. Tanrikulu, and K. Magliano. 1999. *Field study plan for the Central California Ozone Study.*

Gkatzelis, G, M. Coggon, M McDonald, J Peischl, K Aikin, J Gilman, M Trainer, and C Warneke. 2021. "Identifying Volatile Chemical Product Tracer Compounds in U.S. Cities." *Environmental Science & Technology* 55 (1): 188-199.

Gong, P., N. Clinton, and R. T. Y. a. S. J. Pu. 2003. *Extension and input refinement to the ARB wildland fire emissions estimation model Final report, contract number 00-729.* Sacramento, CA: Air Resources Board.

He, H., X-Z. Liang, and D. J. Wuebbles. 2018. "Effects of emissions change, climate change and long-range transport on regional modeling of future U.S. particulate matter pollution and speciation." *Atmospheric Environment*, 166-176. doi:https://doi.org/10.1016/j.atmosenv.2018.02.020.

Heuss, J. M., D. F. Kahlbaum, and G. T. Wolff. 2003. "Weekday/Weekend Ozone Differences: What Can We Learn from Them?" *Journal of the Air & Waste Management Association* 53 (7): 772-788.

Hu, J., C. J. Howard, F. Mitloehner, P. G. Green, and M. J. Kleeman. 2012. "Mobile Source and Livestock Feed Contributions to Regional Ozone Formation in Central California." *Environmental Science and Technology* (46): 2781-2789.

Imperial. 2017. " Imperial County 2017 State Implementation Plan for the 2008 8-Hour Ozone Standard, available at: https://ww3.arb.ca.gov/planning/sip/planarea/imperial/2017o3sip_final.pdf ."

Imperial. 2018. " Imperial County 2018 Annual Particulate Matter Less than 2.5 Microns in Diameter State Implementation Plan, available at: https://ww3.arb.ca.gov/planning/sip/planarea/imperial/final_2018_ic_pm25_sip.pdf ."

Jeanne, P., Saah, D., Esperanza, A., Bytnerowicz, A., Fraczek, W., and Cisneros, R. 2013. "Ozone Distribution in Remote Ecologically Vulnerable Terrain of the Southern Sierra Nevada, Ca." *Environmental Pollution* 182: 343-56.

Jin, L., N. J. Brown, R. A. Harley, J-W. Bao, S. A. Michelson, and J. M. Wilczak. 2010. "Seasonal versus episodic performance evaluation for an Eulerian photochemical air quality model." *Journal of Geophysical Research: Atmospheres* 115, D09302.

Jin, L., S. Tonse, D. S. Cohan, X Mao, R. A. Harley, and N. J. Brown. 2008. "Sensitivity analysis of ozone formation and transport for a central California air pollution episode." *Environmental Science and Technology* 3683-3689.

Kelly, J. T., K. R. Baker, J. B. Nowak, J. G. Murphy, Z. M. Milos, T. C. VandenBoer, R. A. Ellis, et al. 2014. "Fine-scale simulation of ammonium and nitrate over the South Coast Air Basin and San Joaquin Valley of California during CalNex-2010." *Journal of Geophysical Research* (119): 3600-3614. doi:doi:10.1002/2013JD021290.

Kelly, J.T., J. Avise, C. Cai, and A. Kaduwela. 2010. "Simulating particle size distributions over California and impact on lung deposition fraction." *Aerosol Science and Technology* 148-162.

Kelly, J.T., K.R Baker, J.B. Nowak, and J.G Murphy et al. 2014. "Fine-scale simulation of ammonium and nitrate over the South Coast Air Basin and San Joaquin Valley of California during CalNex-2010." *Journal of Geophysical Research: Atmosphere* 3600–3614.

Kulkarni, S., A. P. Kaduwela, J. C. Avise, J. A. DaMassa, and D. Chau. 2014. "An extended approach to calculate the ozone relative response factors used in the attainment demonstration for the National Ambient Air Quality Standards." *Journal of the Air and Waste Management Association* 1204-1213.

Kwok, Roger. 2016. *Meteorology-adjusted Temporal Profiles for Agricultural and Residential Wood Combustion Sectors Using Smoke Gentpro Utility Program.* Sacramento: INTERNAL DRAFT CARB.

Kwok, Roger. 2015. *Modeling Plume Rise of Ocean-going Vessel Emissions.* Sacramento: INTERNAL DRAFT CARB.

LaFranchi, B. W., A. H. Goldstein, and R. C and Cohen. 2011. "Observations of the temperature dependent response of ozone to NOx reductions in the Sacramento, CA urban plume." *Atmospheric Chemistry and Physics* 6945-6960.

Lamarque, J.-F., L. K. Emmons, P. G. Hess, D. E. Kinnison, S. Tilmes, F. Vitt, C. L. Heald, et al. 2012. "CAM-chem: description and evaluation of interactive atmospheric chemistry in the Community Earth System Model." *Geoscientific Model Development* 369-411.

Lehrman, D. 2001. *Characterization of the 2000 Measurement Period.* Interim Report prepared for California Air Resources Board, Technical and Business Systems, Inc.,.

Lehrman, D., D. Bush, B. Knuth, D. Fairley, and C. Blanchard. 2004. *Characterization of the CCOS 2000 measurement period.* Final Report prepared for California Air Resources Board, Technical and Business Systems, Inc.

Lin, M., A. M. Fiore, O. R. Cooper, L. W. Horowitz, A. O. Langford, H. Levy II, B. J. Johnson, V. Naik, and S. J. Oltmans. 2012. "Springtime high surface ozone events over the western United States: Quantifying the role of stratospheric." *Journal of Geophysical Research* D00V22, doi:10.1029/2012JD018151.

Livingstone, P.L., K. Magliano, K. Gurer, P.D. Allen, K.M. Zhang, Q. Ying, and , B.S. Jackson et al. 2009. "Simulating PM concentration during a winter episode in a subtropical valley: Sensitivity simulations and evaluation methods." *Atmospheric Environment* 5971-5977.

Mills, S., S. Weiss, and C. Liang. 2013. "VIIRS day/night band (DNB) stray light characterization and correction." *SPIE Proceedings* Vol. 8866.

Pun, B. K., J. F. Loius, and C. Seigneur. 2008. *A conceptual model of ozone formation in the San Joaquin Valley.* CP049-1-98, Atmospheric and Environmental Research Inc., San Ramon, CA.

Pun, B.K., R.T.F. Balmori, and C. Seigneur. 2009. "Modeling wintertime particulate matter formation in central California." *Atmospheric Environment* 402-409.

Pusede, S. E., and R. C. Cohen. 2012. "On the observed response of ozone to NOx and VOC reactivity reductions in San Joaquin Valley California 1995–present." *Atmospheric Chemistry and Physics* 8323-8339.

Pusede, S. E., D. R. Gentner, P. J. Wooldridge, E. C. Browne, A. W. Rollins, K. E. Min, A. R. Russell, et al. 2014. "On the temperature dependence of organic reactivity, nitrogen oxides, ozone production, and the impact of emission controls in San Joaquin Valley, California." *Atmospheric Chemistry and Physics* 3373-3395.

Ricardo, C., A. Bytnerowicz, D. Schweizer, S. Zhong, S. Traina, and D.H. and Bennett. 2010. "Ozone, Nitric Acid, and Ammonia Air Pollution Is Unhealthy for People and Ecosystems in Southern Sierra Nevada, California." *Environmental Pollution* 158 (10): 3261-71.

Sacramento. 2017. "Sacramento Regional 2008 NAAQS 8-Hour Ozone Attainment And Reasonable Further Progress Plan, available at http://www.airquality.org/ProgramCoordination/Documents/Sac%20Regional%20 2008%20NAAQS%20Attainment%20and%20RFP%20Plan.pdf."

Seinfeld, J. H., and S. N. Pandis. 1998. *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change.* Edited by 1. New York: J. Wiley.

Sen, Zekai. 2016. "2.8.1 Delaney, Varoni, and Thiessen Polygons." In *Spatial Modeling Principles in Earth Sciences*, 57. Springer.

Shahrokhishahraki, N., P. J. Rayner, J. D. Silver, S. Thomas, and R. Schofield. 2022. "High-resolution modeling of gaseous air pollutants over Tehran and validation with surface and satellite data." *Atmospheric Environment.* doi:https://doi.org/10.1016/j.atmosenv.2021.118881.

Shearer, S.M, R.A. Harley, L. Jin, and N.J. Brown. 2012. "Comparison of SAPRC99 and SAPRC07 mechanisms in photochemical modeling for central California." *Atmospheric Environment* 205-216.

Sillman, S. 1999. "The relation between ozone, NOx and hydrocarbons in urban and polluted rural environments." *Atmospheric Environment* 33 (12): 1821-1845.

Simon, H., K. R. Baker, and S. Phillips. 2012. "Compilation and interpretation of photochemical model performance statistics published between 2006 and 2012." *Atmospheric Environment* (61): 124-139.

SJV. 2018. " 2018 PM2.5 Plan for the San Joaquin Valley, available at: http://valleyair.org/pmplans/ ."

SJV. 2008. "2008 PM2.5 Plan, available at: http://www.valleyair.org/Air_Quality_Plans/AQ_Proposed_PM25_2008.htm."

SJV. 2012. "2012 PM2.5 Plan, available at: http://www.valleyair.org/Air_Quality_Plans/PM25Plans2012.htm ."

SJV. 2013. "2013 Plan for the Revoked 1-Hour Ozone Standard, available at: http://valleyair.org/Air_Quality_Plans/Ozone-OneHourPlan-2013.htm ."

SJV. 2016a. "2016 Moderate Area Plan for the 2012 PM2.5 Standard, available at: http://www.valleyair.org/Air_Quality_Plans/docs/PM25-2016/2016-Plan.pdf ."

SJV. 2016b. "2016 Plan for the 2008 8-Hour Ozone Standard, available at: http://valleyair.org/Air_Quality_Plans/Ozone-Plan-2016.htm ."

Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, D. M. Barker, M. G. Duda, X.-Y. Huang, W. Wang, and J. G. Powers. 2008. "Description ofthe Advanced Research WRF version 4,Rep. NCAR/TN-475++STR,Natl. Cent. for Atmos. Res." Boulder, Colo.

SouthCoast. 2012. "Final 2012 Air Quality Management Plan, available at: http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/final-2012-air-quality-management-plan ."

SouthCoast. 2016. "Final 2016 Air Quality Management Plan, available at: http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/cover-and-opening.pdf?sfvrsn=6."

Stein, A.F., R.R Draxler, G.D. Rolph, B.J.B. Stunder, M.D. Cohen, and F. Ngan. 2015 . " NOAA's HYSPLIT atmospheric transport and dispersion modeling system." *Bulletin of the American Meteorological Society* 2059-2077.

Tonse, S. R., N. J. Brown, R. A. Harley, and L. Jin. 2008. "A process-analysis based study of the ozone weekend effect." *Atmospheric Environment* 7728-7736.

UNC Chapel Hill - The Institute for the Environment. 2016. "SMOKE v4.0 User's Manual." September 30. Accessed 02 07, 2020. https://www.cmascenter.org/smoke/documentation/4.0/manual_smokev40.pdf.

Van Ooy, D.J., and J.J. Carroll. 1995. "The spatial variation of ozone climatology on the western slope of the Sierra Nevada." *Atmospheric Environment* 1319-1330.

Ventura. 2016. "Final 2016 Ventura County Air Quality Management Plan, available at: http://www.vcapcd.org/pubs/Planning/AQMP/2016/Final/Final-2016-Ventura-County-AQMP.pdf ."

Vijayaraghavan, K., P. Karamchadania, and C. Seigneur. 2006. "Plume-in-grid modeling of summer air pollution in Central California." *Atmospheric Environment* 5097-5109.

Wang, P., P. Wang, K. Chen, J. Du, and H Zhang. 2022. "Ground-level ozone simulation using ensemble WRF/Chem predictions over the Southeast United States." *Chemosphere.* doi:https://doi.org/10.1016/j.chemosphere.2021.132428.

WesternMojave. 2016. "2016 8-Hour Ozone SIP: Western Mojave Desert Nonattainment Area, available at: https://ww3.arb.ca.gov/planning/sip/planarea/mojavesedsip.htm#2016."

WesternNevada. 2018. "Western Nevada County 8-hour Ozone Attainment Plan, available at: https://ww3.arb.ca.gov/planning/sip/planarea/wncsip.htm."

Wu, Shenglun, Hyung Joo Lee, Andrea Anderson, Shang Liu, Toshihiro Kuwayama, Joh H Seinfeld, and Michael J Kleeman. 2022. "Direct measurements of ozone response to emissions perturbations in California." *Atompheric Chemistry and Phtsics* (Copernicus Publications on behalf of the European Geosciences Union) 4929-4949. doi:10.5194.

Yan, F., Y. Gao, M. Ma, C. Liu, X. Ji, F. Zhao, X. Yao, and H. Gao. 2021. "Revealing the modulation of boundary conditions and governing processes on ozone formation over northern China in June 2017." *Environmental Pollution* 272. doi:https://doi.org/10.1016/j.envpol.2020.115999.

Yienger, J. J., and H. Levy II. 1995. "Empirical model of global soil-biogenic NO_χ emissions." *Journal of Geophysical Research: Atmospheres* 11447-11464.

Zhang, Y., P. Liu, X. Liu, B. Pun, C. Seigneur, M.Z. Jacobson, and W. Wang. 2010. "Fine scale modeling of wintertime aerosol mass, number, and size distributions in

Central California." *Journal of Geophysical Research* D15207, doi:10.1029/2009JD012950.

Zhu, S., Horne, J. R., Kinnon, M. M., Samuelsen, G. S., Dabdub, D. 2019. "Comprehensively assessing the drivers of future air quality in California." *Environment International* 386-398.

B.1.5 Supplemental Materials

Supplemental Materials List of Figures

Figure S 1. Time series of average temperature, relative humidity, wind speed, and direction of all valley sites in April 2018.

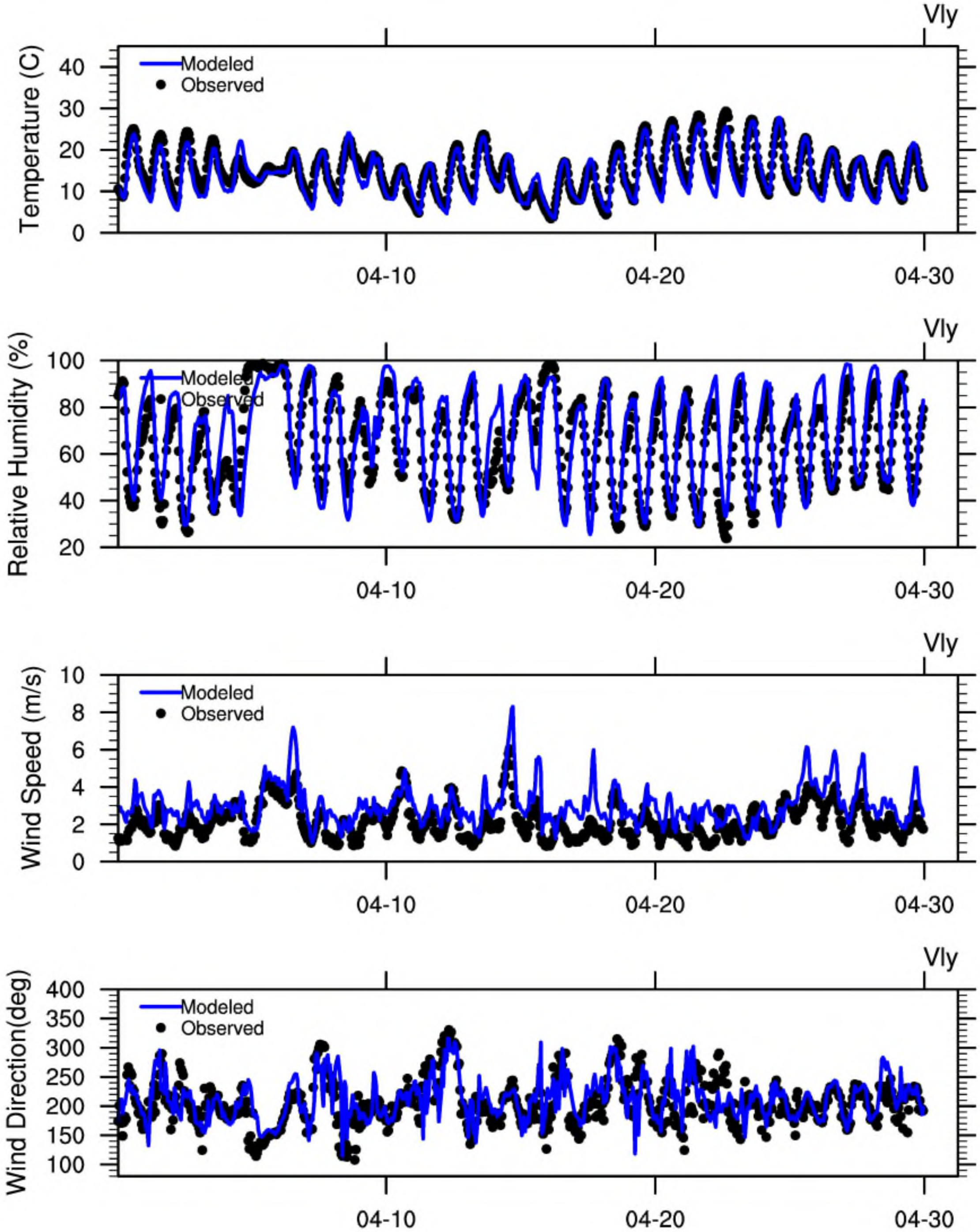


Figure S 2. Time series of average temperature, relative humidity, wind speed, and direction of all mountain sites in April 2018.

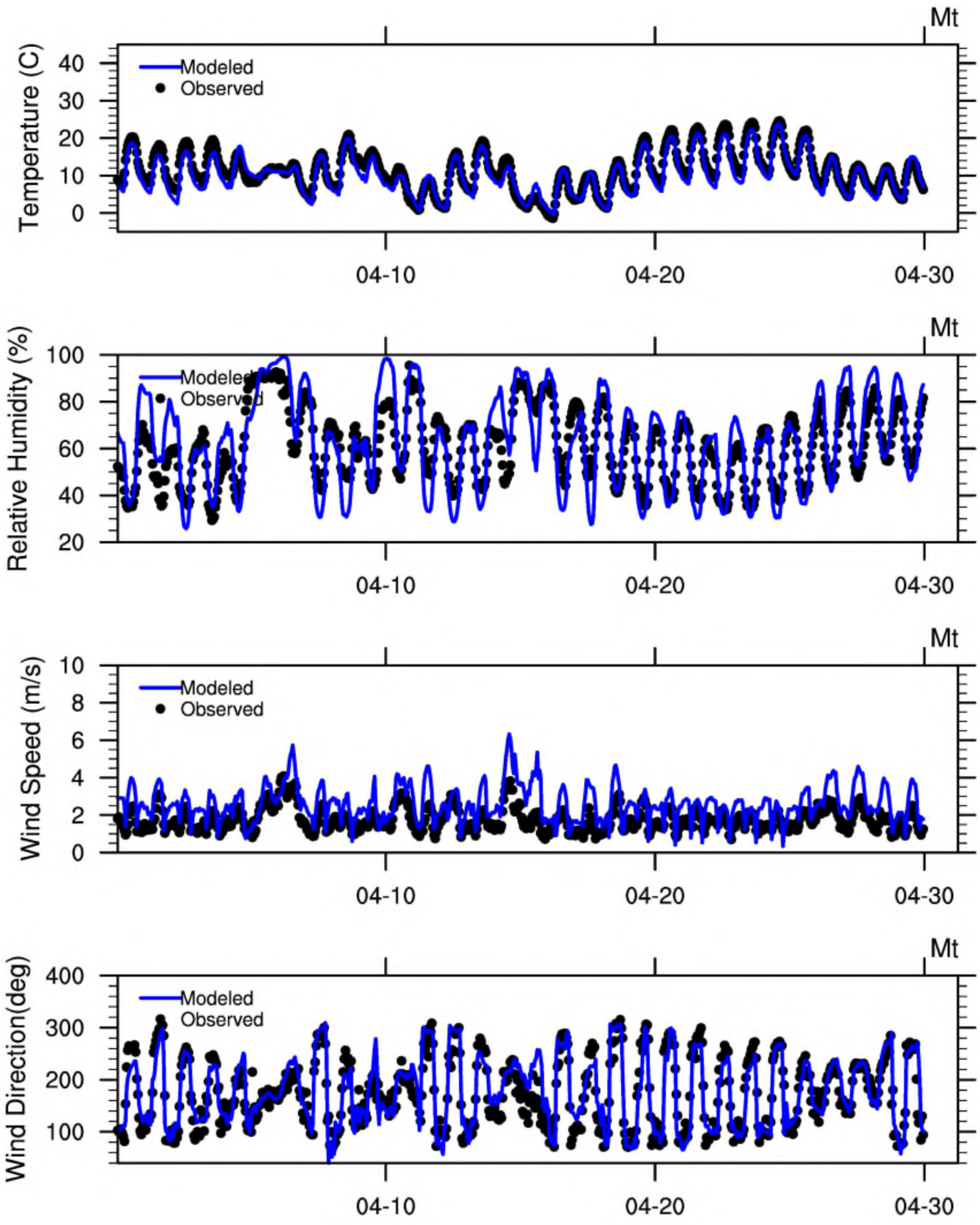


Figure S 3. Time series of average temperature, relative humidity, wind speed, and direction of all valley sites in May 2018.

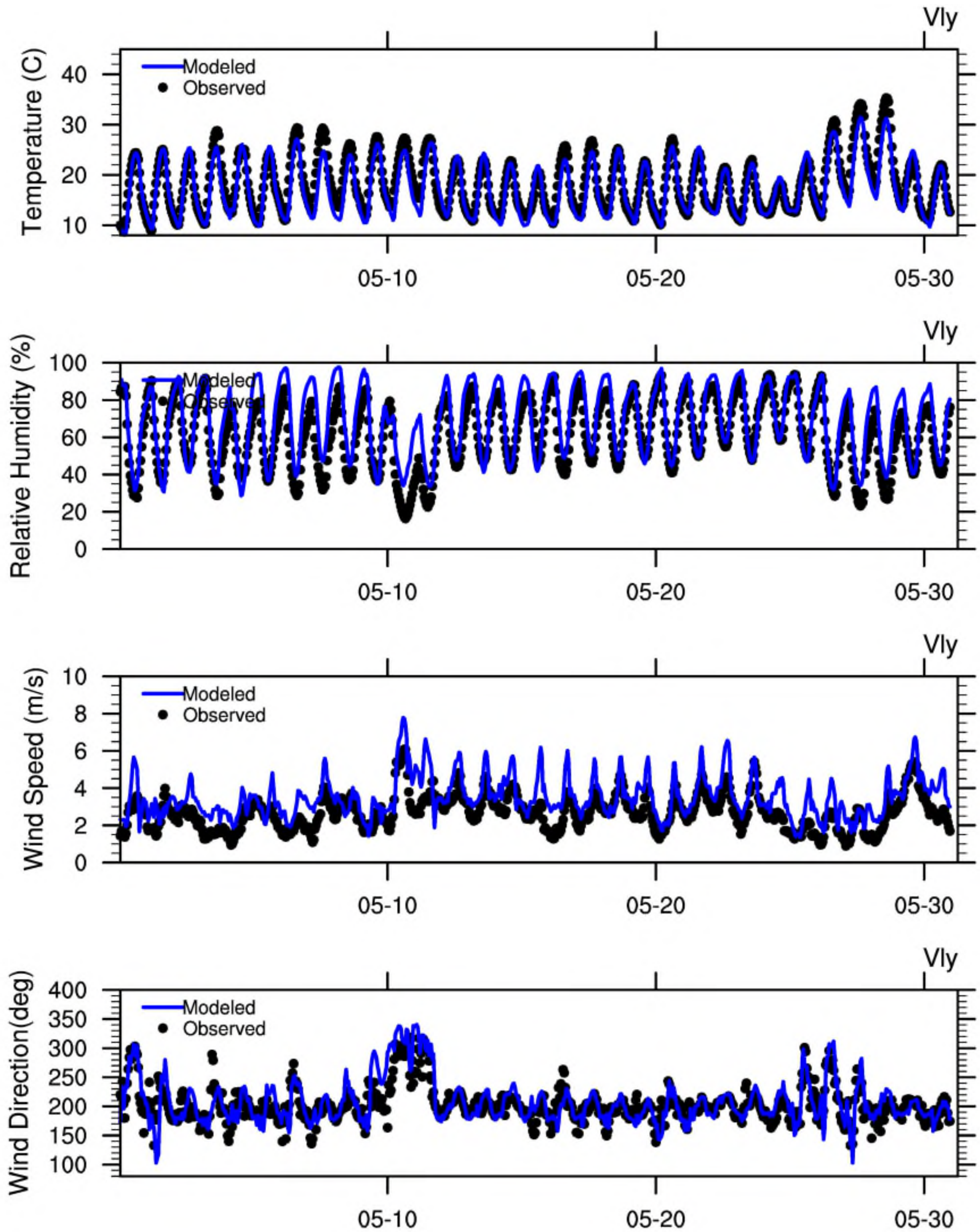


Figure S 4. Time series of average temperature, relative humidity, wind speed, and direction of all mountain sites in May 2018.

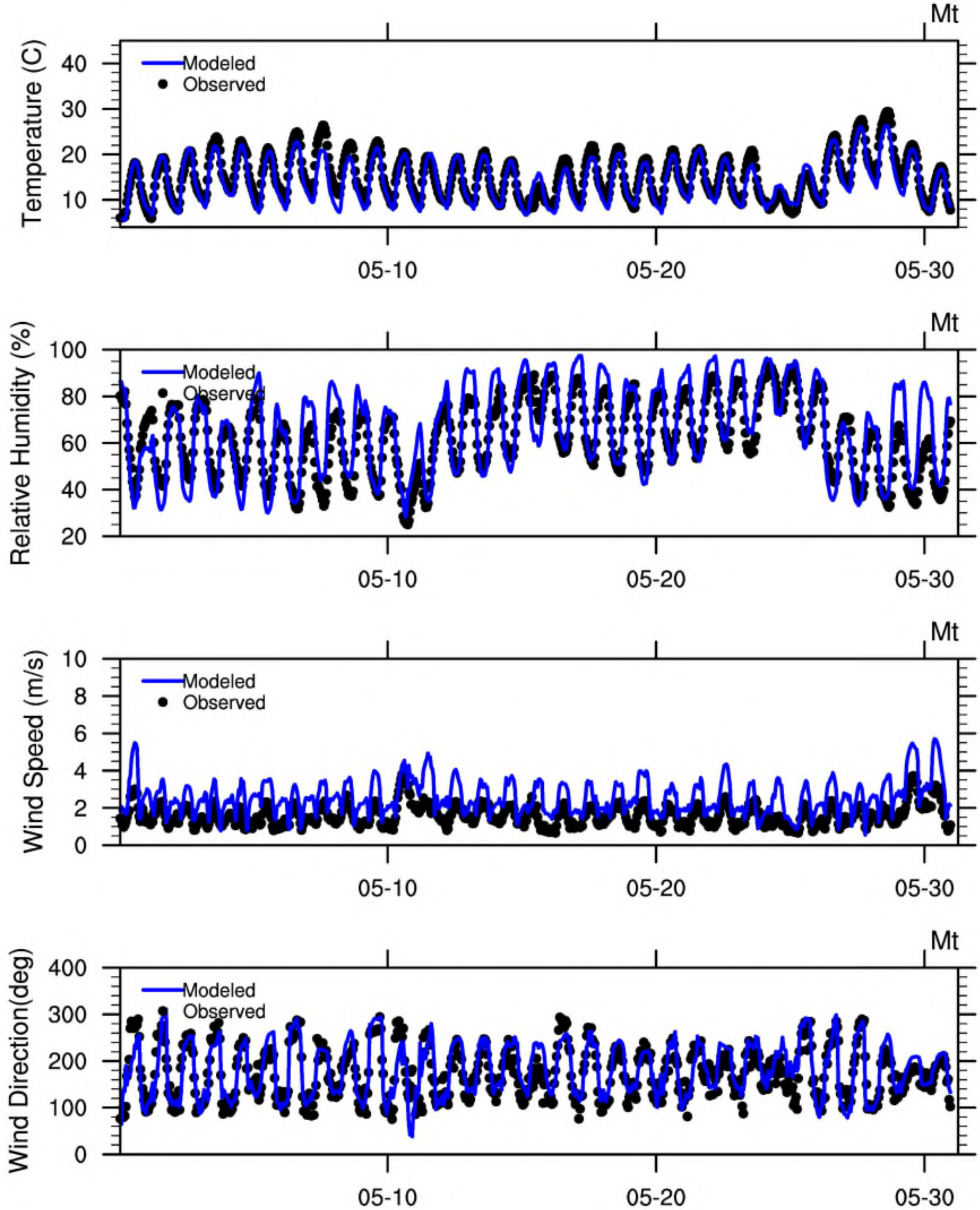


Figure S 5. Time series of average temperature, relative humidity, wind speed, and direction of all valley sites in June 2018.

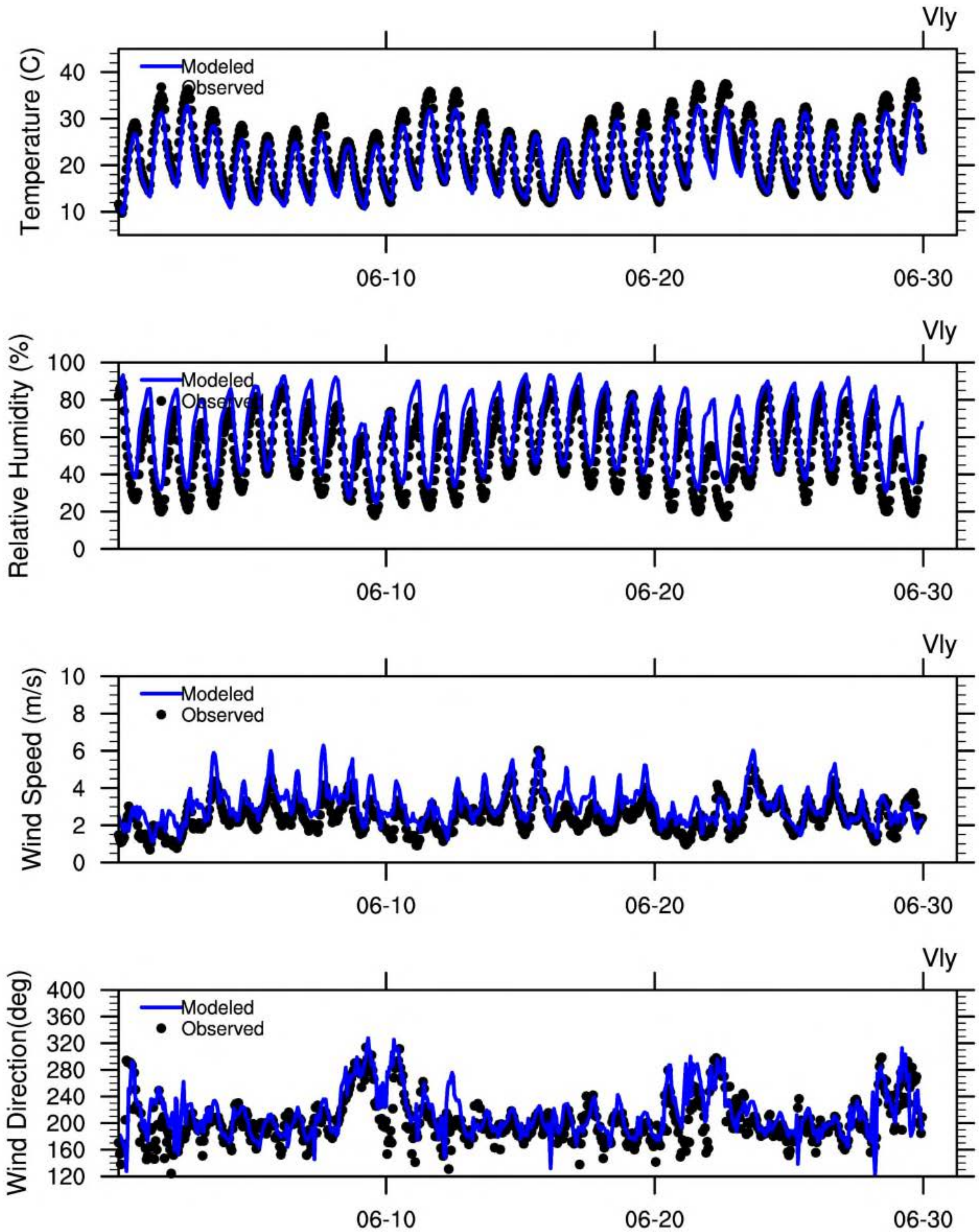
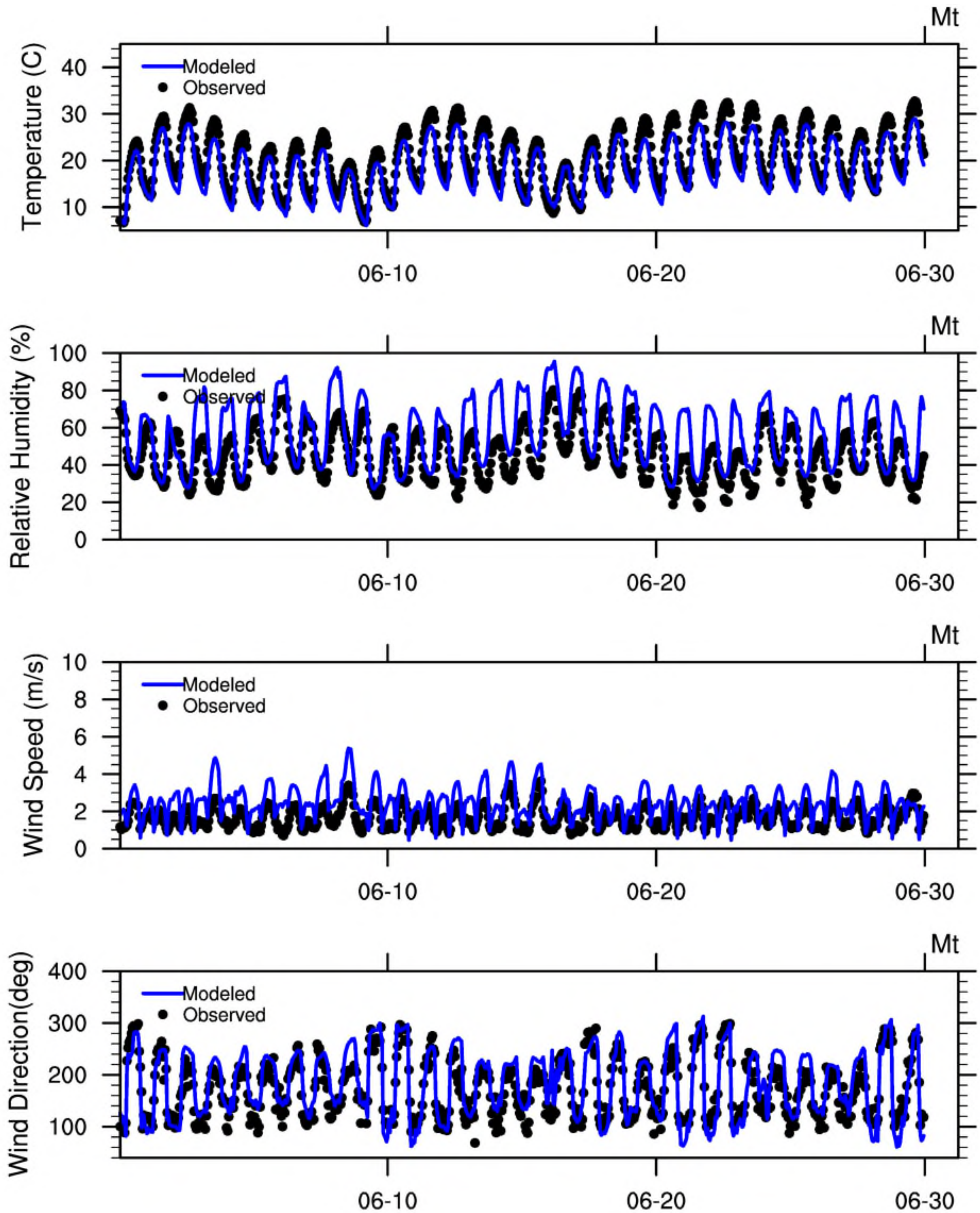


Figure S 6. Time series of average temperature, relative humidity, wind speed, and direction of all mountain sites in June 2018.



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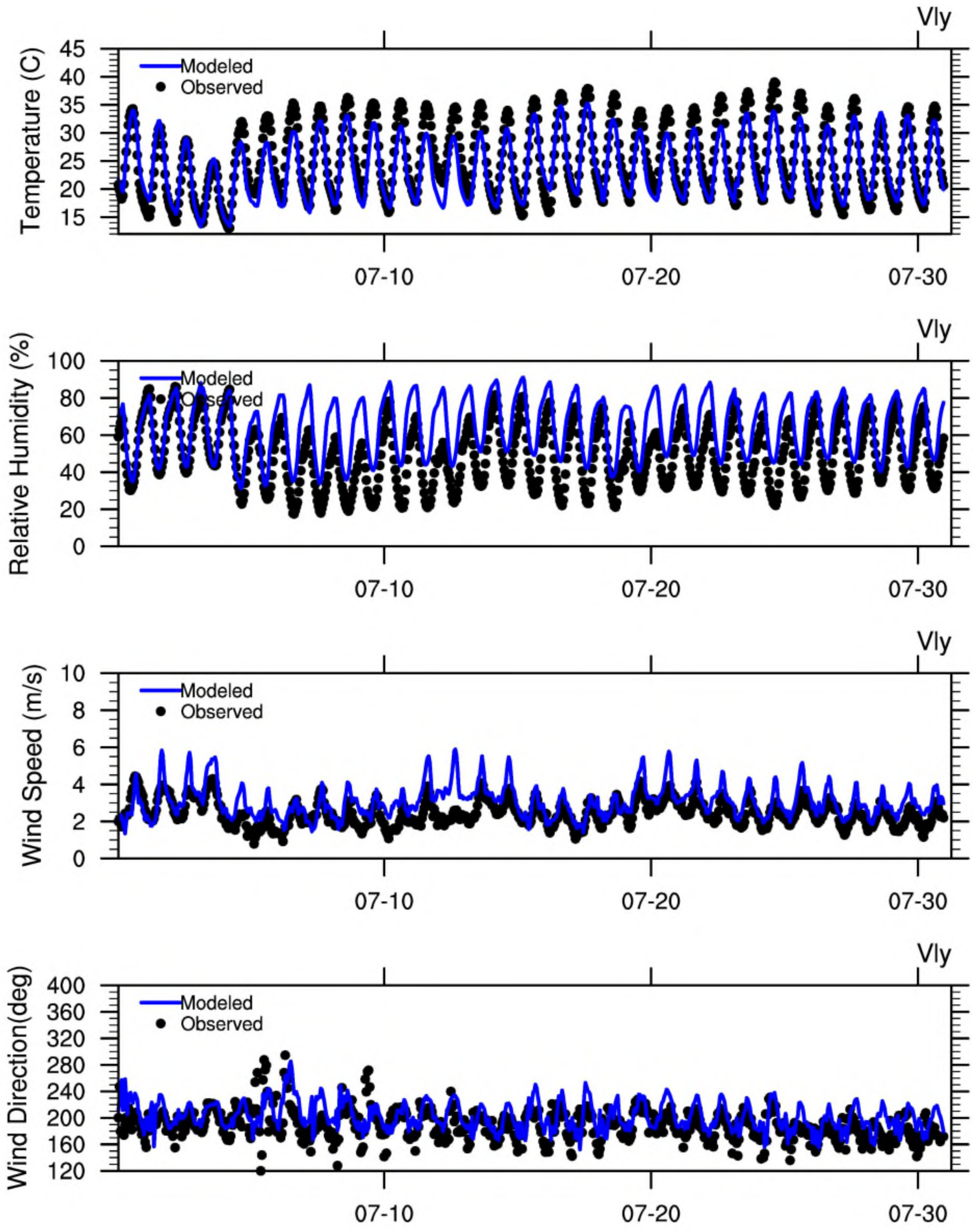


Figure S 8. Time series of average temperature, relative humidity, wind speed, and direction of all mountain sites in July 2018.

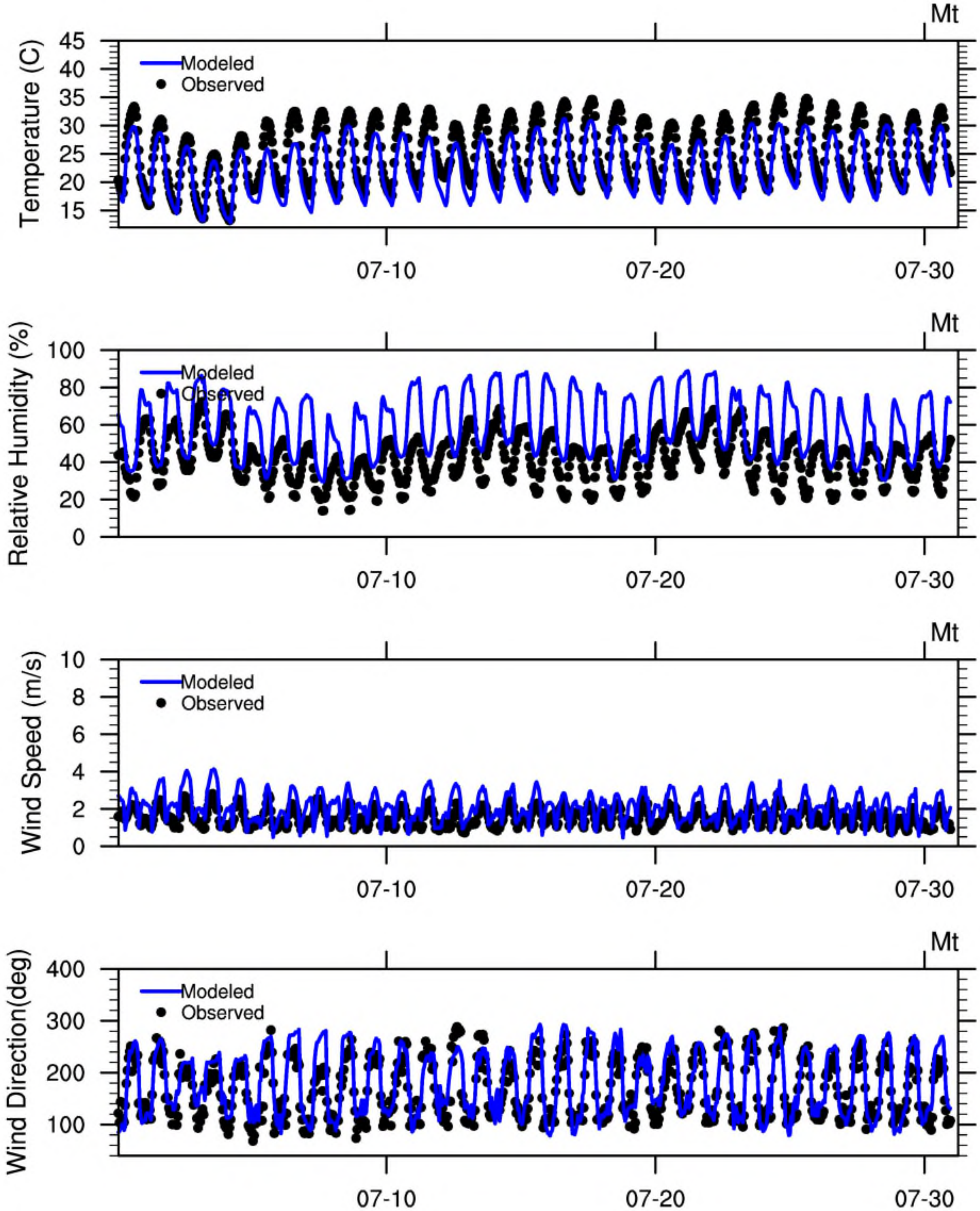


Figure S 9. Time series of average temperature, relative humidity, wind speed, and direction of all valley sites in August 2018.

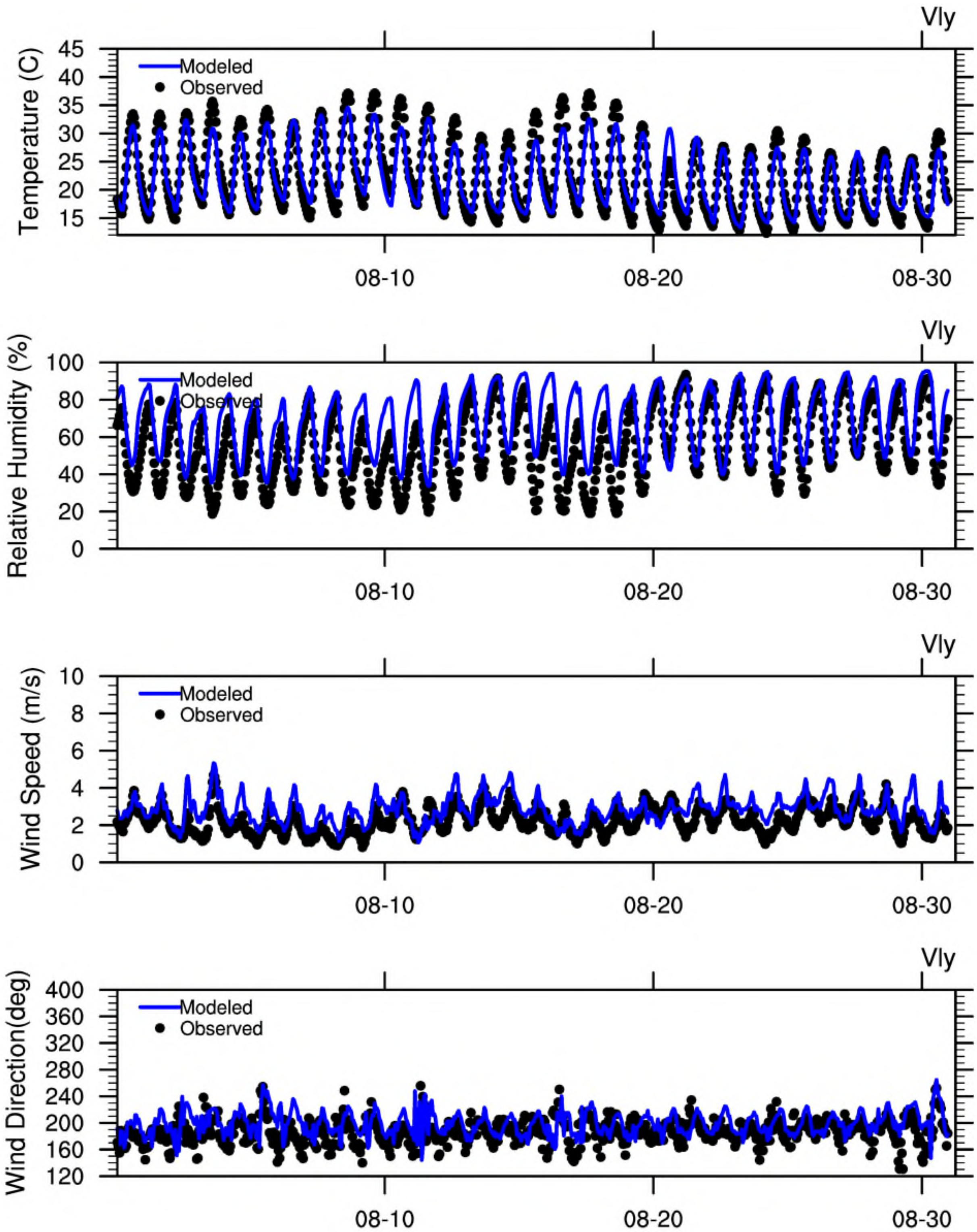
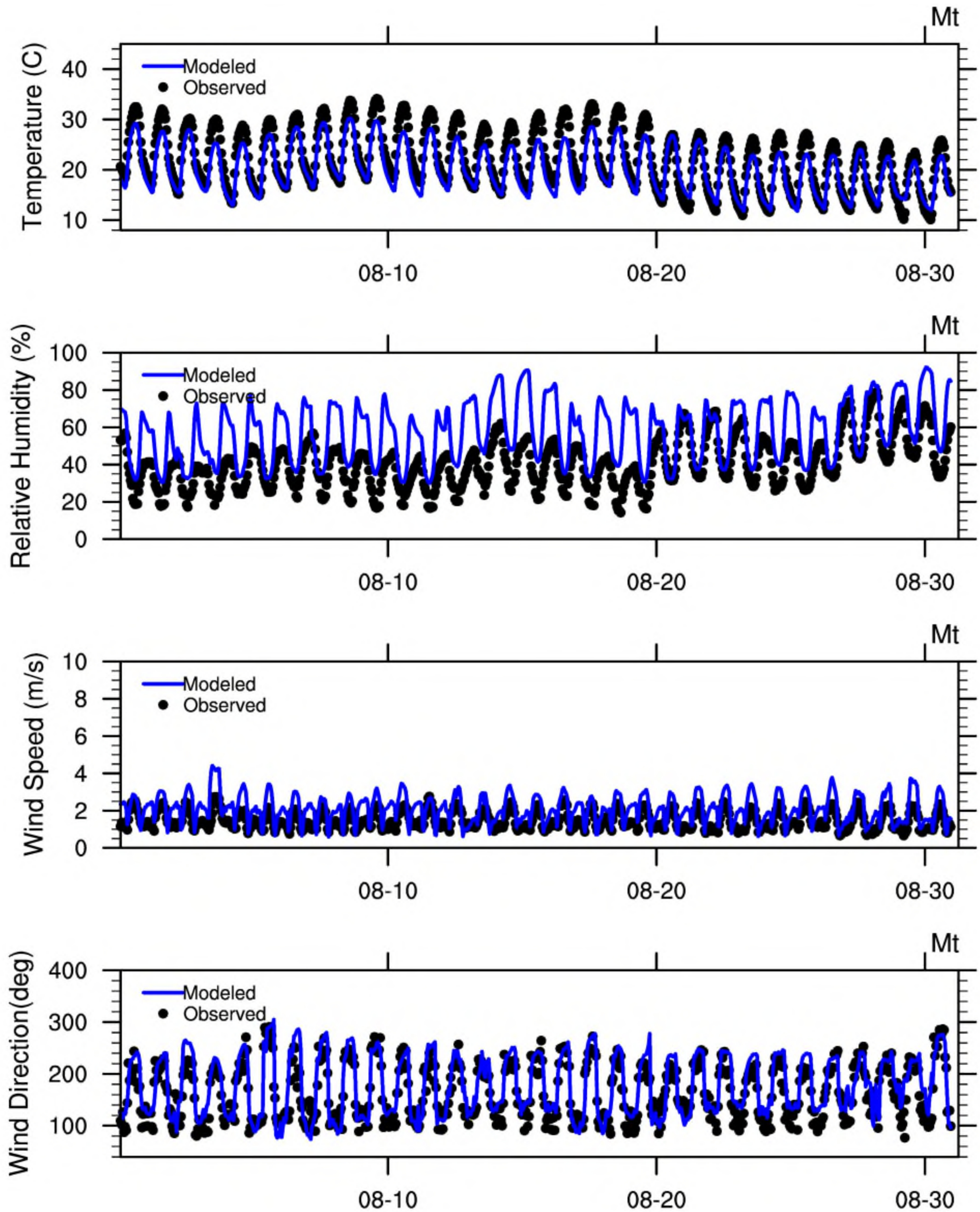


Figure S 10. Time series of average temperature, relative humidity, wind speed, and direction of all mountain sites in August 2018.



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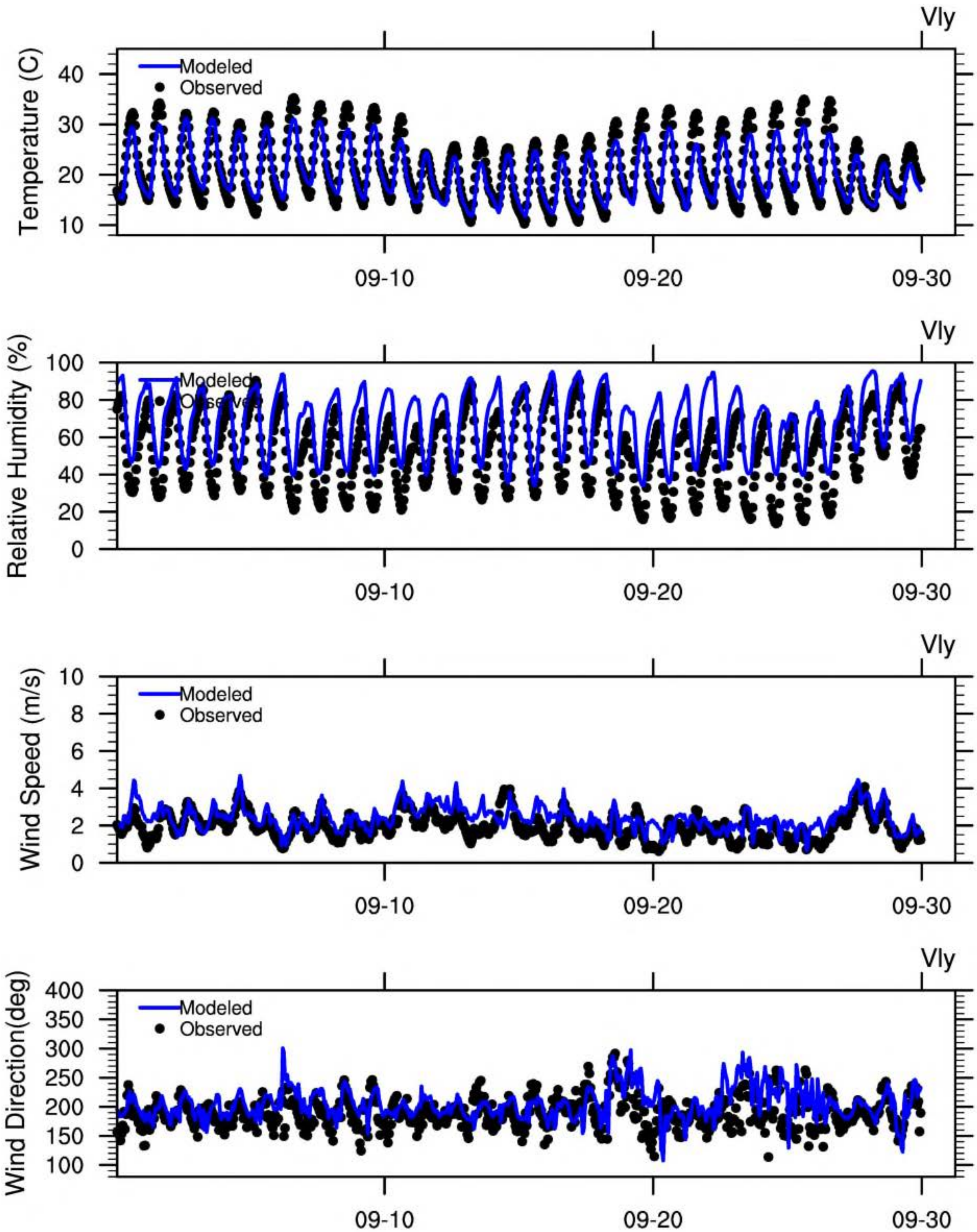
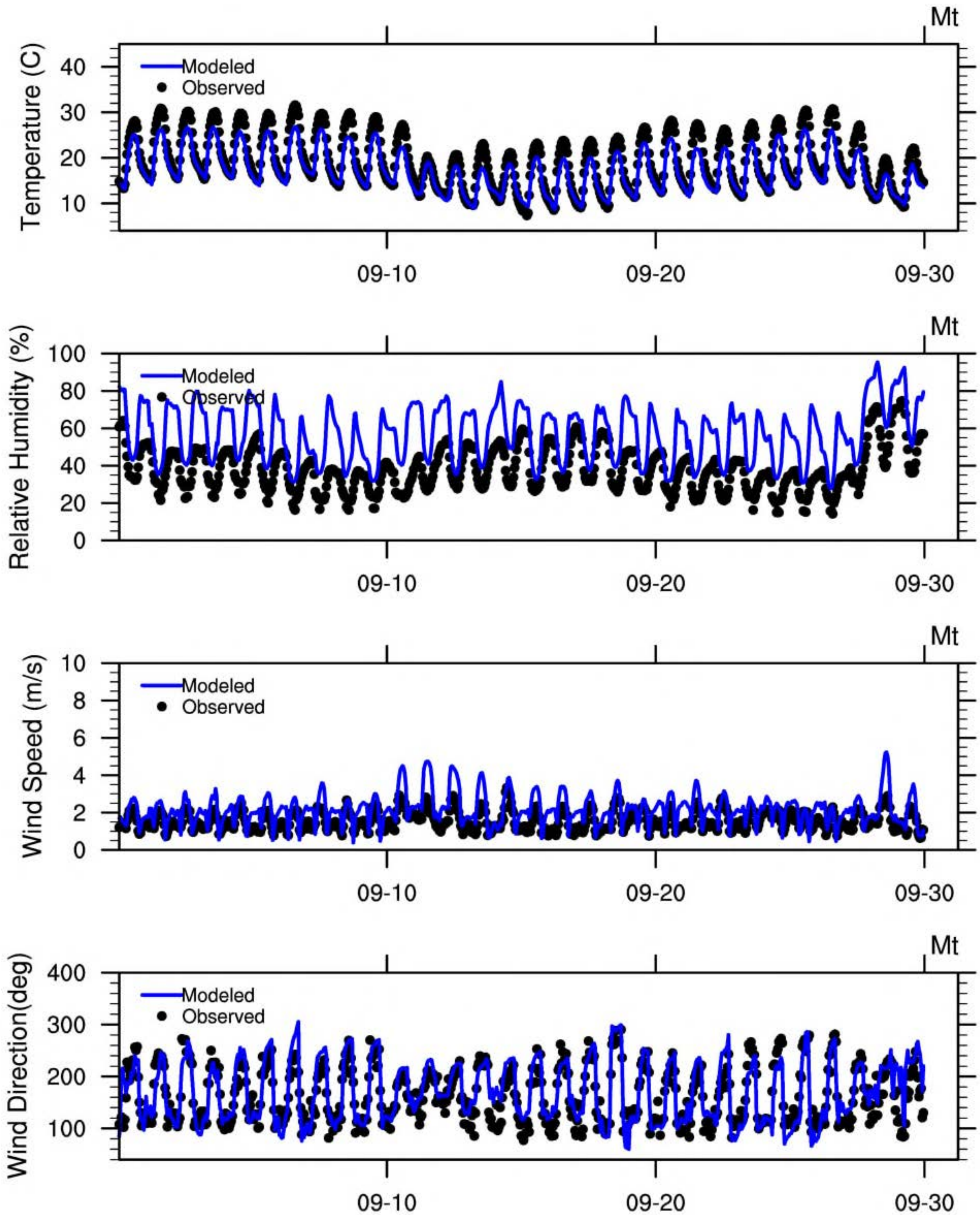


Figure S 12. Time series of average temperature, relative humidity, wind speed, and direction of all mountain sites in September 2018.



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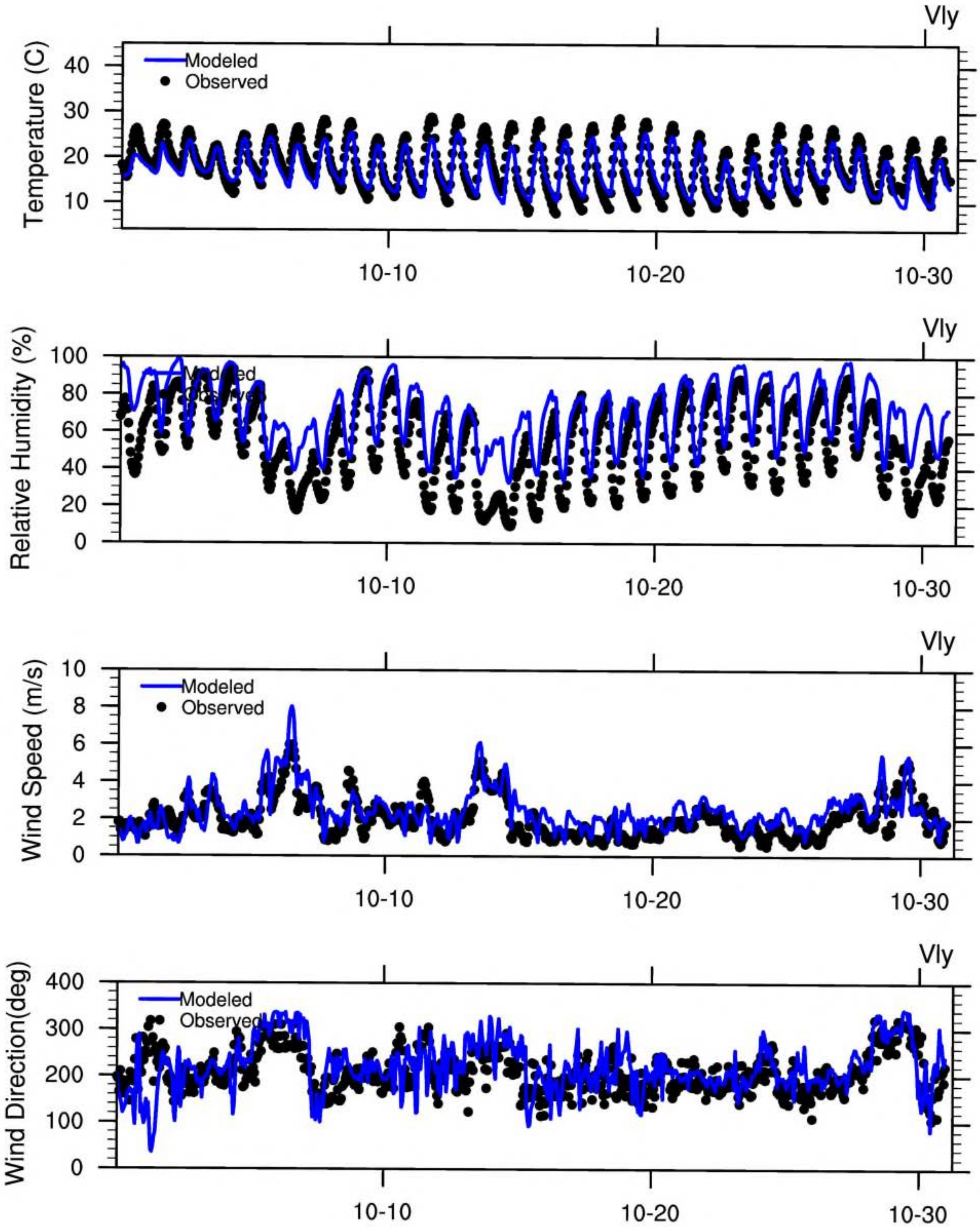

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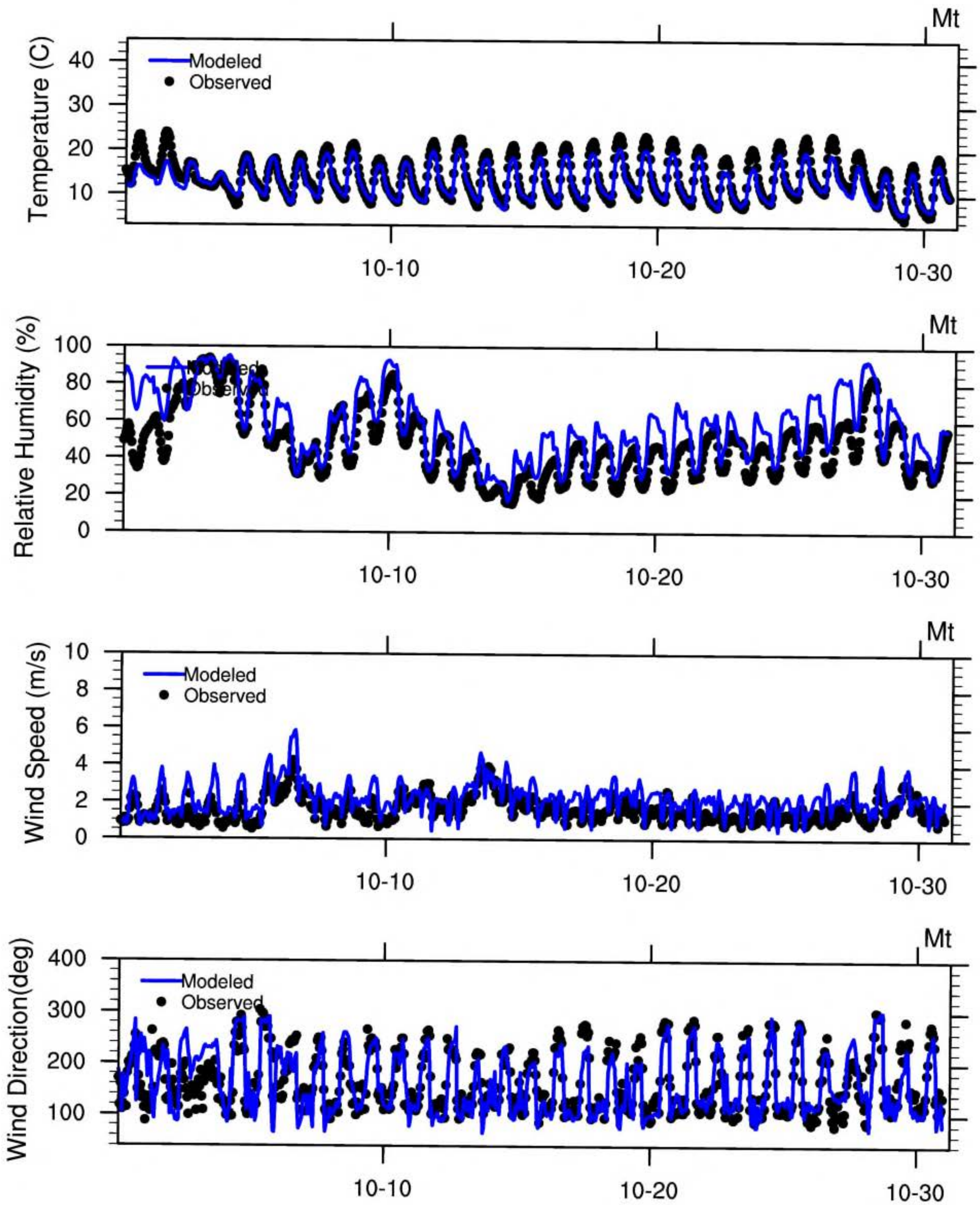

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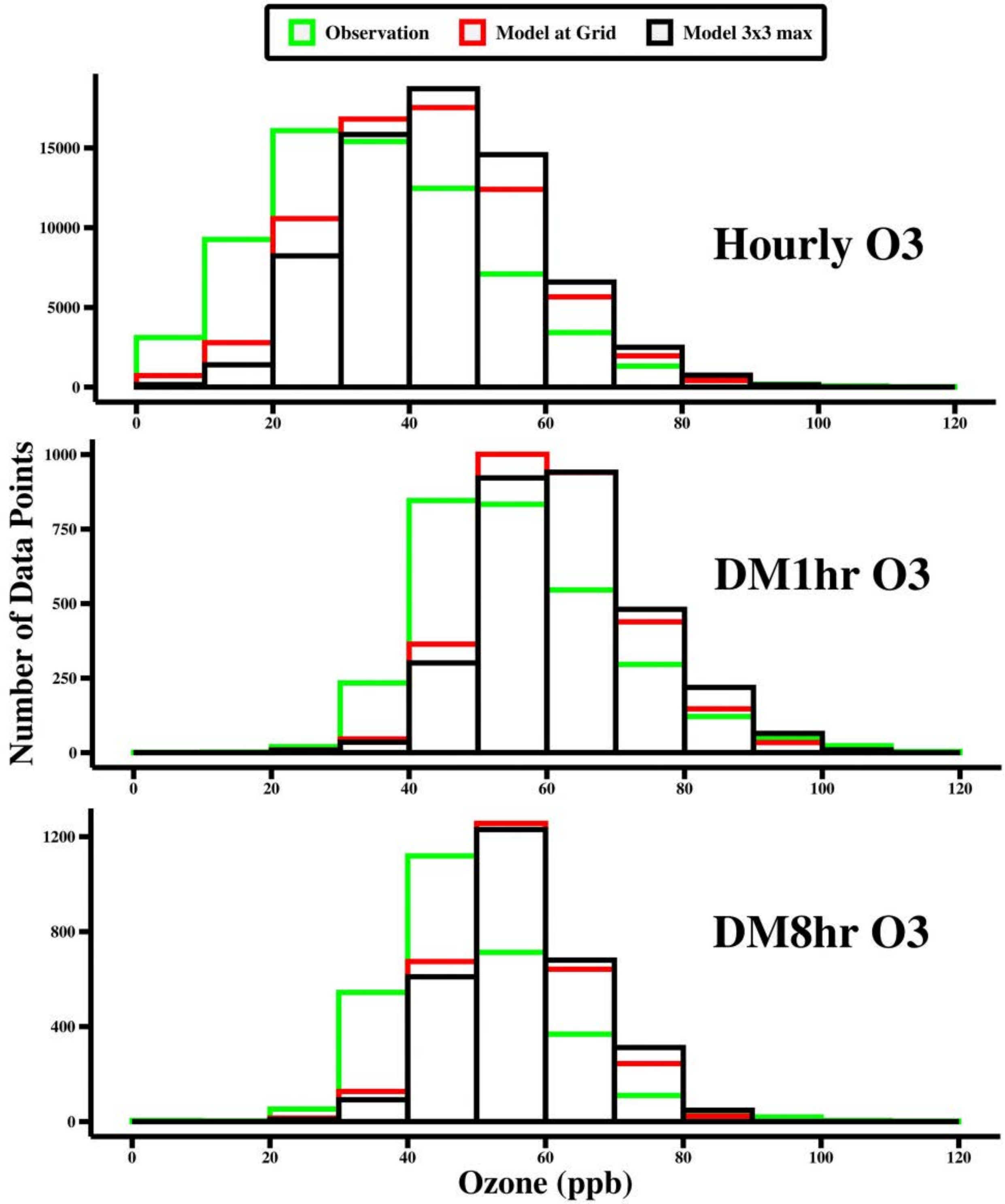

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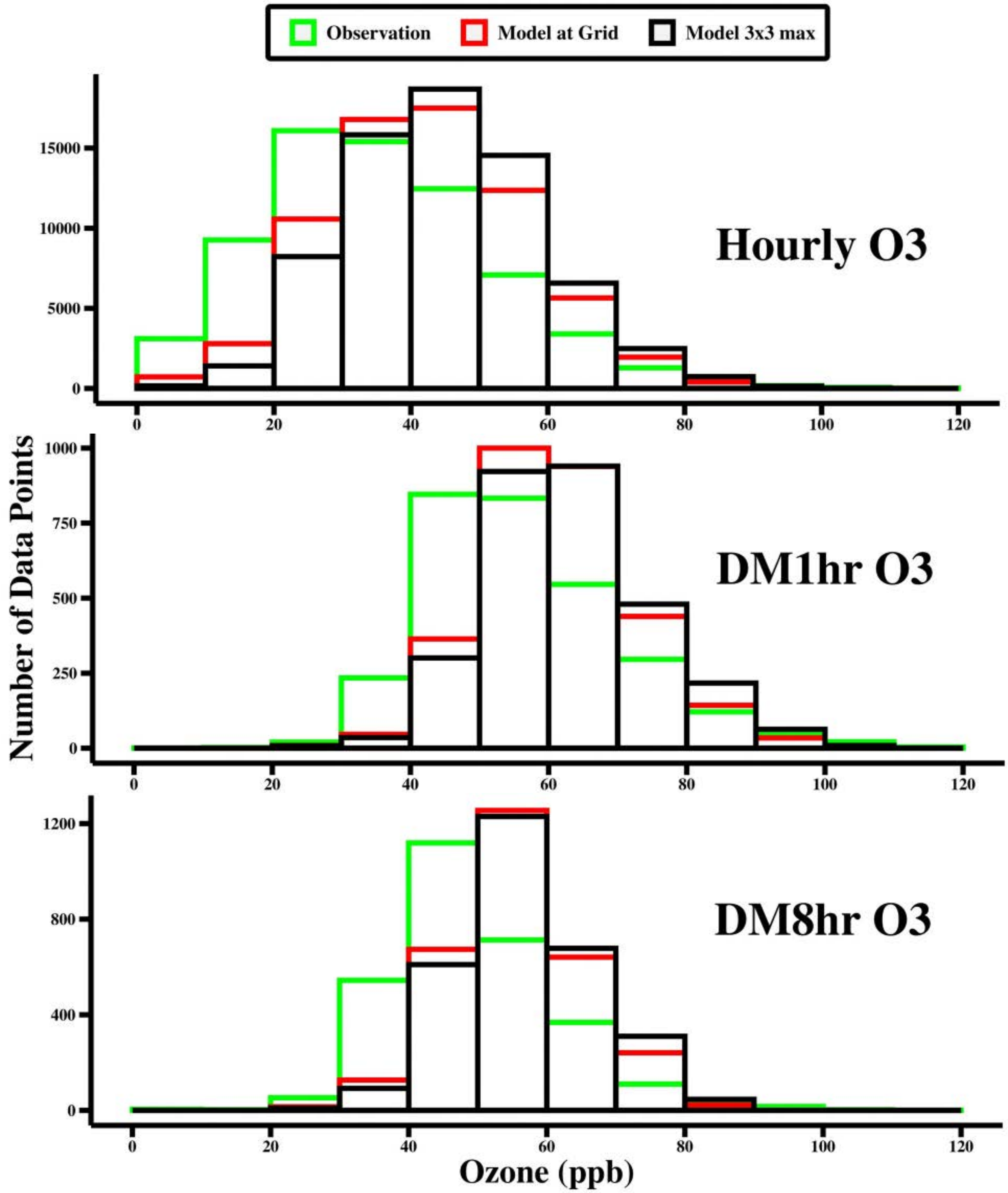

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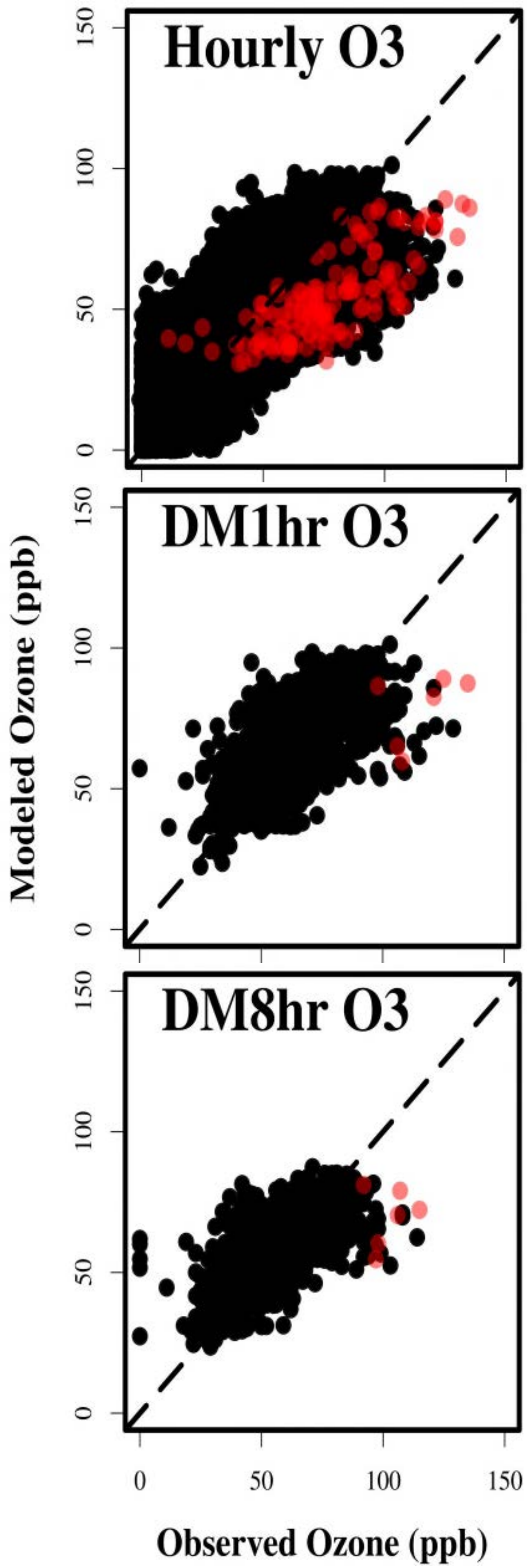

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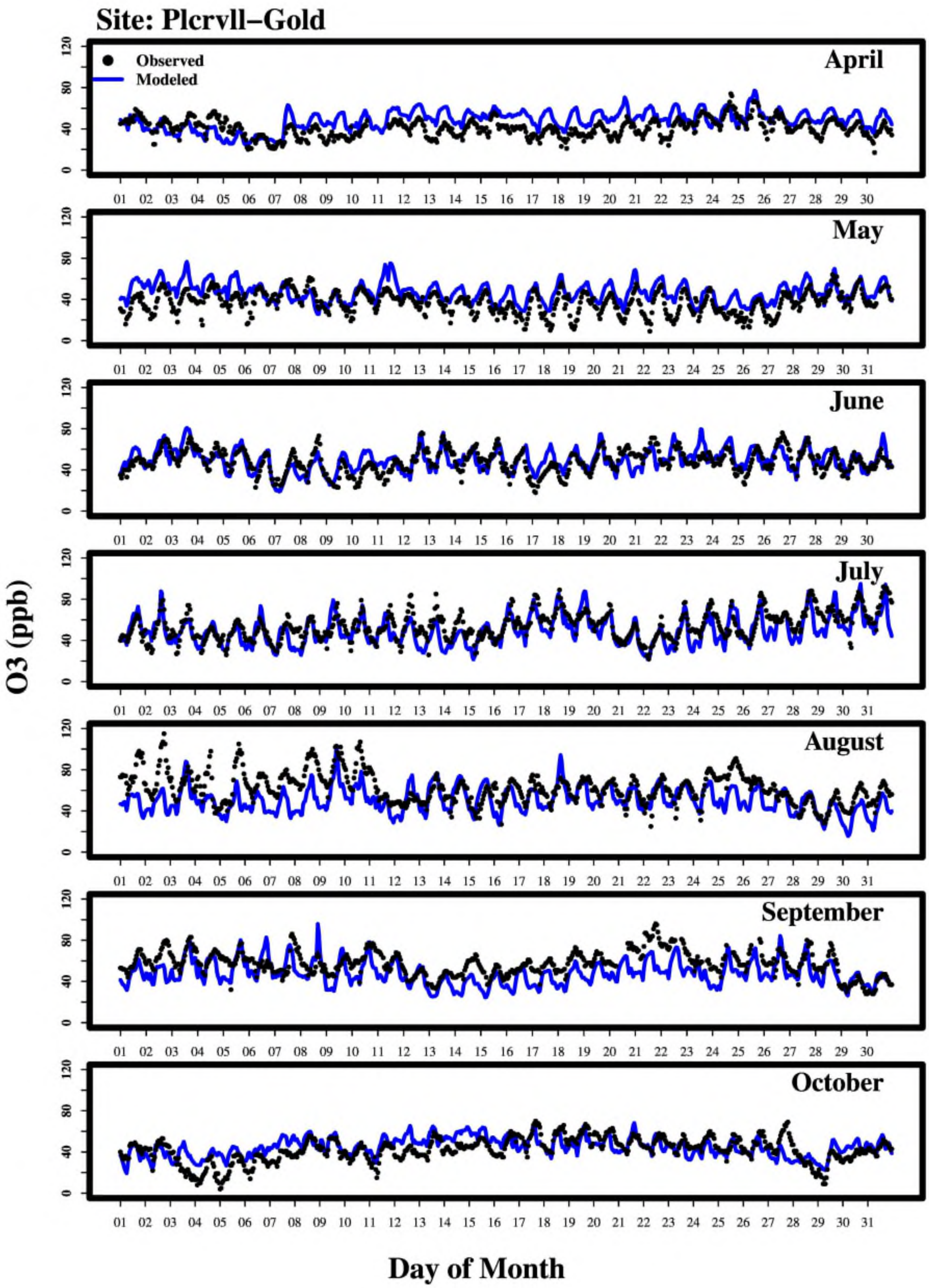

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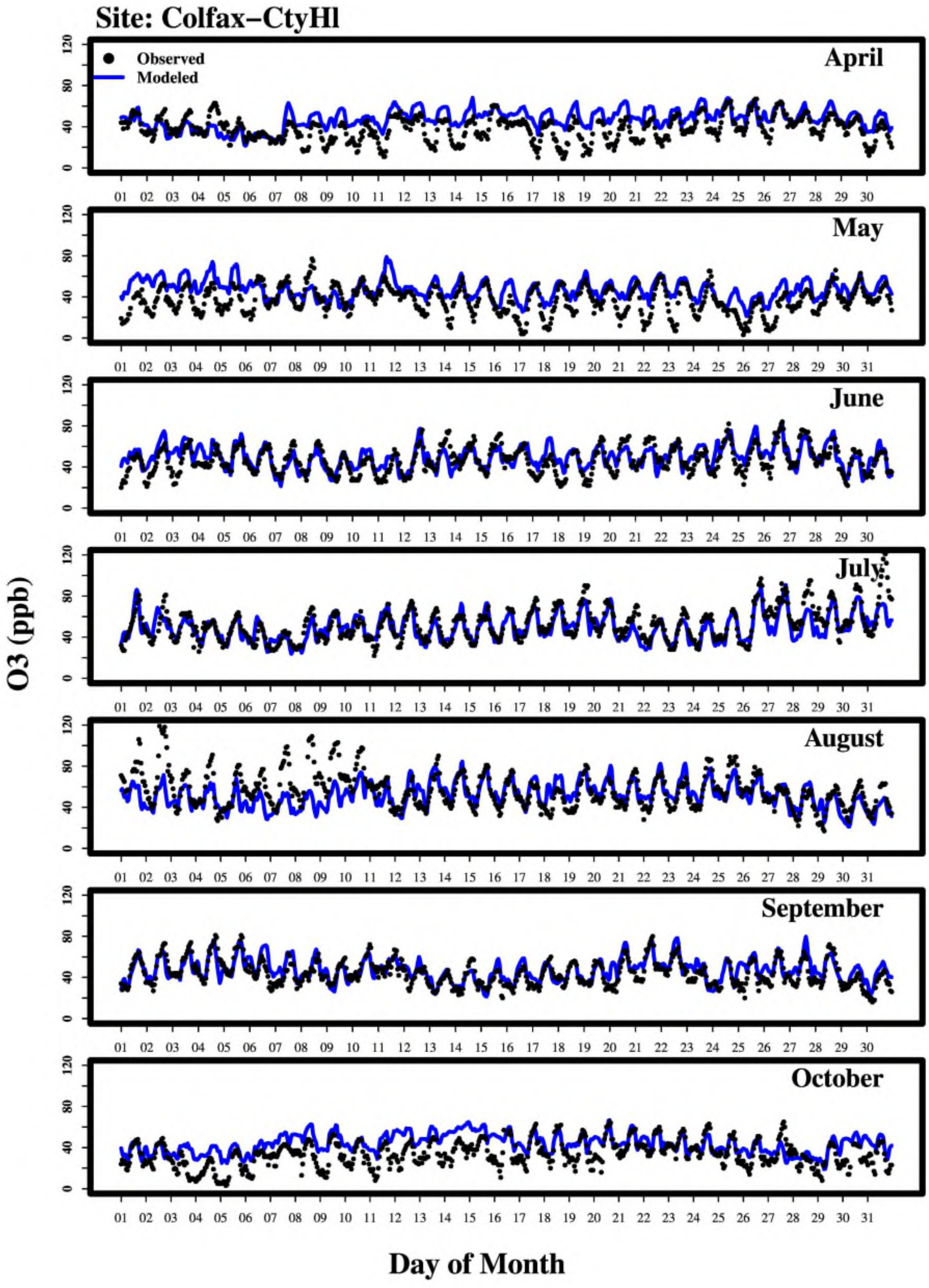

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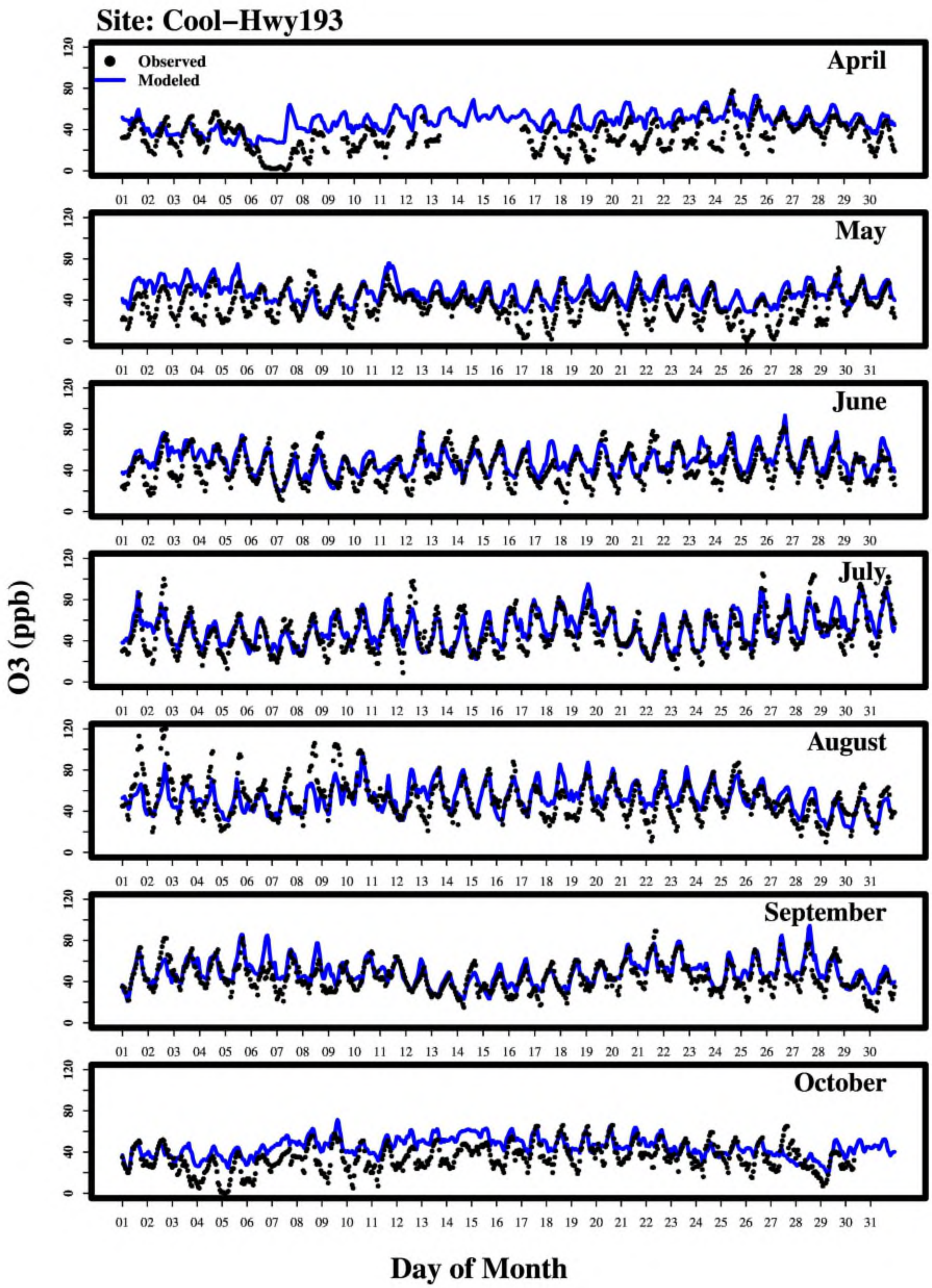

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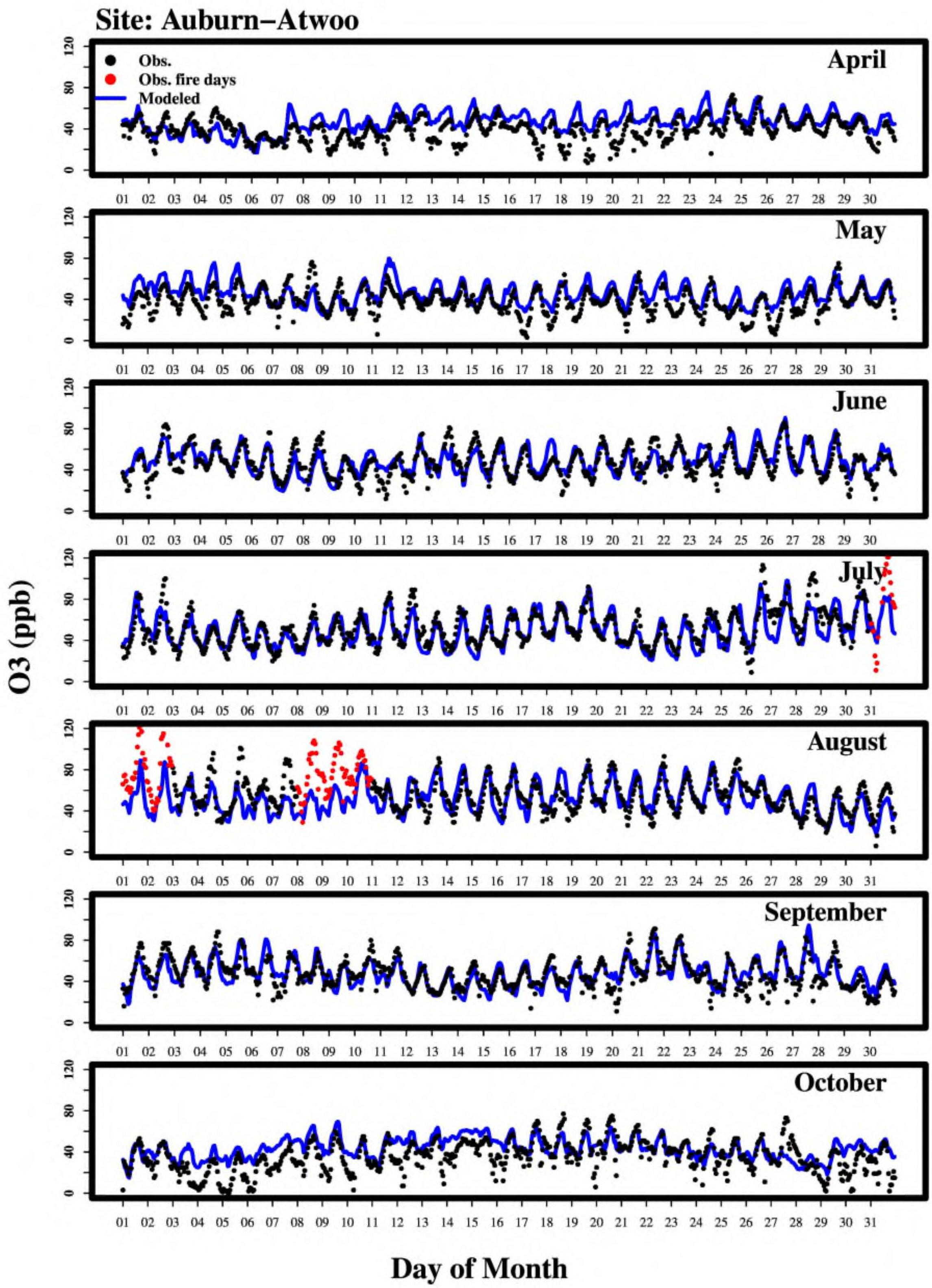

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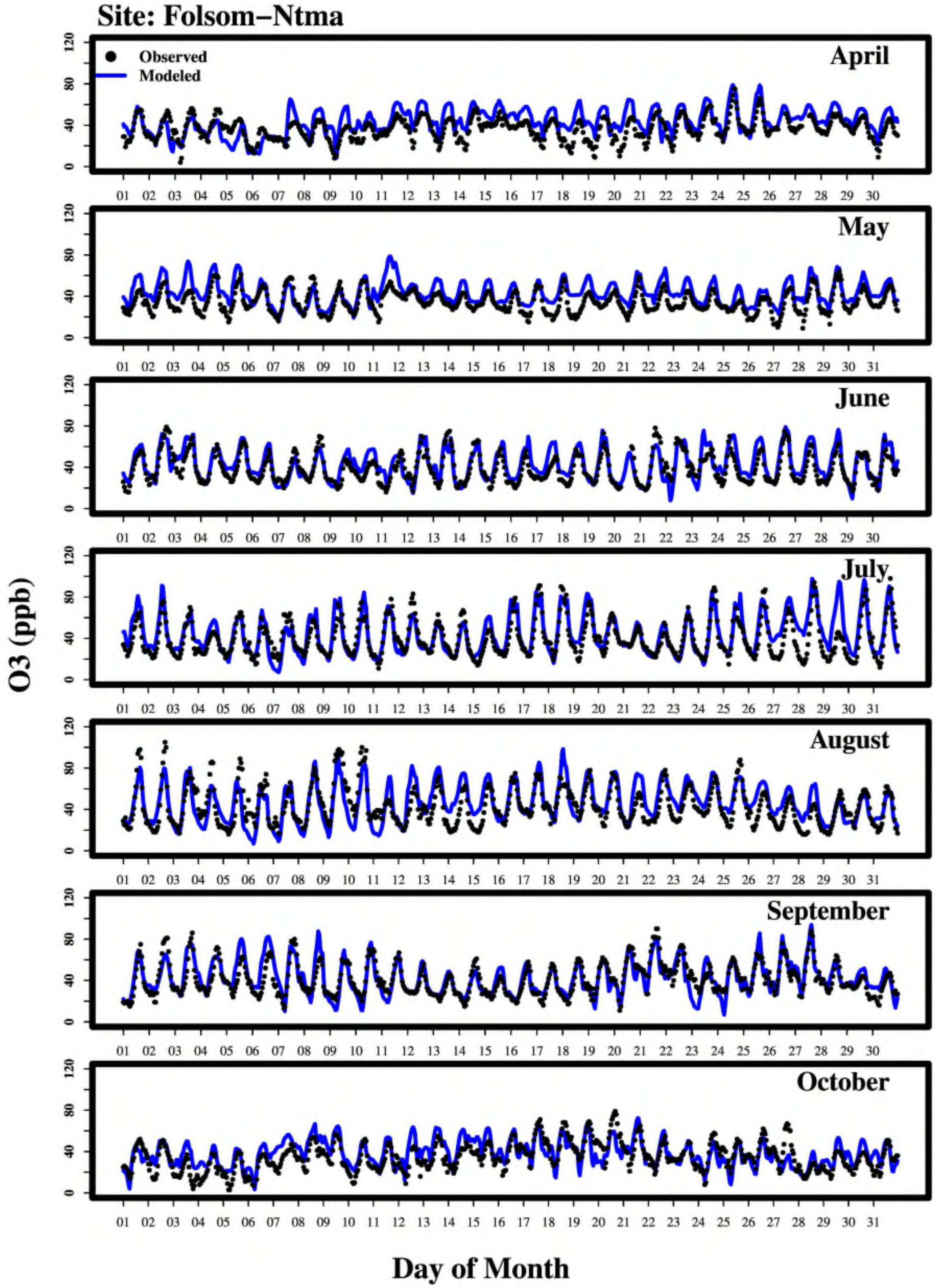

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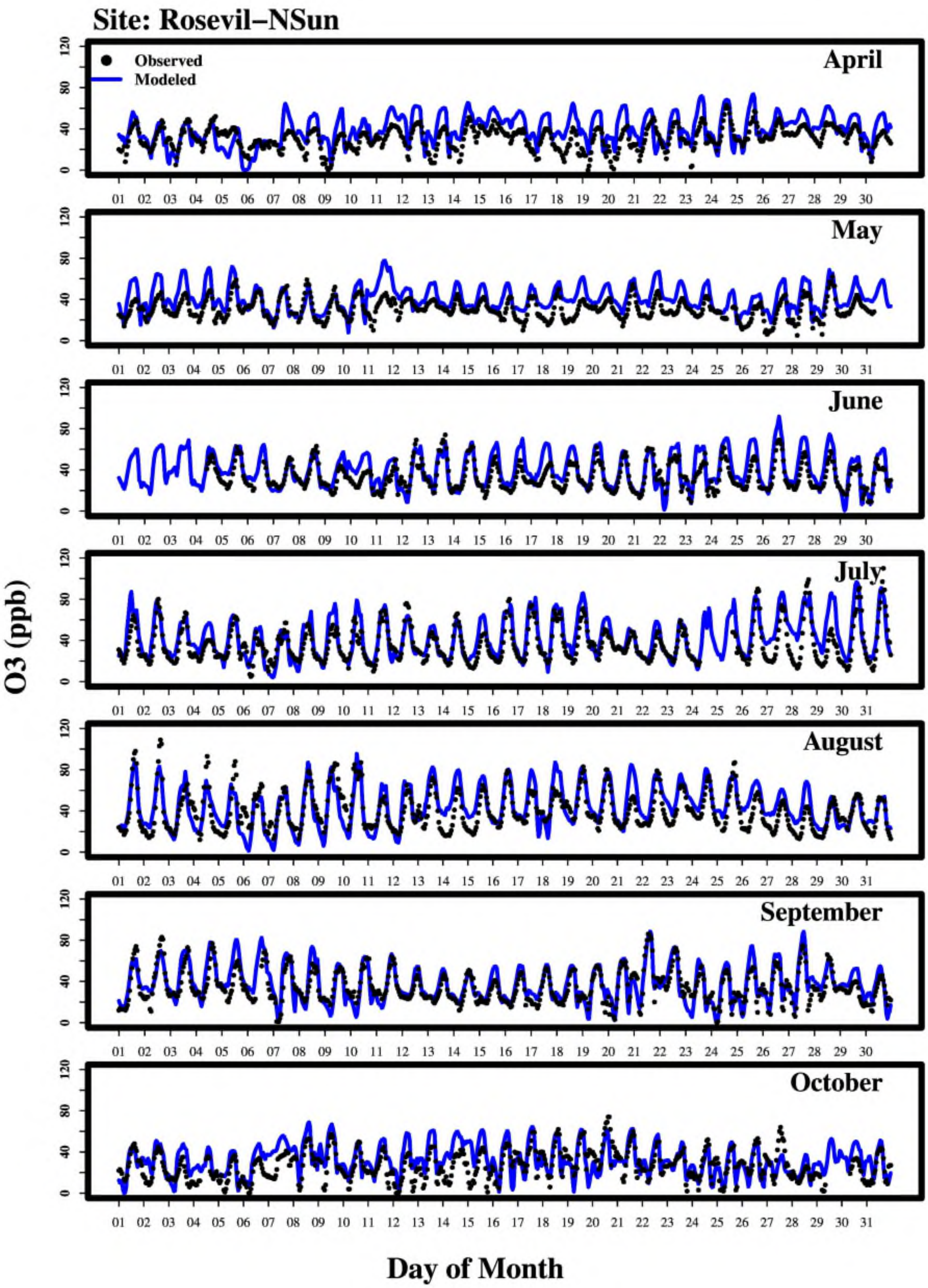

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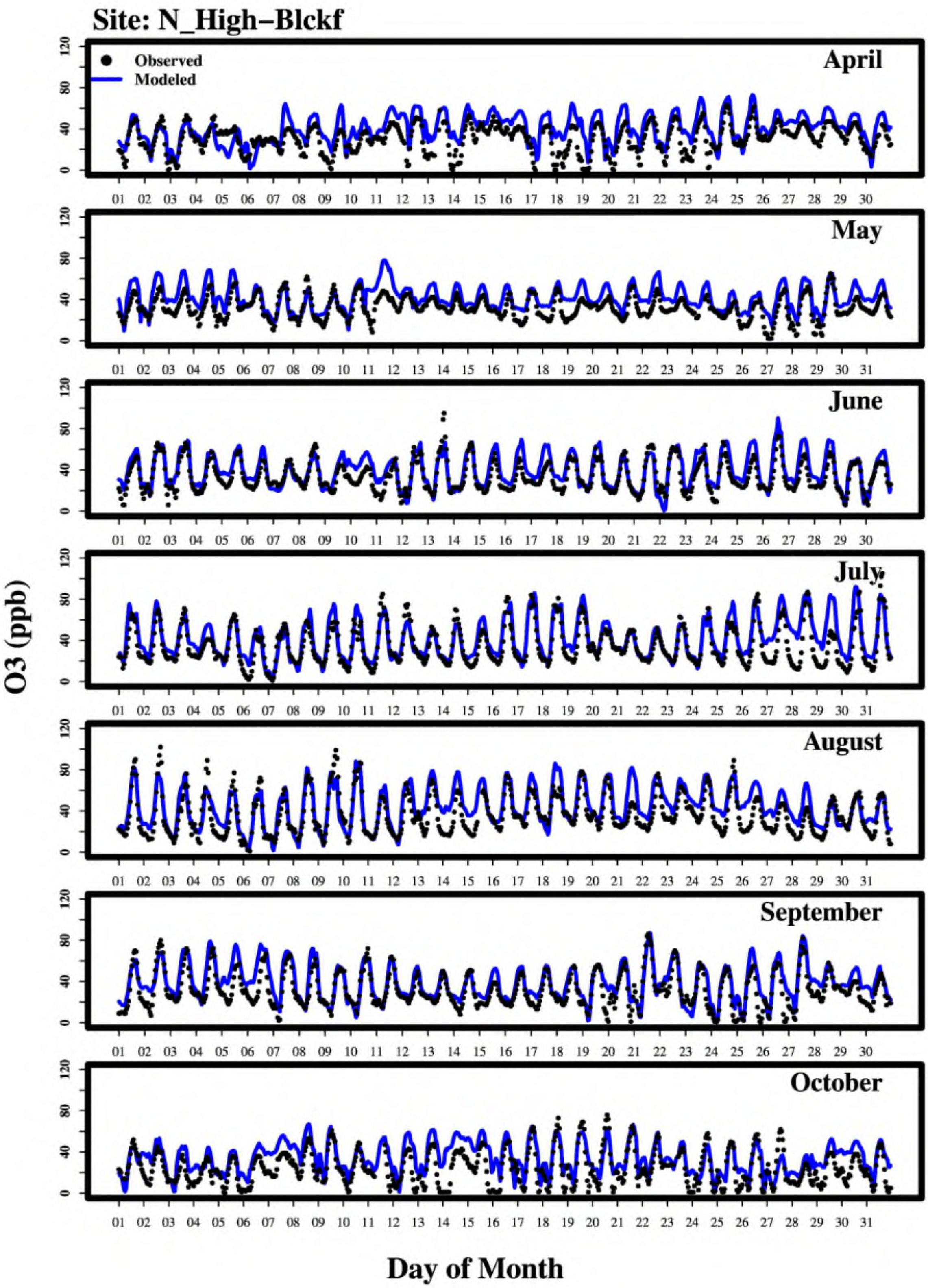

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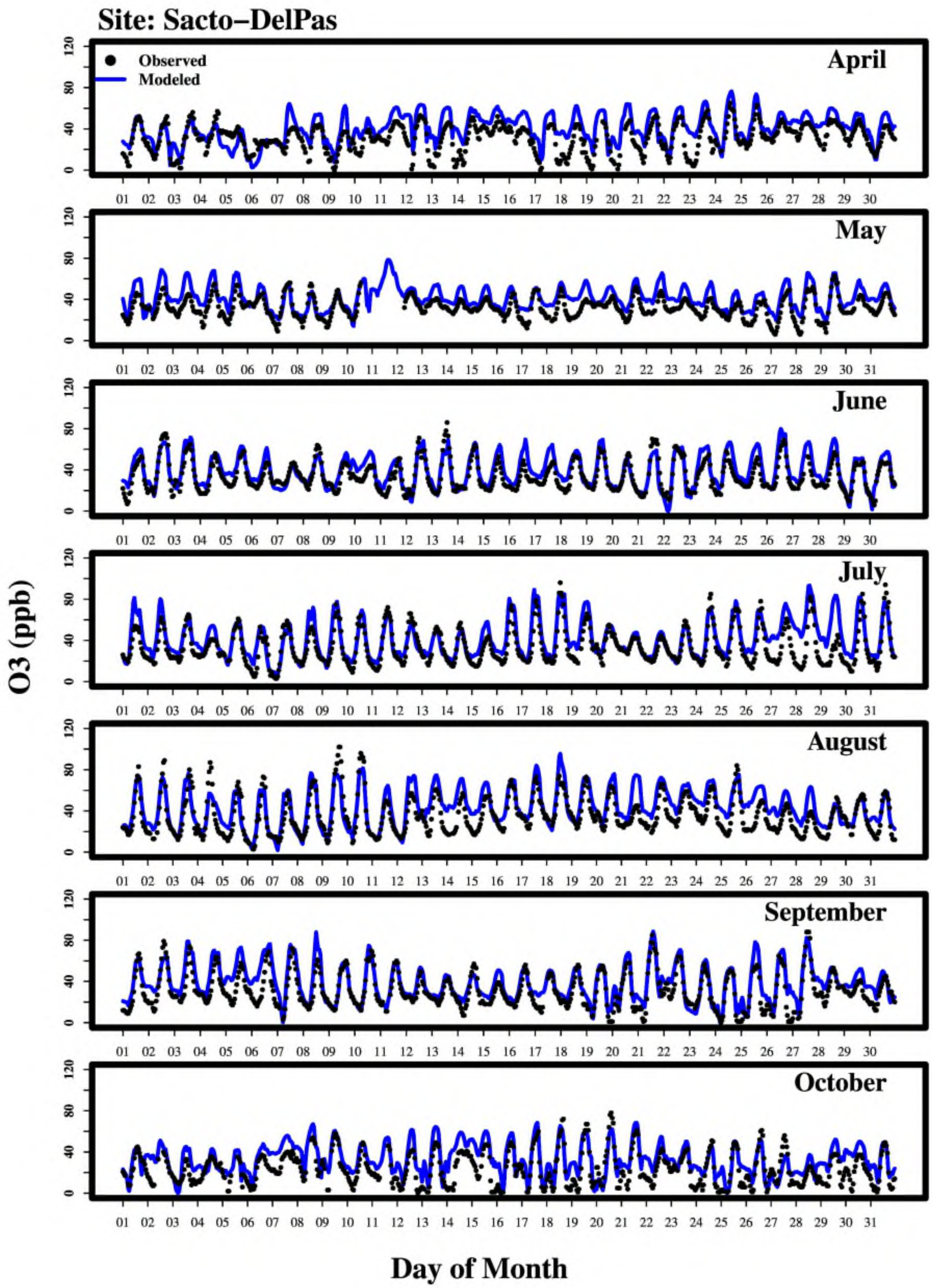

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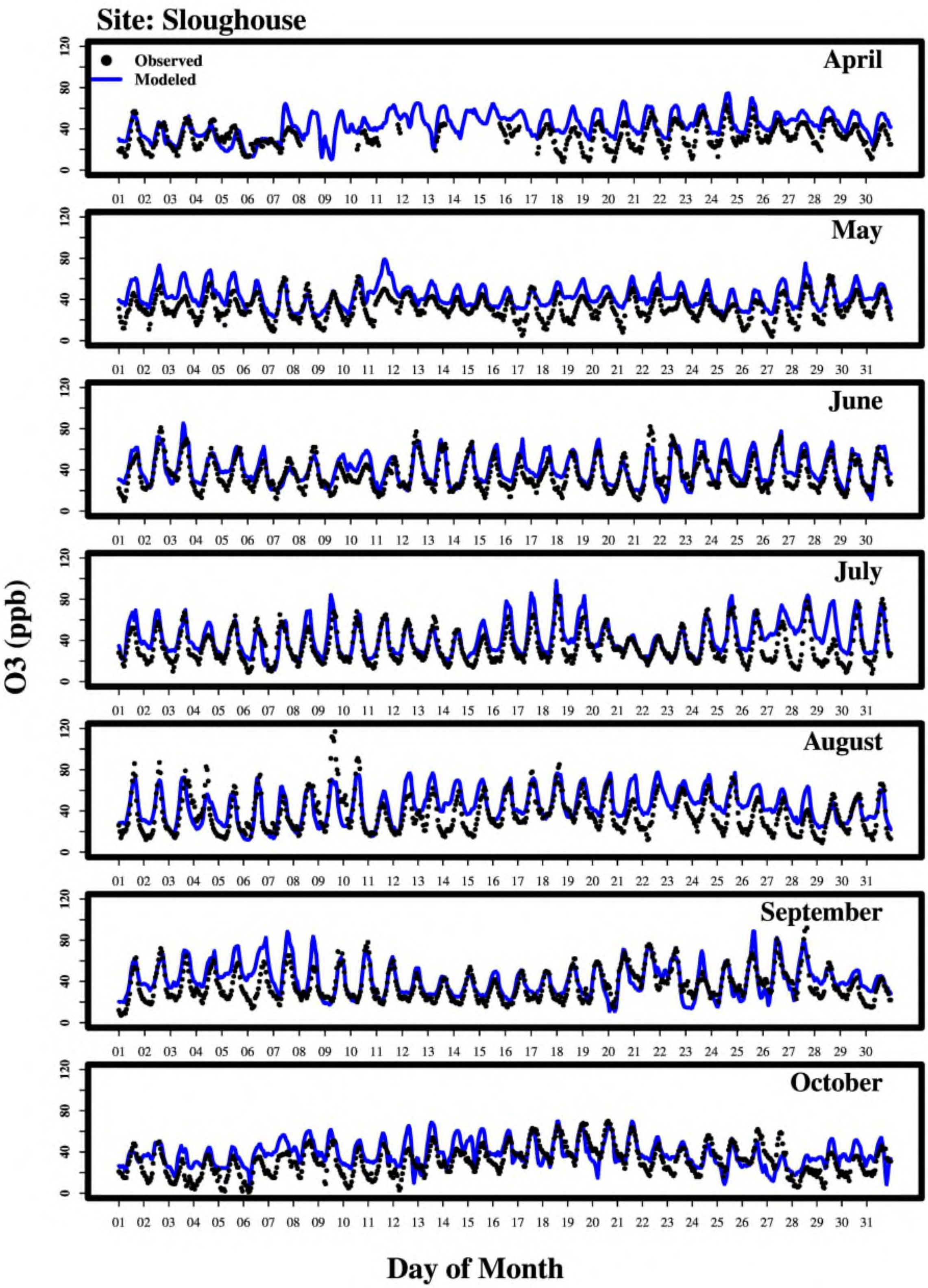

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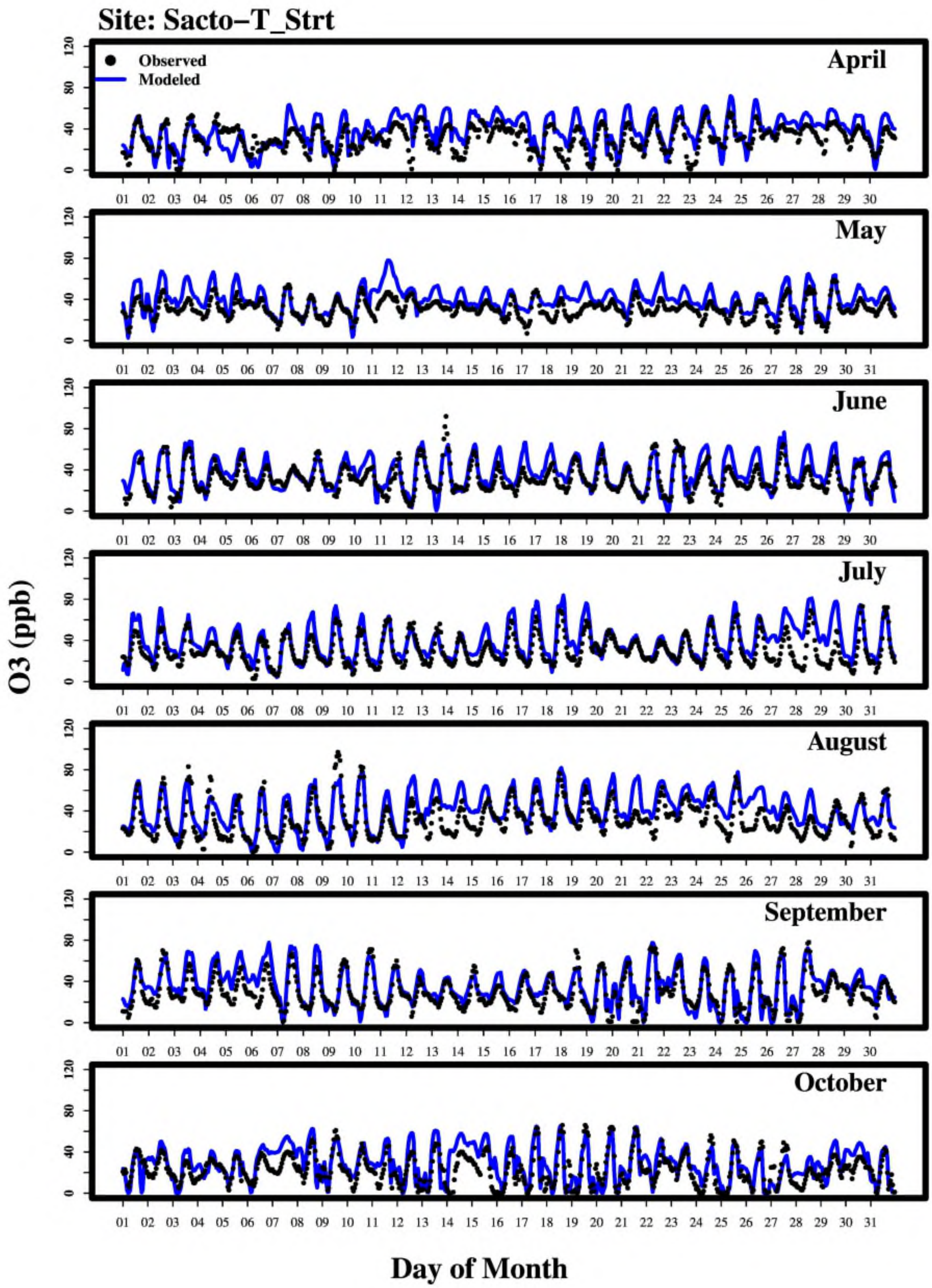

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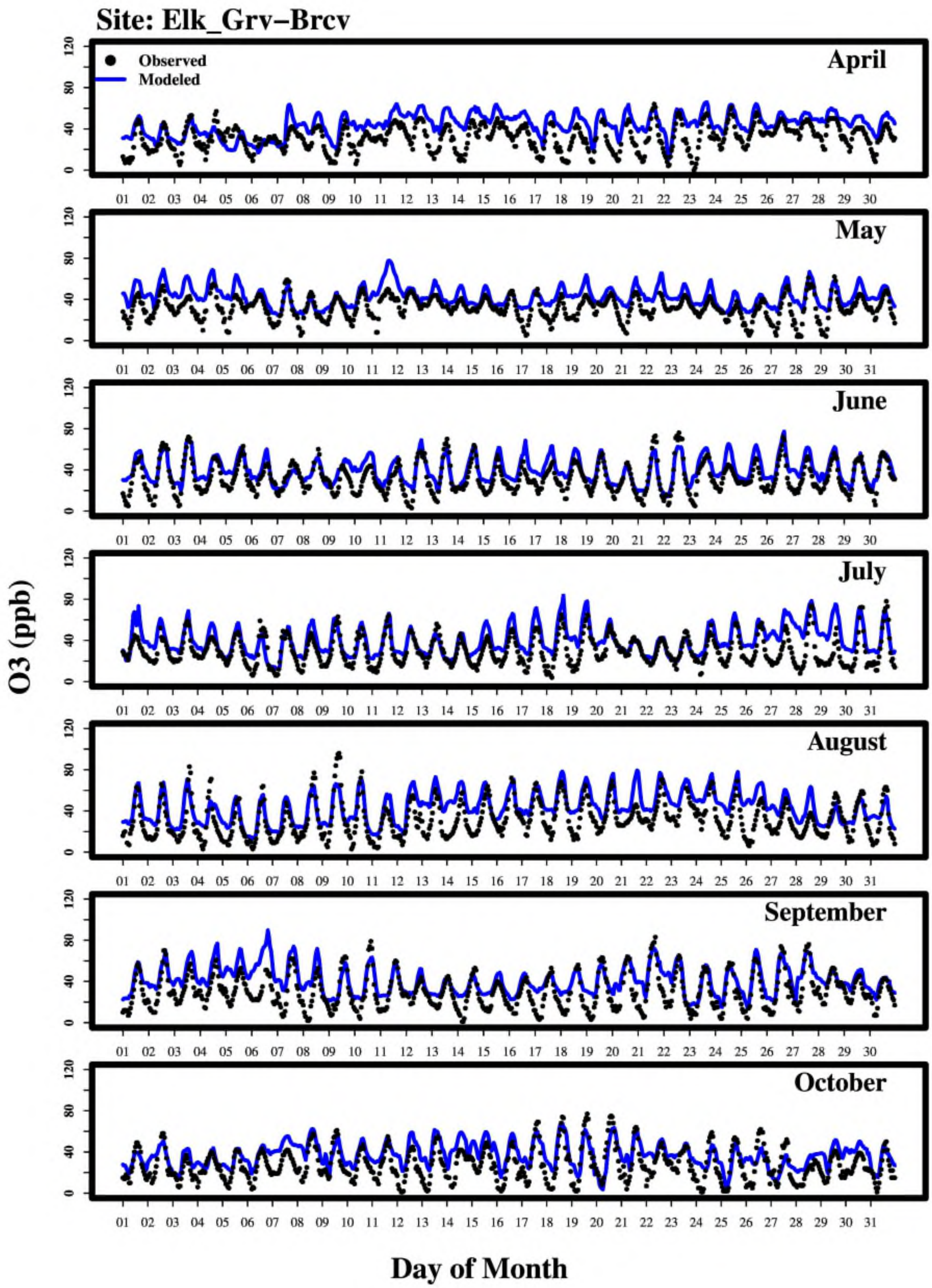

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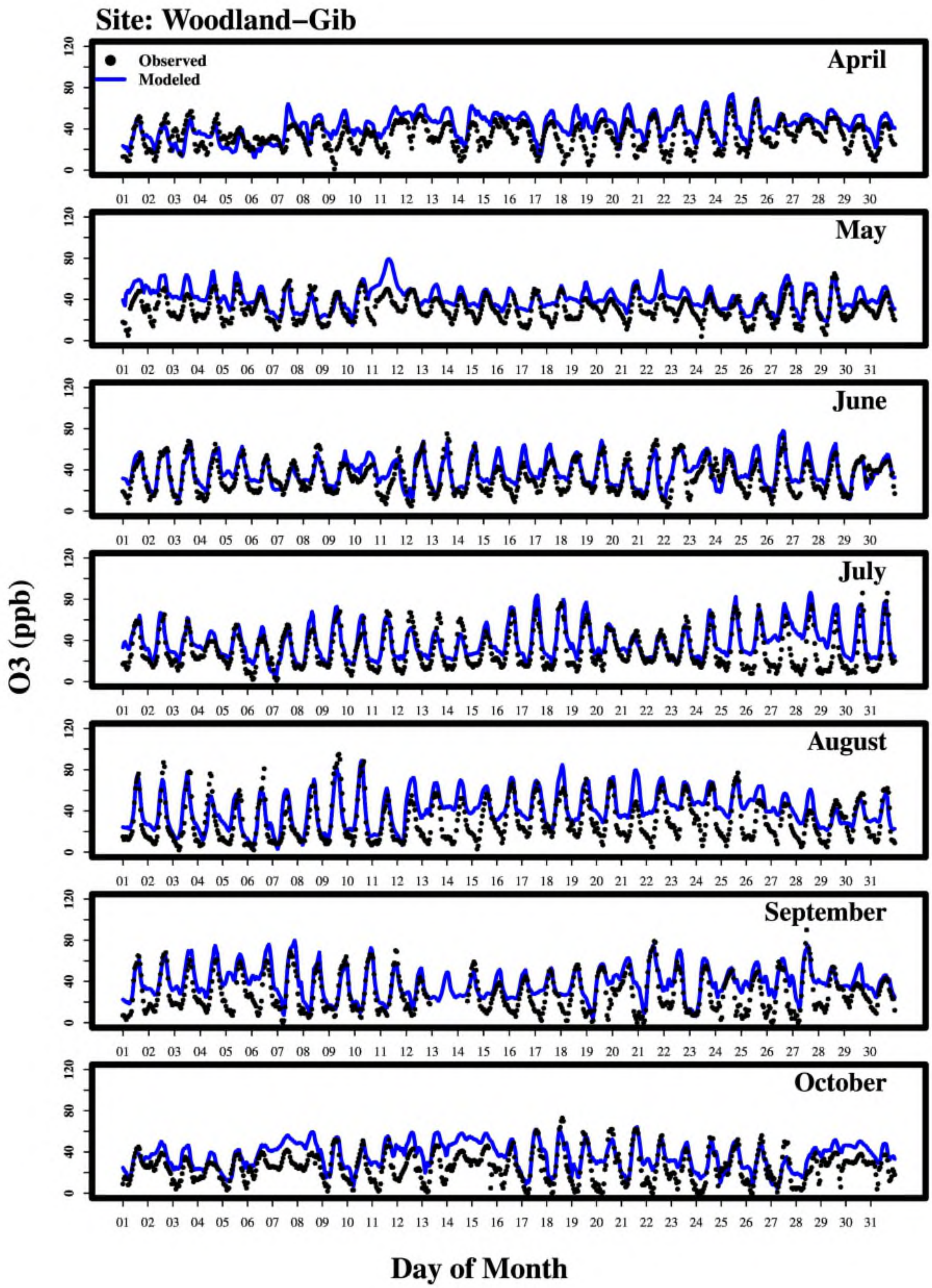

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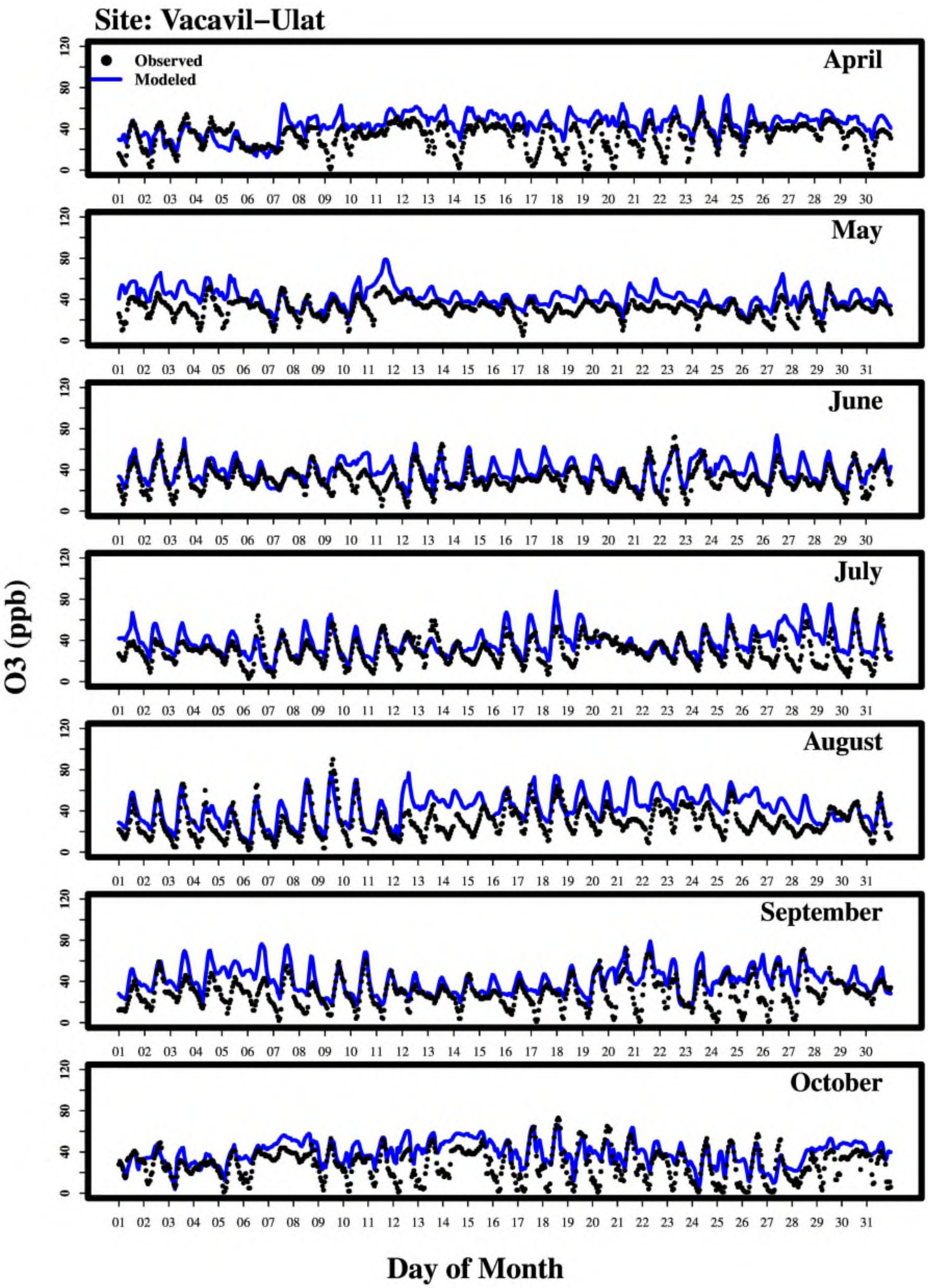

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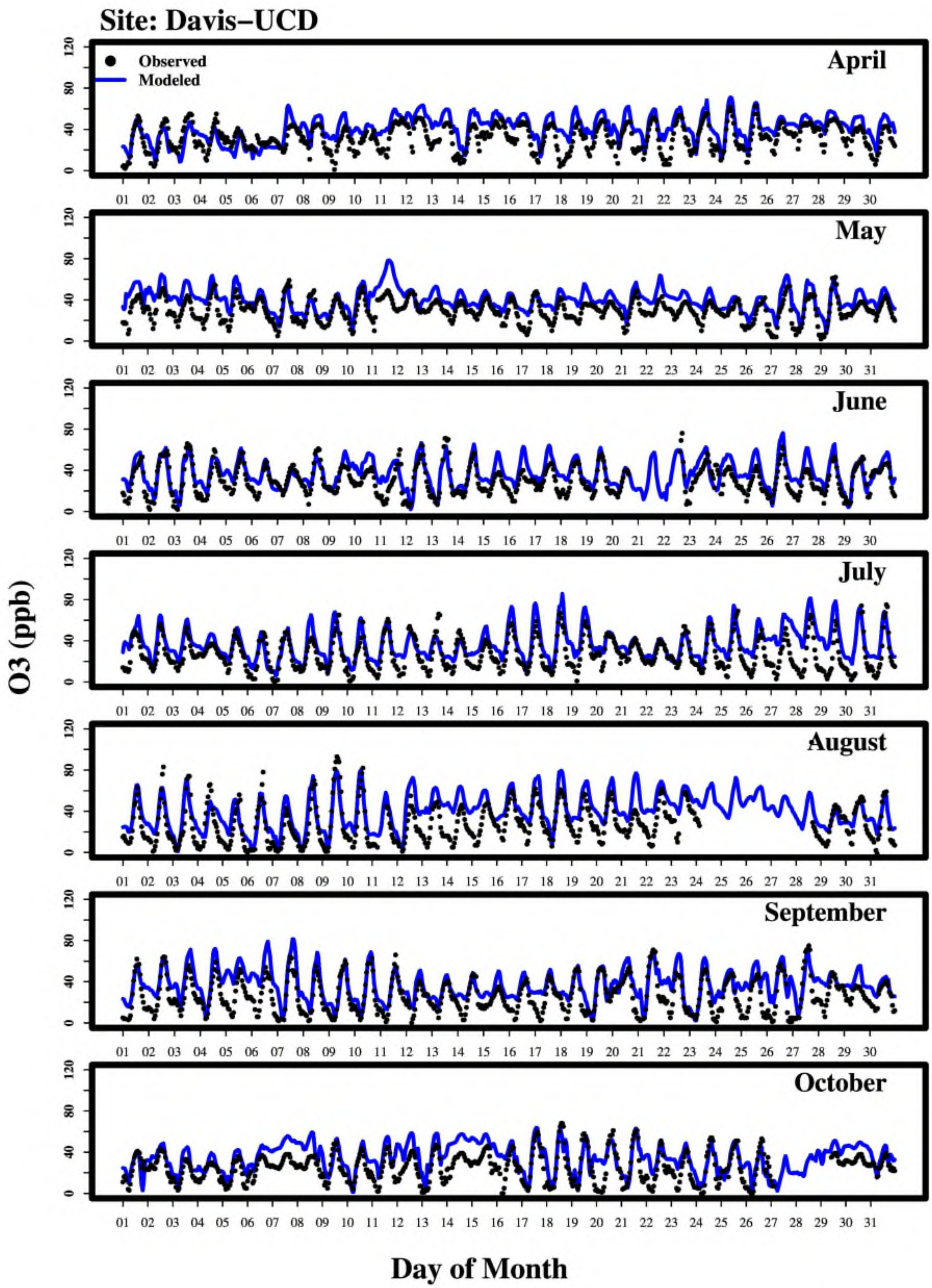

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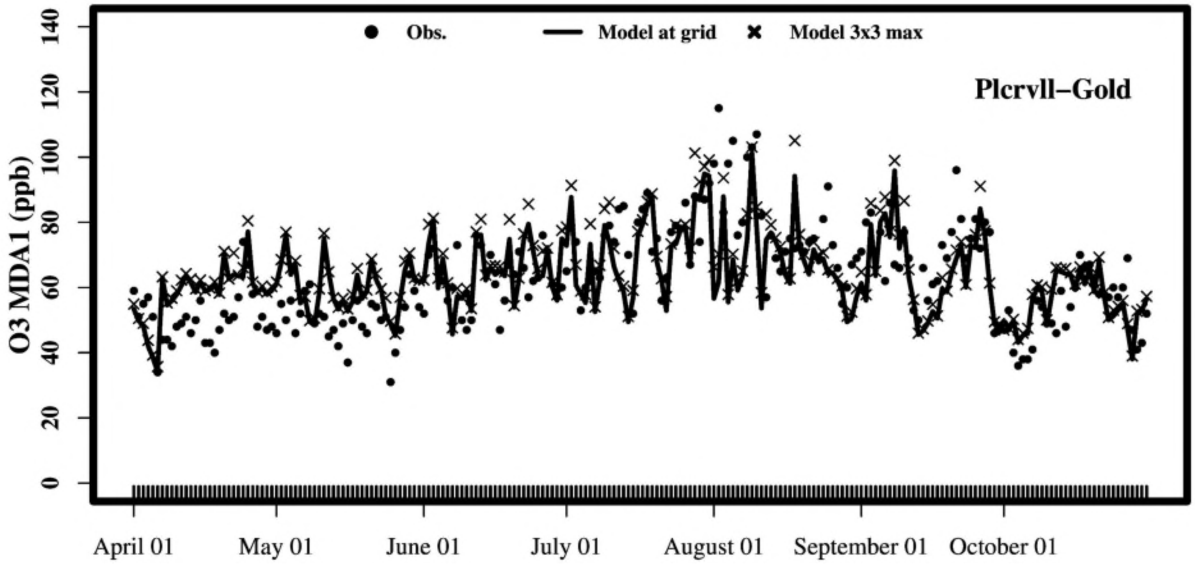

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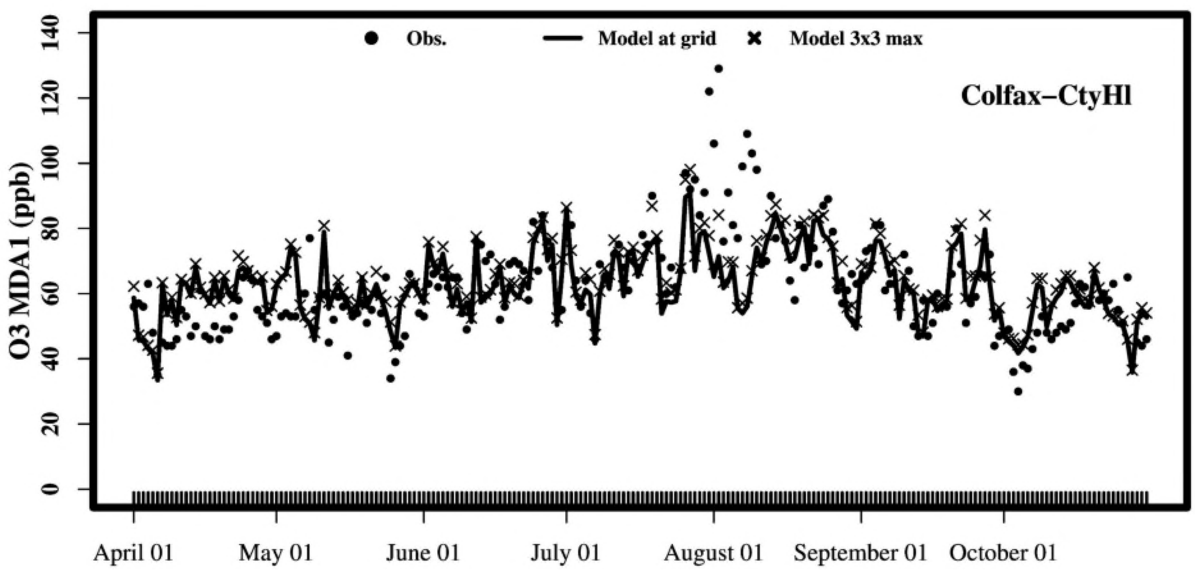

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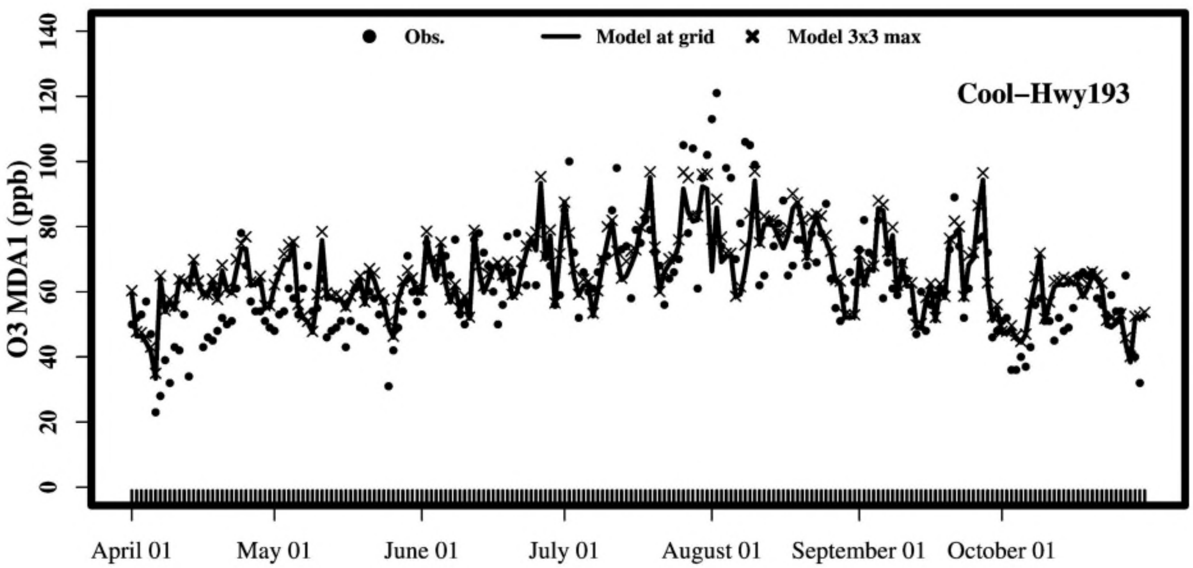

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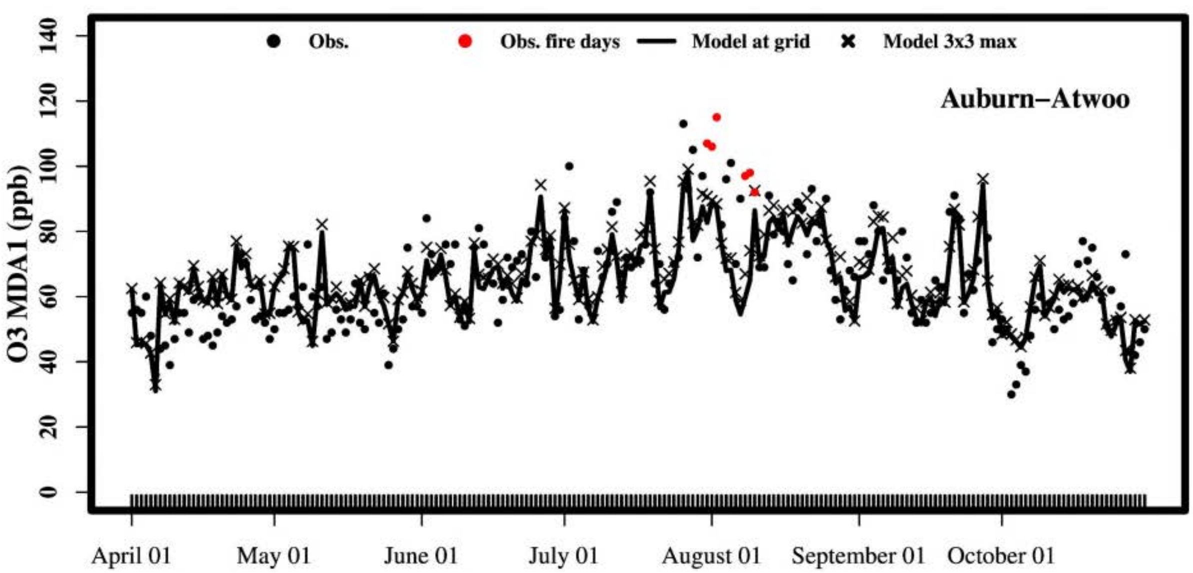

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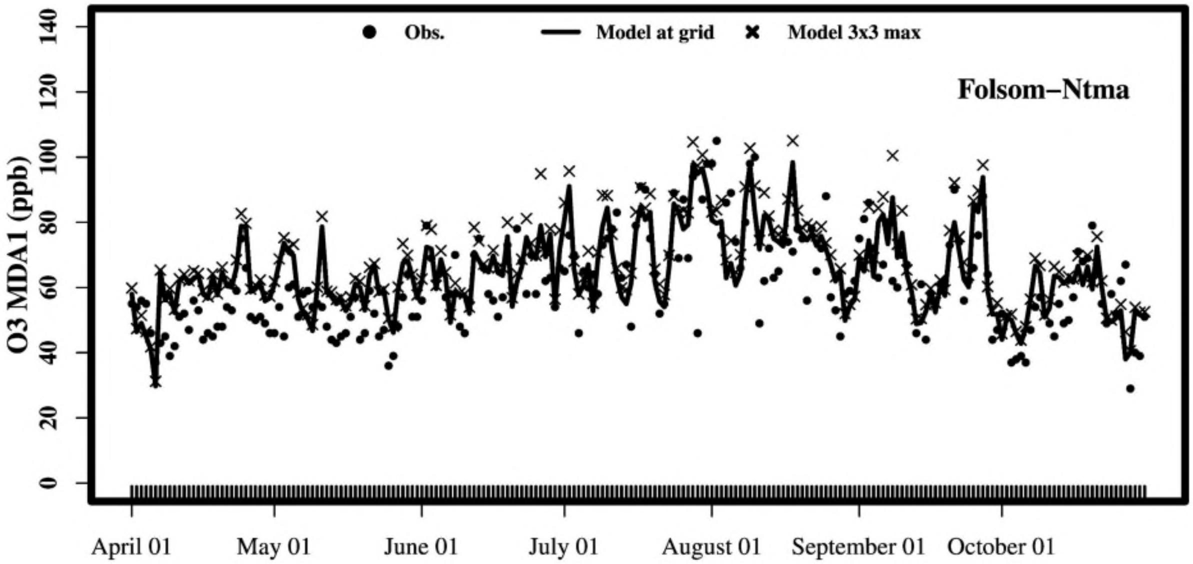

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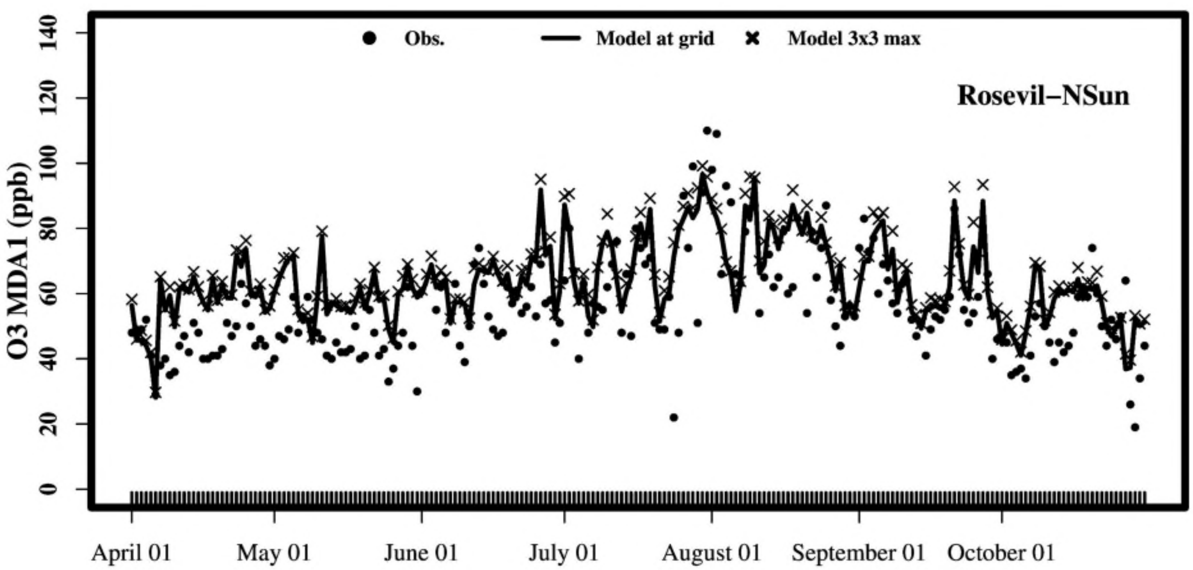

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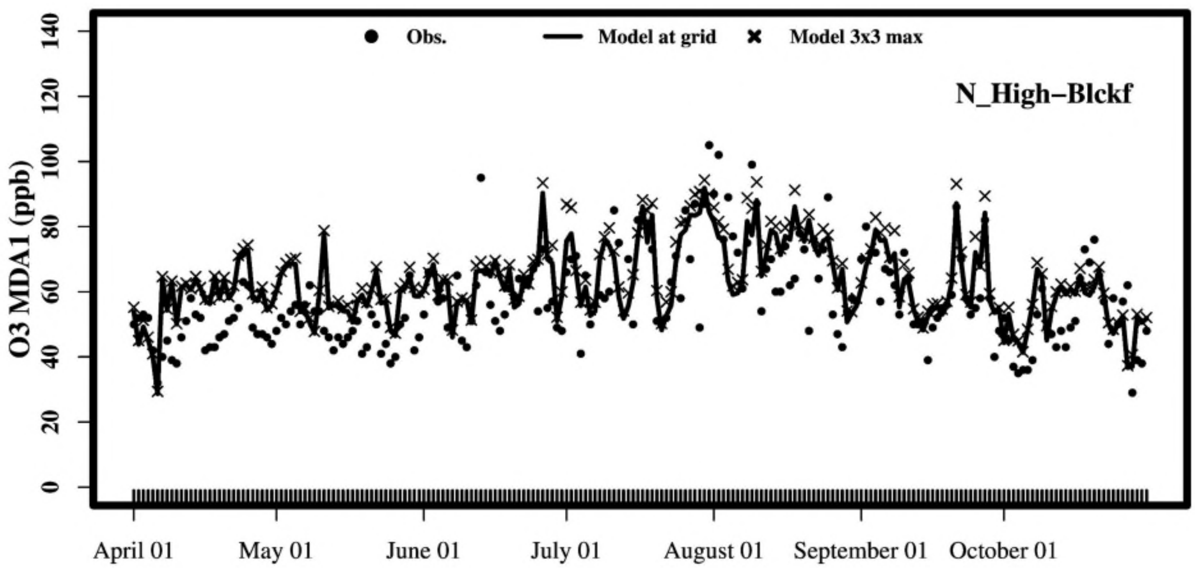

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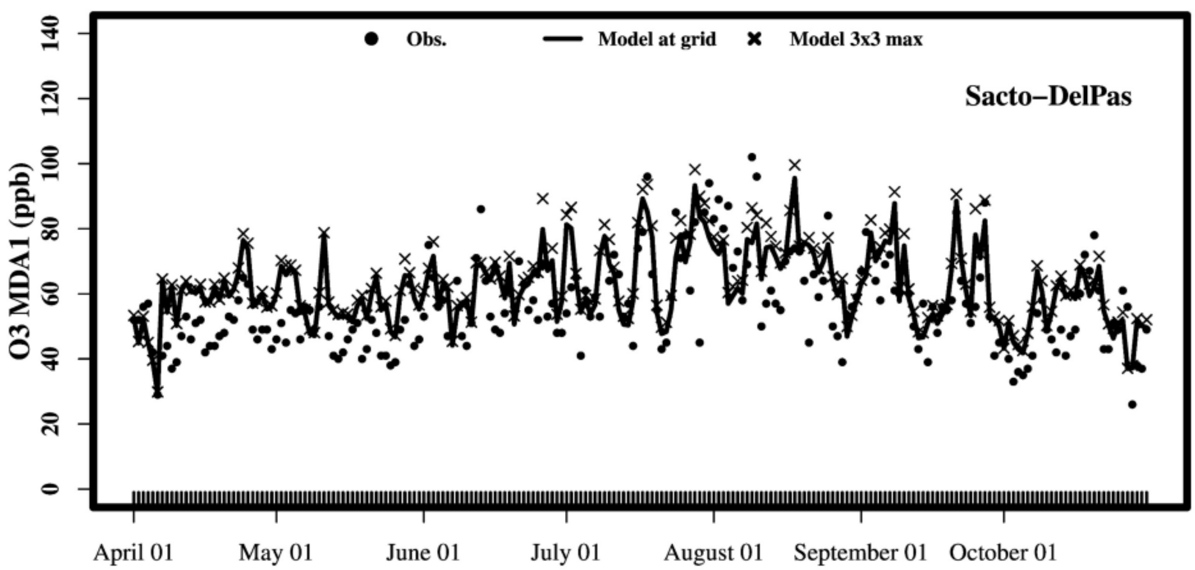

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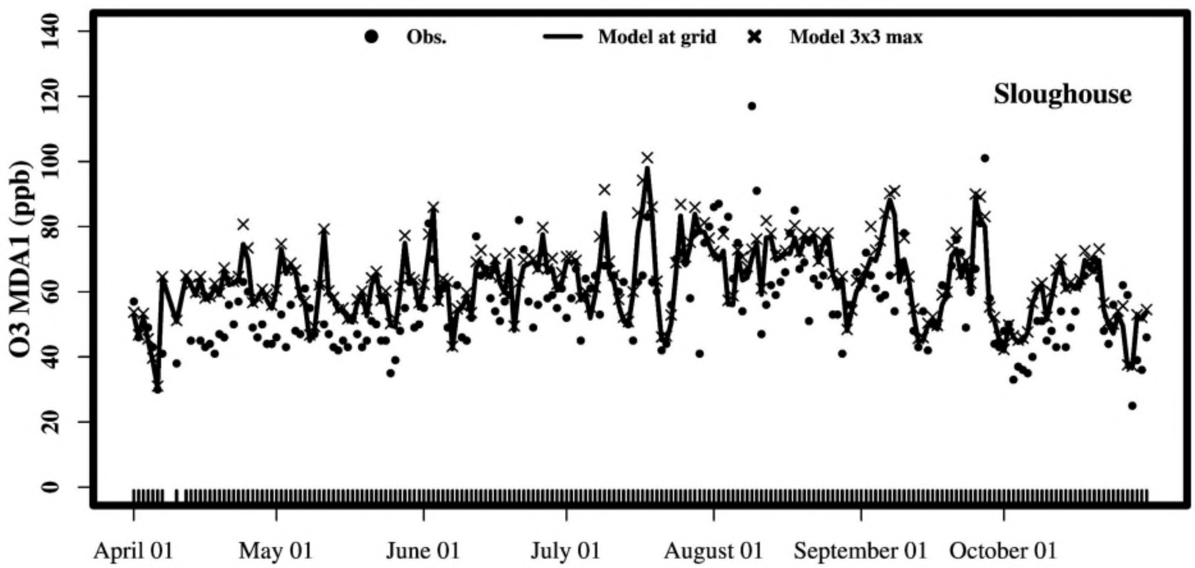

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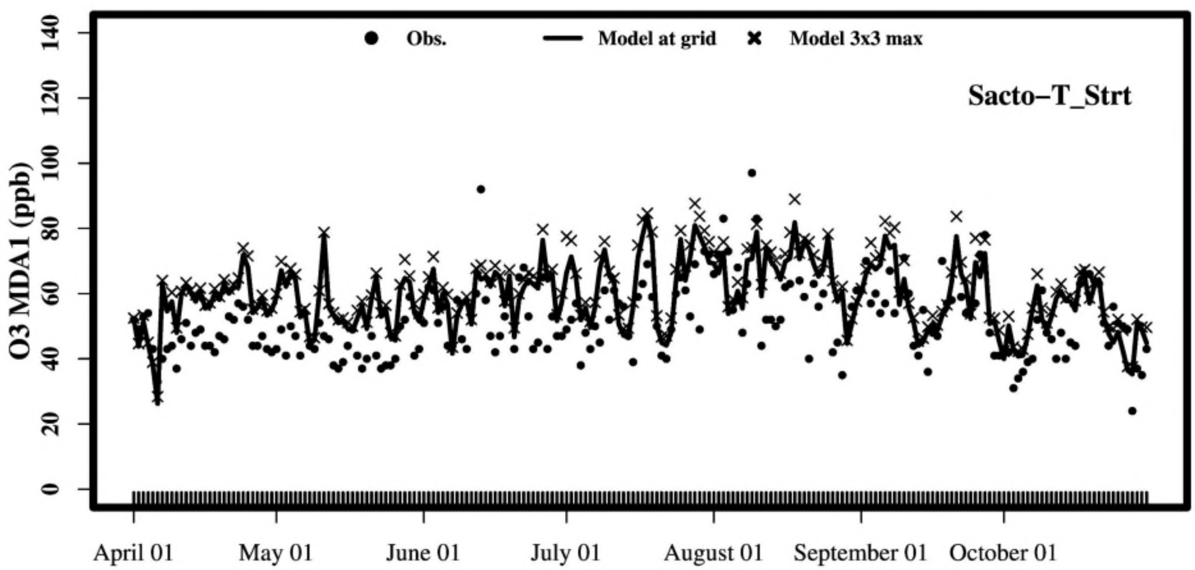

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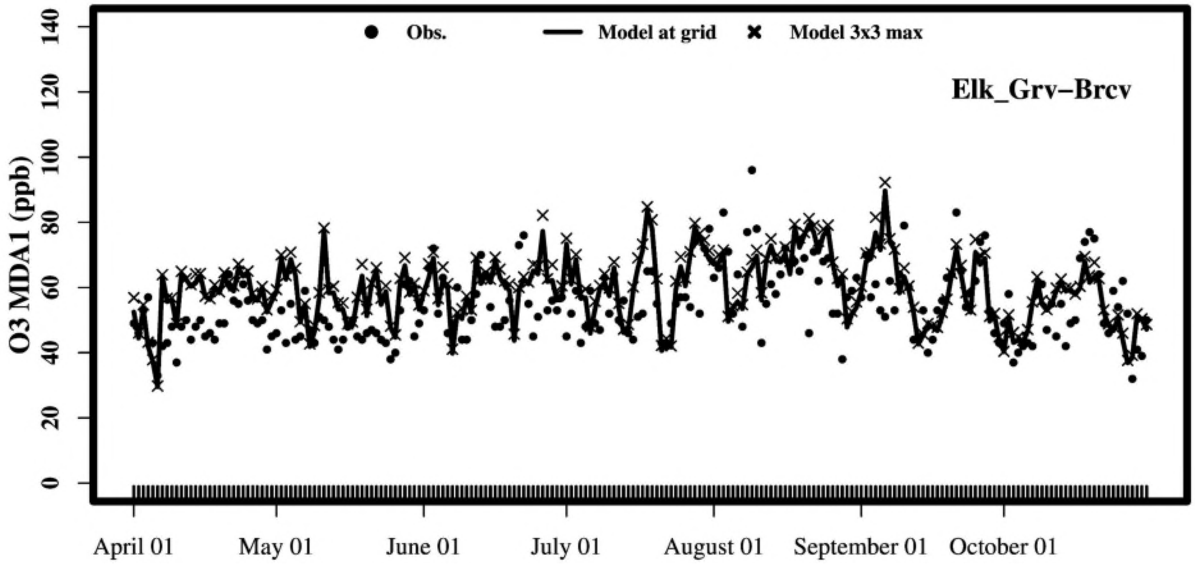

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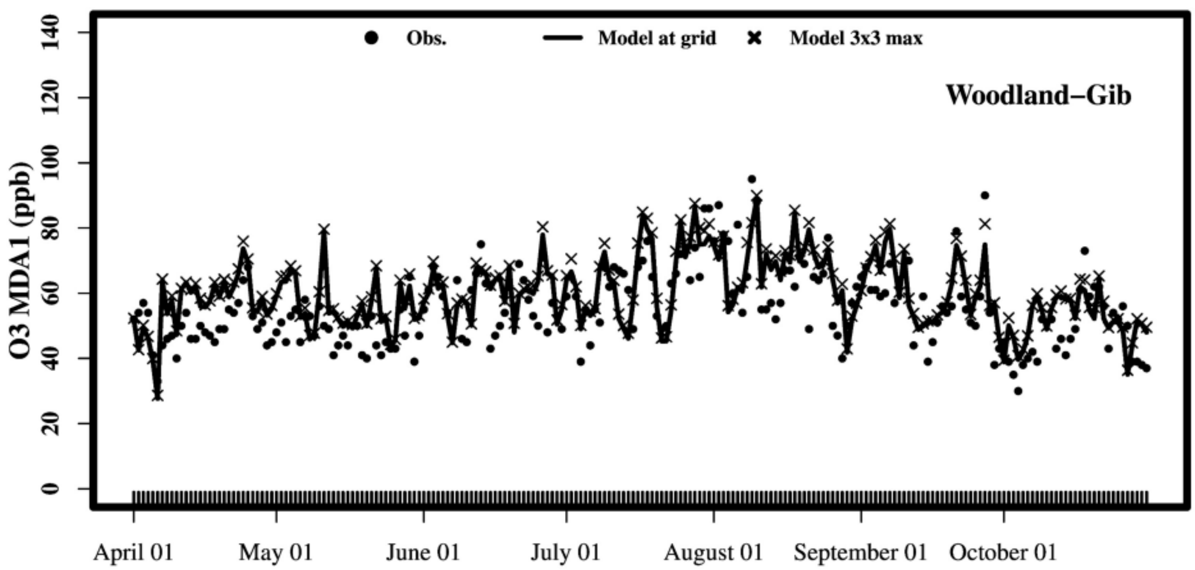

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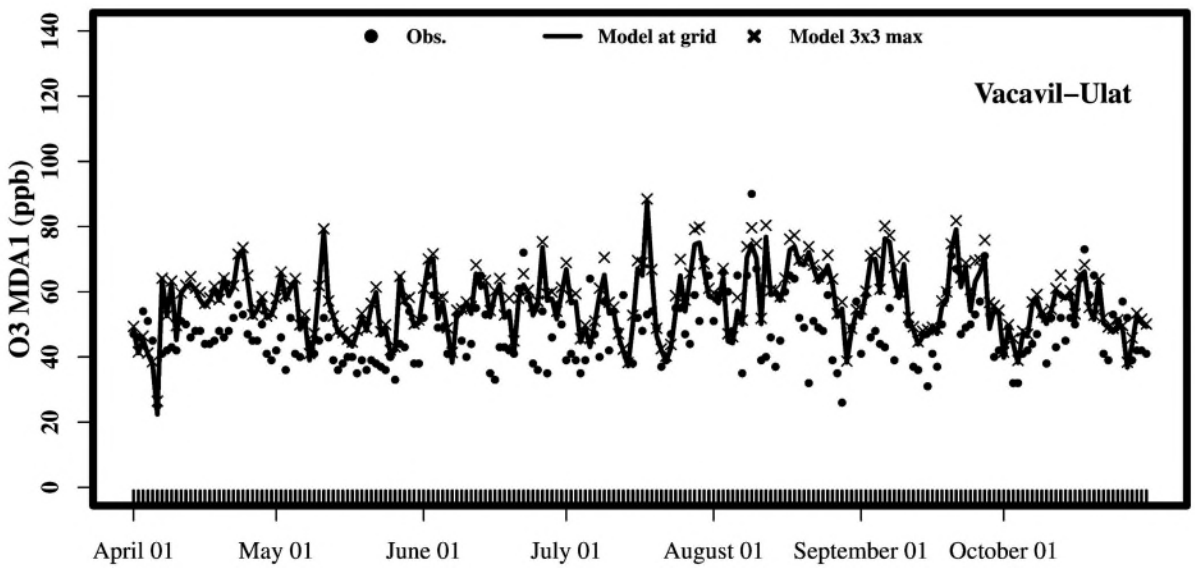

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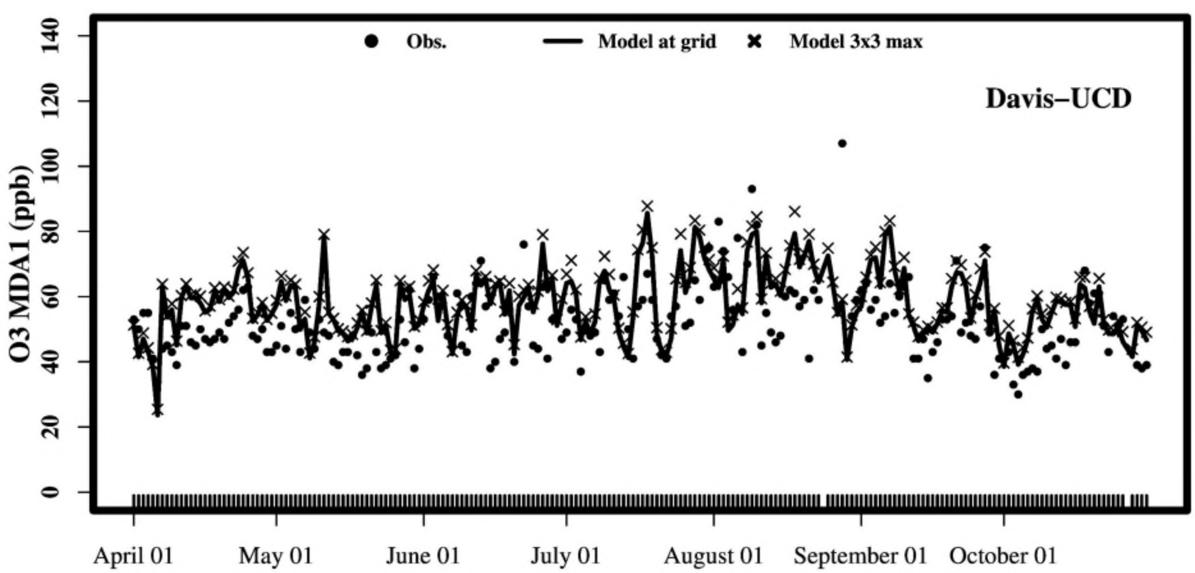

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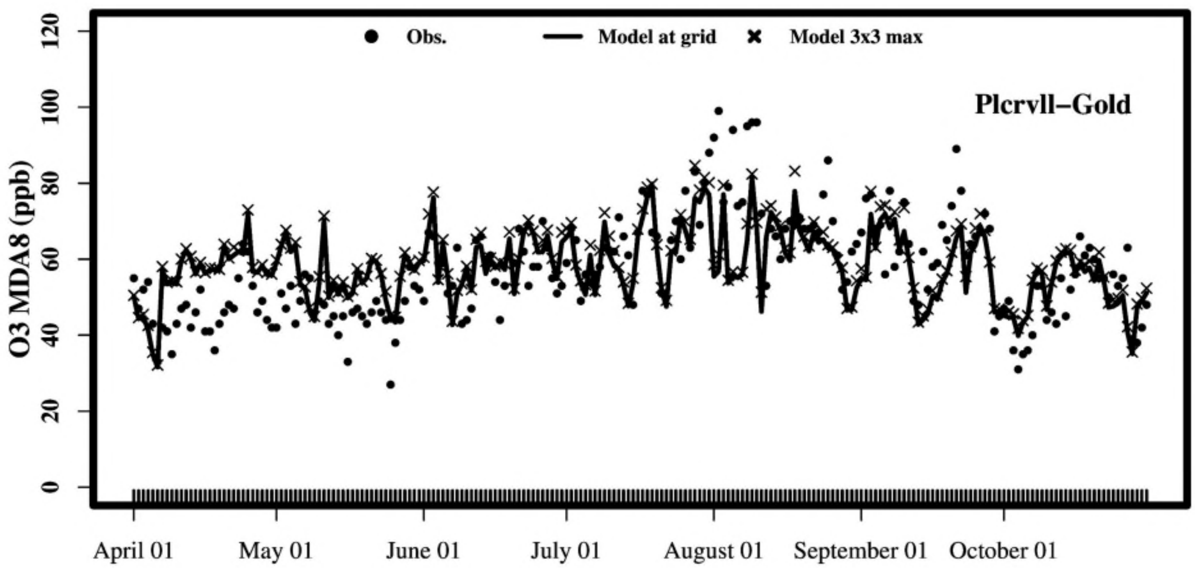

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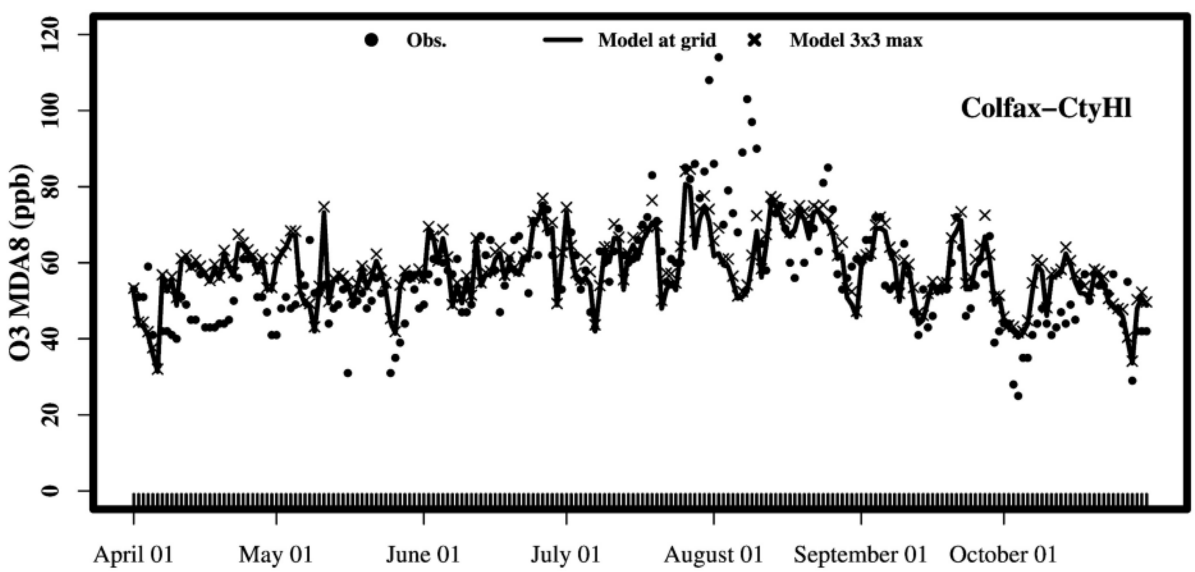

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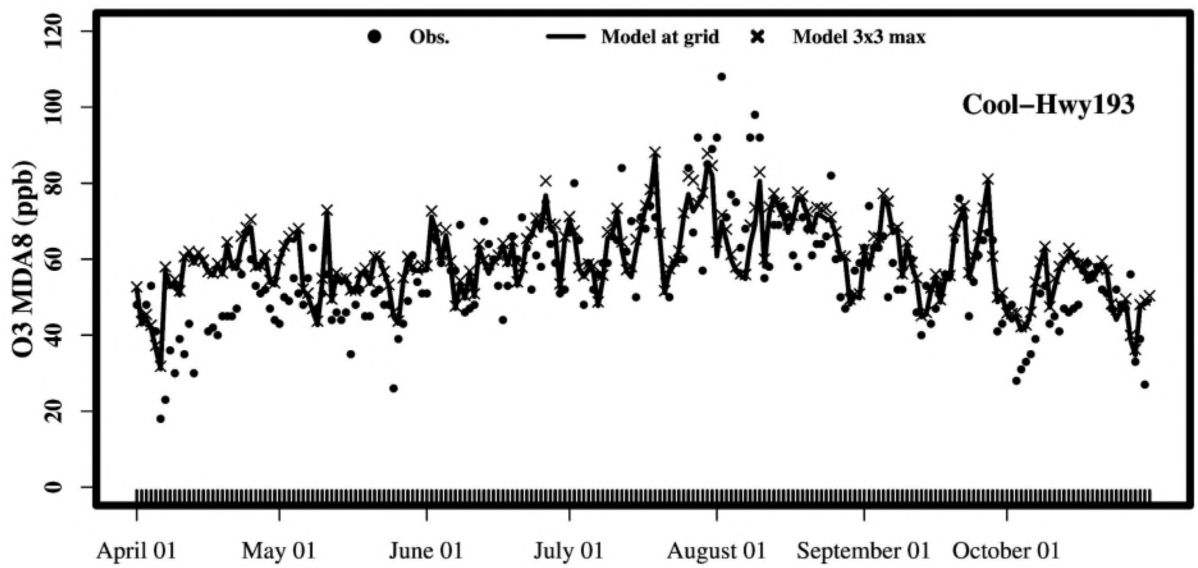

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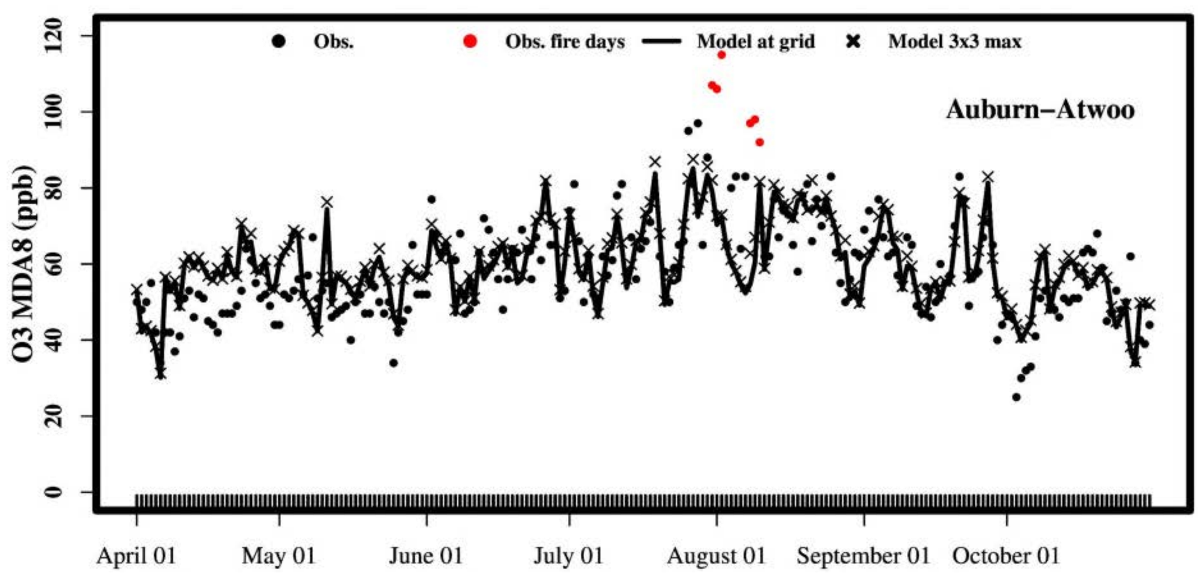

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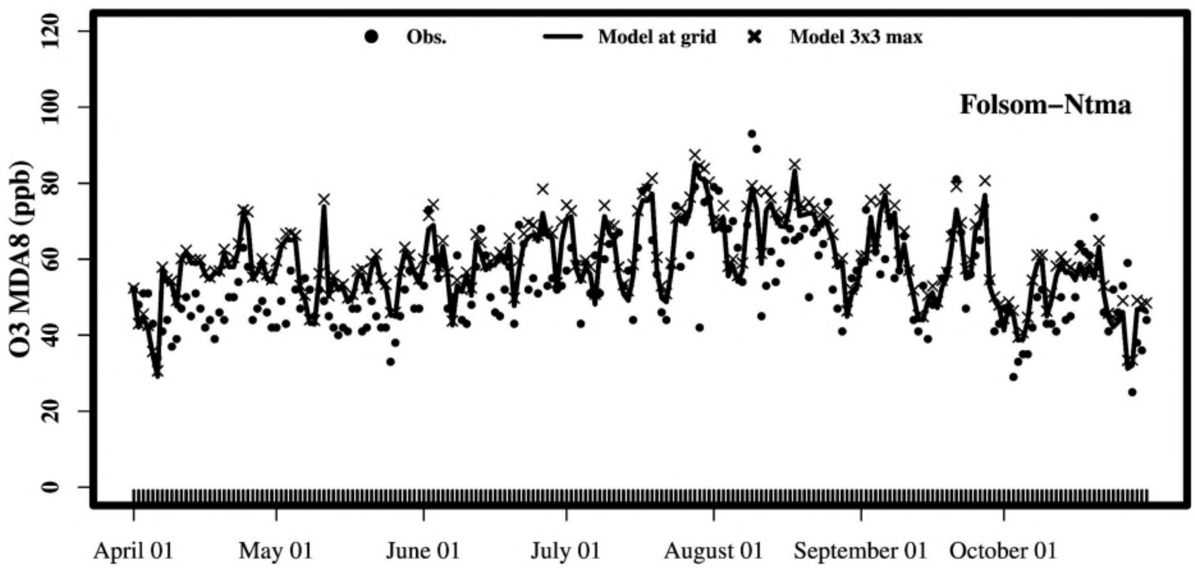

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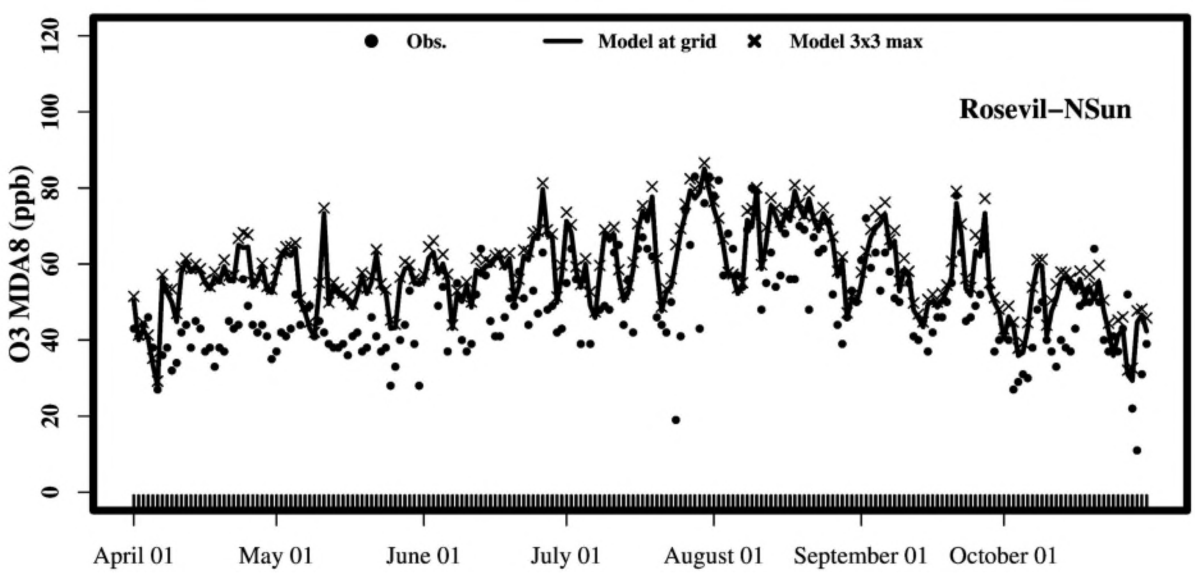

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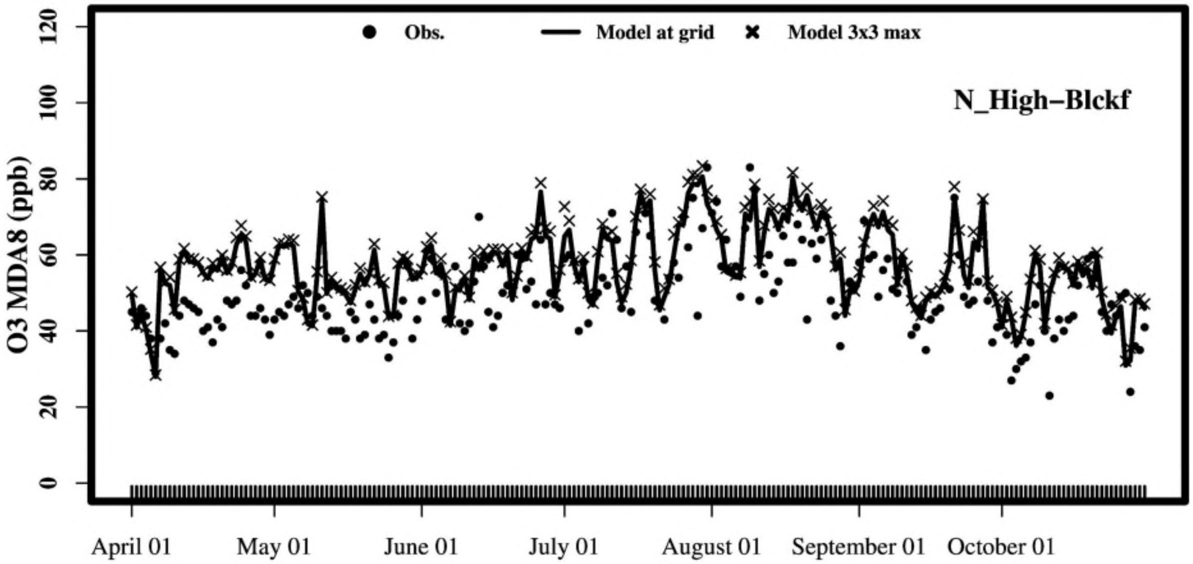

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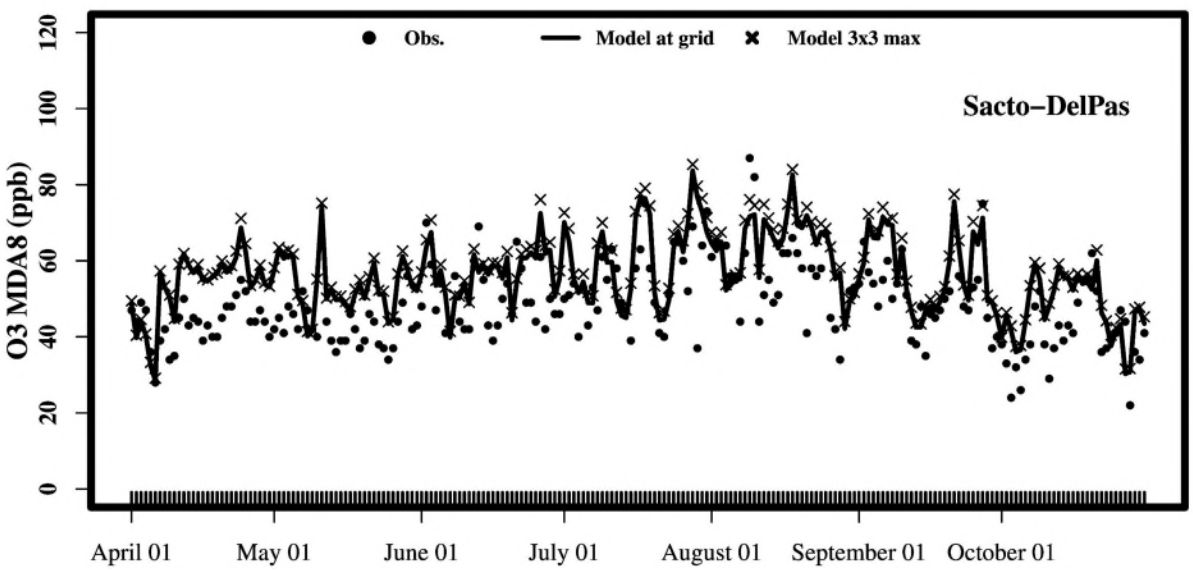

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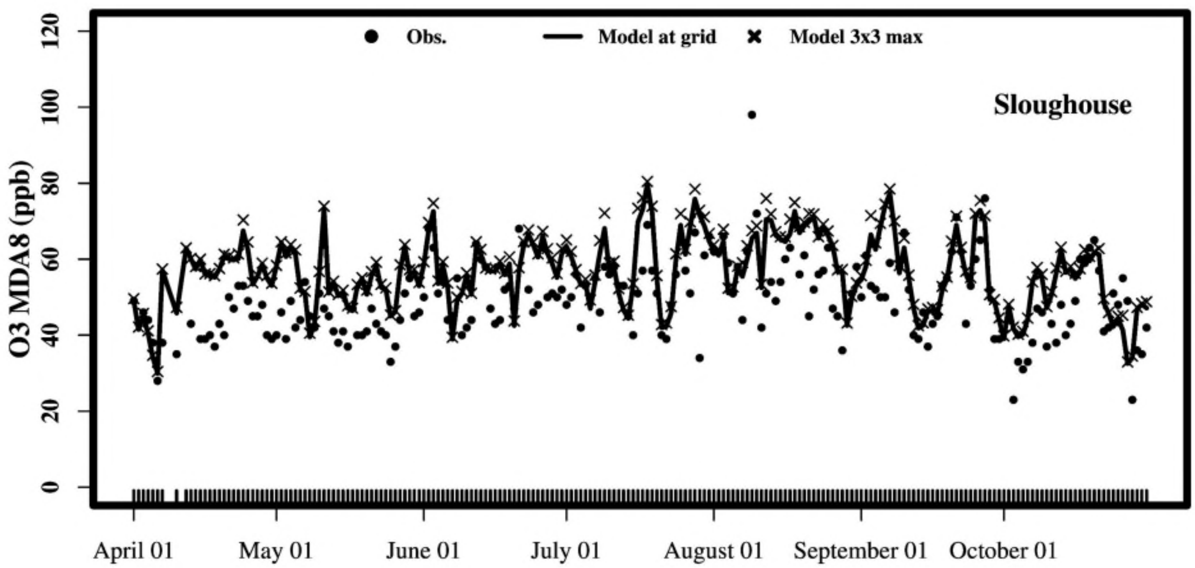


Figure S 55. Time-series of maximum daily average 8-hour ozone at Sacramento-TStreet for the ozone season (April – October 2018)

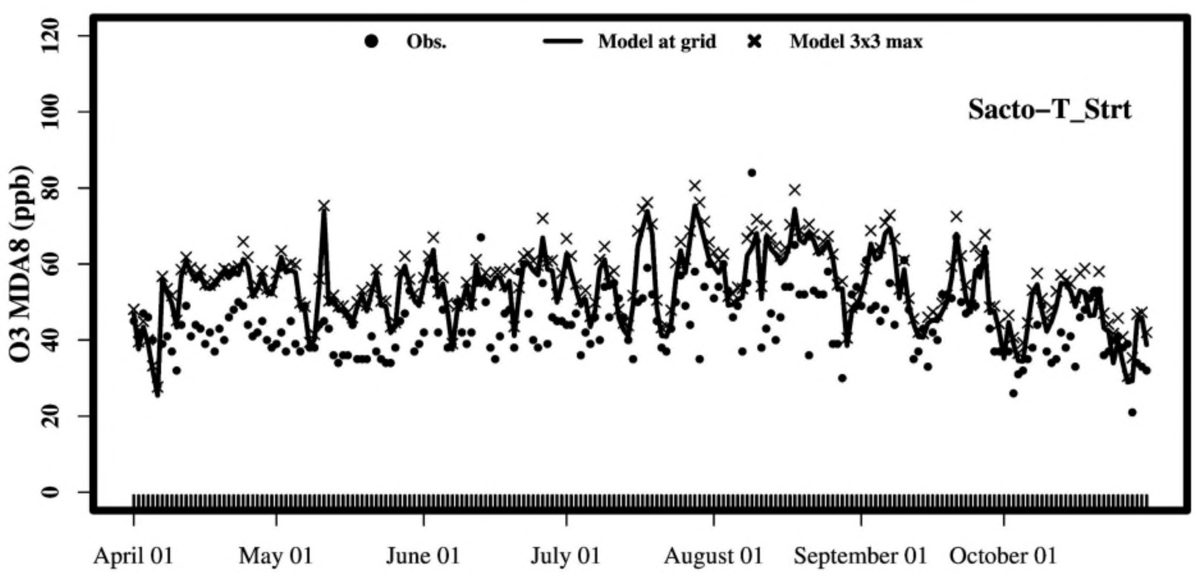


Figure S 56. Time-series of maximum daily average 8-hour ozone at Elk_Grove-Bruceville for the ozone season (April – October 2018)

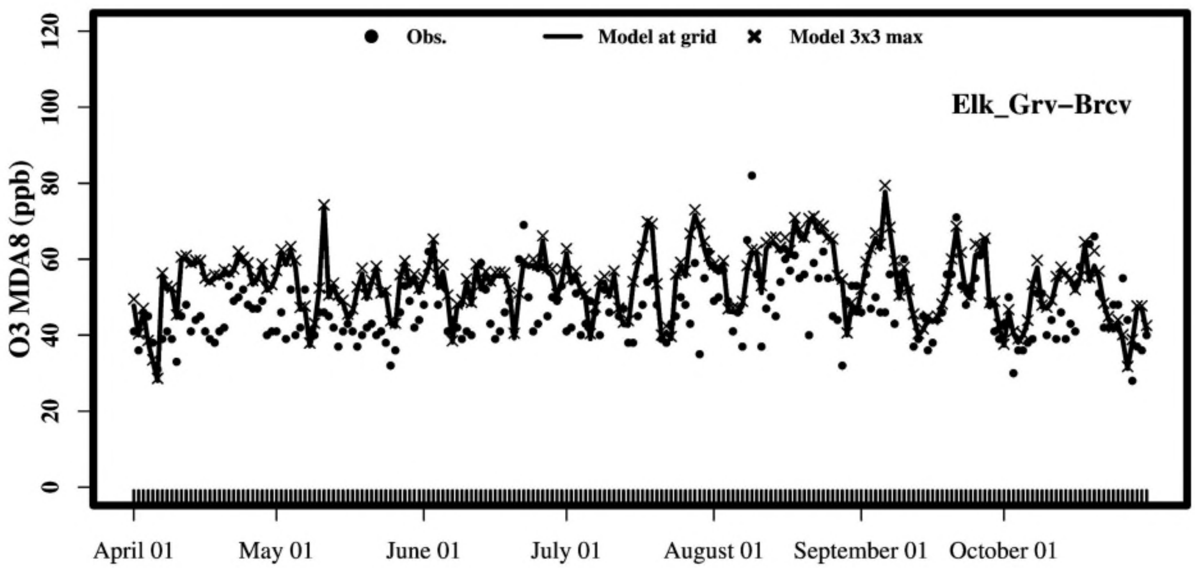


Figure S 57. Time-series of maximum daily average 8-hour ozone at Woodland-Gibson for the ozone season (April – October 2018)

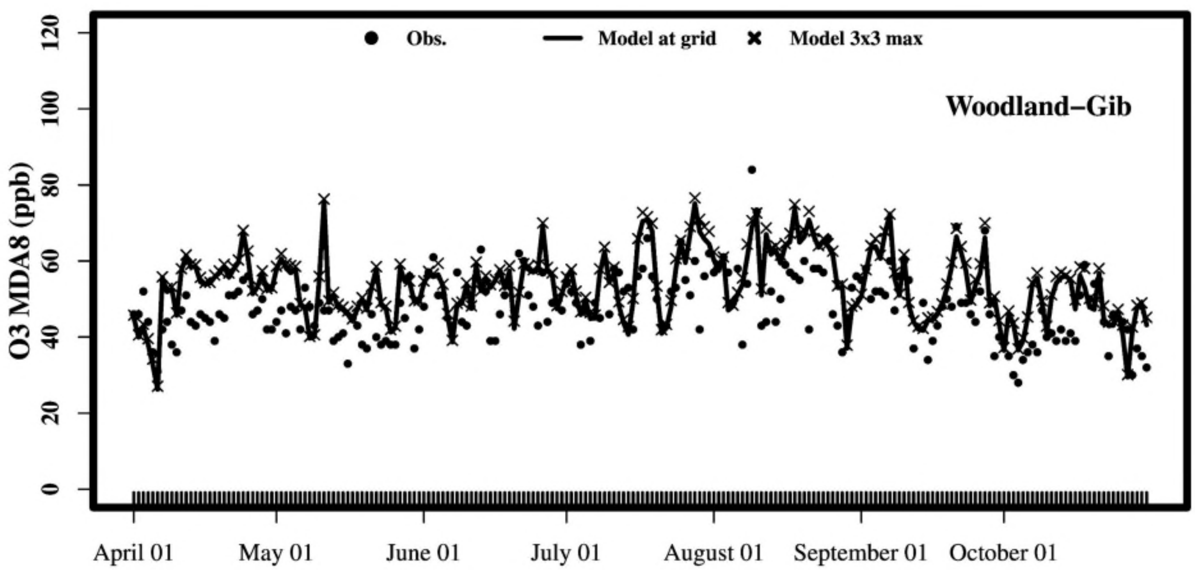


Figure S 58. Time-series of maximum daily average 8-hour ozone at Vacaville-Ulatis for the ozone season (April – October 2018)

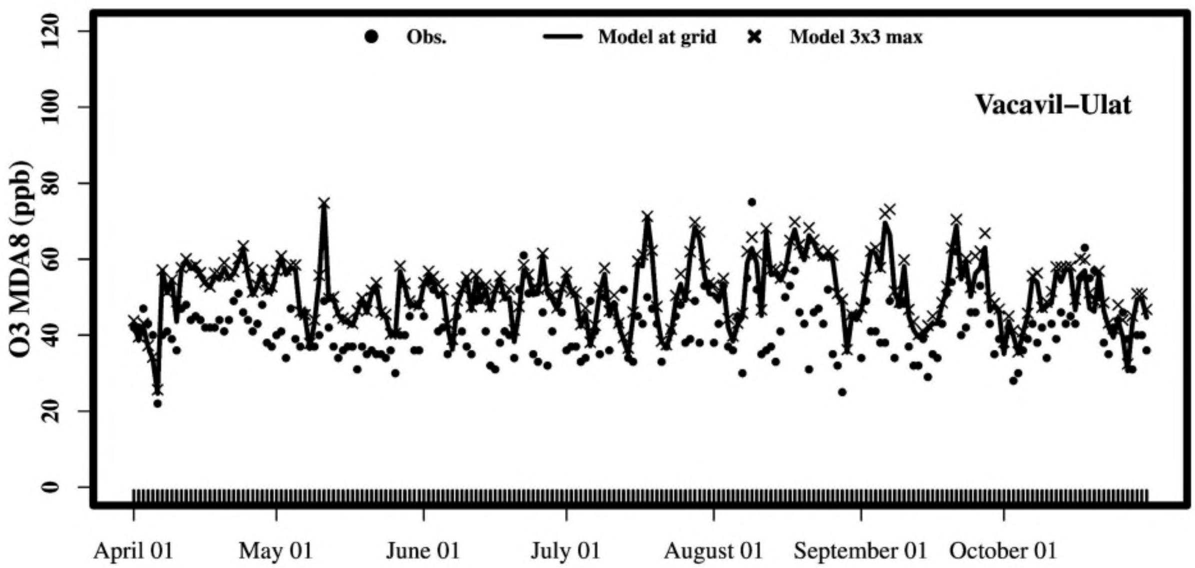


Figure S 59. Time-series of maximum daily average 8-hour ozone at Davis-UCD for the ozone season (April – October 2018)

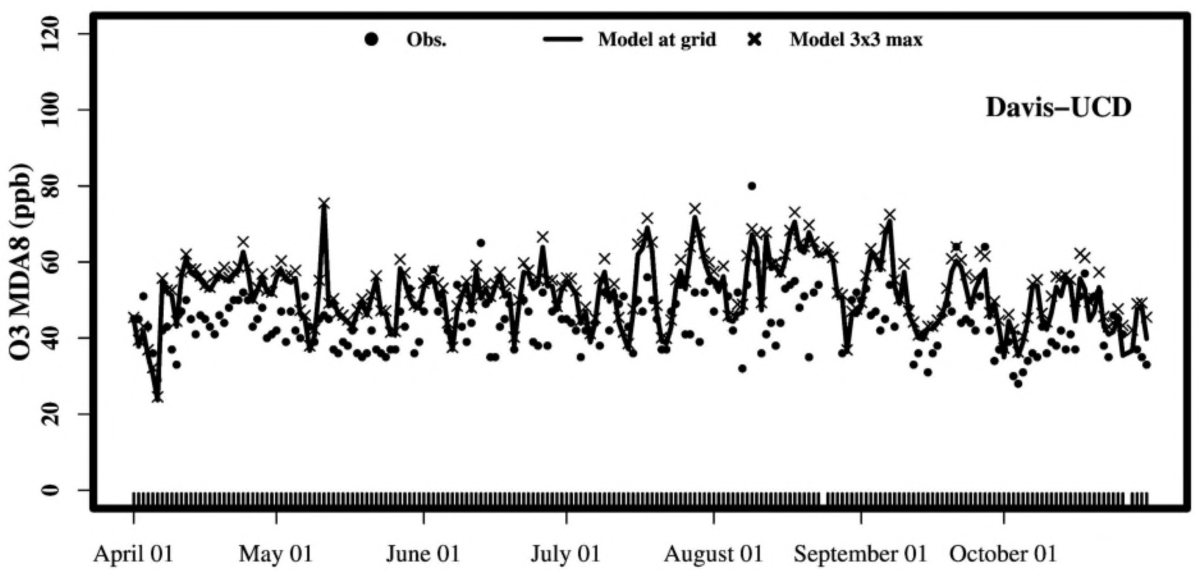


Figure S 60. Observed and modeled daily average NO_X scatter plot for the ozone season in the SFNA (April – October 2018)

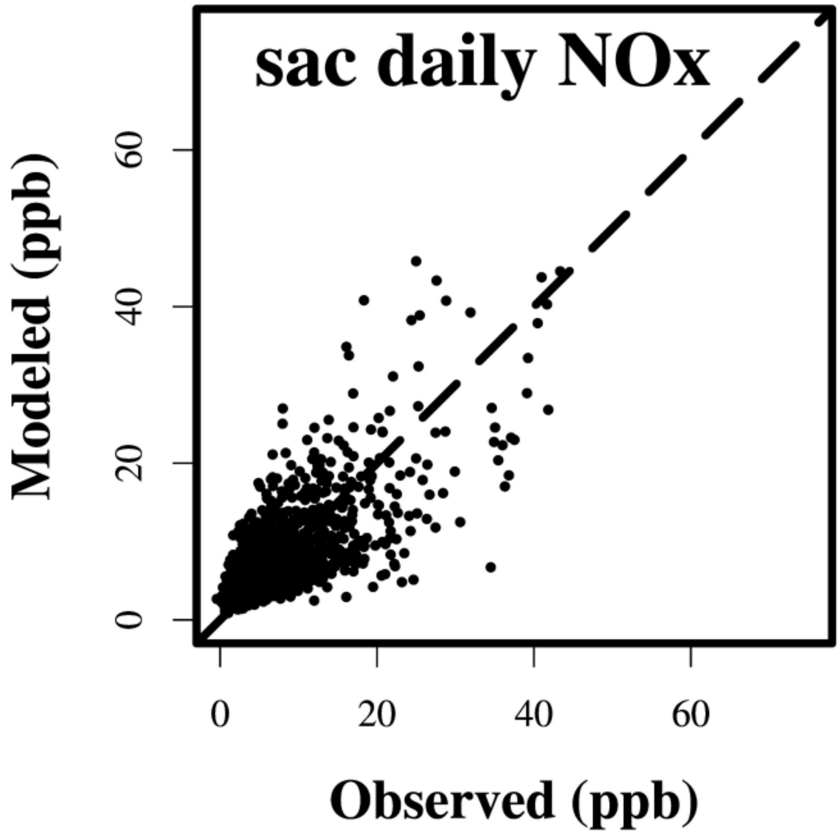
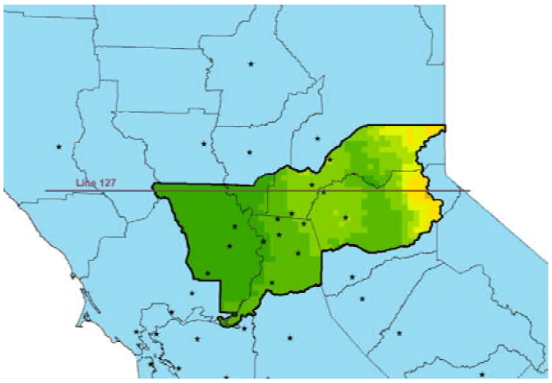


Figure S 61. Curtain plot of monthly averaged 8 hour O_3 concentrations in May 2018 and 2032 along row 127 of modeling domain.



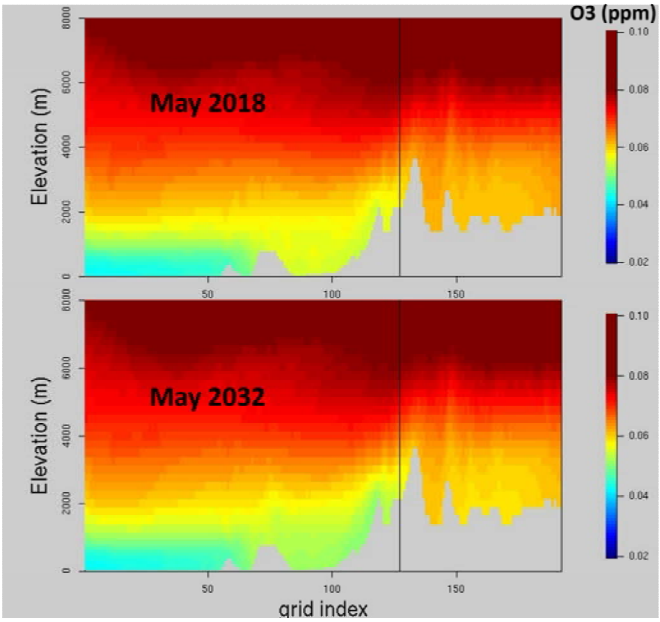


Figure S 62. Curtain plot of monthly averaged 8 hour O_3 concentrations in August 2018 and 2032 along row 127 of modeling domain.

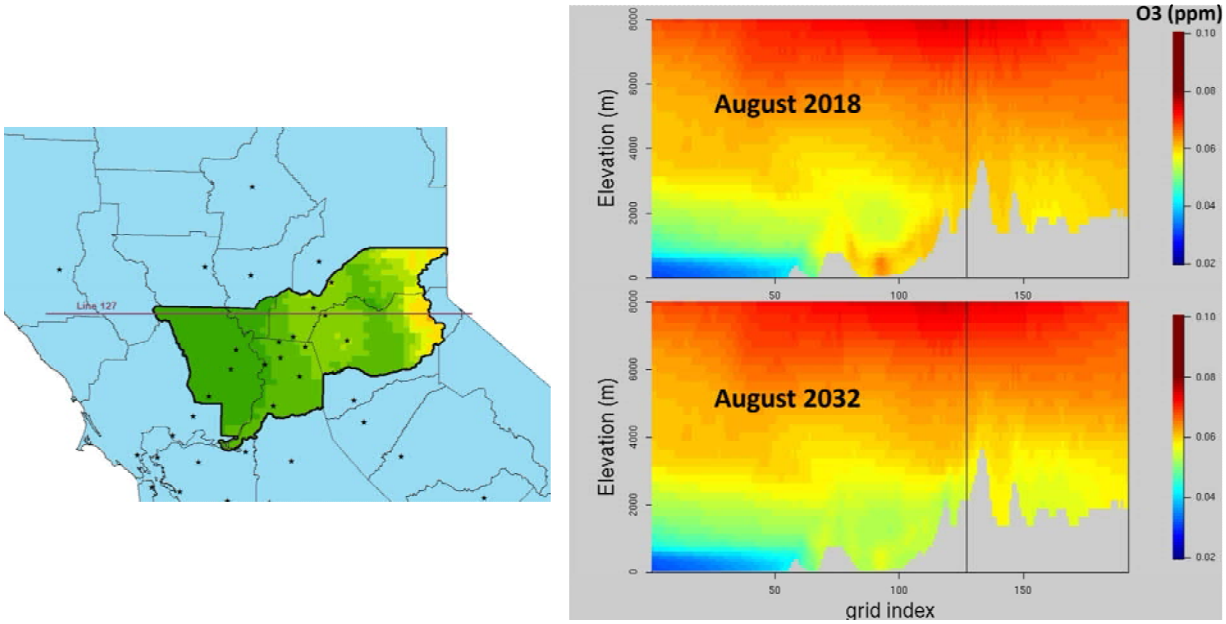
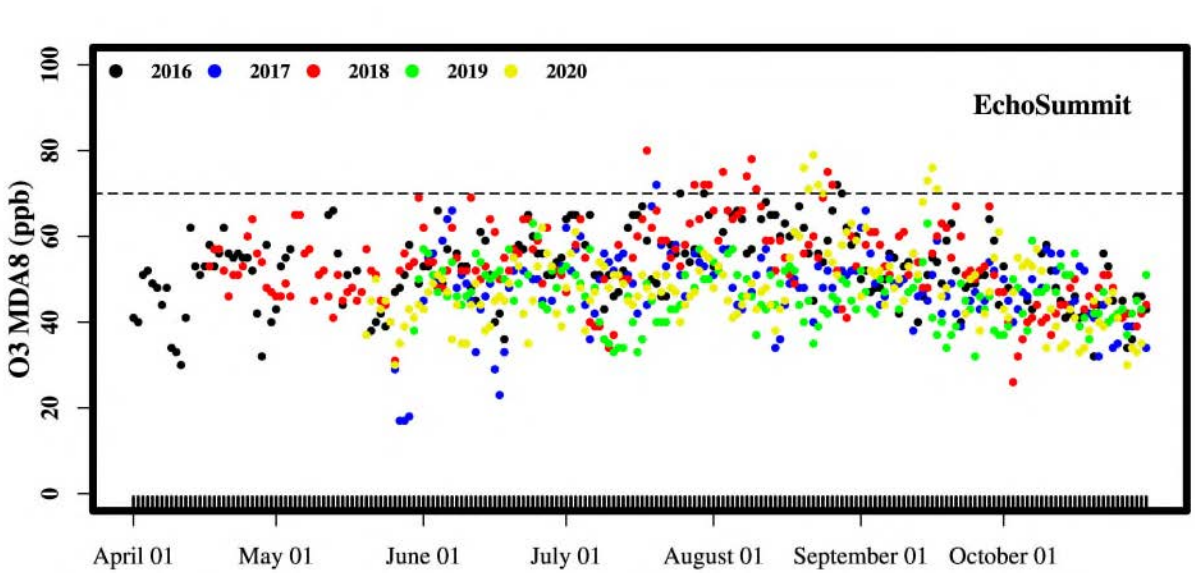


Figure S 63. Time Series of MDA8 O_3 in April to October during 2016 to 2020 at Echo Summit monitor



B.2 Modeling Emissions Inventory

Modeling Emission Inventory for the Sacramento Regional 2015 NAAQS 8-Hour Ozone Attainment and Reasonable Further Progress Plan

February 2023

CALIFORNIA
AIR RESOURCES BOARD

Acronyms

APCD – Air Pollution Control District

AQMD – Air Quality Management District

Caltrans – California Department of Transportation

CalVAD – California Vehicle Activity Database

CARB – California Air Resources Board

CCAQS – Central California Air Quality Studies

CCOS – Central California Ozone Study

CEIDARS – California Emission Inventory Development and Reporting System

CEMS – Continuous emissions monitoring system

CEPAM – California Emission Projection Analysis Model

CMAQ – Community Multi-Scale Air Quality

CRPAQS – California Regional PM10/PM25 Air Quality Study

EIC – Emission Inventory Code

EICSUM – EIC SUMmary category, the first three digits of EIC

ERG – Eastern Research Group

HD – Heavy Duty

I&M – Inspection and Maintenance

MPO – Metropolitan Planning Organization

NLCD – National Land Cover Database

NO_X – Oxides of Nitrogen

OGV – Ocean Going Vessel

PM – Particulate Matter

PM_{10} – Particulate Matter 10 micrometers in diameter and smaller

$PM_{2.5}$ – Particulate Matter 2.5 micrometers in diameter and smaller

ROG – Reactive Organic Gases

RRF – Relative Response Factor

RTPA – Regional Transportation Planning Agencies

RWC – Residential Wood Combustion

SAPRC – Statewide Air Pollution Research Center

SCC – Source Classification Code

SIP – State Implementation Plan

SIPIWG – State Implementation Plan Inventory Working Group

SJV – San Joaquin Valley

SMOKE – Sparse Matrix Operator Kernel Emissions

SSS – State SIP Strategy

TOG – Total Organic Gases

B.2.1 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 (SIPs) 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, *Criteria Pollutant Emission Inventory Data*. 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 processed to serve as the emission input for air quality models. The following sections of this document describe the methods used to prepare the base and future year emissions inventory estimates.

B.2.1.1 Inventory Coordination

Most of this inventory was developed in direct coordination with staff at the regional Air Pollution Control Districts across the state. 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 into early 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, San Diego, Bay Area, Imperial, South Coast, Ventura, and Sacramento.

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 10µm in diameter and smaller) /$PM_{2.5}$ (particulate matter 2.5µm in diameter and smaller) Air Quality Study (CRPAQS).

B.2.1.2 Background

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 United States (Nevada, Arizona, Oregon, Idaho, and Utah) 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 (EPA). 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 pollutants and their precursors 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 B.2.2.5. Additional information on CARB emission inventories can be found at *CARB Emission Inventory Activities*.

B.2.1.3 Inventory Years

The emission inventory scenarios used for air quality modeling must be consistent with U.S. EPA's Modeling Guidance (EPA). 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.

B.2.1.3.1 Base Case Modeling Inventory (2018)

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. Emissions for certain sectors are based on day-specific activities, meteorology, and emission adjustments. Actual district-reported point source emissions were gathered for the year 2017 and forecasted to 2018. The year 2018 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 resulting in a comprehensive emissions inventory for 2018.

B.2.1.3.2 Reference Year Modeling Inventory (2018)

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 2018 reference year inventory represents typical average conditions and emission patterns through the 2018 design value period. This reference emissions inventory is not developed to capture all day-specific emission characteristics; however, this reference inventory does include meteorological effects for 2018 (e.g., temperature, relative humidity, and solar insolation), as well as certain day-specific emission activities, such as agricultural and prescribed burning.

B.2.1.3.3 Future Year Modeling Inventory (2032)

Future year modeling inventories, along with the reference year modeling inventory, are used in the model-derived RRF calculation. Projected inventory year 2032 was chosen to address the modeled attainment year for the 8-hour 2015 ozone standard of 70 ppb.

These inventories maintain the "typical," average patterns of the 2018 reference year modeling inventory. Some sectors of the 2032 inventories include temporal variations that were driven by temperature, relative humidity, and solar insolation effects from reference year (2018) meteorology. Future year point and area source emissions are projected from the 2017 baseline emissions. Future year on-road emission inventories are used as projected by EMFAC.

B.2.1.4 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 B-23 illustrates an enlarged image of the Sacramento Nonattainment area in California (highlighted in yellow) in the statewide 4 km modeling grid.

Figure B-22. Figure B-23 illustrates an enlarged image of the Sacramento Nonattainment area in California (highlighted in yellow) in the statewide 4 km modeling grid.

Figure B-22. Spatial coverage of emissions grid with nonattainment area highlighted in yellow

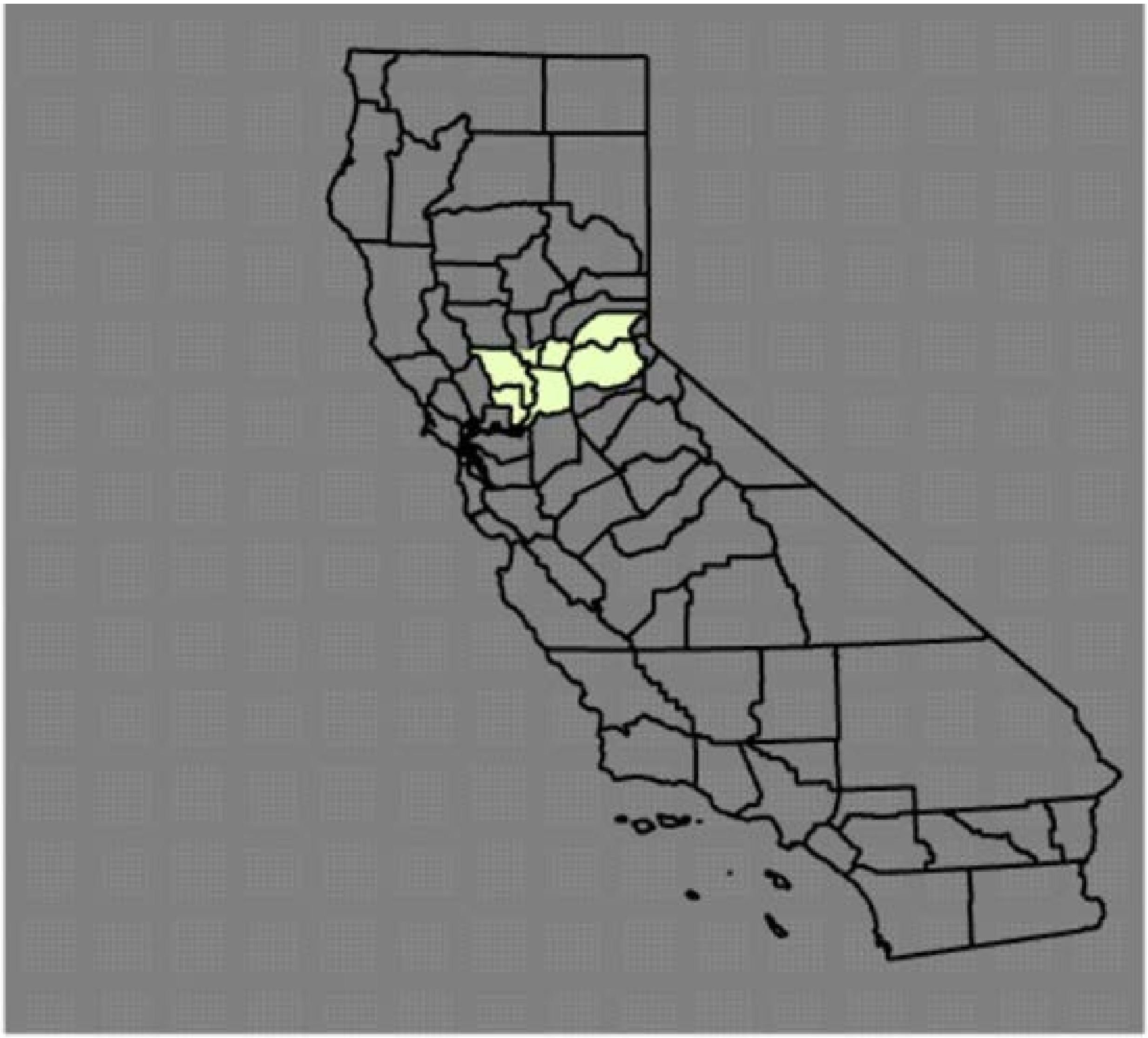
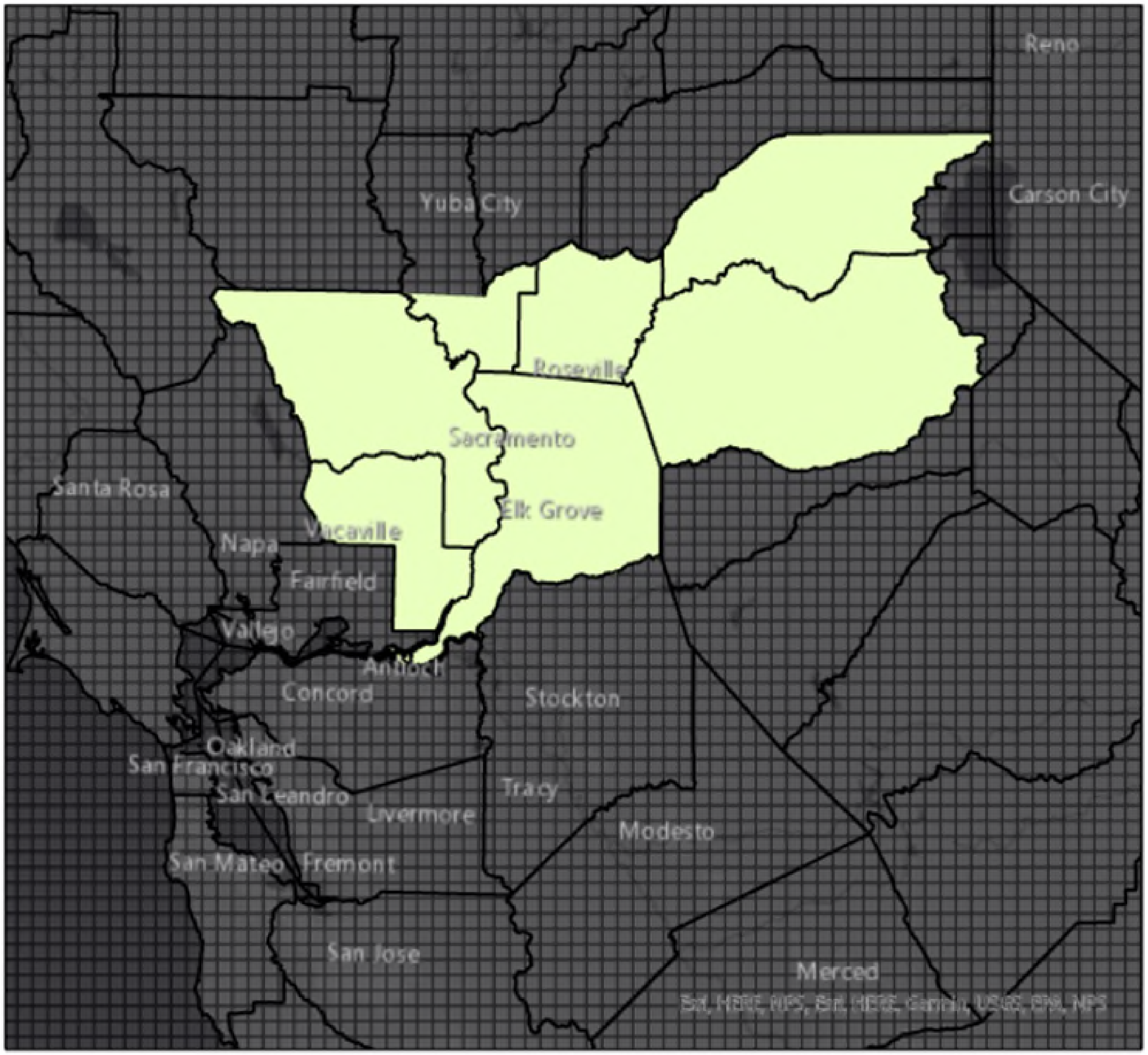


Figure B-23: Sacramento Nonattainment area highlighted in California with statewide 4 km grid overlayed



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 specifications for the statewide modeling domain are summarized in Table B-16.

Table B-16: Modeling domain parameters

Parameter	Statewide domain
Map Projection	Lambert Conformal Conic
Datum	None (Clarke 1866 spheroid)
1st Standard Parallel	30.0° N
2nd Standard Parallel	60.0° N
Central Meridian	-120.5° W
Latitude of projection origin	37.0° N
Coordinate system Units	Meters
Semi-major axis	6370 km
Semi-minor axis	6370 km
Grid size	4 km x 4 km
Number of cells	291 x 321 cells
Lambert origin	(-684,000 m, -564,000 m)
Geographic center	-120.5° Lat and 37.0° Lon

B.2.2 Estimation of Base Year Modeling Inventory

As mentioned in Section B.2.1.3.1, 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.

B.2.2.1 Terminology

The terms “point sources” and “area sources” are often confused. Traditionally, these terms have had different meanings to the developers of planning emissions inventories and the developers of modeling emissions inventories. Table B-17 summarizes the difference in the terms as both sets of terms are used in this document. In modeling terminology, “point sources” traditionally refers to elevated emission sources that exit from a stack and have an associated plume rise. The current inventory includes emissions sources reported by the Air Pollution Control District (APCD). Those sources associated with a facility are treated as either elevated sources or non-elevated. The emissions processor calculates plume rise for elevated sources; non-elevated sources are treated as ground-level sources. Examples of non-elevated emissions sources include landfills and composting facilities. “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 B-17: 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.

B.2.2.2 Emissions Inventory

Modeling emissions are based on the CEPAM inventories for the base year and future year. Since the modeling inventory was processed in parallel to the application of updates to CEPAM the modeling inventory was patched from CEPAM 2019 v1.03 for the following source sectors:

- Off-Road SORE (small off-road engines) rule as adopted by the Board December 2021
- Cargo Handling Equipment (CHE)
- Construction “In Use” Equipment
- Large Spark Ignition (LSI) Forklifts
- Forestry Equipment
- Industrial/Military Rail
- Additional adjustments for Ground Support Equipment (GSE) in South Coast

The resulting modeling inventory matches totals from CEPAM 2019 v1.04.

B.2.2.3 Temporal Distribution of Emissions

The emissions are temporally resolved by month, week, day, and hour to more accurately gauge model performance and ultimately 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 B.2.3.2, B.2.3.3, and B.2.3.5. The temporal distribution of residential wood combustion (RWC) and agricultural ammonia sectors are described in Section B.2.3.6.4 and Section B.2.3.6.5, 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.

B.2.2.3.1 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.

B.2.2.3.2 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 B-18 shows the current DPWK codes.

Table B-18: 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 weekdays, none on Saturday and Sunday	1	1	1	1	1	0	0
6	Six days per week - Uniform activity on weekdays, none 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

Code	WEEKLY CYCLE CODE DESCRIPTION	M	T	W	TH	F	S	S
21	Uniform activity on Saturday and Sunday, half as much activity on weekdays	5	5	5	5	5	10	10
22	Uniform activity on weekdays, reduced activity on weekends	10	10	10	10	10	7	4
23	Uniform activity on weekdays, reduced activity on weekends	10	10	10	10	10	8	8
24	Uniform activity on weekdays; half as much activity on Saturday. Little activity on Sunday	10	10	10	10	10	5	1
25	Uniform activity on weekdays, one third as much on Saturday, little on Sunday	10	10	10	10	10	3	1
26	Uniform activity on weekdays, little activity on Saturday, no activity on Sunday	10	10	10	10	10	3	0
27	Uniform activity on weekdays, half as much activity on weekends	10	10	10	10	10	5	5
28	Uniform activity on weekdays, 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, and Sunday	8	8	8	8	10	10	10

B.2.2.3.3 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 B-19 displays the daily variation factors or current HPDY codes. Code 33 is no longer used for residential fuel combustion in favor of day specific adjustments see Section B.2.3.6.4. Additional temporal profiles are shown in Sub-Appendix B.C.

Table B-19: 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
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

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
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	0	0	0	0	0	0	0	2	4	6	7	9	10	10	10	10	10	10	10	7	5	3	1	0

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
	EVENING AND MORNING HOURS (RECREATIONAL BOAT EXHAUST)																								
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

B.2.2.4 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. 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 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 geographically. Sonoma Technology, Inc. (STI) (Funk, et al., 2001) under 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.

Four basic types of data are used to develop the spatial allocation factors: land use and land cover, satellite imagery, 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 activities (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 (MPOs) or Regional Transportation Planning Agency (RTPA), 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 Sacramento O_3 SIP emission inventory is defined as snapshot October 1st, 2021 (SNP20211001_SORE) with improvements to SORE categories. Detailed methodology for each surrogate can be found in the spatial surrogate methodology document (AMSS, Spatial Surrogate Methodology Document SNP2021-10-01). This working snapshot includes all previous updates noted in surrogate snapshot

2020-10-01 (AMSS), as well as recent improvements outlined below. A summary of the primary spatial surrogates by EICSUM is provided in Sub-Appendix B.D.

- Improvements to small off-road equipment (SORE) surrogates
    - Creation of SNOW-level allocation factors for single family housing and commercial activity related to locations that will only occur with snowfall (snowblowers, etc.).
    - Creation of forest roads spatial surrogate (191) based on the integration of NLCD forest data with the TIGER road network
- Updated to 2016 National Land Cover Database
- Improvements to the Dunn and Bradstreet based surrogates with integration of Digital Maps Products 2017 Parcel data
- Updates to ocean going vessel surrogates based on 2018 Automatic Identification System (AIS)
- Improvement to construction surrogates
    - Creation of a 90:10 ratio split of on-road to offroad construction surrogate
- Improvements to agriculture surrogates
    - Updated input data for Farm Road VMT and inclusion of California Department of Pesticide Regulation (CDPR) data
    - Updated input data to our poultry related surrogate from California Water Board, Southern California Association of Governments (SCAG), and San Diego Association of Governments (SANDAG)
- Creation of a Water bodies and Land mask to remove anomalies caused by AIS satellite bias.

B.2.2.4.1 Spatial Allocation of Area Sources

Area-wide emissions are modeled using a top-down approach where emission totals are estimated for a large geographic area of interest (GAI). Each area source category is assigned a primary spatial surrogate that is used to allocate emissions to a grid cell in CARB’s 4 km 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.

B.2.2.4.2 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. Stationary point sources with stacks are regarded as 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 that will receive the CMAQ in-line plume rise treatment, and group together sources with nearly identical stack parameters 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.

B.2.2.4.3 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 final 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 B.2.3.6.1.

B.2.2.4.4 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 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 the National Oceanic and Atmospheric Administration (NOAA) which reflects anchorage locations codified in the Federal Register.

B.2.2.4.5 Spatial Allocation of On-road Motor Vehicles

The spatial allocation of on-road motor vehicles is based on data from the latest travel demand models provided by local Metropolitan Planning Organizations (MPOs). These model outputs are combined into a statewide transportation network using the Integrated Transportation Network (ITN). For areas without a regional travel demand model, data from the California Department of Transportation (Caltrans) California Statewide Travel Demand Model (CSTDM). For more details, see Section B.2.3.2.3.

B.2.2.5 Speciation Profiles

CARB's emission inventory lists the amounts 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, NO_X, SO_X, total organic gases (TOG) and particulate matter (PM). CO and NH_3 each are single species; NO_X emissions are composed of NO, NO_2 and HONO; and SO_X 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. 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 most current OG profiles and PM profiles are available for download from *CARB's speciation profile web page*. 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 on the *Consolidated List for Speciation Profiles site*. 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 and can also be used for regional toxics modeling. Speciation profiles need to be as complete and accurate as possible. CARB has an ongoing effort to update speciation profiles as data become available through testing of emission sources or surveys of product formulations. New speciation data generally undergo technical and peer review; updates to the profiles are coordinated with end users of the data. The recent additions to CARB's speciation profiles include:

- 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
- PM profiles
    - Tire burning

- o Gasoline vehicle exhaust
- o On-road diesel exhaust
- o Off-road diesel exhaust
- o Ocean going vessel exhaust
- o Aircraft exhaust
- o Concrete batching
- o Commercial cooking
- o Residential fuel combustion-natural gas
- o Coating/painting
- o Cotton ginning
- o Stationary combustion
- o OGV auxiliary boiler combustion
- o Compressed Natural Gas (CNG) vehicle running exhaust

B.2.3 Methodology for Developing Base Case, Baseline, and Future Projected Emissions Inventories

As mentioned in Section B.2.1.3, 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 B.2.3.6. Sections B.2.3.1 through B.2.3.8 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.

B.2.3.1 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 (https://www.cmascenter.org/smoke/). The current SIP modeling uses SMOKE v4.8 (referred as Official SMOKE hereafter) following in-house testing of this version of the software.

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 B.2.4.1. 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 B-18 and Table B-19 are reformatted into an input-ready format as explained in the SMOKE user's manual. Chemical speciation profiles, as described in Section B.2.2.5, 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 NO_X, SO_X, TOG, and PM to produce the species needed by photochemical air quality models.

Emissions for area sources are allocated to grid cells defined by the modeling grid domain in Section B.2.1.4. Emissions are spatially disaggregated using spatial surrogates as described in Section B.2.2.4. 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.

B.2.3.2 Estimation of On-road Motor Vehicle Emissions

B.2.3.2.1 General Methodology

The EMFAC2017 with Metropolitan Planning Organizations specific activity version 10 (MPOv10) 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 *GitHub repository for Emissions Spatial and Temporal Allocator*.

B.2.3.2.2 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. Parameters such as vehicle mix and VMT are compared between the default EMFAC and Caltrans databases prior to spatial allocation to ensure values lie within reasonable limits.

B.2.3.2.3 Spatial Adjustment

CARB works with local Metropolitan Planning Organizations (MPOs) to obtain the latest available output from regional travel demand models. The output link networks from these models are combined into a statewide link network using the Integrated Transportation Network (ITN) framework (CARB). For regions where no local travel demand model data are available, data from the Caltrans California Statewide Travel Demand Model (CSTDM) are used (Caltrans). Data are quality assured by checking network/link volume, vehicle miles traveled (VMT), and spatial rendering. Overlapping networks are checked for duplicate links to avoid overallocation in these regions. Model output years vary between all regional data sources for ITN. The networks are normalized into modeling years used for air quality modeling using county level growth factors from EMFAC. Table B-20 contains the data vintages used in the current working version of the statewide ITN.

Spatial allocation of on-road activity surrogates is split into two vehicle groups, light-duty and heavy-duty. Some major MPOs and Caltrans provide vehicle classification splits in their model link outputs. When possible, this information is incorporated into the ITN.

However, when no vehicle splits are provided by the regional models the total network volumes must be used for both light-duty and heavy-duty spatial distribution. Travel demand model output provides network volume information organized by peak and off-peak time periods. This peak period volume information is disaggregated to create 24 hourly surrogates for an average modeling day.

The link networks are processed through the spatial allocator tool to create gridded surrogates weighted by VMT.

Table B-20: Network information for data sources used in current version of ITN

Network	Counties in Network	Data Vintage
Association of Monterey Bay Area Governments (AMBAG)	Monterey, San Benito, Santa Cruz	2018 RTDM
Butte County Association of Governments (BCAG)	Butte	2020 RTP/SCS
California Statewide Travel Demand Model (CSTDM)	Statewide	Version 3.0
Fresno Council of Governments (FCOG)	Fresno	2019 RTP/SCS
Kings County Association of Governments (KCAG)	Kings	2018 RTP/SCS
Kern Council of Governments (KCOG)	Kern	2018 RTP/SCS
Merced County Association of Governments (MCAG)	Merced	2018 RTP/SCS
Madera County Transportation Commission (MCTC)	Madera	2018 RTP/SCS
Metropolitan Transportation Commission (MTC)	Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma	2017 RTP/SCS
Sacramento Area Council of Governments (SACOG)	El Dorado, Placer, Sacramento, Solano, Sutter, Yolo, Yuba	2020 MTP/SCS
San Diego Association of Governments (SANDAG)	San Diego	2018 RTP/SCS
Santa Barbara County Association of Governments (SBCAG)	Santa Barbara	2017 FSTIP
Southern California Association of Governments (SCAG)	Imperial, Los Angeles, Orange, Riverside, San Bernardino, Ventura	2020 RTP/SCS
San Joaquin Council of Governments (SJCOG)	San Joaquin	2018 RTP/SCS
San Luis Obispo Council of Governments (SLOCOG)	San Luis Obispo	2019 RTP
Shasta Regional Transportation Agency (SRTA)	Shasta	2018 RTP
Stanislaus Council of Governments (StanCOG)	Stanislaus	2018 RTP
Tulare County Association of Governments (TCAG)	Tulare	2018 RTP
Tahoe Metropolitan Planning Organization (TMPO)	El Dorado, Placer	2015 FSTIP

Evaporative surrogates were created using registration data from the California Department of Motor Vehicles (DMV). Vehicle registration was provided by census block group for the entire state. Registration data were split into five vehicle types and two fuel types. Table B-21 shows the vehicle type categories used for the evaporative emission surrogates. Registration counts were totaled over a three-year period (2015-2018) and assigned to the corresponding census block group polygons. Data from the NASA Nighttime Lights (Mills, Weiss and Liang) dataset was used to clip the census block group into areas with active population.

Table B-21: Registration data vehicle type classes.

Vehicle Class Group Name	**Description**
MC	Motorcycles
MH_BUS	Motorhomes and Buses
P	Passenger Vehicles
T1_T4	Light-Heavy Duty Trucks
T5_T7	Heavy-Heavy Duty Trucks

B.2.3.2.4 Temporal Adjustment (Day-of-week adjustments for EMFAC daily totals)

EMFAC2017 produces average day-of-week (DOW) estimates that represent Tuesday, Wednesday, and Thursday. 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 California Vehicle Activity Database (CalVAD) data. The 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 latest activity from the CalVAD database was released in 2012. There are no expected upcoming updates. 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 can’t 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. To fill the missing 24 counties’ data to cover all of California, a county which is nearby and similar in geography is selected to represent 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 B-22 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 Sub-Appendix B.A.

Heavy-heavy duty vehicle fractions were updated using 2018 Performance Measurement System (PeMS) data. Truck volumes were pulled for each county. Day of year specific fractions were calculated relative to an average weekday for each county. Fractions were manually reviewed by staff to check data integrity. Counties without data or poor data quality were screened out and replaced with an older version of fractions from CalVAD.

Table B-22: Vehicle classification and type of adjustment

Vehicle Class	Vehicle type	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

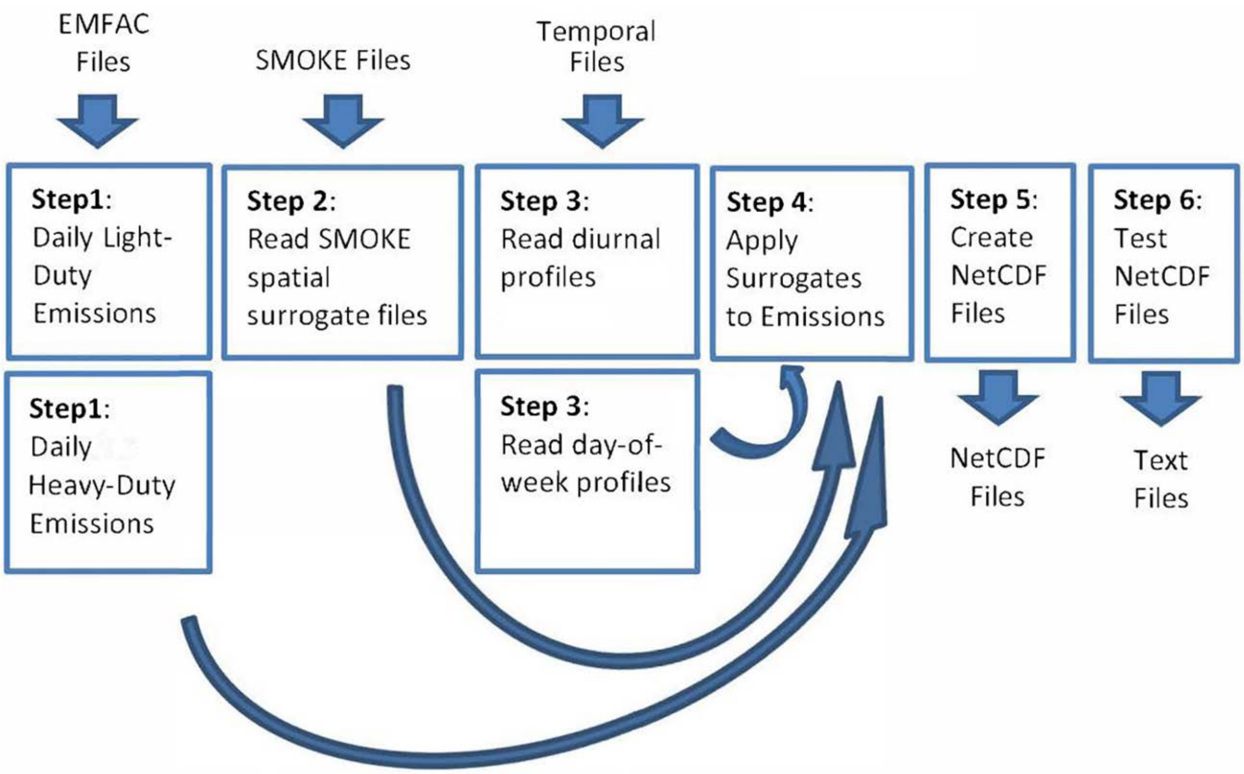
B.2.3.2.5 Temporal Adjustment (Hour-of-day profiles for EMFAC daily totals)

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. Heavy-heavy duty hourly vehicle fractions were updated using 2018 Performance Measurement System (PeMS) data from Caltrans in counties where data were available. The hour-of-day profiles for passenger cars (LD), light- and medium-duty trucks (LM), and heavy heavy-duty trucks (HH) can be found in Sub-Appendix B.B.

B.2.3.2.6 Summary of On-road Emissions Processing Steps

The six steps to process on-road emissions for regional air quality modeling with CMAQ are represented below in Figure B-24. 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 B-24: Workflow for spatial and temporal allocation of on-road emissions



B.2.3.2.7 Adjustment to the Future Year On-road Emissions

The future year on-road mobile source emissions were adjusted to incorporate emission reduction programs for heavy duty vehicles. The reductions applied to the inventory reflect the Low NO_X Standard (CARB, Heavy-Duty Low NOx), Advanced Clean Truck (ACT) (CARB, Advanced Clean Trucks), and Heavy Duty Inspection and Maintenance Regulation (CARB, Heavy-Duty Inspection and Maintenance Regulation). The combined factors for 2026 are shown in Table B-23.

Table B-23: NO_X reductions (TPD) by Air Basin for 2026 and 2032

Region	2026 Reductions (Tpd)	2032 Reductions (Tpd)
El Dorado	0.16	0.27
Placer	0.75	1.46
Sacramento	1.66	2.82
Solano	0.96	2
Sutter	0.08	0.18
Yolo	0.5	1
Total Statewide reductions	65.8	117.29

B.2.3.3 Estimation of Gridded Biogenic Emissions

Biogenic emissions were generated using the MEGAN3.0 biogenic emissions model (https://bai.ess.uci.edu/megan/versions). 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 2018 (https://earthdata.nasa.gov/). 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 (https://archive.USGS.gov/archive/sites/landcover.USGS.gov/green_veg.html). 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 (https://www.itreetools.org/tools/i-tree-eco). Hourly meteorology was provided by 4-km WRF simulations for 2018, and all stress factor adjustments were turned off.

B.2.3.4 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 aircraft emissions during landing, taxiing, and take-off, and converts this data into gridded, hourly emissions as follows:

- Read aircraft emissions from an annual inventory
- Split the emissions into hourly components
- Split any county-wide emissions into individual runways
- Geometrically model the 3D flight paths at each runway
- Intersect the above 3D paths with the 3D modeling grid
- Distribute the hourly aircraft emissions into the 3D grid

More information on GATE is available at the following *GitHub repository for GATE*.

B.2.3.5 Estimation of Ocean-going Vessel (OGV) Emissions

Annual emissions are provided through CEPAM for commercial and military OGV. The Mobile Source Analysis Branch compiled port activity data for 2016 reported for 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 monthly and weekly temporal profiles for OGV sources. 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). For transit, maneuvering, and anchorage, emissions are distributed evenly in two vertical layers (2 and 3) (Kwok).

B.2.3.6 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, 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.

B.2.3.6.1 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, Gong and Scott). 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 (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, Clinton and Pu).

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.

B.2.3.6.2 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. However, the sectors that have been embedded in any CEPAM version are already pre-adjusted. The unadjusted emissions are what is required before making any adjustment. Therefore, the unadjusted paved road dust is based upon CEPAM SIP2019v1.02-v1.01, while the unadjusted unpaved road dust uses an older CEPAM version with 20161130 snapshot. To adjust for precipitation, daily precipitation data for 2018 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.

When 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 matrices.

B.2.3.6.3 Agricultural Burning

Agricultural burn 2018 data processed were reported by air districts. The tons burned provided by the air districts were converted to acres using fuel loading data. 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 and then projected onto a statewide grid for each hour of a specific day.

B.2.3.6.4 Residential Wood Combustion Curtailment

Emissions were reduced to reflect residential wood curtailment (RWC) in San Joaquin Valley APCD and Sacramento Metropolitan AQMD.

A pre-SMOKE utility program called GenTpro is used to generate county-specific temporal profiles based on average temperature by grid cell (UNC Chapel Hill - The Institute for the Environment). Emissions for any given county are only allocated whenever the daily average temperature by grid cell is below 50 °F based on WRF simulated meteorology.

San Joaquin Valley APCD provided areas of curtailment, which are used to mask the spatial surrogates for woodstoves and fireplaces. The masked surrogates were used to apply day-specific curtailment. The corresponding complimentary surrogates were also constructed by subtracting the masked surrogates from the original spatial surrogates. These complimentary surrogates apply to areas without curtailment. For winter months (January, February, November, December) SJVAPCD provided no-burn days by county, from which day-specific CNTLMAT curtailment files were constructed. With these settings, processing of winter months using SMOKE is enabled by merging the outputs of two separate runs. The first run is for the portion with masked surrogates with curtailment via CNTLMAT, and the second run is for the portion that includes complimentary surrogates without curtailment. For non-winter months, SMOKE is only run once with the original spatial surrogates without any curtailment. When curtailment is applied to any county in SJV, wood burning emissions are reduced by 51%.

Areas under Sacramento Metropolitan AQMD (SMAQMD) have their RWC emissions reduced by 70% (i.e. 30% remaining) whenever no-burn days are designated. Curtailment is applied to the full spatial surrogates without exceptions.

B.2.3.6.5 Estimation of Agricultural Ammonia Emissions

Ammonia emissions from fertilizers/pesticides and livestock are separated from the aggregated area source inventory as they are affected by local meteorology. For fertilizers/pesticides, emissions vary by hour based on WRF's two-meter temperature and ten-meter wind speed. For livestock, WRF's ground temperature and aerodynamic resistance drive hourly 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. (UNC Chapel Hill - The Institute for the Environment), while the results of CARB in-house tests were summarized in an internal report (Kwok, Meteorology-adjusted Temporal Profiles for Agricultural and Residential Wood Combustion Sectors Using Smoke Gentpro Utility Program). In general, higher temperature and/or wind speeds favor ammonia emissions. Monthly surrogates based upon the frequency of pesticides applications were also applied to fertilizer NH_3. The sector also has emissions reported by a few individual facilities whose latitudes/longitudes are known.

Thus, the facility-reported livestock were represented as point sources. Another hourly GenTpro file was created just for them. To preserve the spatial distribution, emissions were apportioned to those individual facilities by GAI. SMOKE runs with these spatio-temporal allocations covered criteria pollutants NH_3, PM and TOG.

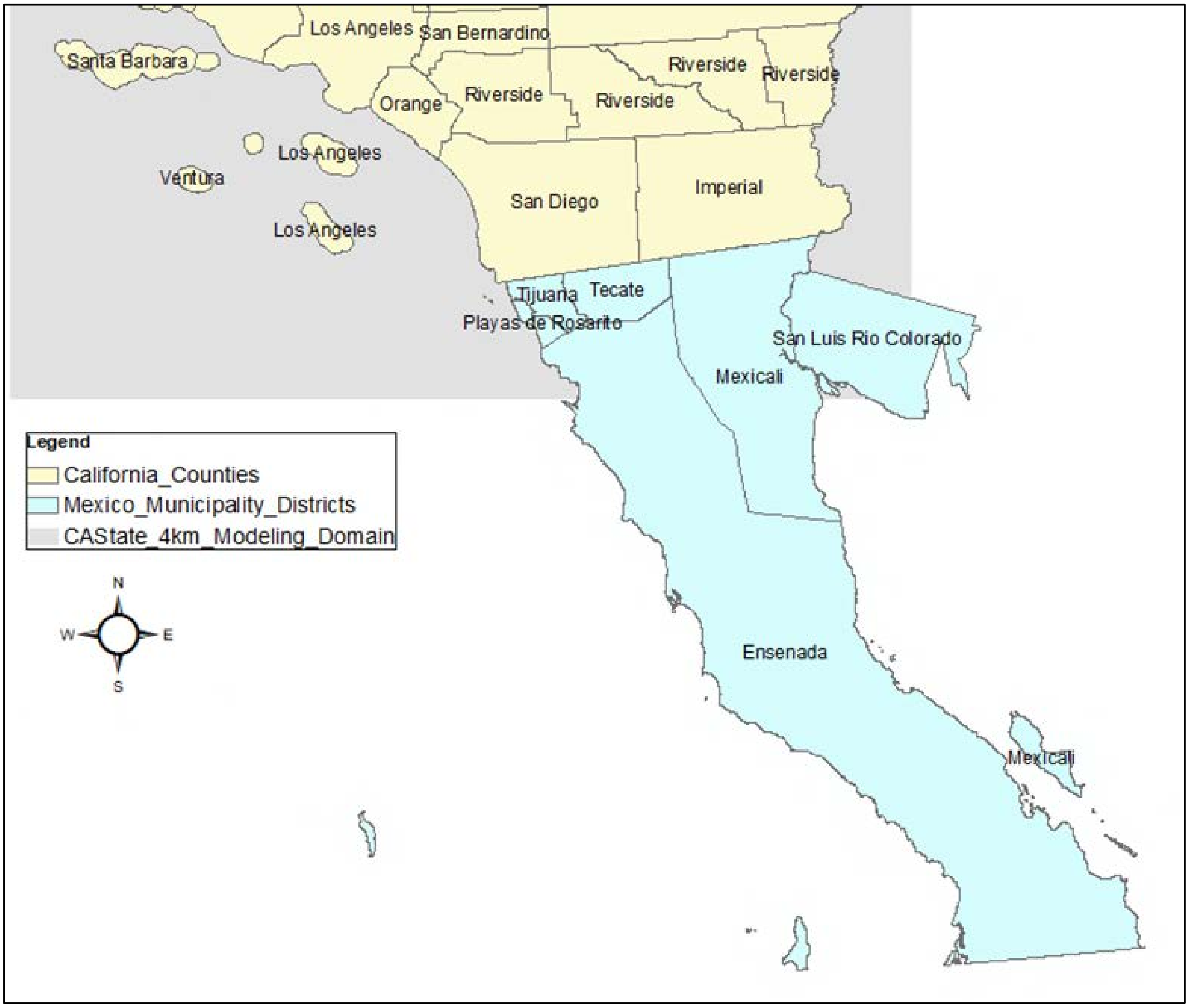
B.2.3.7 Northern Mexico Emissions

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 for area, point and non-road emission sources have been processed using an updated inventory developed by Eastern Research Group Inc. (ERG). This inventory is based on the 2014 Mexico National Emissions Inventory (MNEI) with additional improvements made by ground truthing agricultural burning, brick kilns and improving methods to calculate idling mobile emissions at the border entries (ERG). Base year 2017 emission estimates were developed by projecting the 2014 emissions to 2017. Future year 2037 emissions estimates were developed by interpolating 2014, 2020 and 2025 emission estimates to 2037.

For mobile sources, the U.S. EPA on-road emissions model SMOKE-MOVES (Sparse Matrix Operator Kernel Emissions – Motor Vehicle Emission Simulator) Mexico was used to produce an on-road emissions inventory. The on-road sector is reflective of true 2017 emissions. Future year 2037 emission estimates used the U.S. EPA on-road emissions model SMOKE-MOVES Mexico for future year 2028. SMOKE-MOVES is more comprehensive than the data provided for the on-road sector in the 2014 MNEI, and after discussions with U.S. EPA it was suggested to use SMOKE-MOVES over the 2014 MNEI estimates.

Figure B-25: Outline of Mexico municipalities included in California air quality simulations. The grey box outlines the boundaries of the CAState_4km modeling domain



Under contract to CARB, ERG recently completed an update to the spatial distribution of Mexico's area, non-road, and on-road emissions (ERG). These updates include additional spatial surrogates such as the location of brick kilns, bakeries, ports, airports etc. for the state of Baja California. In addition, the project supports large improvements on emission estimates at two major border crossings (ERG). These updates have been included in the base and future year inventories and the surrogates used are listed in Table B-24.

EPA's National Emission Inventory (NEI) has been used by ARB as a foundation for identifying 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 on-road 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. These EPA-based surrogates are used within the state of Sonora, which was not covered in the ERG contract, and as secondary spatial allocation for the state of Baja CA. Table B-25 lists the EPA-based Mexico surrogates dated as of May 2018.

Table B-24: List indicating ERG developed spatial surrogates for the state of Baja California

Spatial Surrogate ID	Description	Year
100	Mexicali Agriculture	2014
110	Mexicali Agburn	2014
111	Mexicali Agburn Asparagus	2014
112	Mexicali Agburn Bermuda	2014
113	Mexicali Agburn Wheat	2014
120	Airports	2014
130	Autoshop	2014
140	Bakeries	2014
150	Border Crossing	2014
160	Brick Kilns	2014
170	Charbroiling	2014
180	Feedlots	2014
190	Gas Stations	2014
200	Graphic Arts	2014
210	Hospitals	2014
220	Landfills	2014
230	Total Population	2014
231	Rural Population	2014
232	Urban Population	2014
240	Ports	2014
250	Railroads	2014

Spatial Surrogate ID	Description	Year
260	Wastewater	2014
270	Windblown Dust	2014

Table B-25: List of EPA's 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
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**

B.2.3.8 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, non-road, and on-road) 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 2017and 2028[1].

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 the future year 2032 emissions were processed from "2011v3 NEI 2028el_cb6v2_v6_11g" 2028 projections based on the 2011 National Emissions Inventory version three. Spatial and temporal allocations were applied using the EPA ancillary files however, all spatial surrogates were processed through the spatial allocator tool with the California statewide map projection applied.

B.2.3.9 Application of Control Measure Reduction Factors

Future year onroad vehicle emissions were adjusted to reflect statewide reduction commitments for CARB's Low NO_X, ACT, and HD I&M for 2032. SSS adjustments for onroad were applied to the 2032 projected inventory. The onroad adjustments are summarized in Section B.2.3.2.7.

B.2.3.10 Application of Emission Reduction Credits

The Sacramento Federal Nonattainment Area modeling inventory incorporated emission reduction credit (ERC) adjustments to the projected future year (FY) 2032 inventories. Quarterly ERCs for VOC and NO_X in tons per day were received from the SMAQMD for the Sac Metro, Placer, Feather River, and Yolo-Solano districts. The ERC adjustments were applied at the COABDIS level to stationary area and point sources. The annual average daily NO_X and ROG ERCs for 2032 are show in Table B-26.

Table B-26: Annual average ERCs for Sacramento Nonattainment Area

Year	NO_X (TPD)	ROG (TPD)
2032	2.80	3.80

B.2.4 Quality Assurance of Modeling Inventories

As mentioned in Section B.2.1.3.1., base case modeling is intended to demonstrate confidence in the modeling system. Quality assurance of the data is necessary to detect outliers and potential problems with emission estimates. The most important quality assurance checks of the modeling emissions inventory are summarized in the following sections.

1 All inventory and ancillary files for spatial and temporal allocation are available for download at: ftp://newftp.epa.gov/air/emismod/2011/v3platform/ (U.S. EPA, 2018).

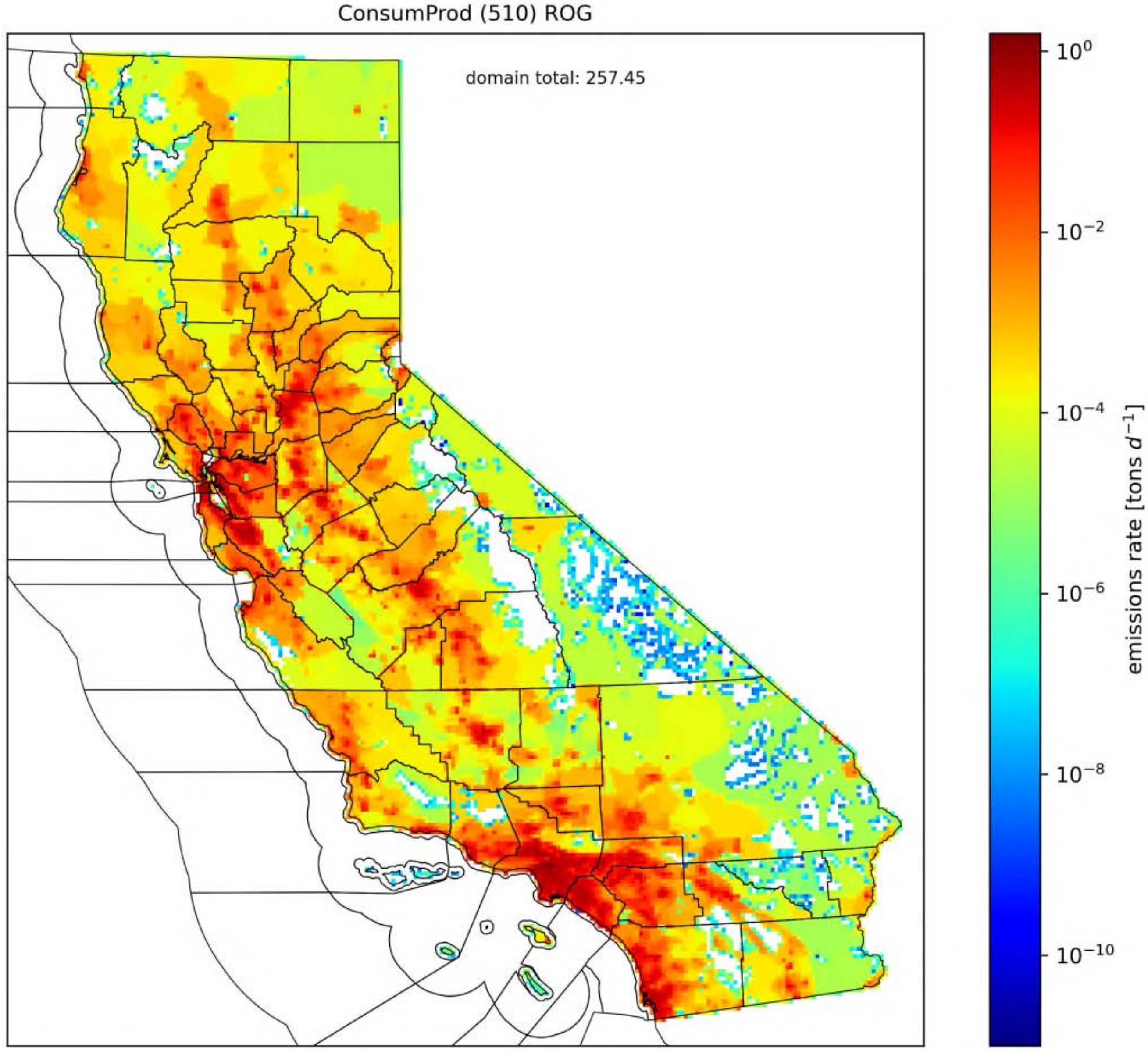
B.2.4.1 Area and Point Sources

All SMOKE inputs are subject to extensive quality assurance procedures performed by CARB staff. Annual and forecasted emissions are carefully reviewed prior to running SMOKE. CARB and district staff review data used to calculate emissions along with other ancillary data, such as temporal profiles and the location of facilities and assignment of SCC to each process. Growth and control information are reviewed and updated as needed.

We also 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 processes daily emissions. Both inventory types use the same temporal data described in Section B.2.2.2. 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, gridded emissions totals are plotted on the statewide modeling domain and visually inspected to check the spatial allocation of emissions. Spatial plots by source category like the one shown in Figure B-26 are carefully screened for proper spatial distribution of emissions.

Figure B-26: Example of an ROG 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. Staff also create and analyze time series plots, and compare aggregate emissions totals with the pre-SMOKE emissions totals obtained from CEPAM.

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.

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, off-road equipment, and commercial harbor craft sectors are among the source categories included in the application of adjustments to temporal allocation.

B.2.4.2 On-road Emissions

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.

- Plot MPO provided data spatially to find any missing or incomplete links.
- Compare spatial distribution of VMT between on and off-peak periods for each MPO.
- Generate time series plots for the on-road emissions files to check the diurnal pattern.
- 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.
- Generate the spatial plot for the on-road emissions files to check if there were any missing emissions.

B.2.4.3 Aircraft Emissions

There are two steps to conduct quality assurance of the aircraft emissions.

- 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.
- Generate the spatial plot for the aircraft emissions files to check if there were any missing emissions.

B.2.4.4 Day-specific Sources

B.2.4.4.1 Wildfires

GIS records for 413 wildfires, 166 prescribed wildland burn events, and 28 wildland fires use reported for 2018 were downloaded from *The California Department of Forestry and Fire Protection's Fire and Resource Assessment Program (FRAP)* 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. 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 compared to the raw fire emissions data to check for accuracy.

B.2.4.4.2 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 agreement between the planning and modeling inventories. 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 model-ready emissions files to make sure the calculations were done correctly. Spatial plots were made to verify the location of each burn.

B.2.4.5 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 B.2.3.2; since weekend travel is generally less than weekday travel, modeling inventory emissions are usually lower when compared to annual average inventories from CEPAM. Figure B-27 is an example of a QA report that summarizes NO_X emissions by category for EIC3 10 through 499 for Sacramento Nonattainment Area. The report compares the monthly and annual processed emissions totals against CEPAM. Please note that this report is only an example since emissions have been updated from what is displayed here.

Figure B-27: Comparison of inventories report

2018 Ozone SIP, Base Year 2018 -- CEPAM 2019 Ozone SIP Ver 1.03 With Off-Road Patch (CEPAM2022V1.01) And Zero Out 430-995-7000-0000 NOx in E. Kern BYr:2018 MYr:2018

Basin:*SV* Spec:*NOx*

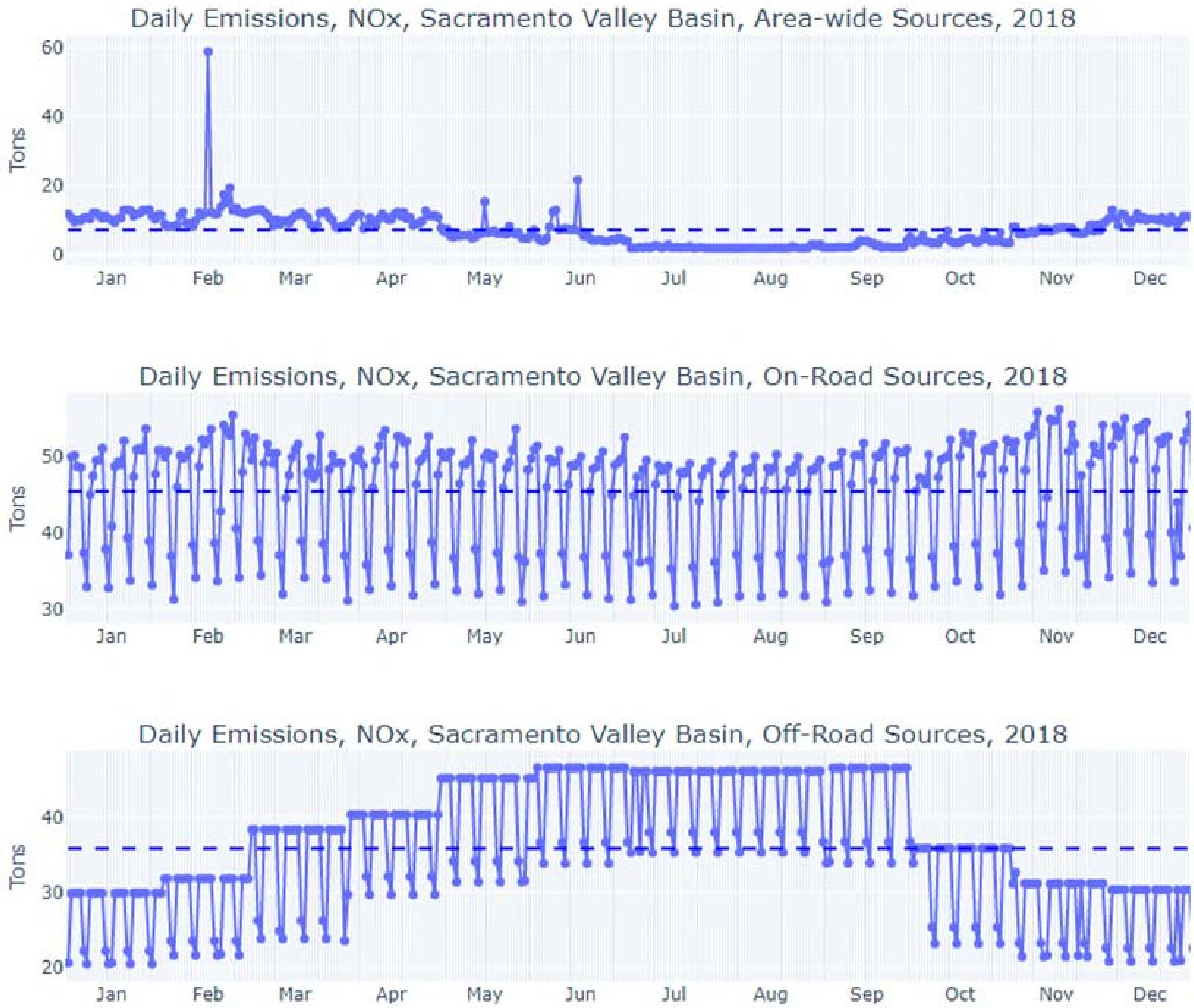
EIC	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	RF3064_19v1.02	RF3084_19v1.03	RF3108_19v1.04	RF3089_22v1.01
10	Electric Utilities	2.04	1.91	1.88	1.77	1.65	1.92	2.15	2.18	2.12	2.76	1.94	2.28	2.05	1.86	2.05	2.05	1.96
20	Cogeneration	1.48	1.43	1.48	0.99	1.43	1.55	1.61	1.58	1.49	1.52	1.48	1.35	1.45	1.63	1.45	1.45	0.99
30	Oil And Gas Production (Combustion)	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.18	2.16	2.16	2.16	2.16	2.16
40	Petroleum Refining (Combustion)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	Manufacturing And Industrial	4.02	4.20	4.60	4.99	5.38	5.40	5.37	5.39	5.35	5.35	4.92	4.39	4.95	4.88	4.95	4.95	5.05
52	Food And Agricultural Processing	1.09	1.08	1.09	2.68	2.69	2.79	3.50	3.87	4.07	1.96	1.39	1.12	2.28	2.21	2.28	2.28	2.23
60	Service And Commercial	10.07	9.67	8.19	6.50	3.62	3.61	3.58	3.65	3.61	3.69	4.06	8.82	5.74	5.61	5.75	6.04	6.30
99	Other (Fuel Combustion)	0.39	0.39	0.39	0.39	0.41	0.41	0.41	0.41	0.41	0.41	0.39	0.39	0.40	0.43	0.40	0.40	0.66
110	Sewage Treatment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	Landfills	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
130	Incinerators	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.04
140	Soil Remediation	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.01
199	Other (Waste Disposal)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	Laundering	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
220	Degreasing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
230	Coatings And Related Process Solvents	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	0.01	0.01	0.01
240	Printing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
250	Adhesives And Sealants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
299	Other (Cleaning And Surface Coatings)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
310	Oil And Gas Production	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.79
320	Petroleum Refining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
330	Petroleum Marketing	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	0.01	0.01	0.09
399	Other (Petroleum Production And Marketing)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
410	Chemical	0.04	0.05	0.06	0.07	0.06	0.06	0.05	0.08	0.07	0.07	0.09	0.08	0.06	0.06	0.06	0.06	0.06
420	Food And Agriculture	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.06	0.08	0.06	0.04	0.04	0.04	0.04	0.04	0.03
430	Mineral Processes	2.64	2.68	2.74	2.76	2.77	2.81	2.79	2.84	2.73	2.79	2.69	2.66	2.74	2.78	2.76	2.76	2.96
440	Metal Processes	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	0.01	0.01	0.01
450	Wood And Paper	0.10	0.10	0.10	0.10	0.10	0.11	0.10	0.11	0.10	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.11
460	Glass And Related Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
470	Electronics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
499	Other (Industrial Processes)	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	0.04	0.02	0.02	0.03

Notes:

- CEPAM refers to annual average emissions from 2019 SIP Baseline Emission Inventory Tool with external adjustments: *CEPAM External Adjustment Reporting Tool*
- Monthly gridded emissions come from GeoVAST mo-yr/avg tabular summary - gid 657

Staff also review how modeling emissions vary over a year. Figure B-28 provides an example of a modeling inventory time series plot for Sacramento Valley Air Basin for area-wide sources, on-road sources, and off-road sources. Again, this figure is only an example.

Figure B-28: Daily variation of NO_X emissions for sources in Sacramento Valley Air Basin in 2018



B.2.4.6 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., 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. Figure B-29 shows the share of area, on-road, and point sources contribution to annual NO_X emissions are shown for the Sacramento Nonattainment Area in 2018. These same sources are shown as a daily timeseries for the Sacramento Nonattainment Area in Figure B-30. These figures are only examples and do not reflect the inventory totals used for SIP attainment modeling.

Figure B-29: Annual processed emissions example for 2018 Sacramento Nonattainment Area NO_X for area, on-road, and point sources

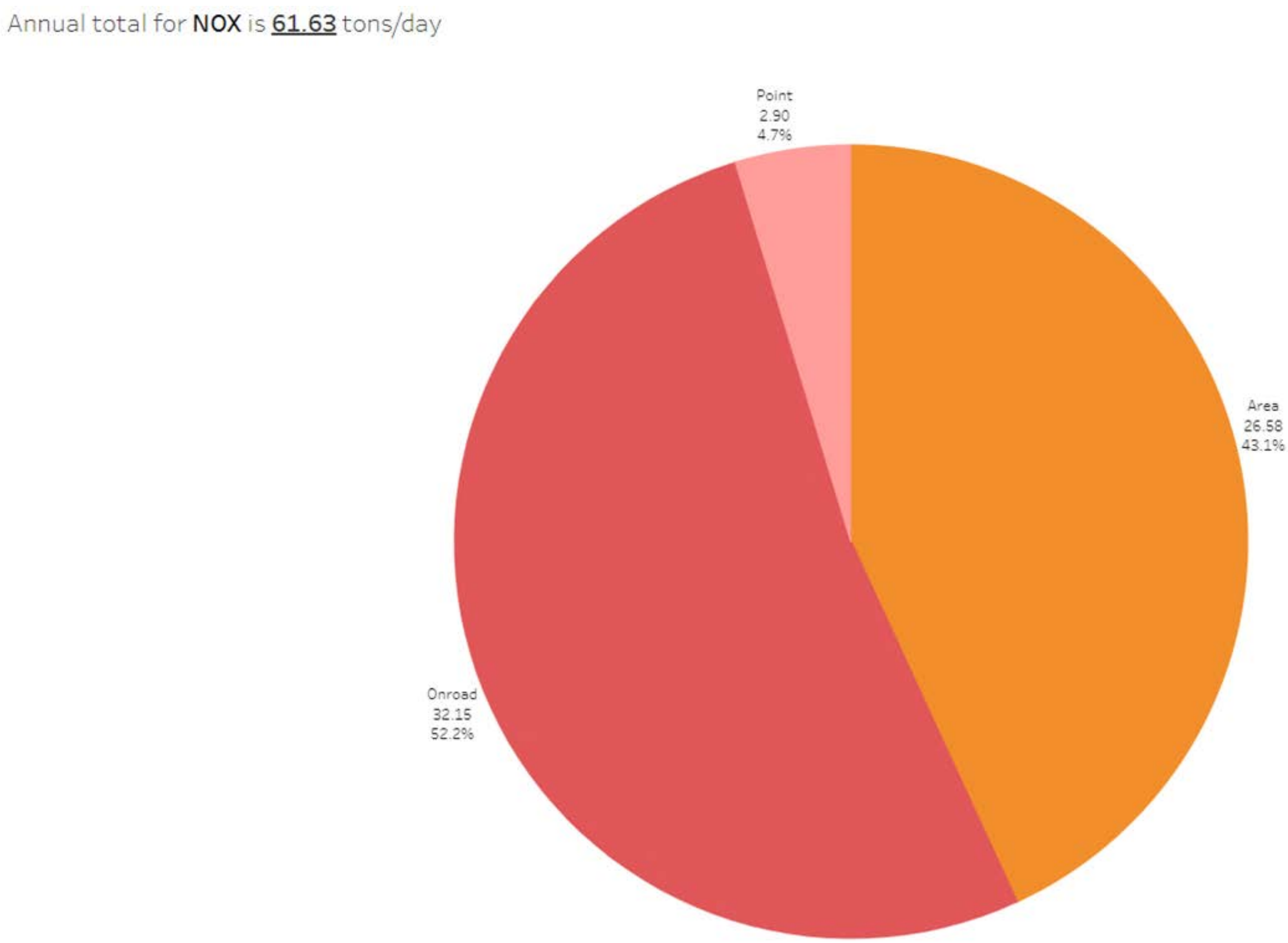


Figure B-30: Example timeseries plot for daily 2018 NO_X emissions from area, on-road, and point sources for Sacramento Nonattainment Area

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. Most sources should have emissions for every day in the modeling period. Exceptions to this apply to sources like fires since burning (natural or planned) does not occur every day. 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.

B.2.5 References

AMSS. *Spatial Surrogate Methodology Document SNP2020-10-01*. Sacramento: INTERNAL DRAFT CARB, 2020.

—. *Spatial Surrogate Methodology Document SNP2021-10-01*. Sacramento: INTERNAL DRAFT CARB, 2021.

Angevine, W. M., et al. "Meteorological model evaluation for CalNex 2010." *Monthly Weather Review* 140 (2012): 3885-3906.

Atsuyuki, O., et al. *Spatial tessellations: concepts and applications of Voronoi diagrams*. Second. John Wiley & Sons, 2009.

Baker, K. R., et al. "Evaluation of surface and upper air fine scale WRF meteorological modeling of the May and June 2010 CalNex period in California." *Atmospheric Environment* 80 (2013): 299-309.

Bao, J.W., et al. "Observed and WRF-simulated low-level winds in a high-ozone episode during the Central California ozone study." *Journal of Applied Meteorology and Climatology* 47 (2008): 2372-2394.

Beaver, S. and A. Palazoglu. "Influence of synoptic and mesoscale meteorology on ozone pollution potential for San Joaquin Valley of California." *Atmospheric Environment* 43.10 (2009).

Blanchard, C.L., et al. "Understanding Relationships between Changes in Ambient Ozone and Precursor Concentrations and Changes in VOC and NOx Emissions from 1990 to 2004 in Central California." Report prepared for the California Air Resources Board. 2008.

Buchholz, R. R., et al. "CESM2.1/CAM-chem Instantaneous Output for Boundary Conditions." UCAR/NCAR - Atmospheric Chemistry Observations and Modeling Laboratory, 2019. <https://doi.org/10.5065/NMP7-EP60>.

Cai, C., et al. "Simulating Reactive Nitrogen, Carbon Monoxide, and Ozone in California During ARCTAS-CARB 2008 with High Wildfire Activity." *Atmospheric Environment* (2016): 28-44.

—. "Simulating the Weekly Cycle of NOx-VOC-HOx-O3Photochemical System in the South Coast ofCalifornia During CalNex-2010 Campaign." *Journal of Geophysical Research: Atmospheres* (2019): 3532–3555.

Caltrans. *Statewide Modeling*. 2020. <https://dot.ca.gov/programs/transportation-planning/multi-modal-system-planning/statewide-modeling>.

CARB. 1990. *Assessment and Mitigation of the Impacts of Transported Pollutants on Ozone Concentrations within California, Staff Report prepared by the Technical Support Division and the Office of Air Quality Planning and Liaison of the California Air Resources Board.* <available at https://www.arb.ca.gov/aqd/transport/assessments/1990.pdf>.

—. *2017 Baseline Inventory and Vehicle Miles Traveled Offset Demonstration for the 2015 70 ppb 8-hour Ozone Standard available at https://ww2.arb.ca.gov/resources/documents/2017-baseline-inventory-and-vehicle-miles-traveled-offset-demonstration-2015-70*. 2020. Jan 2022.

—. "2018 Western Nevada County Planning Area Ozone Attainment Plan available at https://ww3.arb.ca.gov/planning/sip/planarea/wnc/carb_staff_report.pdf." Staff Report. 2018. Jan 2022.

—. *Advanced Clean Trucks*. 07 02 2020. <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks>.

—. *Heavy-Duty Inspection and Maintenance Regulation*. 2021. <https://ww2.arb.ca.gov/rulemaking/2021/hdim2021>.

—. "Heavy-Duty Low NOx." 07 February 2020. <https://ww2.arb.ca.gov/our-work/programs/heavy-duty-low-nox>.

—. "Report on Updates to the California Integrated Transportation Network (ITN)." 2021.

Carter, W.P.L. "Development of a condensed SAPRC-07 chemical mechanism." *Atmospheric Environment* (2010b): 5336-5345.

—. "Development of the SAPRC-07 chemical mechanism." *Atmospheric Environment* (2010a): 5324-5335.

Chen, J., et al. "Modeling air quality in the San Joaquin Valley of California during the 2013 DISCOVER-AQ field campaign." *Atmospheric Environment* 5 (2020): 100067.

Clinton, N., P. Gong and K. Scott. "Quantification of pollutants emitted from very large wildland fires in Southern California." *Atmospheric Environment* (2006): Volume 40, pp. 3686-3695.

Deligiorgi, D. and K. Philippopoulos. "Spatial Interpolation Methodologies in Urban Air Pollution Modeling: Application for the Greater Area of Metropolitan Athens, Greece." *Advanced Air Pollution*. 2011.

EasternKern. "2017 Ozone Attainment Plan, available at: http://www.kernair.org/Documents/Announcements/Attainment/2017%20Ozone%20Plan_EKAPCD_Adopted_7-27-17.pdf." 2017.

EKAPCD. "East Kern County Ozone Attainment Demonstration, Maintenance Plan, and Redesignation Request." 2003. <available at https://www.arb.ca.gov/planning/sip/planarea/easternkern/2003kernplan.pdf>.

Emery, C., et al. "Recommendations on statistics and benchmarks to assess photochemical model performance." *Journal of the Air & Waste Management Association* (2017): 582-598.

Emmons, L. K., et al. "The Chemistry Mechanism in the Community Earth System Model version 2 (CESM2)." *Journal of Advances in Modeling Earth Systems* (2020). <https://doi.org/10.1029/2019MS001882>.

EPA. *Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and RegionalHaze*. Modeling guidance. United States Environmental Protection Agency. North Carollina: U.S. EPA, 2014. 10 July 2015. <http://www.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf>.

—. *https://www3.epa.gov/ttn/emc/cem.html*. 2016. 16 August 2016. <https://www3.epa.gov/ttn/emc/cem.html>.

—. *Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze*. 29 11 2018. <https://www.epa.gov/scram/sip-modeling-guidance-documents>.

—. "NOx Substitution Guidance, available at https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19931201_oaqps_nox_substitution_guidance.pdf." 1993.

—. "Technical Support Document for 2008 Ozone NAAQS Designation." 2008. <https://19january2017snapshot.epa.gov/www3/region9/air/ozone/pdf/R9_CA_NevadaCounty_FINAL.pdf>.

EPA, U.S. "Ozone Designations - 2015 Standards accessible at https://www.epa.gov/sites/default/files/2018-05/documents/ca_tsd_combined_final_0.pdf." 2017. Jan 2022. <https://www.epa.gov/sites/default/files/2018-05/documents/ca_tsd_combined_final_0.pdf>.

ERG. "2014 Northern Baja California Emissions Inventory Project." 2019.

Fast, J. D., et al. "Transport and mixing patterns over Central California during the carbonaceous aerosol and radiative effects study (CARES)." *Atmospheric Chemistry and Physics* 12 (2012): 1759-1783.

Fosberg, M.A. and M.J. Schroeder. "Marine air penetration in Central California." *Journal of Applied Meteorology* 5 (1966): 573-589.

Fujita, E. M., et al. *Field study plan for the Central California Ozone Study*. 1999.

Gkatzelis, G, et al. "Identifying Volatile Chemical Product Tracer Compounds in U.S. Cities." *Environmental Science & Technology* 55.1 (2021): 188-199.

Gong, P., N. Clinton and R. T. Y. a. S. J. Pu. *Extension and input refinement to the ARB wildland fire emissions estimation model Final report, contract number 00-729*. Sacramento, CA: Air Resources Board, 2003.

He, H., X-Z. Liang and D. J. Wuebbles. "Effects of emissions change, climate change and long-range transport on regional modeling of future U.S. particulate matter pollution and speciation." *Atmospheric Environment* 2018: 166-176. <https://www.sciencedirect.com/science/article/pii/S135223101830092X>.

Heuss, J. M., D. F. Kahlbaum and G. T. Wolff. "Weekday/Weekend Ozone Differences: What Can We Learn from Them?" *Journal of the Air & Waste Management Association* 53.7 (2003): 772-788.

Hu, J., et al. "Mobile Source and Livestock Feed Contributions to Regional Ozone Formation in Central California." *Environmental Science and Technology* 46 (2012): 2781-2789.

Imperial. " Imperial County 2017 State Implementation Plan for the 2008 8-Hour Ozone Standard, available at: https://ww3.arb.ca.gov/planning/sip/planarea/imperial/2017o3sip_final.pdf ." 2017.

—. " Imperial County 2018 Annual Particulate Matter Less than 2.5 Microns in Diameter State Implementation Plan, available at: https://ww3.arb.ca.gov/planning/sip/planarea/imperial/final_2018_ic_pm25_sip.pdf ." 2018.

Jeanne, P., Saah, D., Esperanza, A., Bytnerowicz, A., Fraczek, W., and Cisneros, R. "Ozone Distribution in Remote Ecologically Vulnerable Terrain of the Southern Sierra Nevada, Ca." *Environmental Pollution* 182 (2013): 343-56.

Jin, L., et al. "Seasonal versus episodic performance evaluation for an Eulerian photochemical air quality model." *Journal of Geophysical Research: Atmospheres* (2010): 115, D09302.

—. "Sensitivity analysis of ozone formation and transport for a central California air pollution episode." *Environmental Science and Technology* (2008): 3683-3689.

Kelly, J. T., et al. "Fine-scale simulation of ammonium and nitrate over the South Coast Air Basin and San Joaquin Valley of California during CalNex-2010." *Journal of Geophysical Research* 119 (2014): 3600-3614.

Kelly, J.T., et al. "Fine-scale simulation of ammonium and nitrate over the South Coast Air Basin and San Joaquin Valley of California during CalNex-2010." *Journal of Geophysical Research: Atmosphere* (2014): 3600–3614.

—. "Simulating particle size distributions over California and impact on lung deposition fraction." *Aerosol Science and Technology* (2010): 148-162.

Kulkarni, S., et al. "An extended approach to calculate the ozone relative response factors used in the attainment demonstration for the National Ambient Air Quality Standards." *Journal of the Air and Waste Management Association* (2014): 1204-1213.

Kwok, Roger. *Meteorology-adjusted Temporal Profiles for Agricultural and Residential Wood Combustion Sectors Using Smoke Gentpro Utility Program*. Sacramento: INTERNAL DRAFT CARB, 2016.

—. *Modeling Plume Rise of Ocean-going Vessel Emissions*. Sacramento: INTERNAL DRAFT CARB, 2015.

LaFranchi, B. W., A. H. Goldstein and R. C and Cohen. "Observations of the temperature dependent response of ozone to NOx reductions in the Sacramento, CA urban plume." *Atmospheric Chemistry and Physics* (2011): 6945-6960.

Lamarque, J.-F., et al. "CAM-chem: description and evaluation of interactive atmospheric chemistry in the Community Earth System Model." *Geoscientific Model Development* (2012): 369-411.

Lehrman, D. "Characterization of the 2000 Measurement Period." Interim Report prepared for California Air Resources Board. 2001.

Lehrman, D., et al. "Characterization of the CCOS 2000 measurement period." Final Report prepared for California Air Resources Board. 2004.

Lin, M., et al. "Springtime high surface ozone events over the western United States: Quantifying the role of stratospheric." *Journal of Geophysical Research* (2012): D00V22, doi:10.1029/2012JD018151.

Livingstone, P.L., et al. "Simulating PM concentration during a winter episode in a subtropical valley: Sensitivity simulations and evaluation methods." *Atmospheric Environment* (2009): 5971-5977.

Mills, S., S. Weiss and C. Liang. "VIIRS day/night band (DNB) stray light characterization and correction." *SPIE Proceedings* (2013): Vol. 8866.

Pun, B. K., J. F. Loius and C. Seigneur. "A conceptual model of ozone formation in the San Joaquin Valley." CP049-1-98. 2008.

Pun, B.K., R.T.F. Balmori and C. Seigneur. "Modeling wintertime particulate matter formation in central California." *Atmospheric Environment* (2009): 402-409.

Pusede, S. E. and R. C. Cohen. "On the observed response of ozone to NOx and VOC reactivity reductions in San Joaquin Valley California 1995–present." *Atmospheric Chemistry and Physics* (2012): 8323-8339.

Pusede, S. E., et al. "On the temperature dependence of organic reactivity, nitrogen oxides, ozone production, and the impact of emission controls in San Joaquin Valley, California." *Atmospheric Chemistry and Physics* (2014): 3373-3395.

Ricardo, C., et al. "Ozone, Nitric Acid, and Ammonia Air Pollution Is Unhealthy for People and Ecosystems in Southern Sierra Nevada, California." *Environmental Pollution* 158.10 (2010): 3261-71.

Sacramento. "Sacramento Regional 2008 NAAQS 8-Hour Ozone Attainment And Reasonable Further Progress Plan, available at http://www.airquality.org/ProgramCoordination/Documents/Sac%20Regional%202008%20NAAQS%20Attainment%20and%20RFP%20Plan.pdf." 2017.

Seinfeld, J. H. and S. N. Pandis. *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change*. Ed. 1. New York: J. Wiley, 1998.

Sen, Zekai. "2.8.1 Delaney, Varoni, and Thiessen Polygons." *Spatial Modeling Principles in Earth Sciences*. Springer, 2016. 57.

Shahrokhishahraki, N., et al. "High-resolution modeling of gaseous air pollutants over Tehran and validation with surface and satellite data." *Atmospheric Environment* 2022. <https://www.sciencedirect.com/science/article/pii/S1352231021007032>.

Shearer, S.M, et al. "Comparison of SAPRC99 and SAPRC07 mechanisms in photochemical modeling for central California." *Atmospheric Environment* (2012): 205-216.

Sillman, S. "The relation between ozone, NOx and hydrocarbons in urban and polluted rural environments." *Atmospheric Environment* 33.12 (1999): 1821-1845.

Simon, H., K. R. Baker and S. Phillips. "Compilation and interpretation of photochemical model performance statistics published between 2006 and 2012." *Atmospheric Environment* 61 (2012): 124-139.

SJV. " 2018 PM2.5 Plan for the San Joaquin Valley, available at: http://valleyair.org/pmplans/ ." 2018.

—. "2008 PM2.5 Plan, available at: http://www.valleyair.org/Air_Quality_Plans/AQ_Proposed_PM25_2008.htm." 2008.

—. "2012 PM2.5 Plan, available at: http://www.valleyair.org/Air_Quality_Plans/PM25Plans2012.htm ." 2012.

—. "2013 Plan for the Revoked 1-Hour Ozone Standard, available at: http://valleyair.org/Air_Quality_Plans/Ozone-OneHourPlan-2013.htm ." 2013.

—. "2016 Moderate Area Plan for the 2012 PM2.5 Standard, available at: http://www.valleyair.org/Air_Quality_Plans/docs/PM25-2016/2016-Plan.pdf ." 2016a.

—. "2016 Plan for the 2008 8-Hour Ozone Standard, available at: http://valleyair.org/Air_Quality_Plans/Ozone-Plan-2016.htm ." 2016b.

Skamarock, W. C., et al. *Description ofthe Advanced Research WRF version 4,Rep. NCAR/TN-475++STR,Natl. Cent. for Atmos. Res.* Boulder, Colo., 2008.

SouthCoast. "Final 2012 Air Quality Management Plan, available at: http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/final-2012-air-quality-management-plan ." 2012.

—. "Final 2016 Air Quality Management Plan, available at: http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/cover-and-opening.pdf?sfvrsn=6." 2016.

Stein, A.F., et al. " NOAA's HYSPLIT atmospheric transport and dispersion modeling system." *Bulletin of the American Meteorological Society* (2015): 2059-2077.

Tonse, S. R., et al. "A process-analysis based study of the ozone weekend effect." *Atmospheric Environment* (2008): 7728-7736.

UNC Chapel Hill - The Institute for the Environment. "SMOKE v4.0 User’s Manual." 30 September 2016. 07 02 2020. <https://www.cmascenter.org/smoke/documentation/4.0/manual_smokev40.pdf>.

Van Ooy, D.J. and J.J. Carroll. "The spatial variation of ozone climatology on the western slope of the Sierra Nevada." *Atmospheric Environment* (1995): 1319-1330.

Ventura. "Final 2016 Ventura County Air Quality Management Plan, available at: http://www.vcapcd.org/pubs/Planning/AQMP/2016/Final/Final-2016-Ventura-County-AQMP.pdf ." 2016.

Vijayaraghavan, K., P. Karamchadania and C. Seigneur. "Plume-in-grid modeling of summer air pollution in Central California." *Atmospheric Environment* (2006): 5097-5109.

Wang, P., et al. "Ground-level ozone simulation using ensemble WRF/Chem predictions over the Southeast United States." *Chemosphere* 2022. <https://www.sciencedirect.com/science/article/pii/S0045653521029003>.

WesternMojave. "2016 8-Hour Ozone SIP: Western Mojave Desert Nonattainment Area, available at: https://ww3.arb.ca.gov/planning/sip/planarea/mojavesedsip.htm#2016." 2016.

WesternNevada. "Western Nevada County 8-hour Ozone Attainment Plan, available at: https://ww3.arb.ca.gov/planning/sip/planarea/wncsip.htm." 2018.

Wu, Shenglun, et al. "Direct measurements of ozone response to emissions perturbations in California." *Atompheric Chemistry and Phtsics* (2022): 4929-4949. <https://acp.copernicus.org/articles/22/4929/2022/acp-22-4929-2022.pdf>.

Yan, F., et al. "Revealing the modulation of boundary conditions and governing processes on ozone formation over northern China in June 2017." *Environmental Pollution* 272 (2021). <https://www.sciencedirect.com/science/article/pii/S0269749120366884>.

Yienger, J. J. and H. Levy II. "Empirical model of global soil-biogenic NOχ emissions." *Journal of Geophysical Research: Atmospheres* (1995): 11447-11464.

Zhang, Y., et al. "Fine scale modeling of wintertime aerosol mass, number, and size distributions in Central California." *Journal of Geophysical Research* (2010): D15207, doi:10.1029/2009JD012950.

Zhu, S., Horne, J. R., Kinnon, M. M., Samuelsen, G. S., Dabdub, D. "Comprehensively assessing the drivers of future air quality in California." *Environment International* (2019): 386-398.

Sub-Appendix B.A: Day-of-week Redistribution Factors by Vehicle Type and County

The factors shown in Table B-27 and Table B-28 represent the "day-of-week" factors for a broad vehicle class: LD is Light-Duty, LM is Light- and Medium-Duty Trucks, and HH is Heavy Heavy-Duty Trucks.

Table B-27: Day-of-week adjustment for LD and LM vehicle class by county

County	Day of Week	LD	LM
El Dorado	Sunday	1.04	0.68
El Dorado	Monday	1.00	0.97
El Dorado	Tues/Wed/Thurs	1.00	1.00
El Dorado	Friday	1.20	1.01
El Dorado	Saturday	1.15	0.76
El Dorado	Holiday	1.05	1.05
Placer	Sunday	1.07	0.55
Placer	Monday	1.05	1.00
Placer	Tues/Wed/Thurs	1.00	1.00
Placer	Friday	1.17	0.92
Placer	Saturday	1.16	0.62
Placer	Holiday	1.12	1.03
Sacramento	Sunday	0.77	0.49
Sacramento	Monday	0.96	0.95
Sacramento	Tues/Wed/Thurs	1.00	1.00
Sacramento	Friday	1.06	1.04
Sacramento	Saturday	0.88	0.62
Sacramento	Holiday	0.81	0.83
Solano	Sunday	1.01	0.59
Solano	Monday	0.98	0.95
Solano	Tues/Wed/Thurs	1.00	1.00
Solano	Friday	1.13	1.03
Solano	Saturday	1.09	0.72
Solano	Holiday	0.91	0.90
Sutter	Sunday	0.97	0.67
Sutter	Monday	0.99	0.98
Sutter	Tues/Wed/Thurs	1.00	1.00
Sutter	Friday	1.18	1.10
Sutter	Saturday	1.04	0.79
Sutter	Holiday	0.97	0.93
Yolo	Sunday	0.90	0.56
Yolo	Monday	0.97	0.95

County	Day of Week	LD	LM
Yolo	Tues/Wed/Thurs	1.00	1.00
Yolo	Friday	1.10	1.05
Yolo	Saturday	0.99	0.67
Yolo	Holiday	0.89	0.88

Table B-28: Day-of-week adjustment excerpt from July 1st to 7th for HH vehicle class by county

Date	Day of Week	El Dorado	Placer	Sacramento	Solano	Sutter	Yolo
7/1/2018	Sunday	0.56	0.89	0.68	0.57	0.60	0.40
7/2/2018	Monday	0.90	1.21	1.03	0.96	0.94	0.87
7/3/2018	Tuesday	1.00	1.14	0.91	1.02	1.00	0.74
7/4/2018	Holiday	0.98	0.85	0.68	0.61	0.92	0.59
7/5/2018	Thursday	1.00	1.13	1.01	0.90	1.00	0.95
7/6/2018	Friday	0.88	1.19	1.06	0.94	0.96	0.98
7/7/2018	Saturday	0.59	0.88	0.78	0.64	0.58	0.67

Sub Appendix B.B: Hour-of-day Profiles by Vehicle Type and County

The factors shown in the table below represent the different 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. Hourly profiles for LD, LM, and HH by day of week are shown in Table B-29, Table B-30, and Table B-31.

Table B-29: Hour-of-day profiles for LD and LM vehicle classes in El Dorado, Placer, and Sacramento Counties

Day of Week	Hour	El Dorado LD	El Dorado LM	Placer LD	Placer LM	Sacramento LD	Sacramento LM
Sunday	0	0.009	0.017	0.002	0.009	0.019	0.031
Sunday	1	0.005	0.012	0.001	0.002	0.013	0.025
Sunday	2	0.003	0.009	0.000	0.001	0.009	0.021
Sunday	3	0.002	0.008	0.000	0.000	0.007	0.019
Sunday	4	0.002	0.007	0.001	0.001	0.008	0.020
Sunday	5	0.003	0.010	0.002	0.007	0.011	0.023
Sunday	6	0.009	0.017	0.011	0.019	0.017	0.027
Sunday	7	0.023	0.028	0.031	0.035	0.025	0.033
Sunday	8	0.040	0.041	0.056	0.059	0.035	0.042
Sunday	9	0.062	0.060	0.075	0.072	0.049	0.052
Sunday	10	0.082	0.078	0.089	0.088	0.060	0.060
Sunday	11	0.094	0.089	0.099	0.104	0.066	0.063
Sunday	12	0.093	0.090	0.098	0.096	0.072	0.066
Sunday	13	0.091	0.085	0.093	0.093	0.074	0.067
Sunday	14	0.086	0.079	0.090	0.081	0.074	0.064
Sunday	15	0.081	0.074	0.088	0.076	0.072	0.061
Sunday	16	0.076	0.069	0.079	0.072	0.071	0.059
Sunday	17	0.067	0.061	0.066	0.059	0.068	0.056
Sunday	18	0.054	0.048	0.047	0.040	0.061	0.049
Sunday	19	0.043	0.038	0.033	0.031	0.053	0.042
Sunday	20	0.032	0.029	0.021	0.021	0.048	0.038
Sunday	21	0.022	0.023	0.012	0.015	0.040	0.032
Sunday	22	0.014	0.016	0.005	0.012	0.029	0.027
Sunday	23	0.007	0.011	0.002	0.006	0.019	0.023
Monday	0	0.003	0.010	0.000	0.001	0.009	0.018
Monday	1	0.001	0.006	0.000	0.000	0.005	0.015
Monday	2	0.000	0.004	0.000	0.000	0.004	0.015
Monday	3	0.000	0.004	0.000	0.000	0.006	0.018
Monday	4	0.001	0.006	0.000	0.000	0.013	0.026
Monday	5	0.003	0.013	0.002	0.008	0.029	0.040
Monday	6	0.015	0.029	0.025	0.038	0.052	0.057
Monday	7	0.044	0.052	0.060	0.065	0.071	0.066
Monday	8	0.055	0.061	0.078	0.083	0.066	0.064
Monday	9	0.066	0.068	0.077	0.079	0.056	0.059
Monday	10	0.073	0.073	0.079	0.080	0.052	0.057
Monday	11	0.082	0.078	0.084	0.086	0.053	0.058

Day of Week	Hour	El Dorado LD	El Dorado LM	Placer LD	Placer LM	Sacramento LD	Sacramento LM
Monday	12	0.085	0.080	0.084	0.086	0.056	0.059
Monday	13	0.083	0.080	0.085	0.082	0.057	0.059
Monday	14	0.083	0.078	0.086	0.086	0.062	0.060
Monday	15	0.085	0.077	0.091	0.083	0.070	0.064
Monday	16	0.085	0.075	0.095	0.080	0.076	0.063
Monday	17	0.077	0.066	0.074	0.063	0.073	0.057
Monday	18	0.055	0.048	0.042	0.035	0.056	0.044
Monday	19	0.040	0.034	0.020	0.021	0.040	0.031
Monday	20	0.029	0.024	0.011	0.014	0.032	0.024
Monday	21	0.018	0.017	0.005	0.007	0.028	0.019
Monday	22	0.011	0.011	0.002	0.003	0.021	0.015
Monday	23	0.005	0.007	0.000	0.001	0.014	0.011
Tues/Wed/Thurs	0	0.002	0.008	0.000	0.000	0.008	0.018
Tues/Wed/Thurs	1	0.001	0.005	0.000	0.000	0.005	0.015
Tues/Wed/Thurs	2	0.000	0.003	0.000	0.000	0.004	0.015
Tues/Wed/Thurs	3	0.000	0.002	0.000	0.000	0.006	0.017
Tues/Wed/Thurs	4	0.001	0.004	0.000	0.000	0.012	0.024
Tues/Wed/Thurs	5	0.002	0.009	0.000	0.002	0.027	0.038
Tues/Wed/Thurs	6	0.014	0.027	0.020	0.040	0.052	0.057
Tues/Wed/Thurs	7	0.044	0.053	0.060	0.066	0.071	0.066
Tues/Wed/Thurs	8	0.053	0.061	0.077	0.079	0.066	0.063
Tues/Wed/Thurs	9	0.062	0.067	0.070	0.080	0.056	0.059
Tues/Wed/Thurs	10	0.068	0.071	0.072	0.078	0.051	0.057
Tues/Wed/Thurs	11	0.076	0.076	0.079	0.082	0.052	0.057
Tues/Wed/Thurs	12	0.081	0.081	0.082	0.083	0.054	0.058
Tues/Wed/Thurs	13	0.081	0.080	0.080	0.082	0.056	0.059
Tues/Wed/Thurs	14	0.082	0.079	0.085	0.082	0.061	0.061
Tues/Wed/Thurs	15	0.085	0.078	0.092	0.081	0.070	0.064
Tues/Wed/Thurs	16	0.087	0.077	0.099	0.083	0.075	0.063
Tues/Wed/Thurs	17	0.082	0.070	0.082	0.067	0.073	0.057
Tues/Wed/Thurs	18	0.058	0.049	0.047	0.039	0.059	0.046
Tues/Wed/Thurs	19	0.044	0.036	0.025	0.025	0.041	0.033
Tues/Wed/Thurs	20	0.032	0.026	0.015	0.016	0.034	0.026
Tues/Wed/Thurs	21	0.023	0.019	0.009	0.009	0.030	0.021
Tues/Wed/Thurs	22	0.014	0.012	0.004	0.004	0.022	0.016
Tues/Wed/Thurs	23	0.007	0.008	0.001	0.002	0.015	0.012
Friday	0	0.003	0.009	0.000	0.000	0.009	0.019
Friday	1	0.001	0.006	0.000	0.000	0.005	0.016
Friday	2	0.000	0.004	0.000	0.000	0.004	0.016

Day of Week	Hour	El Dorado LD	El Dorado LM	Placer LD	Placer LM	Sacramento LD	Sacramento LM
Friday	3	0.000	0.003	0.000	0.000	0.006	0.017
Friday	4	0.001	0.005	0.000	0.000	0.011	0.024
Friday	5	0.002	0.009	0.000	0.002	0.024	0.036
Friday	6	0.011	0.024	0.014	0.035	0.045	0.053
Friday	7	0.035	0.047	0.048	0.059	0.063	0.063
Friday	8	0.044	0.056	0.064	0.074	0.059	0.061
Friday	9	0.054	0.063	0.065	0.077	0.052	0.058
Friday	10	0.061	0.068	0.068	0.081	0.050	0.057
Friday	11	0.070	0.075	0.075	0.084	0.053	0.059
Friday	12	0.075	0.079	0.079	0.083	0.056	0.060
Friday	13	0.078	0.078	0.079	0.081	0.058	0.060
Friday	14	0.081	0.079	0.085	0.082	0.063	0.062
Friday	15	0.084	0.079	0.090	0.087	0.070	0.063
Friday	16	0.084	0.076	0.091	0.080	0.072	0.060
Friday	17	0.078	0.067	0.079	0.063	0.069	0.055
Friday	18	0.063	0.053	0.054	0.040	0.060	0.046
Friday	19	0.052	0.039	0.035	0.025	0.046	0.035
Friday	20	0.042	0.030	0.026	0.017	0.038	0.026
Friday	21	0.035	0.023	0.021	0.013	0.035	0.022
Friday	22	0.027	0.017	0.016	0.010	0.029	0.018
Friday	23	0.018	0.011	0.010	0.007	0.020	0.013
Saturday	0	0.008	0.017	0.003	0.008	0.016	0.027
Saturday	1	0.004	0.011	0.000	0.001	0.011	0.022
Saturday	2	0.002	0.007	0.000	0.000	0.008	0.020
Saturday	3	0.001	0.006	0.000	0.000	0.007	0.019
Saturday	4	0.001	0.006	0.000	0.000	0.009	0.022
Saturday	5	0.002	0.008	0.001	0.004	0.014	0.027
Saturday	6	0.009	0.018	0.009	0.021	0.023	0.035
Saturday	7	0.023	0.030	0.031	0.044	0.034	0.044
Saturday	8	0.037	0.042	0.053	0.059	0.045	0.052
Saturday	9	0.054	0.058	0.066	0.071	0.054	0.059
Saturday	10	0.070	0.071	0.076	0.081	0.061	0.063
Saturday	11	0.081	0.079	0.083	0.083	0.066	0.065
Saturday	12	0.085	0.081	0.086	0.085	0.068	0.065
Saturday	13	0.084	0.080	0.085	0.084	0.068	0.064
Saturday	14	0.082	0.075	0.086	0.081	0.068	0.061
Saturday	15	0.080	0.075	0.090	0.081	0.067	0.059
Saturday	16	0.079	0.072	0.086	0.081	0.067	0.056
Saturday	17	0.072	0.068	0.074	0.063	0.064	0.052

Day of Week	Hour	El Dorado LD	El Dorado LM	Placer LD	Placer LM	Sacramento LD	Sacramento LM
Saturday	18	0.062	0.054	0.054	0.045	0.057	0.045
Saturday	19	0.050	0.043	0.039	0.031	0.048	0.037
Saturday	20	0.040	0.034	0.029	0.026	0.042	0.031
Saturday	21	0.032	0.027	0.022	0.020	0.040	0.029
Saturday	22	0.024	0.021	0.016	0.016	0.036	0.026
Saturday	23	0.016	0.016	0.009	0.013	0.026	0.020
Holiday	0	0.007	0.013	0.001	0.003	0.013	0.023
Holiday	1	0.004	0.010	0.000	0.000	0.008	0.019
Holiday	2	0.002	0.006	0.000	0.000	0.006	0.018
Holiday	3	0.001	0.005	0.000	0.000	0.006	0.019
Holiday	4	0.001	0.006	0.000	0.000	0.010	0.023
Holiday	5	0.002	0.010	0.001	0.004	0.019	0.032
Holiday	6	0.010	0.022	0.012	0.026	0.031	0.041
Holiday	7	0.031	0.040	0.039	0.050	0.042	0.049
Holiday	8	0.049	0.052	0.068	0.077	0.048	0.054
Holiday	9	0.066	0.067	0.076	0.088	0.052	0.057
Holiday	10	0.079	0.079	0.088	0.084	0.057	0.060
Holiday	11	0.087	0.087	0.095	0.089	0.063	0.065
Holiday	12	0.086	0.086	0.093	0.086	0.067	0.065
Holiday	13	0.084	0.087	0.089	0.093	0.068	0.066
Holiday	14	0.084	0.081	0.087	0.083	0.069	0.065
Holiday	15	0.082	0.073	0.090	0.081	0.070	0.063
Holiday	16	0.081	0.073	0.090	0.089	0.069	0.060
Holiday	17	0.073	0.066	0.073	0.061	0.066	0.054
Holiday	18	0.056	0.050	0.044	0.038	0.058	0.046
Holiday	19	0.042	0.033	0.025	0.020	0.049	0.036
Holiday	20	0.031	0.024	0.015	0.015	0.043	0.030
Holiday	21	0.021	0.016	0.009	0.007	0.037	0.024
Holiday	22	0.012	0.010	0.004	0.003	0.029	0.019
Holiday	23	0.007	0.006	0.002	0.001	0.020	0.014

Table B-30: Hour-of-day profiles for LD and LM vehicle classes in Solano, Sutter, and Yolo Counties

Day of Week	Hour	Solano LD	Solano LM	Sutter LD	Sutter LM	Yolo LD	Yolo LM
Sunday	0	0.017	0.037	0.013	0.020	0.016	0.026
Sunday	1	0.011	0.032	0.008	0.016	0.011	0.019
Sunday	2	0.009	0.030	0.006	0.013	0.008	0.017

Day of Week	Hour	Solano LD	Solano LM	Sutter LD	Sutter LM	Yolo LD	Yolo LM
Sunday	3	0.007	0.027	0.005	0.012	0.006	0.015
Sunday	4	0.007	0.028	0.005	0.012	0.007	0.016
Sunday	5	0.010	0.029	0.008	0.015	0.011	0.020
Sunday	6	0.016	0.032	0.013	0.020	0.016	0.025
Sunday	7	0.021	0.035	0.022	0.028	0.023	0.031
Sunday	8	0.031	0.041	0.034	0.041	0.034	0.041
Sunday	9	0.046	0.048	0.048	0.055	0.048	0.054
Sunday	10	0.059	0.053	0.064	0.068	0.060	0.063
Sunday	11	0.067	0.055	0.075	0.075	0.067	0.067
Sunday	12	0.069	0.055	0.082	0.079	0.071	0.070
Sunday	13	0.070	0.055	0.084	0.079	0.072	0.070
Sunday	14	0.071	0.053	0.084	0.077	0.073	0.069
Sunday	15	0.071	0.052	0.082	0.073	0.073	0.067
Sunday	16	0.071	0.051	0.079	0.068	0.072	0.063
Sunday	17	0.070	0.051	0.072	0.062	0.070	0.059
Sunday	18	0.066	0.048	0.060	0.052	0.063	0.051
Sunday	19	0.060	0.046	0.050	0.043	0.057	0.044
Sunday	20	0.055	0.043	0.041	0.035	0.051	0.038
Sunday	21	0.045	0.039	0.031	0.026	0.042	0.032
Sunday	22	0.032	0.033	0.021	0.019	0.030	0.025
Sunday	23	0.020	0.028	0.013	0.015	0.019	0.020
Monday	0	0.010	0.026	0.008	0.014	0.010	0.018
Monday	1	0.006	0.025	0.005	0.012	0.006	0.015
Monday	2	0.005	0.024	0.004	0.012	0.005	0.014
Monday	3	0.006	0.026	0.006	0.014	0.007	0.016
Monday	4	0.015	0.032	0.011	0.019	0.016	0.025
Monday	5	0.037	0.043	0.023	0.030	0.032	0.040
Monday	6	0.050	0.051	0.042	0.047	0.048	0.052
Monday	7	0.061	0.058	0.060	0.061	0.066	0.065
Monday	8	0.056	0.057	0.059	0.062	0.064	0.064
Monday	9	0.054	0.056	0.056	0.061	0.057	0.062
Monday	10	0.055	0.058	0.058	0.064	0.055	0.061
Monday	11	0.056	0.057	0.062	0.066	0.056	0.062
Monday	12	0.057	0.058	0.066	0.068	0.058	0.062
Monday	13	0.058	0.057	0.067	0.067	0.059	0.061
Monday	14	0.064	0.057	0.070	0.069	0.062	0.062
Monday	15	0.069	0.056	0.073	0.069	0.068	0.063
Monday	16	0.071	0.054	0.075	0.067	0.073	0.062
Monday	17	0.070	0.050	0.073	0.061	0.072	0.057

Day of Week	Hour	Solano LD	Solano LM	Sutter LD	Sutter LM	Yolo LD	Yolo LM
Monday	18	0.054	0.041	0.056	0.046	0.053	0.043
Monday	19	0.042	0.032	0.040	0.031	0.039	0.030
Monday	20	0.035	0.026	0.031	0.022	0.032	0.023
Monday	21	0.029	0.022	0.025	0.017	0.027	0.018
Monday	22	0.023	0.018	0.017	0.012	0.021	0.014
Monday	23	0.016	0.016	0.012	0.009	0.014	0.011
Tues/Wed/Thurs	0	0.009	0.025	0.008	0.014	0.009	0.017
Tues/Wed/Thurs	1	0.005	0.023	0.004	0.011	0.006	0.014
Tues/Wed/Thurs	2	0.004	0.023	0.004	0.011	0.005	0.014
Tues/Wed/Thurs	3	0.005	0.025	0.005	0.013	0.006	0.016
Tues/Wed/Thurs	4	0.013	0.030	0.010	0.018	0.014	0.023
Tues/Wed/Thurs	5	0.035	0.042	0.022	0.029	0.029	0.037
Tues/Wed/Thurs	6	0.050	0.050	0.042	0.047	0.046	0.051
Tues/Wed/Thurs	7	0.061	0.057	0.060	0.061	0.066	0.065
Tues/Wed/Thurs	8	0.056	0.056	0.060	0.062	0.065	0.064
Tues/Wed/Thurs	9	0.053	0.056	0.055	0.060	0.057	0.062
Tues/Wed/Thurs	10	0.052	0.057	0.056	0.061	0.053	0.061
Tues/Wed/Thurs	11	0.052	0.057	0.059	0.064	0.054	0.061
Tues/Wed/Thurs	12	0.054	0.057	0.061	0.065	0.056	0.061
Tues/Wed/Thurs	13	0.057	0.057	0.064	0.066	0.058	0.061
Tues/Wed/Thurs	14	0.064	0.058	0.068	0.068	0.062	0.062
Tues/Wed/Thurs	15	0.070	0.058	0.073	0.069	0.069	0.063
Tues/Wed/Thurs	16	0.073	0.056	0.075	0.067	0.074	0.062
Tues/Wed/Thurs	17	0.072	0.052	0.074	0.063	0.073	0.058
Tues/Wed/Thurs	18	0.058	0.043	0.059	0.048	0.056	0.045
Tues/Wed/Thurs	19	0.046	0.034	0.043	0.034	0.041	0.032
Tues/Wed/Thurs	20	0.038	0.028	0.035	0.025	0.034	0.025
Tues/Wed/Thurs	21	0.032	0.023	0.029	0.019	0.029	0.020
Tues/Wed/Thurs	22	0.025	0.018	0.020	0.013	0.022	0.015
Tues/Wed/Thurs	23	0.016	0.015	0.013	0.009	0.015	0.011
Friday	0	0.009	0.025	0.007	0.014	0.009	0.017
Friday	1	0.006	0.024	0.005	0.011	0.006	0.014
Friday	2	0.005	0.024	0.004	0.011	0.005	0.014
Friday	3	0.005	0.025	0.005	0.012	0.006	0.015
Friday	4	0.011	0.030	0.008	0.016	0.012	0.022
Friday	5	0.027	0.040	0.017	0.026	0.024	0.034
Friday	6	0.039	0.047	0.033	0.040	0.038	0.047
Friday	7	0.050	0.053	0.049	0.054	0.054	0.059
Friday	8	0.048	0.054	0.051	0.057	0.055	0.059

Day of Week	Hour	Solano LD	Solano LM	Sutter LD	Sutter LM	Yolo LD	Yolo LM
Friday	9	0.048	0.055	0.050	0.057	0.051	0.059
Friday	10	0.052	0.056	0.054	0.061	0.052	0.060
Friday	11	0.056	0.058	0.060	0.066	0.056	0.062
Friday	12	0.059	0.058	0.063	0.067	0.059	0.063
Friday	13	0.063	0.058	0.066	0.068	0.062	0.064
Friday	14	0.067	0.058	0.070	0.070	0.066	0.064
Friday	15	0.069	0.057	0.073	0.070	0.070	0.063
Friday	16	0.070	0.054	0.074	0.067	0.071	0.061
Friday	17	0.067	0.050	0.072	0.063	0.069	0.057
Friday	18	0.061	0.044	0.063	0.051	0.060	0.047
Friday	19	0.054	0.037	0.050	0.039	0.049	0.036
Friday	20	0.047	0.031	0.041	0.029	0.041	0.028
Friday	21	0.039	0.025	0.037	0.023	0.036	0.023
Friday	22	0.030	0.020	0.030	0.017	0.029	0.018
Friday	23	0.021	0.016	0.019	0.011	0.019	0.013
Saturday	0	0.014	0.031	0.013	0.019	0.014	0.024
Saturday	1	0.009	0.028	0.008	0.015	0.009	0.019
Saturday	2	0.007	0.027	0.006	0.014	0.008	0.017
Saturday	3	0.006	0.026	0.006	0.013	0.007	0.016
Saturday	4	0.008	0.028	0.007	0.014	0.009	0.019
Saturday	5	0.014	0.031	0.011	0.018	0.014	0.025
Saturday	6	0.022	0.037	0.019	0.026	0.023	0.033
Saturday	7	0.032	0.042	0.032	0.038	0.034	0.044
Saturday	8	0.044	0.049	0.045	0.051	0.046	0.055
Saturday	9	0.056	0.054	0.057	0.062	0.057	0.064
Saturday	10	0.065	0.057	0.067	0.071	0.065	0.070
Saturday	11	0.068	0.058	0.074	0.076	0.069	0.071
Saturday	12	0.067	0.057	0.075	0.075	0.069	0.068
Saturday	13	0.066	0.056	0.075	0.074	0.069	0.065
Saturday	14	0.066	0.055	0.074	0.071	0.068	0.063
Saturday	15	0.066	0.054	0.072	0.068	0.067	0.060
Saturday	16	0.066	0.053	0.070	0.064	0.066	0.056
Saturday	17	0.065	0.050	0.066	0.057	0.063	0.052
Saturday	18	0.058	0.046	0.056	0.047	0.057	0.045
Saturday	19	0.050	0.040	0.046	0.037	0.048	0.035
Saturday	20	0.045	0.036	0.040	0.030	0.042	0.030
Saturday	21	0.041	0.033	0.035	0.025	0.039	0.027
Saturday	22	0.035	0.029	0.028	0.019	0.034	0.023
Saturday	23	0.026	0.023	0.020	0.014	0.024	0.018

Day of Week	Hour	Solano LD	Solano LM	Sutter LD	Sutter LM	Yolo LD	Yolo LM
Holiday	0	0.013	0.029	0.010	0.016	0.012	0.022
Holiday	1	0.008	0.027	0.006	0.013	0.008	0.017
Holiday	2	0.005	0.025	0.004	0.012	0.006	0.015
Holiday	3	0.005	0.026	0.005	0.013	0.006	0.017
Holiday	4	0.008	0.028	0.008	0.016	0.011	0.021
Holiday	5	0.018	0.034	0.014	0.023	0.019	0.030
Holiday	6	0.025	0.040	0.025	0.033	0.027	0.038
Holiday	7	0.032	0.045	0.036	0.044	0.037	0.046
Holiday	8	0.041	0.050	0.046	0.053	0.046	0.054
Holiday	9	0.051	0.055	0.054	0.059	0.053	0.059
Holiday	10	0.062	0.060	0.065	0.069	0.061	0.065
Holiday	11	0.068	0.063	0.074	0.074	0.067	0.069
Holiday	12	0.070	0.061	0.077	0.074	0.069	0.068
Holiday	13	0.071	0.062	0.076	0.074	0.069	0.068
Holiday	14	0.072	0.060	0.075	0.073	0.070	0.066
Holiday	15	0.068	0.056	0.074	0.070	0.069	0.065
Holiday	16	0.066	0.054	0.072	0.066	0.067	0.060
Holiday	17	0.064	0.050	0.068	0.059	0.064	0.055
Holiday	18	0.058	0.042	0.057	0.049	0.057	0.046
Holiday	19	0.051	0.037	0.047	0.036	0.050	0.036
Holiday	20	0.047	0.031	0.039	0.029	0.044	0.029
Holiday	21	0.042	0.026	0.030	0.020	0.039	0.023
Holiday	22	0.033	0.022	0.023	0.015	0.030	0.018
Holiday	23	0.022	0.018	0.015	0.010	0.020	0.014

Table B-31: Hour-of-day profiles excerpt from July 1st to 7th for HH vehicle class by county

Date	Hour	El Dorado	Placer	Sacramento	Solano	Sutter	Yolo
7/1/2018	0	0.025	0.019	0.023	0.018	0.031	0.025
7/1/2018	1	0.016	0.012	0.018	0.011	0.028	0.017
7/1/2018	2	0.012	0.009	0.015	0.010	0.026	0.015
7/1/2018	3	0.009	0.009	0.013	0.007	0.025	0.015
7/1/2018	4	0.009	0.010	0.016	0.010	0.025	0.018
7/1/2018	5	0.016	0.016	0.020	0.013	0.027	0.023
7/1/2018	6	0.029	0.028	0.028	0.020	0.030	0.028
7/1/2018	7	0.038	0.039	0.035	0.029	0.034	0.037
7/1/2018	8	0.045	0.052	0.044	0.038	0.040	0.043
7/1/2018	9	0.054	0.067	0.053	0.051	0.046	0.053
7/1/2018	10	0.064	0.068	0.062	0.061	0.052	0.059

Date	Hour	El Dorado	Placer	Sacramento	Solano	Sutter	Yolo
7/1/2018	11	0.071	0.078	0.064	0.067	0.055	0.059
7/1/2018	12	0.072	0.071	0.066	0.069	0.058	0.062
7/1/2018	13	0.069	0.069	0.068	0.070	0.058	0.069
7/1/2018	14	0.064	0.063	0.063	0.065	0.057	0.063
7/1/2018	15	0.062	0.061	0.062	0.067	0.057	0.057
7/1/2018	16	0.060	0.059	0.060	0.066	0.055	0.057
7/1/2018	17	0.056	0.055	0.054	0.062	0.053	0.056
7/1/2018	18	0.050	0.051	0.052	0.062	0.049	0.051
7/1/2018	19	0.044	0.048	0.048	0.052	0.045	0.052
7/1/2018	20	0.039	0.041	0.044	0.047	0.042	0.043
7/1/2018	21	0.038	0.034	0.037	0.043	0.039	0.039
7/1/2018	22	0.032	0.024	0.031	0.035	0.036	0.030
7/1/2018	23	0.026	0.018	0.025	0.026	0.033	0.027
7/2/2018	0	0.009	0.012	0.013	0.011	0.027	0.013
7/2/2018	1	0.004	0.010	0.012	0.009	0.025	0.011
7/2/2018	2	0.002	0.012	0.012	0.010	0.025	0.011
7/2/2018	3	0.002	0.014	0.015	0.014	0.027	0.018
7/2/2018	4	0.003	0.018	0.024	0.028	0.030	0.030
7/2/2018	5	0.014	0.030	0.038	0.041	0.036	0.047
7/2/2018	6	0.038	0.043	0.052	0.052	0.043	0.061
7/2/2018	7	0.050	0.050	0.059	0.057	0.048	0.064
7/2/2018	8	0.054	0.052	0.060	0.064	0.050	0.058
7/2/2018	9	0.059	0.061	0.059	0.067	0.050	0.062
7/2/2018	10	0.063	0.069	0.059	0.070	0.051	0.060
7/2/2018	11	0.066	0.074	0.062	0.069	0.053	0.060
7/2/2018	12	0.067	0.068	0.062	0.050	0.054	0.058
7/2/2018	13	0.068	0.065	0.061	0.059	0.054	0.056
7/2/2018	14	0.068	0.067	0.062	0.061	0.055	0.055
7/2/2018	15	0.070	0.060	0.060	0.054	0.055	0.057
7/2/2018	16	0.069	0.055	0.056	0.057	0.054	0.062
7/2/2018	17	0.066	0.052	0.052	0.052	0.052	0.055
7/2/2018	18	0.057	0.047	0.044	0.044	0.045	0.040
7/2/2018	19	0.051	0.040	0.035	0.037	0.039	0.034
7/2/2018	20	0.043	0.032	0.031	0.031	0.035	0.029
7/2/2018	21	0.037	0.028	0.028	0.025	0.032	0.022
7/2/2018	22	0.026	0.024	0.025	0.020	0.030	0.019
7/2/2018	23	0.014	0.018	0.020	0.017	0.030	0.019
7/3/2018	0	0.007	0.015	0.015	0.012	0.029	0.018
7/3/2018	1	0.003	0.013	0.012	0.010	0.027	0.011

Date	Hour	El Dorado	Placer	Sacramento	Solano	Sutter	Yolo
7/3/2018	2	0.002	0.012	0.012	0.012	0.027	0.012
7/3/2018	3	0.001	0.013	0.015	0.015	0.029	0.018
7/3/2018	4	0.002	0.019	0.023	0.028	0.031	0.029
7/3/2018	5	0.007	0.029	0.035	0.042	0.037	0.041
7/3/2018	6	0.038	0.042	0.052	0.053	0.044	0.055
7/3/2018	7	0.055	0.049	0.059	0.058	0.050	0.057
7/3/2018	8	0.060	0.052	0.059	0.058	0.051	0.050
7/3/2018	9	0.064	0.057	0.056	0.065	0.050	0.050
7/3/2018	10	0.065	0.063	0.057	0.064	0.051	0.050
7/3/2018	11	0.068	0.064	0.059	0.066	0.052	0.054
7/3/2018	12	0.070	0.067	0.059	0.066	0.053	0.053
7/3/2018	13	0.069	0.064	0.059	0.059	0.053	0.054
7/3/2018	14	0.069	0.065	0.059	0.055	0.053	0.057
7/3/2018	15	0.069	0.062	0.063	0.055	0.053	0.062
7/3/2018	16	0.068	0.057	0.061	0.051	0.052	0.076
7/3/2018	17	0.064	0.054	0.058	0.052	0.050	0.066
7/3/2018	18	0.054	0.045	0.048	0.042	0.044	0.051
7/3/2018	19	0.047	0.042	0.036	0.038	0.038	0.037
7/3/2018	20	0.041	0.033	0.031	0.031	0.034	0.034
7/3/2018	21	0.035	0.031	0.028	0.027	0.031	0.028
7/3/2018	22	0.027	0.029	0.025	0.023	0.029	0.020
7/3/2018	23	0.016	0.023	0.020	0.017	0.028	0.017
7/4/2018	0	0.015	0.025	0.025	0.020	0.028	0.027
7/4/2018	1	0.010	0.018	0.021	0.017	0.027	0.025
7/4/2018	2	0.006	0.015	0.019	0.015	0.026	0.021
7/4/2018	3	0.005	0.016	0.018	0.015	0.027	0.022
7/4/2018	4	0.003	0.018	0.022	0.018	0.029	0.028
7/4/2018	5	0.008	0.022	0.028	0.025	0.032	0.031
7/4/2018	6	0.029	0.035	0.036	0.036	0.036	0.041
7/4/2018	7	0.045	0.046	0.041	0.046	0.042	0.043
7/4/2018	8	0.052	0.059	0.047	0.050	0.048	0.050
7/4/2018	9	0.059	0.060	0.056	0.055	0.050	0.058
7/4/2018	10	0.066	0.065	0.060	0.058	0.053	0.063
7/4/2018	11	0.071	0.072	0.063	0.063	0.057	0.068
7/4/2018	12	0.074	0.079	0.065	0.063	0.056	0.064
7/4/2018	13	0.074	0.070	0.063	0.061	0.058	0.059
7/4/2018	14	0.071	0.065	0.060	0.059	0.056	0.054
7/4/2018	15	0.067	0.056	0.057	0.057	0.055	0.053
7/4/2018	16	0.069	0.052	0.053	0.053	0.054	0.043

Date	Hour	El Dorado	Placer	Sacramento	Solano	Sutter	Yolo
7/4/2018	17	0.065	0.044	0.047	0.051	0.051	0.044
7/4/2018	18	0.056	0.042	0.042	0.051	0.045	0.039
7/4/2018	19	0.045	0.037	0.039	0.049	0.041	0.039
7/4/2018	20	0.040	0.029	0.036	0.043	0.037	0.033
7/4/2018	21	0.033	0.023	0.032	0.037	0.033	0.030
7/4/2018	22	0.023	0.028	0.041	0.032	0.031	0.036
7/4/2018	23	0.015	0.022	0.030	0.025	0.029	0.027
7/5/2018	0	0.007	0.014	0.015	0.011	0.029	0.016
7/5/2018	1	0.003	0.009	0.011	0.008	0.027	0.012
7/5/2018	2	0.002	0.008	0.011	0.009	0.027	0.012
7/5/2018	3	0.001	0.011	0.013	0.013	0.029	0.018
7/5/2018	4	0.002	0.017	0.021	0.024	0.031	0.028
7/5/2018	5	0.007	0.028	0.035	0.038	0.037	0.040
7/5/2018	6	0.038	0.042	0.051	0.049	0.044	0.052
7/5/2018	7	0.055	0.054	0.058	0.057	0.050	0.052
7/5/2018	8	0.060	0.049	0.057	0.060	0.051	0.058
7/5/2018	9	0.064	0.063	0.059	0.064	0.050	0.060
7/5/2018	10	0.065	0.072	0.063	0.066	0.051	0.058
7/5/2018	11	0.068	0.069	0.063	0.067	0.052	0.059
7/5/2018	12	0.070	0.070	0.065	0.066	0.053	0.061
7/5/2018	13	0.069	0.068	0.063	0.063	0.053	0.064
7/5/2018	14	0.069	0.065	0.062	0.060	0.053	0.057
7/5/2018	15	0.069	0.059	0.059	0.058	0.053	0.062
7/5/2018	16	0.068	0.055	0.055	0.053	0.052	0.060
7/5/2018	17	0.064	0.048	0.050	0.051	0.050	0.057
7/5/2018	18	0.054	0.045	0.045	0.045	0.044	0.041
7/5/2018	19	0.047	0.044	0.038	0.037	0.038	0.036
7/5/2018	20	0.041	0.036	0.033	0.032	0.034	0.030
7/5/2018	21	0.035	0.028	0.029	0.027	0.031	0.026
7/5/2018	22	0.027	0.024	0.025	0.024	0.029	0.023
7/5/2018	23	0.016	0.019	0.020	0.018	0.028	0.019
7/6/2018	0	0.010	0.016	0.016	0.014	0.032	0.016
7/6/2018	1	0.004	0.012	0.014	0.012	0.030	0.013
7/6/2018	2	0.003	0.012	0.013	0.011	0.030	0.015
7/6/2018	3	0.002	0.014	0.016	0.015	0.030	0.020
7/6/2018	4	0.003	0.017	0.023	0.027	0.033	0.030
7/6/2018	5	0.008	0.028	0.034	0.039	0.038	0.038
7/6/2018	6	0.038	0.040	0.050	0.048	0.045	0.049
7/6/2018	7	0.054	0.046	0.056	0.056	0.050	0.053

Date	Hour	El Dorado	Placer	Sacramento	Solano	Sutter	Yolo
7/6/2018	8	0.059	0.056	0.054	0.062	0.052	0.056
7/6/2018	9	0.062	0.062	0.057	0.064	0.052	0.057
7/6/2018	10	0.065	0.068	0.059	0.067	0.054	0.059
7/6/2018	11	0.067	0.072	0.063	0.065	0.055	0.064
7/6/2018	12	0.070	0.070	0.061	0.068	0.055	0.063
7/6/2018	13	0.068	0.067	0.065	0.064	0.054	0.059
7/6/2018	14	0.067	0.064	0.063	0.056	0.054	0.060
7/6/2018	15	0.068	0.057	0.059	0.053	0.052	0.055
7/6/2018	16	0.065	0.052	0.055	0.053	0.050	0.057
7/6/2018	17	0.059	0.057	0.052	0.049	0.047	0.056
7/6/2018	18	0.051	0.047	0.044	0.044	0.042	0.044
7/6/2018	19	0.044	0.039	0.038	0.036	0.035	0.037
7/6/2018	20	0.038	0.031	0.033	0.030	0.030	0.032
7/6/2018	21	0.035	0.027	0.028	0.027	0.028	0.026
7/6/2018	22	0.031	0.025	0.026	0.023	0.026	0.023
7/6/2018	23	0.029	0.021	0.021	0.018	0.024	0.020
7/7/2018	0	0.032	0.022	0.024	0.019	0.038	0.028
7/7/2018	1	0.020	0.017	0.019	0.015	0.034	0.018
7/7/2018	2	0.010	0.012	0.016	0.014	0.032	0.018
7/7/2018	3	0.007	0.012	0.016	0.013	0.031	0.019
7/7/2018	4	0.006	0.016	0.020	0.017	0.032	0.024
7/7/2018	5	0.013	0.024	0.027	0.024	0.034	0.031
7/7/2018	6	0.039	0.041	0.037	0.031	0.039	0.038
7/7/2018	7	0.046	0.050	0.043	0.040	0.046	0.047
7/7/2018	8	0.052	0.057	0.049	0.048	0.052	0.049
7/7/2018	9	0.061	0.065	0.058	0.054	0.056	0.055
7/7/2018	10	0.067	0.067	0.063	0.060	0.060	0.055
7/7/2018	11	0.070	0.074	0.063	0.065	0.061	0.058
7/7/2018	12	0.071	0.074	0.064	0.064	0.060	0.061
7/7/2018	13	0.067	0.074	0.062	0.060	0.057	0.065
7/7/2018	14	0.065	0.068	0.062	0.062	0.055	0.060
7/7/2018	15	0.062	0.058	0.060	0.058	0.051	0.056
7/7/2018	16	0.060	0.053	0.054	0.058	0.048	0.056
7/7/2018	17	0.054	0.047	0.050	0.055	0.044	0.051
7/7/2018	18	0.046	0.041	0.047	0.056	0.038	0.044
7/7/2018	19	0.038	0.034	0.041	0.049	0.033	0.041
7/7/2018	20	0.034	0.027	0.035	0.040	0.028	0.038
7/7/2018	21	0.029	0.027	0.035	0.038	0.025	0.032
7/7/2018	22	0.027	0.023	0.031	0.034	0.023	0.032

Date	Hour	El Dorado	Placer	Sacramento	Solano	Sutter	Yolo
7/7/2018	23	0.025	0.016	0.024	0.024	0.021	0.023

Sub-Appendix B.C: Additional Temporal Profiles

OGV temporal profiles were constructed based on 2016 port activities of all vessels, compiled by an in-house section in CARB. Fractions for the ports of Long Beach, Los Angeles, Oakland, and San Diego were updated using aggregated AIS data from 2015 through 2019. All vessel types were grouped by port area boundary and divided into day of week and monthly activity fractions (Table B-32 and Table B-33). 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). The areas labeled with a "+" received area source profile updates and "*" received inline only updates.

Hourly temporal profiles were updated for consumer products Table B-34 and Table B-35. The new profiles were developed by the Consumer Products and Air Quality Assessment Branch based on research on identifying volatile chemical product tracer compounds in U.S. cities (Gkatzelis, Coggon and McDonald).

Table B-32: 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	0.084	0.088	0.081	0.078	0.081	0.084	0.084	0.090	0.081	0.090	0.080	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	0.081	0.078	0.077	0.086	0.088	0.093	0.085	0.075	0.088	0.086	0.082	0.082
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	0.087	0.088	0.087	0.087	0.084	0.083	0.081	0.082	0.081	0.079	0.081	0.081

Port areas/waters	Profile ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Port of Long Beach*	M_LGB	0.084	0.086	0.082	0.083	0.081	0.087	0.084	0.082	0.086	0.084	0.081	0.080

Table B-33: 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	0.150	0.151	0.161	0.151	0.135	0.121	0.130
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	0.150	0.162	0.169	0.142	0.129	0.117	0.131
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	0.142	0.145	0.153	0.155	0.150	0.135	0.121
Port of Long Beach*	W_LGB	0.138	0.140	0.148	0.147	0.152	0.144	0.132

Table B-34: Consumer products diurnal profile assignment codes and descriptions

Tracer Diurnal Profile Assignment	CEIDARS HPDY	HPDYN
PCBTF	86	INCREASING ACTIVITY FROM 9AM TO 2PM AND DECREASING UNTIL 10PM. PCBTF TRACER (CP)
D-4 Siloxane	87	MINOR PEAK AT 5 AM, PEAK ACTIVITY AT 2PM AND 6PM. D4-SILOXANE TRACER (CP)
Monoterpenes	88	ACTIVITY STARTS AT 6AM, 12PM PEAK, OSCILLATES TO 8PM. MONOTERPENE TRACER (CP)
PDCB	89	PEAK ACTIVITY FROM 6PM TO 9PM. MINOR PEAKS AT 5AM AND 12PM.
D-5 Siloxane	90	PRIMARY PEAK ACTIVITY AT 12PM AND SECONDARY AT 8PM. D5-SILOXANE TRACER (CP)

Table B-35: Consumer products hourly temporal profiles

HOUR	PCBTF TRACER (CP)"	D4-SILOXANE TRACER (CP)"	MONOTERPENE TRACER (CP)"	PDCB Tracer (CP)	D5-SILOXANE TRACER (CP)"
0	0.009	0.015	0.015	0.019	0.016
1	0.011	0.017	0.015	0.022	0.018
2	0.012	0.018	0.014	0.023	0.016

HOUR	PCBTF TRACER (CP)"	D4-SILOXANE TRACER (CP)"	MONOTERPENE TRACER (CP)"	PDCB Tracer (CP)	D5-SILOXANE TRACER (CP)"
3	0.012	0.020	0.012	0.026	0.015
4	0.017	0.032	0.013	0.041	0.022
5	0.020	0.038	0.013	0.046	0.027
6	0.017	0.031	0.016	0.036	0.025
7	0.014	0.024	0.025	0.028	0.026
8	0.016	0.026	0.042	0.027	0.034
9	0.026	0.037	0.061	0.033	0.058
10	0.048	0.048	0.074	0.040	0.081
11	0.072	0.055	0.083	0.041	0.088
12	0.097	0.063	0.074	0.038	0.077
13	0.121	0.075	0.069	0.030	0.055
14	0.108	0.070	0.062	0.022	0.039
15	0.079	0.053	0.063	0.024	0.039
16	0.074	0.047	0.064	0.042	0.047
17	0.076	0.073	0.054	0.080	0.050
18	0.061	0.085	0.061	0.097	0.057
19	0.043	0.068	0.063	0.102	0.068
20	0.031	0.049	0.051	0.088	0.063
21	0.016	0.026	0.025	0.049	0.042
22	0.011	0.017	0.014	0.027	0.021
23	0.009	0.015	0.015	0.019	0.016

Sub-Appendix B.D: Spatial Surrogate Assignments

The primary spatial surrogate for each EICSUM and the corresponding data source are listed in Table B-36 below.

Table B-36: Primary surrogate assignment at the EICSUM level, description, and data source

EICSUM	EICSUM Name	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	Gas Well	California Department of Conservation, Division of Oil, Gas and Geothermal Resources

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
30	Oil and Gas Production (Combustion)	431	Oil well	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	Farm Road Vehicle Miles Traveled	Department of Pesticide Regulation
60	Service and Commercial	621	UCD Service, Commercial, 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	Publicly Owned Treatment Works	State Water Resources Control Board
120	Landfills	341	Landfills	Calrecyle - Solid Waste Information System (Swis) Dataset
130	Incinerators	302	UCD Industrial	Longitudinal Employer-Household Dynamics (LEHD)
140	Soil Remediation	302	UCD Industrial	Longitudinal Employer-Household Dynamics (LEHD)
199	Other (Waste Disposal)	343	Compost	Calrecycle - Solid Waste Information System (SWIS) Dataset
199	Other (Waste Disposal)	390	Nonirrigated Pastureland	National Land Cover Database (NLCD)
199	Other (Waste Disposal)	470	Publicly Owned Treatment Works	State Water Resources Control Board
210	Laundering	150	Drycleaners	Dun & Bradstreet's Market Insight Database
220	Degreasing	120	Autobody Shops	Dun & Bradstreet's Market Insight Database
220	Degreasing	302	UCD Industrial	Longitudinal Employer-Household Dynamics (LEHD)
230	Coatings and Related Process Solvents	120	Autobody Shops	Dun & Bradstreet's Market Insight Database
230	Coatings and Related Process Solvents	743	Wood Furniture	Dun & Bradstreet's Market Insight Database
230	Coatings and Related Process Solvents	302	UCD Industrial	Longitudinal Employer-Household Dynamics (LEHD)

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
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)
310	Oil and Gas Production	211	Gas well	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	(US DOT)/Bureau of Transportation Statistics' (BTS's) National Transportation Atlas Database (NTAD)
330	Petroleum Marketing	200	Gas Stations	Dun & Bradstreet's Market Insight Database
330	Petroleum Marketing	520	Refineries and Tank Farms	FEMA and the ARB CEIDAR Database
330	Petroleum Marketing	214	Gas Distribution	U.S. Energy Information Administration
399	Other (Petroleum Production and Marketing)	200	Gas Stations	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
420	Food and Agriculture	320	Irrigated Cropland	National Land Cover Database (NLCD)
430	Mineral Processes	590	Sand and Gravel Mines	National Atlas
440	Metal Processes	738	Metal Parts	Dun & Bradstreet's Market Insight Database
450	Wood And Paper	732	Wood	Dun & Bradstreet's Market Insight Database
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

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
510	Consumer Products	550	Residential and Nonresidential Change Industrial Employment	Council of Government (Cog) Housing and Employment
510	Consumer Products	252	UCD Total Housing	Metropolitan Planning Organization (MPO)/Council of Government (COG) Data /California Statewide Travel Demand Model (CSTDM) Data
510	Consumer Products	280	Housing and Restaurants	Combo: Metropolitan Planning Organization (MPO)/Council of Government (COG) Data /California Statewide Travel Demand Model (CSTDM) Data and Dun & Bradstreet Market Insight
510	Consumer Products	260	Housing and Autobody	Combo: Metropolitan Planning Organization (MPO)/Council of Government (COG) Data /California Statewide Travel Demand Model (CSTDM) Data and Dun & Bradstreet Market Insight
510	Consumer Products	120	Autobody Shops	Dun & Bradstreet's Market Insight Database
510	Consumer Products	739	Other Coatings	Dun & Bradstreet's Market Insight Database
510	Consumer Products	270	Housing and Commercial Employment	Metropolitan Planning Organization (MPO)/Council of Government (COG) Data /California Statewide Travel Demand Model (CSTDM) Data
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	Population, Commercial Employment and Hospitals	Metropolitan Planning Organization (MPO)/Council of Government (COG) Data /California Statewide Travel Demand Model (CSTDM) Data and ESRI
510	Consumer Products	672	Developed Land High Density	National Land Cover Database (NLCD)
520	Architectural Coatings and Related Process Solvents	230	HE Square Feet	Council of Government (COG) Housing and Employment

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
520	Architectural Coatings and Related Process Solvents	270	Housing and Commercial Employment	Metropolitan Planning Organization (MPO)/Council of Government (COG) Data /California Statewide Travel Demand Model (CSTDM) Data
520	Architectural Coatings and Related Process Solvents	110	All Paved Roads	Tiger Geodatabases from U.S. Census Bureau
530	Pesticides/Fertilizers	230	HE Square Feet	Council of Government (COG) Housing and Employment
530	Pesticides/Fertilizers	512	Pesticides No Methyl Bromide	Department of Pesticide Regulation
530	Pesticides/Fertilizers	514	Pesticides Methyl Bromide	Department of Pesticide Regulation
530	Pesticides/Fertilizers	732	Wood	Dun & Bradstreet's Market Insight Database
540	Asphalt Paving / Roofing	588	UCD On-road Construction	Caltrans Highway Construction Projects Dataset (Line)
610	Residential Fuel Combustion	573	Fireplaces	Digital Map Products 2017 Parcel Data
610	Residential Fuel Combustion	572	Residential Liquid Petroleum Gas Heating	US Census American Community Survey (ACS)
620	Farming Operations	356	Horse Ranches	CARB Green House Gas Inventory Group
620	Farming Operations	320	Irrigated Cropland	National Land Cover Database (NLCD)
620	Farming Operations	690	Land Prep	Department of Pesticide Regulation
630	Construction and Demolition	588	UCD On-road Construction	Caltrans Highway Construction Projects Dataset (Line)
630	Construction and Demolition	587	UCD Offroad Construction	Storm Notice of Intent (NOI) Dataset
640	Paved Road Dust	590	Sand and Gravel Mines	National Atlas
640	Paved Road Dust	610	Secondary Paved Roads	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)

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
645	Unpaved Road Dust	720	Farm Road Vehicle Miles Traveled	Department of Pesticide Regulation
645	Unpaved Road Dust	660	Unpaved Roads	Tiger Geodatabases from U.S. Census Bureau
650	Fugitive Windblown Dust	391	Pasture	National Land Cover Database (NLCD)
650	Fugitive Windblown Dust	660	Unpaved Roads	Tiger Geodatabases from U.S. Census Bureau
650	Fugitive Windblown Dust	160	Dry Lake Beds	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	Primary Roads	Tiger Geodatabases from U.S. Census Bureau
670	Managed Burning and Disposal	674	Developed Land Low Density	National Land Cover Database (NLCD)
670	Managed Burning and Disposal	190	Forestland	National Land Cover Database (NLCD)
670	Managed Burning and Disposal	720	Farm Road Vehicle Miles Traveled	Department of Pesticide Regulation
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	SJV APCD & 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
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	Commercial Airports	Federal Aviation Administration, National Transportation Atlas Database (NTAD)
810	Aircraft	320	Irrigated Cropland	National Land Cover Database (NLCD)

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
820	Trains	491	Linehaul	ARB In-House Rail Modeling
820	Trains	360	Metrolink Lines	Federal Railroad Administration / National Transportation Atlas Database (NTAD)
820	Trains	490	Rail Lines	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	(US DOT)/Bureau of Transportation Statistics' (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	Ship Lanes	Marine Cadastre Automatic Identification System
833	Ocean Going Vessels	460	Ports	(US DOT)/Bureau of Transportation Statistics' (BTS's) National Transportation Atlas Database (NTAD)
833	Ocean Going Vessels	383	Military Ships	Marine Cadastre - Military Vessel
833	Ocean Going Vessels	640	Ship Lanes	Marine Cadastre Automatic Identification System
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	(US DOT)/Bureau of Transportation Statistics' (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

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
835	Commercial Harbor Craft	339	Dredge	Marine Cadastre Coastal Maintained Channels
840	Recreational Boats	338	Ocean Recreation Boats	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 and Recreation Boats	U.S. Geological Survey (USGS)
840	Recreational Boats	335	Lakes, Rivers, Recreation Boats	U.S. Geological Survey (USGS)
850	Off-Road Recreational Vehicles	220	Golf Courses	ESRI
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	Unpaved Roads	Tiger Geodatabases from U.S. Census Bureau
850	Off-Road Recreational Vehicles	170	Elevation over 1500 m	U.S. Geological Survey (USGS)
860	Off-Road Equipment	580	Residential Nonresidential Change	Council of Government (COG) Housing and Employment
860	Off-Road Equipment	630	Service and Commercial Employment, Schools, Golf Courses and Cemeteries	Council of Government (COG) Service and Commercial Employment & Esri
860	Off-Road Equipment	460	Ports	(US DOT)/Bureau of Transportation Statistics' (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

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
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)
860	Off-Road Equipment	485	TRU	Integrated Transportation Network and Caltrans Truck Network And Digital Map Products 2017 Parcel Data
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 Family 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	191	Forestland Roads	NLCD in conjunction with TIGER road network
860	Off-Road Equipment	587	UCD Offroad Construction	Storm Notice of Intent (NOI) Dataset
870	Farm Equipment	720	Farm Road Vehicle Miles Traveled	Department of Pesticide Regulation
890	Fuel Storage And Handling	651	UCD Single Family 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, Recreation boats	U.S. Geological Survey (USGS)
910	Biogenic Sources	672	Developed Land High Density	National Land Cover Database (NLCD)
910	Biogenic Sources	190	Forestland	National Land Cover Database (NLCD)
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)

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
930	Wildfires	391	Pasture	Sierra Research Agtool Contract
940	Windblown Dust	412	Fugitive Dust	National Land Cover Database (NLCD)

APPENDIX C
Current Control Measures

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C. Current Control Measures

C.I. CARB Mobile Source Program: Key Mobile Source Regulations and Programs Providing Emission Reductions

Given the severity of California's air quality challenges and the need for ongoing emission reductions, the California Air Resources Board (CARB or Board) 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 (CAAA or 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.

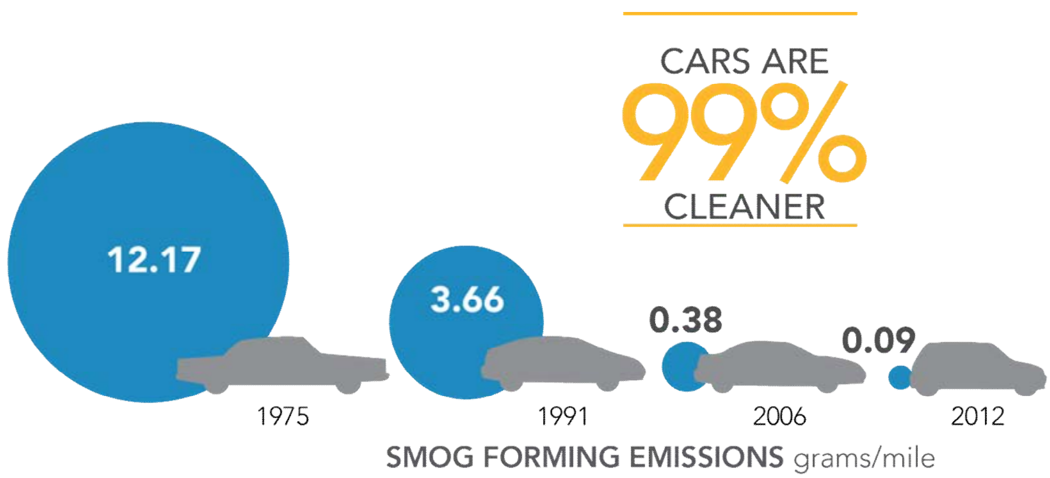
In 1998, CARB identified diesel particulate matter as a toxic air contaminant. Since then, CARB adopted numerous regulations aimed at reducing exposure to diesel particulate matter while concurrently providing reductions in oxides of nitrogen (NO_X) from freight transport sources like heavy-duty diesel trucks, transportation sources like passenger cars and buses, and off-road sources like large construction equipment. Phased implementation of these regulations will continue to produce 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 vehicles and engines. Key incentive programs include: Low Carbon Transportation, Air Quality Improvement Program, VW Mitigation Trust, Community Air Protection, Carl Moyer Program, Goods Movement Program, Clean Off-Road Equipment (CORE) and Funding Agricultural Replacement Measures for Emission Reductions (FARMER). These incentive-based programs work in tandem with regulations to accelerate deployment of cleaner technology.

C.I.A. Light-Duty Vehicles

Figure C-1 illustrates the trend in CARB smog forming emission standards for light-duty vehicles. Cars are 99 percent cleaner than they were in 1975 due to CARB's longstanding light-duty mobile source program. 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. In 1970, CARB required auto manufacturers to meet the first standards to control NO_X 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.

Figure C-1 Light-Duty Emission Standards



As a result of these efforts, light-duty vehicle emissions in the Sacramento Metropolitan nonattainment area (Sacramento Metro area) have been reduced significantly since 1990 and will continue to go down through 2032. From today, light-duty vehicle NO_X emissions are projected to decrease by over 64 percent in 2032. Key light-duty programs include Advanced Clean Cars (ACC), On-Board Diagnostics, Reformulated Gasoline, Incentive Programs, and the Enhanced Smog Check Program.

C.I.A.1. Advanced Clean Cars

CARB's groundbreaking 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 this program is evident: California is the world's largest market for Zero Emission Vehicles (ZEVs), with over 87 models available today, including battery-electric, plug-in hybrid electric, and fuel cell electric vehicles. A wide variety are now available at lower price points, attracting new consumers. As of February 2022, Californians, who drive only 10 percent of the nation's cars, now account for over 40 percent of all zero-emission cars in the country. 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 requirements, 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 (GHG) 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 also included amendments affecting the current ZEV requirements 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 will continue to achieve benefits into the future as new cleaner cars enter the fleet and displace older and dirtier vehicles.

Going beyond these regulations, California will be transitioning to zero emissions. In support of California's transition to zero-emission vehicles, in 2020, Governor Newsom signed Executive Order N-79-20[1] which established a goal that 100 percent of California sales of new passenger cars and trucks be zero-emission by 2035. Advanced Clean Cars II (ACC II), a measure in the 2016 State SIP Strategy, is a significant effort critical to meeting air quality standards and was adopted by the CARB Board in August 2022. ACC II is consistent with the Governor Newson's Executive Order and has the goal of cutting emissions from new combustion vehicles while taking all new vehicle sales to 100 percent zero-emission no later than 2035.

1 Executive Order N-79-20 https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf

With this order and many other recent actions, Governor Newsom has recognized that air pollution remains a challenge for California that requires bold action. Zero-emission vehicle commercialization in the light-duty sector is well underway. Longer-range battery electric vehicles are coming to market that are cost-competitive with gasoline fueled vehicles and hydrogen fuel cell vehicles are now also seeing significant sales. Autonomous and connected vehicle technologies are being installed on an increasing number of new car models. A growing network of retail hydrogen stations is now available, along with a rapidly growing battery charger network.

C.I.A.2. On Board Diagnostics (OBD)

OBD systems serve an important role in helping to ensure that engines and vehicles maintain low emissions throughout their full life. 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. Many states currently use the OBD system as the basis for passing and failing vehicles in their inspection and maintenance programs, as is exemplified by California's Smog Check program.

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. The Board has modified the OBD II regulation in regular updates since initial adoption to address manufacturers' implementation concerns and, where needed, to strengthen specific monitoring requirements. Most recently, the Board amended the regulation in 2021 to require manufacturers to implement Unified Diagnostic Services (UDS) for OBD communications, which will provide more information related to emissions-related malfunctions that are detected by OBD systems, improve the usefulness of the generic scan tool to repair vehicles, and provide needed information on in-use monitoring performance. UDS implementation would be required for all 2027 and subsequent model year light- and medium-duty vehicles and engines, as well as some heavy-duty vehicles and engines.

C.I.A.3. California Enhanced Smog Check Program

The Bureau of Automotive Repair (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 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 cut points;
- Visible smoke test; and
- Inspection of light- and medium-duty diesel vehicles.

The next major change in the Program 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, supported by CARB and BAR, promised faster and less expensive Smog Check inspections by taking advantage of the second generation of OBD software installed on all vehicles. 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.

C.I.A.4. Reformulated Gasoline (CaRFG)

Since 1992, CARB has been regulating the formulation of gasoline through the California Reformulated Gasoline program (CaRFG). The CaRFG program has been implemented in three phases, and has resulted 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, which 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.

C.I.A.5. Incentive Programs

There are many different incentive programs focusing on light-duty vehicles that produce extra emission reductions beyond traditional regulations. Incentive programs encourage both the early retirement of dirty, older cars and the purchase of newer, lower-emitting vehicle engines and technologies. 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.

The State, in partnership with the local air districts, has a well-established history of using incentive programs to advance technology development and deployment, and to achieve early emission reductions. Since 1998, CARB and California's local air districts have been administering incentive funding to accelerate the deployment and turnover to cleaner vehicles, starting with the Moyer Program. In recognition of the key role that incentives play in complementing State and local air quality regulations to reduce emissions, the scope and scale of California's air quality incentive programs has since greatly expanded. Each of CARB's incentive programs has its own statutory requirements, goals, and categories of eligible projects that collectively provide for a diverse and complex incentives portfolio. CARB uses this portfolio approach to incentives to accelerate development and early commercial deployment of the cleanest mobile source technologies and to improve access to clean transportation.

The Fiscal Year (FY) 2021-22 State Budget included an unprecedented level of investment in ZEVs, with $2.3 billion allocated for CARB over the next three years, specifically dedicated to incentive-based turnover of mobile source vehicles and equipment, as part of a $3.9 billion comprehensive, multi-agency package to accelerate progress toward the State's zero-emission vehicle goals established under Executive Order N-79-20. With the 2022-23 State Budget, Governor Newsom is further reinforcing California's commitment to transitioning away from combustion vehicles with an additional $6.1 billion in ZEV investments over the next 5 years.

C.I.A.5.a. Low Carbon Transportation Investments and Air Quality Improvement Program (Clean Transportation Incentives)

California's Low Carbon Transportation Investments and the Air Quality Improvement Program form CARB's major incentive funding program, which works in concert with the State's larger portfolio of clean transportation investments. Together, the Low Carbon Transportation Investments and Air Quality Improvement Program are known as the Clean Transportation Incentives program; they provide mobile source incentives to reduce greenhouse gas, criteria pollutant, and toxic air contaminant emissions through the deployment of advanced technology and clean transportation in the light-duty and heavy-duty sectors.

The Clean Transportation Incentives Program is part of California Climate Investments and is designed to accelerate the transition to advanced technology low carbon freight and passenger transportation, with a priority on providing health and economic benefits to California's most disadvantaged communities, and with a focus on increasing deployment of zero-emission vehicles and equipment wherever possible. Low Carbon Transportation Investments are supported by California's Cap-and-Trade auction proceeds. The Air Quality Improvement Program (AQIP) is a mobile source incentive program that focuses on reducing criteria pollutant and diesel particulate emissions with concurrent GHG reductions. AQIP is appropriated from the Air Quality Improvement Fund.

Each year, the legislature appropriates funding to CARB for the Low Carbon Transportation Investments and Air Quality Improvement Programs, and allocations are used to fund multiple programs in the passenger vehicle, on-road heavy-duty, and off-road vehicle sectors, including: the Clean Vehicle Rebate Project (CVRP); Enhanced Fleet Modernization Program and Plus-Up Pilot Project (Clean Cars 4 All); and the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP).

C.I.A.5.a.i. Clean Vehicle Rebate Program (CVRP)

As one of the programs funded through the Clean Transportation Incentives program, CVRP is a vehicle purchasing incentives program that provides consumer rebates to reduce the price for new ZEV purchases, and 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. In FY 2021-22, CVRP was allocated $525 million.

C.I.A.5.a.ii. Clean Cars 4 All (CC4A)

Clean Cars 4 All (formerly known as the Enhanced Fleet Modernization Program Plus-Up Pilot Project) is another Clean Transportation Incentives program for passenger vehicles. Clean Cars 4 All 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. The budget for FY 2021-22 included $75 million for the statewide expansion of CC4A.

C.I.A.5.a.iii. Other Clean Transportation Equity Investments

CARB also funds a suite of transportation equity pilot projects aimed at increasing access to clean transportation and mobility options for priority populations in disadvantaged and low-income communities, and for lower-income households. This includes clean vehicle ownership projects, clean mobility options, streamlining access to funding and financing opportunities, and increasing community outreach, education and exposure to clean technologies. Clean Transportation Equity pilot projects exemplify the importance of understanding the unique needs across communities and provide lessons for how we most directly address barriers to collectively achieve our equity, air quality, and climate goals. Major Clean Transportation Equity Investment programs include: Clean Mobility Options, Clean Mobility in Schools, Financing Assistance; and Sustainable Transportation Equity Project **(**STEP). Clean Transportation Equity Investment projects were allocated $150 million in the FY 2021-22 budget, which includes the $75 million for CC4A mentioned above.

Financing Assistance provides eligible consumers buy-down and financing opportunities to purchase or lease a new or used clean vehicle, such as a conventional hybrid electric vehicle (HEV), plug-in hybrid (PHEV), or battery electric vehicle (BEV). Clean Mobility in Schools Projects are located within disadvantaged communities and are intended to encourage and accelerate the deployment of new zero-emission school buses, school fleet vehicles, passenger cars, lawn and garden equipment, and can incorporate alternative modes of transportation like transit vouchers, active transportation elements, and bicycle share programs. In the light-duty sector, some of the Clean Mobility Options programs that CARB funds include the Clean Mobility Options Voucher Pilot Program

(CMO). CMO provides voucher-based funding for low-income, tribal, and disadvantaged communities to fund zero-emission shared and on-demand services such as carsharing, ridesharing, bike sharing, and innovative transit services. STEP is a new transportation equity pilot program that funds zero-emission carsharing, bike sharing, public transit, and shared mobility subsidies, among other projects.

C.I.A.6. Consumer Assistance Program

California's voluntary vehicle retirement program, the Consumer Assistance Program (CAP), is administered by BAR and provides low-income consumers repair assistance including up to $1,200 in emissions-related repairs if their vehicle fails its biennial Smog Check Test inspection, and/or up to $1,500 per vehicle for retiring operational vehicles at BAR-contracted dismantler sites.

C.I.B. Medium- and Heavy-Duty On-Road Trucks

Due to the benefits of CARB's longstanding heavy-duty mobile source program, heavy-duty on-road vehicle emissions in the Sacramento Metro nonattainment area have been reduced significantly since 1990 and will continue to decrease through 2032. From today, medium- and heavy-duty NO_X emissions are projected to decrease by over 71 percent in 2032. Key programs contributing to those reductions include new heavy-duty engine standards, cleaner diesel fuel requirements, California's Truck and Bus Regulation and incentive programs.

C.I.B.1. Heavy-Duty Engine Standards

Since 1990, heavy-duty engine NO_X 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 NO_X standards, there have been several generations of optional lower NO_X standards put in place over the past 15 years. Most recently in 2015, engine manufacturers were allowed to certify to three optional NO_X emission standards of 0.1g/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, and to encourage the development of cleaner engines.

C.I.B.2. Optional Low- NO_X Standards for Heavy-Duty Diesel Engines

In 2013, California established optional low- NO_X standards for heavy-duty diesel engines (Optional Reduced Emissions Standards for Heavy-Duty Engines regulation), with the most aggressive standard being 0.02 g/bhp-hr, 90 percent below the federally required standard. The optional low- NO_X standards were developed to pave the way for more stringent mandatory standards by encouraging manufacturers to develop and certify low-NO_X engines and incentivizing potential customers to purchase these low-NO_X engines. By 2019, a total of fifteen engines families, some using natural gas and others using liquefied petroleum gas, had been certified to the optional low-NO_X standards.

C.I.B.3. Heavy-Duty Engine and Vehicle Omnibus Regulation

In 2021, CARB comprehensively overhauled how NO_X emissions from new heavy-duty engines are regulated in California through the adoption of the Heavy-Duty Engine and Vehicle Omnibus Regulation which reduces NO_X emissions from the engines in medium- and heavy-duty vehicle classes. The Omnibus Regulation includes NO_X certification emission standards and in-use standards that significantly reduce tailpipe NO_X emissions during most vehicle operating modes such as high-speed steady-state, transient, low load urban driving, and idling modes of operation. Additionally, revisions to the emissions warranty, useful life, emissions warranty and reporting information and corrective action procedures, and durability demonstration procedures provide additional emission benefits by encouraging more timely repairs to emission-related malfunctions and encouraging manufacturers to produce more durable emission control components, thereby reducing the rate at which engine emission controls fail and emissions increase.

C.I.B.4. Cleaner In-Use Heavy-Duty Trucks (Truck and Bus Regulation)

California's Truck and Bus Regulation or In-Use Heavy-Duty Truck Rule was first adopted in December 2008. This rule represents a multi-year effort to turn over the legacy fleet of heavy-duty on-road 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 California's 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 goat trucks, 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 verifies 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 been 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 (TRUCRS), 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.

C.I.B.5. Heavy-Duty Inspection and Maintenance Regulation

To ensure heavy-duty trucks remain clean in-use, CARB adopted in 2021 the Heavy-Duty Inspection and Maintenance Regulation, which requires periodic demonstrations that vehicles' emissions control systems are properly functioning in order to legally operate within the State. This regulation is designed to achieve criteria emissions reductions by ensuring that malfunctioning emissions control systems are repaired in a timely fashion.

C.I.B.6. Heavy-Duty On-Board Diagnostics (HD OBD)

OBD systems serve an important role in helping to ensure that engines and vehicles maintain low emissions throughout their full life. OBD systems monitor virtually all emission controls on gasoline and diesel engines, including catalysts, particulate matter (PM) filters, exhaust gas recirculation systems, oxygen sensors, evaporative systems, fuel systems, and electronic powertrain components as well as other components and systems that can affect emissions when malfunctioning. The systems also provide specific diagnostic information in a standardized format through a standardized serial data link on-board the vehicles. The use and operation of OBD systems ensure reductions of in-use motor vehicle and motor vehicle engine emissions through improvements in emission system durability and performance.

The CARB originally adopted comprehensive Heavy-Duty OBD regulations in 2005 for model year 2010 and subsequent heavy-duty engines and vehicles, referred to as HD OBD. In 2009, the Board updated the HD OBD regulation, adopted specific enforcement requirements, and aligned the HD OBD with OBD requirements for medium-duty vehicles.

In 2021, CARB again amended the HD OBD regulation; the 2021 amendments require manufacturers to implement Unified Diagnostic Services for OBD communications, which will provide more information related to emissions-related malfunctions that are detected by OBD systems, improve the usefulness of the generic scan tool to repair vehicles, and provide needed information on in-use monitoring performance.

C.I.B.7. 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 diesel particulate matter, which is considered a toxic air contaminant in California. 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.

C.I.B.8. Advanced Clean Truck Regulation (ACT)

In June 2020, CARB adopted the Advanced Clean Trucks regulation, a first of its kind regulation requiring medium- and heavy-duty manufacturers to produce ZEVs as an increasing portion of their sales beginning in 2024. The Advanced Clean Trucks regulation is a manufacturers ZEV sales requirement and a one-time reporting requirement for large entities and fleets. This regulation is expected to result in roughly 100,000 heavy-duty ZEVs operating on California's roads by 2030 and nearly 300,000 heavy-duty ZEVs by 2035. With the adoption of the Advanced Clean Trucks regulation, CARB Resolution 20-19 directs staff to return to the Board with a zero-emission fleet rule and sets the following targets for transitioning California's heavy-duty vehicle sectors to ZEVs:

- 100 percent zero-emission drayage, last mile delivery, and government fleets by 2035;
- 100 percent zero-emission refuse trucks and local buses by 2040;
- 100 percent zero-emission-capable vehicles in utility fleets by 2040; and
- 100 percent zero-emission everywhere else, where feasible, by 2045.

As mentioned earlier, the Governor signed Executive Order N-79-20 in September 2020, which directs CARB to adopt regulations to transition the State's transportation fleet to ZEVs. This includes transitioning the State's drayage fleet to ZEVs by 2035 and transitioning the State's truck and bus fleet to ZEVs by 2045 where feasible.

C.I.B.9. Innovative Clean Transit (ICT) and Zero-Emission Airport Shuttle Regulation

To achieve the needed emission reductions from heavy-duty applications, CARB is driving the use of zero-emission heavy-duty vehicles in strategic applications, including urban transit buses and airport ground transportation. The Innovative Clean Transit regulation was the first of these programs. It was adopted in December 2018 and requires all public transit agencies to gradually transition to a 100 percent zero-emission bus fleet and encourages them to provide innovative first- and last-mile connectivity and improved mobility for transit riders. Beginning in 2029, 100 percent of new purchases by transit agencies must be Zero Emission Buses, with a goal for full transition by 2040. It applies to all transit agencies that own, operate, or lease buses in California with a GVWR greater than 14,000 lbs. It includes standard, articulated, over-the-road, double-decker, and cutaway buses.

The Zero-Emission Airport Shuttle Regulation, adopted in June 2019, requires airport shuttle operators in California to transition to 100 percent ZEV technologies. Airport shuttle operators must begin adding zero-emission shuttles to their fleets in 2027 and complete the transition to ZEVs by the end of 2035. The regulation applies to airport shuttle operators who own, operate, or lease vehicles at any of the 13 California airports regulated under this rule.

C.I.B.10. Incentive Programs

There are many different incentive programs focusing on heavy-duty vehicles that accelerate turnover to cleaner technologies, and thereby produce extra emission reductions beyond traditional regulations. 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.

C.I.B.10.a. Low Carbon Transportation Investments and Air Quality Improvement Program (Clean Transportation Incentives)

In addition to funding passenger vehicle incentive programs, the Low Carbon Transportation Investments and the Air Quality Improvement Program (Clean Transportation Incentives) also provides incentive funding for heavy-duty vehicles. This program both funds projects to accelerate fleet and engine turnover to cleaner existing technologies through the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) and Truck Loan Assistance program, as well as funding demonstration and pilot projects.

Beyond the vehicle purchasing incentives programs (CVRP and Clean Cars 4 All) and Clean Transportation Equity Investments, an additional $873 million was allocated in the FY 2020-2021 budget for on-road heavy-duty trucks and off-road equipment. CARB provides these incentive funds following the principles of the portfolio approach, meaning that funding is provided across multiple sectors and applications – as well as across multiple technologies to support both the technologies that are providing emission reductions today, as well as those that are needed to meet future goals as the technology matures. This includes funding for demonstration and pilot projects, vouchers for advanced clean technologies, and financing and support for small fleets transitioning to cleaner technologies. Additionally, this year funding was set aside specifically for drayage trucks, transit buses, and school buses, all of which are primed to rapid transition to zero-emission.

C.I.B.10.a.i. Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)

CARB's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) serves as the cornerstone program in CARB's advanced technology heavy-duty incentive portfolio. HVIP has provided funding since 2010 to support the long-term transition to cleaner combustion and zero-emission vehicles in the heavy-duty market. The program helps offset the higher costs of clean vehicles, and additional incentives are available for providing disadvantaged community benefits. HVIP responds to a key market challenge by making clean vehicles more affordable for fleets through point-of-purchase price reductions. With an HVIP voucher, technology-leading vehicles can be as affordable as their traditional fossil-fueled counterparts, enabling fleets of all sizes to deploy advanced technologies that are cleaner and quieter. HVIP is the earliest model in the United States to demonstrate the function, flexibility, and effectiveness of first-come first-served incentives that reduce the incremental cost of commercial vehicles. HVIP is fleet-focused, providing a streamlined and user-friendly option to encourage purchases and leases of advanced clean trucks and buses throughout California. Approved dealers are a key part of HVIP success and are trained to facilitate the application process**.** Vocations include freight and drayage trucks, delivery vans, utility vehicles, transit, school, and shuttle buses, refuse trucks, and more. In FY 2021-22, the Legislature allocated $569.5 million for HVIP.

C.I.B.10.a.ii. Truck Loan Assistance Program

CARB's Truck Loan Assistance Program was created through a one-time appropriation of approximately $35 million in the 2008 State Budget to implement a heavy-duty loan program that assists on-road fleets affected by the Truck and Bus Regulation and the Heavy-Duty Tractor-Trailer Greenhouse Gas Regulation. CARB has continued to operate this program with subsequently appropriated AQIP funds of around $28 million annually to provide financing opportunities to small-business truckers who don't meet conventional lending criteria and are unable to qualify for traditional financing for cleaner trucks. As of February 2022, about $187 million in Truck Loan Assistance Program funding has been provided to small business truckers for the purchase of approximately 36,000 cleaner trucks, exhaust retrofits, and trailers. In FY 2021-22, $28.6 million was allocated for the Truck Loan Assistance Program.

C.I.B.10.a.iii. Demonstration and Pilot projects

In addition to funding HVIP and the Truck Loan Assistance Program, the Clean Transportation Incentives program is the only program in CARB's portfolio, and one of the only programs in the State, that funds demonstration and pilot projects to support early market deployment of nascent zero-emission technologies. The purpose of the Advanced Technology Demonstration and Pilot Projects is to help accelerate the next generation of advanced technology vehicles, equipment, or emission controls, which are not yet commercialized. As such, it provides a testing ground for innovative projects focused on improving access to clean transportation for priority communities. In FY 2021-22, $80 million was allocated for heavy-duty advanced technology demonstration and pilot projects, which are intended to help bring to market-readiness zero emission (ZE) heavy-duty technologies that are poised to deploy commercially in the near future in both on- and off-road applications. This includes zero-emission long-haul trucks, strategic truck range extenders, and ZE applications along freight facilities/corridors.

In heavy-duty applications, the goods movement sector is a focus for incentive funding, with CARB funding multiple demonstration and pilot programs to drive zero-emission technologies in last mile delivery trucks, drayage trucks, and heavy-duty trucks and tractors. The *USPS Zero-Emission Delivery Truck Pilot Commercial Deployment Project* is deploying battery electric last-mile delivery trucks in the USPS fleet, together with the associated charging infrastructure. The project will demonstrate the practicality and economic viability of the widespread adoption of a variety of ZE medium- and heavy-duty vehicle technologies in delivery applications. The *Battery Electric Drayage Truck Demonstration* project is a $40 million Statewide demonstration of forty-four zero-emission battery electric and plug-in hybrid drayage trucks that, since 2018, have been in operation serving major California ports in five air districts (South Coast, Bay Area, San Joaquin Valley, Sacramento, and San Diego). Battery electric drayage trucks are used to transport cargo to or from California's ports and intermodal rail yards. Installation of charging infrastructure that enables safe charging of the trucks for statewide demonstration is also included as part of this project. To accelerate the deployment of zero-emission technologies in heavier freight applications, the $44.8 million *Volvo Low Impact Green Heavy Transportation Solutions* project is funding Class 8 heavy-duty battery electric trucks equipped with battery electric tractors to facilitate creation of a zero-emission goods movement system from the Ports of Long Beach and Los Angeles to four freight handling facilities in disadvantaged communities.

Clean transportation incentives have also funded demonstrations and pilot projects for ZE urban transit buses. The $22.3 million *Fuel Cell Electric Bus Commercialization Consortium* in the Bay Area and Southern California is funding battery and fuel cell urban transit buses, which will better serve communities' transit needs, substantially reduce greenhouse gas emissions, eliminate criteria pollutants, and provide economic benefits.

C.I.B.10.a.iv. Clean Transportation Equity Investments

As mentioned earlier, Clean Mobility in Schools Projects are also encouraging and accelerating the deployment of new zero-emission heavy-duty engines and vehicles, including battery electric school buses and clean school fleet vehicles.

C.I.B.10.b. Moyer Program

The Carl Moyer Memorial Air Quality Standards Attainment Program (Moyer Program), funded by dedicated revenue from the DMV's smog abatement fee and a fee on the purchase of new tires, provides approximately $60 million in grant funding annually through local air districts for cleaner-than-required engines and equipment. Since 1998, approximately $1 billion has been allocated to date. The Moyer Program provides monetary grants to private companies and public agencies to clean up their heavy-duty engines beyond that required by law through retrofitting, repowering or replacing their engines with newer and cleaner ones. These grants are issued locally by air districts. Projects that reduce emissions from heavy-duty on-road engines qualify, including heavy-duty trucks, drayage trucks, emergency vehicles, public agency and utility vehicles, school buses, solid waste collection vehicles, and transit fleet vehicles.

As the regulatory, technological and incentives landscape have changed significantly since the creation of the Moyer Program and to address evolving needs, the Legislature has periodically modified the program to better serve California. Most recently, Senate Bill (SB) 513 (Beall, 2015) has provided new opportunities for the Moyer Program to contribute significant emission reductions alongside implemented regulations, advance zero and near-zero technologies, and combine program funds with those of other incentive programs.

In the FY 2021-22 budget, the Legislature appropriated an additional $45 million in Moyer Program funding to support the replacement of diesel trucks with ultra-low NO_X trucks certified to meet the 0.02 g/bhp-hr NO_X standard or lower. Currently, only the South Coast Air Quality Management District and the San Joaquin Valley Air Pollution Control District would be eligible for these funds. In November 2021, the Board approved increases to the Moyer Program cost-effectiveness limits and funding caps for optional advanced technology and zero-emission replacement projects for on-road heavy-duty trucks. Increasing the cost-effectiveness thresholds is designed to increase funding opportunities and ensures that the Moyer Program continues to focus on developing the most advanced zero-emission and low emission technologies, consistent with encouraging further emissions reductions. These changes included increasing the threshold for on-road zero-emission vehicles, which includes zero-emission school buses, from $100,000 to $500,000 per unit.

The Moyer Program also funds CARB's On-Road Heavy-Duty Voucher Incentive Program (VIP), which provides funding opportunities for small fleet owners with 10 or fewer vehicles to quickly replace their older heavy-duty diesel or alternative fuel vehicles. Under this program, fleet owners may be eligible for funding of up to $410,000 for replacing their existing vehicle(s) to be scrapped and replaced by new trucks (zero-emission or certified to the optional 0.02 g/bhp-hr NO_X standard), or up to $50,000 for replacing their existing fleet with used vehicles with 2013 model year or later engines. Air districts have the discretion to set certain local eligibility requirements based upon local priorities.

C.I.B.10.c. Goods Movement Emission Reduction Program (Prop 1B)

The Prop 1B Program was created to reduce exposure for populations living near freight corridors and facilities that were being adversely impacted by emissions from goods movement. This program provided incentives to owners of equipment used in freight movement to upgrade to cleaner technologies sooner than required by law or regulation. Voters approved $1 billion in total funding for the air quality element of the Prop 1B Program to complement $2 billion in freight infrastructure funding under the same ballot initiative.

Beginning in 2008, the Goods Movement Emission Reduction Program funded by Prop 1B has funded cleaner trucks for the region's transportation corridors; the final increment of funds implemented projects through 2020. The $1 billion program was a partnership between CARB and local agencies, air districts, and seaports to quickly reduce air pollution emissions and health risk from freight movement along California's trade corridors. While all Prop 1B Program funds have been awarded to the local air districts for implementation, the program framework exists to serve as a mechanism to award clean truck funds through newer funding programs.

C.I.B.10.d. Volkswagen (VW) Mitigation Trust

In 2015, after a CARB-led investigation, in concert with the United States Environmental Protection Agency (EPA), VW admitted to deliberately installing emission defeat devices on nearly 600,000 VW, Audi, and Porsche diesel vehicles sold in the United States, approximately 85,000 of which were sold in California. The VW California settlement agreement includes both a Mitigation Trust to mitigate the excess NO_X emissions caused by the company's use of illegal defeat devices in their vehicles, as well as a ZEV Investment Commitment to help grow the State's expanding ZEV program. The Mitigation Trust includes approximately $423 million for California to be used as specified in the settlement agreement. Per the Beneficiary Mitigation Plan approved by CARB in 2018, this funding will be used to replace older heavy-duty trucks, buses, and freight vehicles and equipment with cleaner models, with a focus on zero-emission technologies where available and cleaner combustion everywhere else, as well as to fund light-duty ZEV infrastructure. In addition, there have been mitigation funds established as the result of other settlements from which funding is used to support clean technologies.

C.I.B.10.e. Community Air Protection Incentives (AB 617 | Community Air Protection Program)

Since the 2016 State SIP Strategy elucidated the need for additional legislative assistance in funding turnover programs to accelerate the deployment and adoption of cleaner technologies, the Legislature has since 2017 established a number of new incentive programs that are implemented through CARB through various budget bills. The State Legislature has provided substantial funding to achieve early emissions reductions in the communities most impacted by air pollution. In its 2018 funding allocation, the Legislature expanded the possible uses of AB 617 funds to include Moyer and Proposition 1B eligible projects with a priority on zero-emission projects, zero-emission charging infrastructure, stationary source projects, and additional projects consistent with the CERPs.

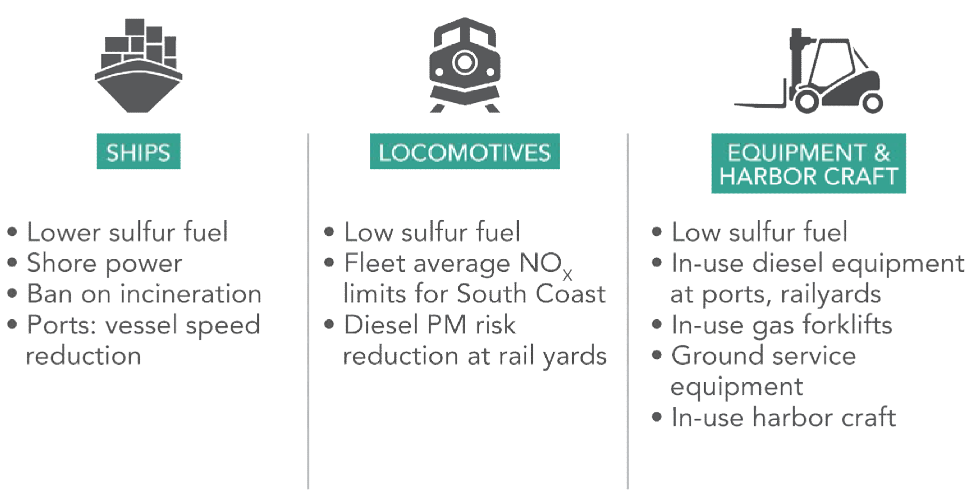
CARB and air districts partner to run the programs, with CARB developing guidelines and the districts administering funds for their regions. In most cases throughout the State, selected communities have identified mobile source emissions as a target for reductions. It is likely that a significant portion of the AB 617-allocated funding will incentivize the accelerated turnover to cleaner vehicles and equipment in and around low-income and disadvantaged communities.

C.I.C. Off-Road Sources

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 C-2 illustrates the comprehensive suite of emission control measures applicable to the broad variety of engines and vehicles that fall under the Off-Road category. As a result of these emission control efforts, off-road emissions in the Sacramento Metro nonattainment area have been reduced significantly since 1990 and will continue to decrease through 2032. From today, NO_X emissions from off-road sources that are not primarily regulated Federally are projected to decrease by over 52 percent by 2032. Key programs in this sector include the Off-Road Engine Standards, Locomotive Engine Standards, Clean Diesel Fuel, Cleaner In-Use Off-Road Regulation, and the In-Use Large Spark Ignition (LSI) Fleet Regulation.

Figure C-2 Off-Road Vehicle and Equipment Control Programs



C.I.C.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 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, 2016, and 2021. The 1990 - 2016 regulations were implemented through three tiers of progressively more stringent exhaust emission standards that were phased in between 1995 and 2008. The most recent suite of amendments (December 2021) requires most newly manufactured SORE engines be zero emission starting in 2024.

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.

To control emissions from Transport Refrigeration Units (TRUs), CARB adopted in 2004 the Airborne Toxic Control Measure (ATCM) for In-Use Diesel-Fueled TRUs, TRU Generator Sets, and Facilities where TRUs Operate, which set increasingly stringent engine standards to reduce diesel particulate matter emissions from TRUs and TRU generator sets. The ATCM for TRUs was subsequently amended in 2010 and 2011, and most recently in February 2022, as the first phase of CARB's current push to develop new requirements to transition diesel-powered TRUs to zero-emission technology in two phases. The February 2022 adoption, Part 1 amendments to the existing TRU Airborne Toxic Control Measure (ATCM), requires the transition of diesel-powered truck TRUs to zero-emission. CARB plans to develop a subsequent Part 2 regulation to require zero-emission trailer TRUs, domestic shipping container TRUs, railcar TRUs, and TRU generator sets, for future Board consideration.

C.I.C.2. Cleaner In-Use Off-Road Equipment (Off-Road Regulation)

The Off-Road Regulation was first approved in 2007 and subsequently amended in 2010 in light of the impacts of the economic recession. Equipment affected by this regulation is 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 NO_X 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; and
- The Off-road Listserv, providing equipment owners and dealerships with timely announcement of regulatory changes, regulatory assistance documents, and reminders for deadlines.

C.I.C.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 diesel particulate matter which is considered a toxic air contaminant by the State of California. 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.

C.I.C.4. Locomotive Engine Standards

The Clean Air Act and the 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” (EPA interpreted new engines in locomotives to mean remanufactured engines, as well). EPA has approved two sets of national locomotive emission regulations (1998 and 2008). In 1998, EPA approved the initial set of national locomotive emission regulations. These regulations primarily emphasized NO_X reductions through Tier 0, 1, and 2 emission standards. Tier 2 NO_X emission standards reduced older uncontrolled locomotive NO_X emissions by up to 60 percent, from 13.2 to 5.5 g/bhphr.

In 2008, 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. 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/bhphr), 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 NO_X and PM emission standards. The EPA Tier 4 NO_X and PM emission standards further reduced emissions by approximately 95 percent from uncontrolled levels.

In April 2017, CARB petitioned 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 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. EPA has not yet responded to this petition.

C.I.C.5. Marine Sources and Ocean-Going Vessels (OGVs)

To reduce emissions from Ocean Going Vessels (OGV), CARB has adopted the Ocean-Going Vessel Fuel Regulation, “Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline” (2008) and the Ocean-Going Vessels At Berth Regulation (2007).

The At-Berth Regulation requires container ships, passenger ships, and refrigerated-cargo ships at six California ports to meet compliance requirements for auxiliary engines while they are docked, including emission or power reduction requirements. Reduced vessel speeds also provide emission reduction benefits, and programs are operated by local air districts along the California coast to incentivize lower speeds. CARB staff received comments during the public process about including a statewide vessel speed reduction program. In the 2022 State SIP Strategy, the CARB measure for ‘Future Emissions Reductions from Ocean-Going Vessels’ considers options available under CARB authority to achieve further emissions reductions, including developing a statewide vessel speed reduction program.

In 2007, CARB adopted the Commercial Harbor Craft Regulation (CHC Regulation), which reduces toxic and criteria emissions. Commercial harbor craft include any private, commercial, government, or military marine vessels including, but not limited to ferries, excursion vessels, tugboats (including ocean-going tugboats), barges, and commercial and commercial passenger fishing boats. This regulation was subsequently amended in 2010, and again in March 2022, to establish expanded and more stringent in-use requirements to cover more vessel categories and mandate accelerated deployment of zero-emission and advanced technologies in vessel categories where technology feasibility has been demonstrated.

To control emissions from personal watercraft, CARB staff is also exploring development of Spark-Ignition Marine Engine Standards, as described in the 2022 State SIP Strategy. For this measure, CARB would develop and propose catalyst-based standards for outboard and personal watercraft engines greater than or equal to 40 kW in power that will gradually reduce emission standards to approximately 70 percent below current levels and consider actions that would require a percentage of outboard and personal watercraft vessels to be propelled by zero-emission technologies for certain applications.

C.I.C.6. Large Spark-Ignition (LSI) Engines and Forklifts

Forklift fleets are subject to in-use fleet requirements either under the LSI fleet regulation, if fueled by gasoline or propane, or under the off-road diesel fleet regulation, if fueled by diesel. Both regulations require fleets to retire, repower, or replace higher-emitting equipment in order to maintain fleet average standards.

Large spark-ignition engines, which are defined as spark-ignition (i.e., Otto-cycle) engines greater than 25 horsepower, are used in a variety of equipment, including, but not limited to, forklifts, airport ground support equipment (GSE), sweeper/scrubbers, industrial tow tractors, generator sets, and irrigation pumps. LSI equipment is found in approximately 2,000 fleets throughout the state operating at warehouses and distribution centers, seaports, airports, railyards, manufacturing plants, and many other commercial and industrial facilities.

CARB first adopted emission standards for off-road LSI engines in 1998. The original LSI regulation required engine manufacturers to certify new LSI engines to a 3.0 gram per brake horsepower-hour (g/bhp-hr) standard that, by 2004, represented a 75 percent reduction in emissions compared with uncontrolled LSI. Building on this success, in 2002, EPA subsequently harmonized the national standard with California’s standard, starting with the 2004 model year and adopted a more stringent 2.0 g/bhp-hr standard for 2007 and subsequent model year engines. The federal program demonstrated that additional reductions from new engines were technically feasible and cost-effective. In the 2003 State Implementation Plan for Ozone (2003 SIP), California committed to two additional LSI measures—one for the development of more stringent new engine standards and another for the development of in-use fleet requirements.

CARB adopted these two LSI measures in a 2006 rulemaking, which harmonized California’s standard with EPA’s 2.0 g/bhp-hr standard starting with the 2007 model year, set forth a more stringent 0.6 g/bhp-hr California standard starting with the 2010 model year, and established in-use LSI fleet requirements. The 0.6 g/bhp-hr standard represents a 95 percent emission reduction versus uncontrolled LSI engines and is still in effect today.

The in-use element of the 2006 rulemaking, adopted as the Large Spark-Ignition Engine Fleet Requirements Regulation (LSI Fleet Regulation), which was eventually amended in 2010 and 2016, requires fleet operators with four or more LSI forklifts to meet fleet average emission standards. The 2006 LSI rulemaking and 2010 amendments required specific hydrocarbon + NO_X fleet average emission level standards that became increasingly more stringent over time. The focus of the 2016 amendments was to collect data from fleet operators in order to inform the development of requirements that would support the broad-scale deployment of Zero-Emission equipment in LSI applications. The 2016 amendments also required fleet operators to report key compliance information to CARB and extended to 2023 requirements from the prior LSI Fleet Regulations that were otherwise due to sunset in 2016.

C.I.C.7. Cargo Handling Equipment (CHE)

Cargo handling equipment (CHE) includes yard trucks (hostlers), rubber-tired gantry cranes, container handlers, forklifts, dozers, and other types. The Cargo Handling Equipment (CHE) Regulation established requirements for in-use and newly purchased diesel-powered equipment at ports and intermodal rail yards. CARB adopted the CHE in 2005, which established best available control technology (BACT) for new and in-use mobile CHE that operate at California's ports and intermodal rail yards through accelerated turnover of older equipment through retrofits and/or replacement to cleaner on- or off-road engines. Since 2006, the CHE Regulation has resulted in reductions of diesel PM and NO_X at ports and intermodal rail yards throughout California.

C.I.C.8. Incentive Programs

There are many 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 off-road combustion engines and equipment, and zero-emission technologies. CARB is expanding incentives for zero-emission off-road equipment through targeted demonstration and pilot project categories in the off-road sector, and increased funding.

C.I.C.8.a. Low Carbon Transportation Investments and Air Quality Improvement Program (Clean Transportation Incentives)

As mentioned earlier, $873 million was allocated in the FY 2020-2021 budget for off-road equipment and on-road heavy-duty trucks under the Clean Transportation Incentives programs. In the off-road sector, major programs include the Clean Off-Road Equipment Voucher Incentive Project (CORE), and Demonstration and Pilot Programs. Off-road equipment categories that are prioritized for funding include agricultural and construction equipment, small off-road engines (SORE) such as lawn and garden equipment, heavier cargo handling equipment (CHE), and ZE applications at railyards, marine ports, freight facilities, and along freight corridors.

C.I.C.8.a.i. Clean Off-Road Equipment Voucher Incentive Project

The Clean Off-Road Equipment Voucher Incentive Project (CORE) is a voucher project similar to HVIP, but for advanced technology off-road equipment. CORE is intended to accelerate deployment of advanced technology in the off-road sector by providing a streamlined way for fleets to access funding that helps offset the incremental cost of such technology. CORE targets commercial-ready products that have not yet achieved a significant market foothold. By promoting the purchase of clean technology over internal combustion options, the project is expected to reduce emissions, particularly in areas that are most impacted, help build confidence in zero-emission technology in support of CARB strategies and subsequent regulatory efforts where possible, and provide other sector-wide benefits, such as technology transferability, reductions in advanced-technology component costs, and larger infrastructure investments. CORE provides vouchers to California purchasers and lessees of zero-emission off-road equipment on a first-come, first-served basis, with increased incentives for equipment located in disadvantaged communities.

CARB launched CORE at the end of 2019 through a one-time $40 million allocation in the fiscal year 2017-18 Funding Plan to support zero-emission freight equipment through CORE. Since that time, CORE has been allocated significant additional funds, including $194.95 million from the FY 2021-22 budget. This allocation includes $30 million of dedicated funds appropriated by the Legislature in SB 170 to provide incentives for professional landscaping services in California operated by small businesses or sole proprietors to purchase zero-emission small off-road equipment.

C.I.C.8.a.ii. Demonstration and Pilot Projects

As mentioned earlier, in FY 2021-22, $80 million was allocated for off-road and on-road heavy-duty advanced technology demonstration and pilot projects. CARB is focusing funding on off-road demonstration and pilot projects that include heavier cargo handling equipment (CHE), clean equipment in rail, marine, and ports applications, and zero-emission equipment along freight facilities/corridors.

For the *Port of LA Multi-Source Facility Demonstration Project*, the Los Angeles Harbor Department (Port of LA) was awarded $14.5 million to operate multiple near zero- or zero-emission technologies to move goods from ships through the Green Omni Terminal. This project is demonstrating the viability of electrified CHE, forklifts, and a ships at-berth vessel emissions control system. The *Zero-Emission Freight "Shore to Store"* Project will use $41.1 million to fund electric yard tractors, hydrogen fuel cell Class 8 on-road trucks, and a large capacity hydrogen fueling station in Ontario, CA. Additional zero- and near zero-emission freight facility projects include a $5.8 million *Zero-Emission for California Ports* project at the Port of LA, which will fund hybrid fuel cell and electric yard trucks, as well as hydrogen fueling stations. Further, the San Joaquin Valley's *Net-Zero Farming and Freight Facility Demonstration Project* is funding battery electric trucks equipped with all-electric transport refrigeration units (eTRUs) to facilitate clean freight transport, and transportation of agricultural produce between packing and warehouse facilities.

C.I.C.8.b. Funding Agricultural Replacement Measures for Emission Reductions (FARMER)

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 Legislature has allocated over $323 million towards the Funding Agricultural Replacement Measures for Emission Reductions (FARMER) Program since 2017. The program provides funding through local air districts for incentivizing the introduction of lower-emissions agricultural harvesting equipment, heavy-duty trucks, agricultural pump engines, tractors, and other equipment used in agricultural operations. Since October 2019, the FARMER Program also includes a project category for demonstration projects and modifications to the zero-emission agricultural utility terrain vehicle (UTV), heavy-duty agricultural truck, and off-road mobile agricultural equipment trade-up pilot project categories. As of March 31, 2022, the FARMER Program has spent $298 million on over 7,000 pieces of agricultural equipment and will reduce 1,210 tons of PM2.5 and 20,000 tons of NO_X over the lifetime of the projects, Statewide.

C.I.C.8.c. Moyer Program

In addition to funding on-road incentives, the Moyer Program provides monetary grants to reduce emissions from off-road equipment such as construction and agricultural equipment, marine vessels and locomotives, forklifts, TRUs, and airport ground support equipment.

C.I.C.8.d. Goods Movement Emission Reduction Program (Prop 1B)

As discussed earlier, Proposition 1B was a $1 billion partnership between CARB and local agencies, air districts, and seaports to quickly reduce air pollution emissions and health risk from freight movement along California's trade corridors. Over the course of six years, the program has upgraded ships at-berth, cargo handling equipment, locomotives, TRUs, and harbor craft.

C.I.D. Conclusions

In conclusion, CARB has implemented the most comprehensive mobile source emissions control program in the nation. CARB's mobile source control program is robust and targets all sources of emissions through a four-pronged approach. First, increasingly stringent emissions standards drive the use of the cleanest available engines and equipment and minimize emissions from new vehicles and equipment. Second, to speed the turnover of older, dirtier engines and equipment to cleaner new equipment, in-use programs target emissions from the existing fleet by requiring vehicle and fleet owners to transition legacy fleets and vehicles to the cleanest vehicles and emissions control technologies. Third, incentive programs help fleet owners to replace older, dirtier vehicles and equipment with the cleanest technologies, while also facilitating the development of the next generation of clean technologies that are needed to meet future air quality targets. Finally, cleaner fuels minimize emissions from all combustion engines being used across the State.

This multi-faceted approach has not only spurred the development and use of increasingly cleaner technologies and fuels, it has also provided significant emission reductions across all mobile source sectors that go far beyond national programs or programs in other states.

C.II. Current local stationary and area sources control measures

The SFNA air districts have been regulating air pollution sources since the 1970s. Current rules and their emission benefits have helped and will continue to help make progress toward achieving the nonattainment area's clean air goals.

C.II.A. Existing Local VOC Control Measures

Table C-1 lists the current air districts' rules for different VOC emissions reduction categories. The numbers in parentheses are the year which the rule was initially adopted. The following sections provide a brief description of the control measures.

Table C-1 Current VOC Rules by SFNA Air District.

	Sac Metro AQMD	El Dorado AQMD	Feather River AQMD	Placer County APCD	Yolo-Solano AQMD
VOC Rule Category					
Adhesives	Rule 460 Adhesive and Sealants (1997)	Rule 236 Adhesives (1995)		Rule 235 Adhesives (1995)	Rule 2.33 Adhesive Operations (1994)
Aerospace Coatings	Rule 456 Aerospace Assembly and Component Coating Operations (1993)				
Architectural Coatings	Rule 442 Architectural Coating (1982)	Rule 215 Architectural Coatings (1994)	Rule 3.15 Architectural Coatings (1991)	Rule 218 Architectural Coatings (1979)	Rule 2.14 Architectural Coatings (1979)
Asphalt Paving Material	Rule 453 Cutback and Emulsified Asphalt Paving Materials (1981)	Rule 224 Cutback and Emulsified Asphalt Paving Materials (1991)		Rule 217 Cutback and Emulsified Asphalt Paving Materials (1979)	Rule 2.28 Cutback and Emulsified Asphalts (1994)
Auto Refinishing	Rule 459 Automotive, Truck and Heavy Equipment Refinishing Operations (1996)	Rule 230 Automotive Refinishing Operations (1994)	Rule 3.19 Motor Vehicle and Mobile Equipment Coating Operations (1998)	Rule 234 Automotive Refinishing Operations (1995)	Rule 2.26 Motor Vehicle and Mobile Equipment Coating Operations (1994)
Bakeries	Ruel 458 Large Commercial Bread Bakeries (1994)				
Bulk Terminal	Rule 446 Storage of Petroleum Products () Rule 447 Organic Liquid Loading (1974)	Rule 244 Organic Liquid and Transport Vessels (2001)	Rule 3.9 Organic Liquid and Transfer (1991)	Rule 212 Storage of Organic Liquids (1977) Rule 213 Gasoline Transfer into Stationary Storage Containers (1979)	Rule 2.21 Organic Liquid Storage and Transfer (1994)

	Sac Metro AQMD	El Dorado AQMD	Feather River AQMD	Placer County APCD	Yolo-Solano AQMD
VOC Rule Category					
Can & Coil Coatings				Rule 223 Metal Container Coating (1981)	
Confined Animal Facility	Rule 410 Reduction of Animal Matter (1972); Rule 496 Large Confined Animal Facilities (2006)	Rule 221 Reduction of Animal Matter (Unknown)		Rule 222 Reduction of Animal Matter (1979)	Rule 11.2 Confined Animal Facilities Permit Program (2006)
Dry Cleaning	Rule 444 Petroleum Solvent Dry Cleaning (1981)	Rule 218 Perchloroethylene Dry Cleaning Operations (1980)			Rule 9.7 Perchloroethylene Dry Cleaning Operation (1994)
Fugitive Emissions	*Rule 443 Leaks from Synthetic Organic Chemical and Polymer Manufacturing (1979)*	*Rule 245 Valves and Flanges (2001)*			Rule 2.23 - Fugitive Hydrocarbon Emissions (1997)
GDF	Rule 449 Gasoline Transfer into Stationary Storage Containers (1975)	Rule 238 Gasoline Transfer and Dispensing (2001)	Rule 3.8 Gasoline Dispensing Facilities (1991)	Rule 214 Transfer of Gasoline into Vehicle Fuel Tanks (1979); Rule 215 Transfer of Gasoline into Tank Trucks, Trailers and Railroad Tank Cars at Loading Facilities (1979)	Rule 2.22 Gasoline Dispensing Facilities (1974)
Graphic Arts	Rule 450 Graphics Art Operations (1981)	Rule 231 Graphics Arts Operations (1994)		Rule 239 Graphic Arts Operations (1994)	Rule 2.29 Graphics Arts Printing Operations (1994)
Landfill Gas	Rule 485 Municipal Landfill Gas (1997)		Rule 3.18 Standards for Municipal Solid Waste Landfills (1997)		Rule 2.38 Standards for Municipal Solid Waste Landfills (1997)
Misc. Metal Parts & Products Coatings	Rule 451 Surface Coating of Miscellaneous Metal Parts and Products (1979) Rule 468 Surface Coating of Plastic Parts and Products (2018)			Rule 245 Surface Coating of Metal Parts and Products (2008)	Rule 2.25 Metal Parts and Products Coating Operations (1980)

	Sac Metro AQMD	El Dorado AQMD	Feather River AQMD	Placer County APCD	Yolo-Solano AQMD
VOC Rule Category					
Plastics Coating	Rule 468 Surface Coating of Plastic Parts and Products (2018)			Rule 249 Surface Coating of Plastic Parts and Products (2013)	
Polyester Resin Operations	Rule 465 Polyester Resin Operations (1997)	Rule 240 Polyester Resin Operations (2000)		Rule 243 Polyester Resin Operations (2003)	Rule 2.30 Polyester Resin Operations (1993)
Semiconductor Manufacturing				Rule 244 Semiconductor Manufacturing Operations (1995)	
Surface Preparation/ Cleanup	Rule 451 Surface Coating of Miscellaneous Metal Parts and Products (1979); Rule 454 Degreasing Operations (1979) Rule 466 Solvent Cleaning (2002)	Rule 225 Solvent Cleaning and Degreasing Operations (1994) Rule 235 Surface Preparation and Cleanup (1995)	Rule 3.14 Surface Preparation and Clean-up (1991)	Rule 216 Organic Solvent Cleaning and Degreasing Operations (1979) Rule 240 Surface Preparation and Cleanup (1995)	Rule 2.31 Solvent Cleaning and Degreasing (1994) Rule 2.35 Pharmaceutical Manufacturing Operations (1994)
Synthetic Organics Chemical Manufacturing Industry	Rule 464 Organic Chemical Manufacturing Operations (1998)				Rule 2.41 Expandable Polystyrene Manufacturing Operations (2008)
Wood Coatings	Rule 463 Wood Products Coatings (1996)	Rule 237 Wood Products Coatings (1995)	Rule 3.20 Wood Products Coating Operations (2005)	Rule 236 Wood Products Coating Operations (1994) Rule 238 Factory Coating of Flat Wood Paneling (1994)	Rule 2.39 Wood Products Appliances (2004)

C.II.A.1. Adhesives and Sealants

Adhesives are used to bond one surface to another by attachment. A variety of adhesives are available for applications including, but not limited to, architectural applications such as carpet, flooring, and roofing, as well as adhesives for plastic, tires, traffic marking tape, metal, fiberglass, and marine applications. Contact adhesives, for example, provide a quick bond between two surfaces by applying pressure without requiring fastening. Large quantities of adhesives are used in manufacturing furniture, the automotive industry, and in the construction industry. Sealants have adhesive properties and are generally used to fill, seal, waterproof, or weatherproof gaps or joints between two surfaces. They are used heavily in the construction industry. This control measure reduces emissions by limiting the VOC content in these materials.

C.II.A.2. Architectural Coatings

This control measure regulates the VOC content of coatings applied to stationary structures and their appurtenances. These coatings include general use flat and non-flat coatings as well as specialty coatings, such as industrial maintenance coatings, lacquers, floor coatings, roof coatings, and stains. This control measure regulates the VOC content of architectural coatings that are manufactured, sold, and used in the nonattainment area.

C.II.A.3. Asphalt Paving Material

Cutback asphalt is a blend of asphalt cement and solvent. The solvent ranges in volatility depending upon the need for rapid cure (uses highly volatile gasoline or naphtha), medium cure (uses less volatile kerosene), or slow cure (uses low volatility oils). The VOCs evaporate when the cutback asphalt cures, and can range from 20% to 50% by volume, averaging 35%. This control measure regulates VOC emissions from the use of cutback and emulsified asphalt in paving materials, paving and maintenance operations. It also prohibits the sale and use of the asphalt materials that do not meet the requirements specified in the measure.

C.II.A.4. Bakeries

Bakeries emit VOC emissions from their baking process. This control measures regulate the VOC emissions from large commercial bakeries, which produce more than or equal to 100 pounds per operating day of VOC emissions during the baking process. A facility must install technologically feasible and cost-effective control devices, such as thermal regeneration and catalytic incineration.

C.II.A.5. Bulk Terminal

Bulk terminal is an organic liquid distribution facility which receives organic liquid from the refinery by means other than truck. This control measure regulates VOC emissions from loading of organic liquids. This control measure also applies to loading of organic liquids to any tank truck, trailer, or railroad tank car from a bulk plant or a bulk terminal.

C.II.A.6. Confined Animal Facility

Confined animal facilities are commercial agricultural operations that are used for the raising of animals, including cattle, calves, chickens, ducks, goats, horses, sheep, swine, rabbits, and turkeys. The animals are corralled, penned, or otherwise confined in restricted areas and fed by a means other than grazing. VOCs are emitted from manure and feed as well as directly from the animals. This control measure reduces emissions from a variety of emission points, including feed, silage, milking parlors, free stalls, corrals, solid waste, and liquid waste. Facility operators may choose from a list of mitigation measures that best suits their individual operations.

C.II.A.7. Dry Cleaning

Dry cleaning operations use different types of cleaning solvents in its operations. The control measure limits VOC emissions from petroleum solvents used in dry cleaning. Dry cleaning operations that use solvents other than petroleum solvents are exempt.

C.II.A.8. Fugitive Emissions

Fugitive emissions are the release of hydrocarbons from leaking components at oil and gas production and processing facilities, refineries, chemical plants, gasoline terminals, and pipeline transfer stations. This control measure limits fugitive VOC emissions from components such as valves and flanges, fittings, pumps, compressors, pressure relief devices, diaphragms, hatches, sightglasses, and meters.

C.II.A.9. Gasoline Dispensing Facility

Gasoline dispensing facilities release VOC emission of gasoline vapor into the atmosphere during the transfer of gasoline from any stationary storage tank or delivery vessel into any motor vehicle fuel tank. This control measure required CARB-certified equipment used in the transfer process, which reduces the VOC emission of gasoline vapor into the atmosphere.

C.II.A.10. Graphic Arts

Graphic arts operations use different types of materials, such as coatings, adhesives, inks, e.g., printing ink, metallic ink, ultraviolet ink, fountain solutions, thinners, reducers, catalysts, colorants, to make graphics. This control measure applies to graphic arts operations, including screen printing operations, at any stationary source regardless of the substrate. This control measure limits the VOC content of materials used in graphic arts operations, including the solvents used for cleaning.

C.II.A.11. Landfill Gas

Municipal Solid Waste (MSW) landfills are used to dispose of residential refuse. After the waste is buried and compacted, anaerobic decomposition of the organic material generates large amounts of gas, which contains methane and VOCs. This control measure sets standards for gas collection and control systems, monitoring, reporting and recordkeeping requirements. Landfill gas emissions are reduced using a network of collection wells and blowers, which capture the landfill gas and deliver it to a combustion device, such as a flare, engine, boiler, or turbine.

C.II.A.12. Polyester Resin Operations

This control measure regulates VOC emissions during the curing of the resin. Emissions must be reduced by complying with limits on the monomer content of the resin, using vapor suppressants, using closed-mold systems, or using an emissions capture and control system. The control measure applies to all polyester resin (composite) operations, which include, but are not limited to, manufacture of: bathware products, vanity installations, recreational and commercial watercraft hulls, recreational vehicle bodies, building panels and appliances, automotive, aerospace and aircraft components, and structural components for chemical process equipment and storage tanks.

C.II.A.13. Semiconductor Manufacturing

This control measure regulates the VOC emissions from semiconductor manufacturing operations. The control measure applies only to the manufacture of semiconductor and other related integrated circuits.

C.II.A.14. Surface Coating Operations

This control measure regulated the coating operation for different types of products and/or substrates. VOC emissions from the surface coating operations result from the evaporation of the organic solvents. These emissions occur in several places during the operation, including surface preparation and cleanup, application of the coating, drying of the parts, and cleanup of the application equipment. This control measure is subcategorized based on products and/or substrate, including the following:

- Aerospace Coating
- Automotive Refinishing
- Can and Coil Coating
- Miscellaneous Metal Parts and Products
- Plastic Parts and Products
- Wood coating

C.II.A.15. Surface Preparation/Cleanup

Surface preparation and cleanup control measure limits VOC emissions from solvents used in cleaning operations during the production, repair, maintenance or servicing of parts, products, tools, machinery, or equipment, or in general work areas. Degreasing is a cleanup process, which is widely used by automotive repair and maintenance facilities and by other types of commercial and manufacturing facilities. Organics solvents are also used in coating operations for cleaning of coating application equipment, such as spray guns, brushes, etc.

C.II.A.16. Synthetic Organics Chemical Manufacturing Industry

The synthetic organics chemical manufacturing industry control measure regulates VOC emissions from organic chemical manufacturing operations, including pharmaceutical and cosmetic manufacturing operations. The control measure only applies to pharmaceutical and cosmetic manufacturing plants, which includes lowering the applicability thresholds for the entire facility and for individual process equipment and increasing the combined system efficiency for control equipment.

C.II.B. Existing Local NO_X Control Measures

Table C-2 lists the current air districts' rules for different NO_X emissions reduction categories, and the following sections provide a brief description of the control measures. The numbers in parentheses are the year which the rule was initially adopted.

Table C-2 Current NO_X Rules by SFNA Air District

	SMAQMD	El Dorado AQMD	Feather River AQMD	Placer County APCD	Yolo-Solano AQMD
NO_X Rule Category					
Boilers & Steam Generators	Rule 411 NO_X from Boilers, Process Heaters, and Steam Generators (1995)	Rule 209 Fossil Fuel-Steam Generator Facility (Unknown) Rule 229 Industrial, Institutional, And Commercial Boilers, Steam Generators, And Process Heaters (Unknown) Rule 232 Biomass Boiler (1994)	Rule 3.21 Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters (2006)	Rule 209 Fossil Fuel-Steam Facility Rule 231 Industrial, Institutional, And Commercial Boilers, Steam Generators and Process Heaters (1994) Rule 233 Biomass Boilers (1994)	Rule 2.16 Fuel Burning Heat or Power Generators Rule 2.27 Large Boiler (1993) Rule 2.43 Biomass Boilers (2010) Rule 2.45 Boilers (2019)
Gas Turbines	Rule 413 Stationary Gas Turbines (1995)			Rule 250 Stationary Gas Turbines (1994)	Rule 2.34 Stationary Gas Turbines (1994)
Internal Combustion Engines	Rule 412 Stationary IC Engines Located at Major Stationary Sources of NOX (1995)	Rule 233 Stationary Internal Combustion Boilers (1994)	Rule 3.22 Stationary Internal Combustion Engines (2009)	Rule 242 Stationary Internal Combustion Engines (2003)	Rule 2.32 -- Stationary Internal Combustion Engines (2001)
Residential & Small Water Heaters	Rule 414 Water Heaters, Boilers and Process Heaters Rated Less Than 1,000,000 BTU Per Hour (1996)	Rule 239 Natural Gas-Fired Residential Water Heaters (Unknown)	Rule 3.23 Natural Gas-Fired Water Heaters, Small Boilers, and Process Heaters (2016)	Rule 246 Natural Gas-Fired Water Heaters (1997) Rule 247 Natural Gas-Fired Water Heaters, Small Boilers And Process Heaters (2013)	Rule 2.37 Natural Gas-Fired Water Heaters and Small Boilers (1994)
Central Furnace/Miscellaneous Combustion Unit	Rule 419 NO_X from Miscellaneous Combustion Units (2018)				Rule 2.44 Central Furnaces (2009)

C.II.B.1. Boilers, Process Heaters, and Steam Generators

Boilers and process heaters are used to provide hot water and steam for a variety of industrial and commercial applications, including space heating, food processing, garment laundering, and equipment sterilization. Manufacturing operations use process heaters to heat materials or equipment during the manufacturing process. The equipment burners can be fired on solid, liquid, or gaseous fuels. NO_X emissions are generated from the combustion of the fuel. This control measure regulates NO_X emission from units fired on gaseous or nongaseous fuels with a rate heat input capacity to as low as 1 million British Thermal Unit (BTU) per hour.

C.II.B.2. Gas Turbines

Gas turbines use exhaust gasses from the combustion of gaseous or liquid fuels to spin the turbine blades, driving a shaft and producing mechanical power. In most stationary applications, the shaft is coupled to an electrical generator, which converts the mechanical power into electricity. Gas turbines systems are classified as either simple cycle or combined cycle. In a simple cycle system, heat from the hot exhaust gases is not recovered. In a combined cycle system, heat from the exhaust gases is used to produce steam, which passes through a steam turbine, producing additional power. Gas turbines control measure regulates NO_X emissions from the operation of stationary gas turbines. The control measure applies to all stationary gas turbines with output ratings equal to or greater than 0.3 megawatt (MW), or input of 3 million BTU per hour and operated on gaseous and/or liquid fuel.

C.II.B.3. Internal Combustion Engines

Internal combustion (IC) engines are used in a wide variety of applications, including electrical power generation, liquid pumping, gas compression, mobile equipment, and vehicles. NO_X is generated in IC engines from both the oxidation of nitrogen in the air (thermal NO_X) and from the oxidation of fuel-bound nitrogen (fuel NO_X). Emissions of NO_X can be reduced using combustion controls, which modify the combustion characteristics, or using post-combustion controls, such as nonselective catalytic reduction (NSCR) and selective catalytic reduction (SCR). Internal Combustion Engines control measure regulates NO_X, CO, and non-methane hydrocarbons emissions from the operation of stationary internal combustion engines located at a major stationary source of NO_X. It applies to any stationary internal combustion engine rated at more than 50 brake horsepower.

C.II.B.4. Residential & Small Water Heaters

Water heaters and small boilers predominantly burn natural gas and are used to heat water and generate steam. These units are used in a variety of applications, including in homes, restaurants, retail stores, schools, hotels, and office buildings. Residential & Small Water Heaters control measure regulates NO_X emissions from water heaters, boilers, and process heaters. The control measure applies to any person who manufactures, distributes, offers for sale, sells, or installs any type of water heater fired with gaseous or nongaseous fuels for use in SFNA.

C.II.B.5. Furnace

Residential heating accounts for a large fraction of residential energy consumption. Most residential furnaces use natural gas as fuel, which produces NO_X during the combustion process. Furnaces control measure limits NO_X emissions from natural gas-fired, fan-type central furnaces, which is no more than 40 nanogram (ng) of NO_X per Joule of heat output. Only certified furnaces can be sold or installed in the air districts adopted the control measure.

C.II.B.6. Miscellaneous Combustion Sources

There are other types of combustion equipment not subject to those control measures, such as dryers, dehydrators, heaters, kilns, furnaces, crematories, incinerators, heated pots, cookers, roasters, heated tanks, evaporators, distillation units, afterburners, degassing units, vapor incinerators, catalytic or thermal oxidizers, and remediation units. This control measure would limit NO_X emissions from combustion equipment that requires a permit but is not subject to the other NO_X emissions control measures. The NO_X emission limits are based on the type of device and the process temperature.

APPENDIX D
Reasonably Available Control Measure (RACM) Analysis

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D Reasonably Available Control Measure Analysis

D.1 RACM Assessment – Statewide Sources

The Clean Air Act (Act) requires the implementation of all reasonably available control measures (RACM) as expeditiously as practicable and shall provide for attainment of the air quality standards. This section demonstrates that for the 70 ppb 8-hour ozone standard, California's mobile source and consumer products measures along with the Department of Pesticides (DPR) measures meet the RACM requirement in the Sacramento Metro nonattainment area.

D.1.1 RACM Requirements

United States Environmental Protection Agency (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. Section 172(c)(1) of the Act requires SIPs to provide for the implementation of RACM as expeditiously as practicable. 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 ensure the State continues to meet RACM requirements and achieve its emissions reductions goals in the future, California continues to develop new programs and regulations to strengthen its overall mobile source program and to achieve new emissions reductions from mobile sources.

D.1.2 RACM For Mobile Sources

D.1.2.1 Waiver and Authorizations

While section 209 of the Act preempts other states from adopting emission standards and other emission-related requirements for new motor vehicles and engines that differ from the federal standards set by EPA, the Act provides California with the ability to seek a waiver or authorization from the federal preemption clause in order to enact emission standards and other emission-related requirements for new motor vehicles and engines, as well as new and in-use off-road vehicles and engines[1] – provided that the California standards are at least as protective as applicable federal standards.

[1] Locomotives and engines less than 175 horsepower (hp) used in farm and construction equipment are exempt from California's waiver authority.

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: the Advanced Clean Cars (ACC) regulations for light-duty vehicles (including the Zero-Emission Vehicle (ZEV) and the Low-Emission Vehicle III (LEV III) regulations); the On-Board Diagnostics (OBD) regulation; the Heavy-Duty Idling, Malfunction and Diagnostics System Regulation; the In-Use Off-Road Diesel Fleets Regulation; the Large Spark Ignition (LSI) Fleet Regulation; and the Mobile Cargo Handling Equipment (CHE) regulation. Further, CARB has recently submitted waiver requests for: the Advanced Clean Transit (ACT) regulation; the Zero-Emission Airport Shuttle Buses Regulation; the Zero-Emission Powertrain Certification Regulation, and the Heavy-Duty Omnibus Regulation. Other authorizations include the Off-Highway Recreational Vehicles and the Portable Equipment Registration Program (PERP).

Additionally, CARB obtained an authorization from 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 Act and do not require a waiver under section 209(b).

The waiver and authorizations California has received are integral to the success and stringent emission requirements that characterize CARB's mobile source program. Due to California's unique waiver authority under the Act, no other state or nonattainment area has the authority to promulgate mobile source emission standards at levels that are more stringent than the federal standards. Other states can elect to match either the federal standards or the more stringent California standards. As such, no state or nonattainment area has a more stringent suite of mobile source emission control programs than California, implying a de-facto level of control that at least meets, if not exceeds, RACM.

D.1.2.2 CARB's Mobile Source Controls

CARB's current mobile source control program, along with efforts at the local and federal level, has been tremendously successful in reducing emissions of air pollutants, resulting in significantly cleaner vehicles and equipment in operation today.

CARB developed its 2022 State Strategy for the State Implementation Plan (2022 State SIP Strategy)[2] through a multi-step measure development process, including extensive public consultation, to develop and evaluate potential strategies for mobile source

[2] CARB 2022 State Strategy for the State Implementation Plan (2022 State SIP Strategy) https://ww2.arb.ca.gov/resources/documents/2022-state-strategy-state-implementation-plan-2022-state-sip-strategy

categories under CARB's regulatory authority that could contribute to expeditious attainment of the 70 ppb 8-hour ozone standard, as well as supporting attainment for other national and State air quality standards. This effort builds on the measures and commitments already made in the 2016 State SIP Strategy and expands on the scenarios and concepts included in the 2020 Mobile Source Strategy, CARB's multi-pollutant planning effort that identifies the pathways forward to achieve the State's many air quality, climate, and community risk reduction goals. The Board adopted the 2022 State SIP Strategy in September 2022.

With the 2022 State SIP Strategy, CARB is pursuing an unprecedented variety of new measures to reduce emissions from the sources under our authority using all mechanisms available. The measures included in the 2022 State SIP Strategy encompass actions to establish requirements for cleaner technologies (both zero emissions and near zero emissions), deploy these technologies into the fleet, and to accelerate the deployment of cleaner technologies.

D.1.2.3 Light- and Medium-Duty Vehicles

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 NO_X emissions along with hydrocarbon emissions, which together form smog. The simultaneous control of emissions from motor vehicles and fuels led to the use of cleaner-burning gasoline that has removed the emissions equivalent of 3.5 million vehicles from California's roads.

Light- and medium-duty vehicles are currently regulated under California's ACC program, which includes the LEV III and ZEV programs. 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. Since first adopted in 1990, CARB's LEV I and LEV II, and the ZEV Programs have resulted in the production and sales of hundreds of thousands of ZEVs in California. Advanced Clean Cars II (ACC II), a measure in the 2016 State SIP Strategy, is a significant effort critical to meeting air quality standards. ACC II, which was adopted by the CARB Board in August 2022, has the goal of cutting emissions from new combustion vehicles while taking all new vehicle sales to 100 percent zero-emission no later than 2035.

For passenger vehicles, the 2022 State SIP Strategy includes actions to increase the penetration of ZEVs by targeting ride-hailing services offered by transportation network companies through the Clean Miles Standard regulation in order to reduce GHG and criteria pollutant emissions and promote electrification of the fleet. For motorcycles, the 2022 State SIP Strategy proposes more stringent exhaust and evaporative emissions standards along with zero-emissions sales thresholds. The primary goal of the On-Road Motorcycle New Emissions Standard measure is to reduce emissions from new, on-road motorcycles by adopting more stringent exhaust and evaporative emissions standards along with zero-emissions sales thresholds.

CARB is also active in implementing in-use programs for owners of older dirtier vehicles to retire them early. The “car scrap” programs, like Clean Cars 4 All and Clean Vehicle Rebate Project provide monetary incentives to replace old vehicles with zero-emission vehicles. Other California programs and goals such as the 2012 Governor’s Executive Order to put 1.5 million zero-emission vehicles on the road by 2025 and will produce substantial and cost-effective emission reductions from the light-duty vehicle sector.

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. There are no additional measures that, when considered in aggregate, would advance the attainment date by at least one year.

D.1.2.4 Heavy-Duty Vehicles

California’s heavy-duty vehicle emissions control program includes requirements for increasingly stringent new engine emission standards and addresses vehicle idling, certification procedures, on-board diagnostics, emissions control device verification, and in-use measures to ensure that emissions from the existing vehicle fleet remain adequately controlled. Taken together, the on-road heavy-duty vehicle program is designed to achieve in 2023 an on-road heavy-duty diesel fleet with 2010 engines emitting 98 percent less NO_X and $PM_{2.5}$ than trucks sold in 1986.

Other significant in-use control measures CARB has in place include: the On-Road Heavy-Duty Diesel Vehicle (In-Use) Regulation; the Drayage (Port or Rail Yard) Regulation; the Public Agency and Utilities Regulation; the Solid Waste Collection Vehicle Regulation; the Heavy-Duty (Tractor-Trailer) Greenhouse Gas (GHG) Regulation, the Airborne Toxic Control Measures (ATCM) to Limit Diesel-Fueled Commercial Motor Vehicle Idling; the Heavy-Duty Diesel Vehicle Inspection Program; the Periodic Smoke Inspection Program (PSIP); the, Fleet Rule for Transit Agencies; the Lower-Emission School Bus Program; and Heavy-Duty Truck Idling Requirements.

In 2013, California recognized the heavy-duty engines could be cleaner and established optional low-NO_X standards for heavy-duty diesel engines (Optional Reduced Emissions Standards for Heavy-Duty Engines regulation), with the most aggressive standard being 0.02 g/bhp-hr, 90 percent below the 2010 federal standard. Further, in 2021, CARB adopted the Heavy-Duty Engine and Vehicle Omnibus Regulation (Omnibus Regulation) which made the 0.02 g/bhp-hr a mandatory standard, and comprehensively overhauled how NO_X emissions from new heavy-duty engines are regulated in California. The

Omnibus Regulation also includes in-use standards that significantly reduce tailpipe NO_X emissions during most vehicle operating modes, and revisions to the emissions warranty, useful life, emissions warranty and reporting information and corrective action procedures, and durability demonstration procedures.

To further control emissions from the in-use fleet, CARB adopted in 2021 the Heavy-Duty Inspection and Maintenance Regulation, which requires periodic demonstration that vehicles' emissions control systems are properly functioning in order to legally operate within the State. This regulation is designed to achieve criteria emissions reductions by ensuring that malfunctioning emissions control systems are timely repaired.

In June 2020, CARB adopted the ACT regulation, a first of its kind regulation requiring medium- and heavy-duty manufacturers to produce ZEVs as an increasing portion of their sales beginning in 2024. This regulation is expected to result in roughly 100,000 ZEVs by 2030 and nearly 300,000 ZEVs by 2035. Most recently in the ongoing efforts to go beyond federal standards and achieve further reductions, the 2022 State SIP Strategy includes the complementary Advanced Clean Fleets measure. Through this program, CARB is developing a medium and heavy-duty zero-emission fleet regulation with the goal of achieving a zero-emission truck and bus California fleet by 2045 everywhere feasible, and significantly earlier for certain market segments such as last mile delivery and drayage applications.

The 2022 State SIP Strategy also includes the Zero-Emissions Trucks Measure, which would accelerate the number of zero-emission heavy-duty vehicles beyond existing measures, and the proposed Advanced Clean Fleets regulation. The Zero-Emissions Trucks Measure was developed in response to comments from the public related to turning over heavy-duty trucks at the end of their useful life. The Zero Emissions Trucks Measure targets the replacement of older trucks in order to increase the number of heavy-duty ZEVs as soon as possible and reduces emissions from fleets not affected by the Advanced Clean Fleets measure. CARB is exploring new methods to replace older trucks, including market signal tools, that would not unduly burden low-income truckers, provide flexibility, and target reductions in the areas that need it most.

In addition, CARB’s significant investment in incentive programs provides an additional mechanism to achieve maximum emission reductions from this source sector. California has a variety of programs to incentivize clean heavy-duty vehicles that include the Carl Moyer Air Quality Standards Attainment Program, the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project, the Truck Loan Program, and AB 617 Community Air Protection Funds.

Taken together, California’s emission standards, fuel specifications, and incentive programs for on-road heavy-duty vehicles represent all measures that are technologically and economically feasible within California. There are no additional measures that, when considered in aggregate, would advance the attainment date by at least one year.

D.1.2.5 Off-Road Vehicles and Engines

California regulations for off-road equipment include not only increasingly stringent emission standards for new off-road diesel engines, but also in-use requirements and idling restrictions. CARB has programs in place to control emissions from various new off-road vehicles and equipment. CARB also has in-use programs for off-road vehicles and equipment, including the In-Use Off-Road Diesel Fueled Fleets Regulation (Off-Road Regulation) and Large Spark-Ignition Engine Fleet Requirements Regulation, as well as incentive programs including the Clean Off-Road Equipment (CORE) Voucher Incentive Project. CARB adopted amendments to the small off-road engine regulations in December 2021, the Transport Refrigeration Unit Part 1 regulatory action in February 2022, and will be proposing the Zero-Emission Off-Road Forklift regulation in the next year.

The Off-Road Regulation, adopted in 2010, is an extensive program designed to accelerate the penetration of the cleanest equipment into California's fleets, and impose idling limits on off-road diesel vehicles. The program goes beyond emission standards for new engines through comprehensive in-use requirements for legacy fleets. CARB also included in the 2022 State SIP Strategy a measure for amendments to the existing Off-Road Regulation. These amendments were approved by CARB in November 2022 and create additional requirements to the currently regulated fleets by targeting the oldest and dirtiest equipment that is allowed to operate indefinitely under the current regulation's structure, through an operational ban on the oldest and dirtiest equipment and limitations on vehicles added to a fleet.

The LSI Engine Fleet Requirements Regulation applies to operators of forklifts, sweeper/scrubbers, industrial tow tractors, and airport ground support equipment (GSE). The 2006 LSI rulemaking and 2010 amendments required operators of in-use fleets to achieve specific hydrocarbon + NO_X fleet average emission level standards that became more stringent over time. CARB adopted amendments to the small off-road engine (SORE) regulations in December 2021 that will accelerate the transition of SORE equipment to Zero-Emission Equipment (ZEE). Deployment of ZEE is key to meeting the expected emission reductions in the 2016 State SIP Strategy.

As discussed in the 2016 State SIP Strategy, CARB is also developing new requirements to transition diesel-powered transport refrigeration units (TRUs) to zero-emission technology in two phases. CARB adopted the Part 1 amendments to the existing TRU ATCM in February 2022, which requires the transition of diesel-powered truck TRUs to zero-emission. As discussed in the 2022 State SIP Strategy, CARB plans to develop a subsequent Part 2 regulation to require zero-emission trailer TRUs, domestic shipping container TRUs, railcar TRUs, and TRU generator sets, for future Board consideration.

Additionally, the 2022 State SIP Strategy includes the Tier 5 Off-Road New Compression-Ignition Engine Standards measure to reduce NO_X and PM emissions from new, off-road compression-ignition engines by adopting more stringent exhaust standards for all power categories. Compression-ignition engines are used in a wide range of off-road equipment including tractors, excavators, bulldozers, graders, and backhoes. The standards considered for this measure would be more stringent than required by current EPA and European Stage V nonroad regulations and would require the use of best available control technologies for both PM and NO_X.

CARB is also developing a measure, as described in the 2022 State SIP Strategy, to accelerate the development and production of zero-emission off-road equipment and powertrains through the Off-Road Zero-Emission Targeted Manufacturer Rule. Existing zero-emission regulations and regulations currently under development target a variety of sectors (e.g., forklifts, cargo handling equipment, off-road fleets, small off-road engines, etc.) however, as technology advancements occur, more sectors, including wheel loaders, excavators, and bulldozers) could be accelerated through this measure.

Further, CARB implements a number of incentive programs and projects to advance the turnover of off-road equipment to cleaner technologies. The Moyer Program has provided funding towards on- and off-road equipment for decades. CORE is a newer project that is intended to accelerate deployment of advanced technology in the off-road sector and targets commercial-ready products that have not yet achieved a significant market foothold. For engines and equipment used in agricultural processes, CARB has the Funding Agricultural Replacement Measures for Emission Reductions (FARMER) program to support fleet turnover to cleaner 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. There are no additional measures that, when considered in aggregate, would advance the attainment date by at least one year.

D.1.2.6 Marine Sources

Commercial harbor craft include any private, commercial, government, or military marine vessels including, but not limited to ferries, excursion vessels, tugboats (including ocean-going tugboats), barges, and commercial and commercial passenger fishing boats. CARB's Commercial Harbor Craft Regulation (CHC Regulation) was adopted in 2007 to reduce toxic and criteria emissions to protect public health and subsequently amended in 2010. As described in the Draft 2022 State SIP Strategy, the Board also adopted amendments to the CHC Regulation in March 2022, which establish expanded and more stringent in-use requirements to cover more vessel categories and mandate accelerated deployment of zero-emission and advanced technologies in vessel categories where technology feasibility has been demonstrated.

To reduce emissions from Ocean Going Vessels (OGV), CARB has adopted to date the Ocean-Going Vessel Fuel Regulation "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" (2008) and the Ocean-Going Vessels At-Berth Regulation (2007). The At-Berth Regulation requires container ships, passenger ships, and refrigerated-cargo ships at six California ports to meet compliance requirements for auxiliary engines while they are docked, including emission or power reduction requirements. Reduced vessel speeds also provide emission reduction benefits, and programs are operated by local air districts along the California coast to incentivize lower speeds. CARB staff received comments during the public process about including a statewide vessel speed reduction program. In the Draft 2022 State SIP Strategy, the CARB measure for 'Future Emissions Reductions from Ocean-Going Vessels' discusses pursuing options available under CARB authority to achieve further emissions reductions, including developing a statewide vessel speed reduction program.

To control emissions from personal watercraft, CARB staff is also exploring development of more stringent Spark-Ignition Marine Engine Standards, as described in the 2022 State SIP Strategy. For this measure, CARB would develop and propose catalyst-based standards for outboard and personal watercraft engines greater than or equal to 40 kW in power that will gradually reduce emission standards to approximately 70 percent below current levels and consider actions that would require a percentage of outboard and personal watercraft vessels to be propelled by zero-emission technologies for certain applications.

Taken together, California's comprehensive suite of emission standards, fuel specifications, and incentive programs for marine vehicles and engines represent all measures that are technologically and economically feasible within California. There are no additional measures that, when considered in aggregate, would advance the attainment date by at least one year.

D.1.2.7 Fuels

As mentioned earlier, cleaner burning fuels also play an important role in reducing emissions from motor vehicles and engines in these source categories. CARB has adopted standards to ensure that the fuels sold in California are the cleanest in the nation. These programs include the California Reformulated Gasoline program (CaRFG), which controls emissions from gasoline, and the Ultra-Low Sulfur Diesel requirements (2006), which provide the nation's cleanest diesel fuel specifications and help to ensure that diesel fuels burn as cleanly as possible and work synergistically with cleaner-operating heavy-duty trucks equipped with advanced emission control systems that debuted in 2007, 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. There are no additional measures that, when considered in aggregate, would advance the attainment date by at least one year.

D.1.2.8 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. EPA has previously acknowledged the strength of the program through the waiver process, and in their approvals of CARB's regulations and District plans.

In its 2021 approval of the area's 2017 Sacramento Area Regional Ozone Plan for the 75 ppb 8-hour ozone standard, EPA approved the State's current control program and measure commitments from the 2016 State SIP Strategy as meeting RACM requirements for the Sacramento Metro area. In its proposal for that final action, EPA found that,

> *"Based on our review of these RACM analyses and the Districts' and CARB's adopted rules… there are, at this time, no additional RACM that would further advance attainment of the 2008 ozone NAAQS in the Sacramento Metro Area. For the foregoing reasons, we propose to find that the Sacramento Metro Area Ozone SIP provides for the implementation of all RACM as required by CAA"*[3]

In addition to declarations that CARB's mobile source control program meets RACM requirements, EPA has also provided past determinations that CARB's mobile source control program meets the more rigorous Best Available Control Measure (BACM) requirements. As BACM requirements are considered a more stringent threshold to meet than RACM, EPA has stated that a determination that the control program has meet BACM requirements also constitutes a conclusion that it meets RACM requirements.[4]

3 85 FR 68509 https://www.federalregister.gov/documents/2020/10/29/2020-23032/approval-of-air-quality-implementation-plans-california-sacramento-metro-area-2008-8-hour-ozone

4 "We interpret the BACM requirement as generally subsuming the RACM requirement (i.e., if we determine that the measures are indeed the ''best available,'' we have necessarily concluded that they are ''reasonably available''). Consequently, our proposed approval of the… provisions relating to the implementation of BACM also constitutes a proposed finding that the Plan provides for the implementation of RACM."
69 FR 5411 https://www.federalregister.gov/documents/2004/02/04/04-2264/approval-and-promulgation-of-implementation-plans-for-california-san-joaquin-valley-pm-10

EPA has acknowledged CARB's mobile source control program as meeting BACM in and in their 2019 approval of the South Coast's $PM_{2.5}$ Serious Area Plan. In their 2018 proposal for that approval, EPA noted that,

> *"With respect to mobile sources, we recognize that CARB's current program addresses the full range of mobile sources in the South Coast through regulatory programs for both new and in-use vehicles… Overall, we believe that the program developed and administered by CARB and SCAG provide for the implementation of BACM for $PM_{2.5}$ and $PM_{2.5}$ precursors in the South Coast nonattainment area."*[5]

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 CARB's control measures includes 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 new measures included in the 2022 State SIP Strategy, there are no additional reasonable available control measures that would advance attainment of the 70 ppb 8-hour ozone standard in the Sacramento Metro nonattainment area. 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.

D.1.3 RACM for Consumer Products

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 2021 with amendments to Consumer Products Regulation and Method 310.

5 83 FR 49872 https://www.federalregister.gov/documents/2018/10/03/2018-21560/approval-and-promulgation-of-implementation-plans-california-south-coast-serious-area-plan-for-the

EPA also regulates consumer products. EPA's consumer products regulation was promulgated in 1998, however, federal consumer products VOC limits have not been revised since their adoption. 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. There are no additional reasonable available control measures that, when considered in aggregate, would advance attainment of the 70 ppb 8-hour ozone standard in the Sacramento Metro nonattainment area. 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 consumer product control program fully meets the requirements for RACM.

D.1.4 RACM for Pesticides

The Department of Pesticide Regulation (DPR) is the State agency responsible for regulating the application of pesticides, which are a source of VOCs in the Sacramento Metro area. California began including in the SIP controls to reduce VOC emissions from pesticide applications in the 1994 Ozone SIP. The 1994 Ozone SIP included a commitment to reduce VOC emissions from pesticide use 20 percent below the 1990 baseline emission levels by 2005, with flexibility to achieve reductions of less than 20 percent if less pesticidal VOC emissions reductions were needed in a given district. This commitment, known as the 1994 Pesticide Element, governed the application of agricultural and structural pesticides in five California nonattainment areas: South Coast, San Joaquin Valley, Sacramento Metro, Ventura County, and the Southeast Desert.

Under the Pesticide Element of the 1994 Ozone SIP, California's commitment for the Sacramento Metro area was to adopt and submit to EPA by 1997, any regulations necessary to reduce VOC emissions resulting from agricultural and structural pesticides by 20 percent of the 1990 base year emissions.[6] DPR has adopted and submitted the requisite regulations to EPA and has continued to strengthen their programs to further reduce exposure and emissions to pesticides in California. DPR compiles and publishes annual reports on VOC emissions from pesticides. In its latest report, DPR identified that VOC emissions in the Sacramento Metro nonattainment area were 56 percent lower than

[6] 62 FR 1150 https://www.govinfo.gov/content/pkg/FR-1997-01-08/pdf/97-144.pdf#page=1 (January 8, 1997).

the 1990 base year, and thus remain in compliance with the SIP goal benchmark of 20 percent below 1990 levels.[7]

Beyond ensuring that the control measures in the Sacramento Metro area are maintaining VOC emissions from pesticides that do not exceed the prescribed limits, DPR assessment indicates that no other state, aside from California, is required to adopt into their SIP measures to reduce VOC emissions from pesticides. This requirement suggests that the California pesticide control program exceeds the RACT threshold of "reasonably available" control technologies and meets at least the more stringent threshold of "best available" control technologies (BACT).

Finally, the pesticide control program currently being implemented in the Sacramento Metro area has been found by EPA to meet RACT/RACM requirements. In 2012, as part of their final approval of California's 2009 Field Fumigant Regulations and the Revised SIP Commitment for the SJV, EPA evaluated California's field fumigant regulations for the South Coast, Ventura County, Southeast Desert, San Joaquin Valley, and Sacramento Metro nonattainment areas, and concluded that the controls met RACT requirements:

> *"[U.S.] EPA believes, based on the information provided in the CDPR's alternatives analysis, and the research cited to support it, that CDPR has demonstrated that the proposed regulations are stringent enough to implement RACT-level controls on the application of pesticides."8*

EPA has also approved the RACM demonstration in the 80 ppb 8-hour ozone SIPs for the South Coast and San Joaquin Valley, including the VOC control measures,[9] as well as the RACM demonstration in the $PM_{2.5}$ SIP for the South Coast.[10] Finally, EPA has also determined that California's pesticide control program meets the more stringent control level requirements of BACM, as was affirmed in the Technical Support Document for EPA's action to approve California's 2009 Field Fumigant Regulations and the Revised SIP Commitment,[11] wherein they reference their prior approval of the PM10 SIPs for South Coast and Southeast Desert[12] and other SIPs:

7 California DPR October 2021 "Annual Report on Volatile Organic Compound Emissions from Pesticides for 1990 – 2019" https://www.cdpr.ca.gov/docs/emon/vocs/vocproj/2019_voc_annual_report.pdf

8 EPA Technical Support Document for Final Rule (August 14, 2012) https://www.regulations.gov/document/EPA-R09-OAR-2012-0194-0023

9 See 77 FR 12652 (March 1, 2012) (SJV 2007 8-hour Ozone SIP), and 77 FR 12674 (March 1, 2012) (South Coast 8-hour Ozone Plan)

10 76 FR 69928 (November 9, 2011)

11 EPA *Technical Support Document for Final Rule* (August 14, 2012) https://www.regulations.gov/document/EPA-R09-OAR-2012-0194-0023

12 70 FR 69081 (November 14, 2005)

> *"The approval of the fumigant regulations is consistent with these approved RACM/BACM demonstrations and therefore will not interfere with these SIPs' compliance with the RACM/BACM requirements."*

Beyond the VOC controls provided by the pesticide control program currently being implemented, the 2022 State SIP Strategy also includes a measure to reduce emissions associated with the use of a pesticide known as 1,3-Dichloropropene (1,3-D), which is considered a VOC. This measure was developed to limit short-term air concentrations of 1,3-D, a fumigant used to control nematodes, insects, and disease organisms in soil, by shifting application methods to those with lower emissions, such as requiring applicators to use totally impermeable film (TIF) tarpaulins or other mitigation measures. DPR is in the process of developing this regulation, which has a targeted effective date of 2024.

In summary, DPR's pesticide regulations represent all measures that are technologically and reasonably available in the context of the Sacramento Metro nonattainment area's 70 ppb 8-hour ozone attainment plan and meets RACM. There are no additional measures that, when considered in aggregate, would advance the attainment date by at least one year.

D.2 RACM Analysis – SFNA Air Districts

D.2.1 RACM requirements

This Appendix describes the Reasonably Available Control Measure (RACM) analysis that was conducted for the Sacramento Federal Nonattainment Area (SFNA). This analysis complies with Clean Air Act (CAA) Section 172(c)(1) which requires a nonattainment plan to:

> *"provide for the implementation of all reasonably available control measures as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology) and shall provide for attainment of the national primary ambient air quality standards."*

United States Environmental Protection Agency's (USEPA) RACM policy (80 FR 12282-12283; USEPA, 1999) indicates that nonattainment areas "should consider all available measures that are potentially reasonably available". Sources of potentially reasonable measures include measures adopted in other nonattainment areas and measures that the USEPA has identified in guidelines or other documents.

Areas should consider all reasonably available measures for implementation in light of local circumstances. However, areas are only required to adopt measures if they are economically and technologically feasible and (alone or cumulatively) will advance the attainment date by one year or more, or are necessary for reasonable further progress (RFP) (80 FR 12282). EPA "does not believe that Congress intended the RACM requirement to compel the adoption of measures that are absurd, unenforceable, or impracticable." (57 FR 13498)

D.2.2 Process of identifying RACM

To identify all RACM, District staff reviewed multiple sources of control measure information, including:

- Control measures included in the attainment plan for the 2008 8-hour National Ambient Air Quality Standard (NAAQS) (SMAQMD, et al, 2017)
- Rules adopted or amended between January 2006 and July 2022 in the Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), San Diego Air Pollution Control District (SDAPCD), San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD), and Ventura County Air Pollution Control District (VCAPCD); and
- USEPA's Reasonably Available Control Technology (RACT)/ Best Available Control Technology (BACT)/ Lowest achievable Emission Rate (LAER) Clearinghouse;

- California Air Resources Board's (CARB's) BACT Clearinghouse;
- SCAQMD's 2022 Air Quality Management Plan; and
- Rules from other areas of the nation with similar nonattainment status, including Houston-Galveston-Brazoria, TX; Dallas-Fort Worth, TX; and Baltimore, MD.

Staff from each of the five air districts in the SFNA performed the RACM analysis for the stationary and areawide sources in their jurisdictions. For each potential RACM measure, the emissions inventory, emissions reductions, and cost effectiveness were estimated.

D.2.3 Conclusions

The RACMs collectively would not advance the attainment date or contribute to RFP for the Sacramento region because of the insufficient or non-quantifiable level of potential emission reductions they may generate. Several RACMs were determined to be impracticable and excluded due to excessive cost-effectiveness estimates. Tables D-1 through D-5 contain a list of the measures evaluated by each of the five air districts and a brief discussion of the conclusions.

D.2.4 Sacramento Metropolitan Air Quality Management District (SMAQMD)

Table D-1 SMAQMD Stationary/Area Source Control Measures Considered

Rule No.[13]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
460	Adhesives and Sealants	VOC limits on adhesives and sealants	Reduce VOC limits on adhesives and sealants similar to rules adopted by SCAQMD and SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.587	VOC: 0.1923
442	Architectural Coatings	VOC limits on coatings	Reduce the VOC limits on architectural coatings similar to the rules adopted by SCAQMD and SJVUAPCD and the 2019 and 2020 CARB SCMs	Included in evaluation of attainment advancement	VOC: 1.576	VOC: 0.1837
459	Automotive Refinishing	VOC limits on coatings	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.5621	VOC: 0
411	Boilers	NO_X limits on boiler/steam generators with a rated heat input capacity of 1 mmBtu/hr or greater	Reduce NO_X limits similar to SCAQMD and SJVUAPCD requirements	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.3671	NO_X: 0
	Brandy and Wine Aging	None	Establish VOC emissions standards to reduce evaporative VOC emissions from the fermentation process at distilleries and wineries similar to SJVUAPCD requirements	No sources subject to control	VOC: 0.2948	VOC: 0

[13] A blank indicates no current rule in place for that type of stationary or area source.

Rule No.[13]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
452	Can Coating	VOC limits on coatings	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.2050	VOC: 0
	Commercial Cooking	VOC emission standards for large commercial bread bakeries	Establish standards to control VOC emissions from commercial charbroilers similar to SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.2534	VOC: 0.0039
	Composting Operations	None	Establish work practice requirements to reduce VOC emissions from green waste composting similar to SCAQMD and SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.2506	VOC: 0.0822
496	Confined Animal Facilities	Implement VOC emission mitigation measures from a menu of options	Reduce animal-count applicability thresholds; increase number of mitigation measures, and control efficiency	Included in evaluation of attainment advancement	VOC: 1.628	VOC: 0.161
	Flares	None	Establish NO_X emission standards for flares similar to SJVUAPCD requirements	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.0782	NO_X: 0
	Furnaces (Residential)	None	Establish point-of-sale NO_X emissions standard for natural gas-fired central furnaces similar to SCAQMD and SJVUAPCD requirements	Included in evaluation of attainment advancement	NO_X: 0.4002	NO_X: 0.088

Rule No.[13]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Further Control of High-Emitting Spray Booth Facilities	None	Require additional controls to reduce VOC emissions from spray booths at facilities emitting > 20 tons per year	No sources	VOC: 0	VOC: 0
446/447/ 448	Gasoline Storage, Loading, and Degassing of Tanks and Pipelines	VOC emission standards for organic liquid storage tanks; vapor-recovery requirements for loading at bulk plants and bulk terminals	Reduce VOC emission limits for gasoline loading at bulk plants and bulk terminals to be as stringent as BAAQMD; establish VOC emission standards for degassing storage tanks and pipelines similar to SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.3872	VOC: 0
	Glass Melting Furnaces	None	Establish NO_X emission limits for glass melting furnaces	No sources	NO_X: 0	NO_X: 0
450	Graphic Arts	VOC limits on inks, coatings, adhesives or use emission control system	Reduce VOC limits for flexographic ink on porous substrates, extreme performance ink, and metallic ink to be as stringent as SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.4745	VOC: 0
412	Internal Combustion (IC) Engines	NO_X emission limits on IC engines located at major stationary sources of NO_X	Reduce NO_X limits to be stringent as SCAQMD; expand applicability to include non-major stationary sources of NO_X	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.6125	NO_X: 0

Rule No.[13]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
464	Industrial Wastewater	Requirements for covers and emission control systems for wastewater collection and treatment systems at organic chemical plants	Lower applicability thresholds to require controls on more wastewater streams, increase required efficiency of VOC control devices similar to SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.0017	VOC: 0.0013
	Liquefied Petroleum Gas (LPG) Transfer and Dispensing	None	Establish standards to control VOC emissions from LPG transfer and dispensing similar to the rules adopted by SCAQMD and VCAPCD	Included in evaluation of attainment advancement	VOC: 0.5693	VOC: 0.1608
	Metal Melting Furnaces	None	Establish NO_X emission limits for metal melting furnaces	No sources	NO_X: 0	NO_X: 0
451	Metal Parts and Products Coating	VOC limits on coatings, strippers, cleaning solvents	Reduce VOC limits for general one-component, extreme high gloss, and prefabricated architectural coatings, similar to SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.2643	VOC: 0.0162
	Metal Working Fluids	None	Establish VOC limits on metalworking fluids and direct-contact lubricants similar to the rules adopted by SCAQMD and VCAPCD	Included in evaluation of attainment advancement	VOC: 0.2217	VOC: 0.1197
440	Miscellaneous Coatings	None	Establish VOC limits and application method requirements for coating operations not covered by other rules, similar to SCAQMD, SJVUAPCD, VCAPCD, and BAAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.2919	VOC: 0.0450

Rule No.[13]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Miscellaneous Combustion Sources	None	Establish NO_X emission limits on miscellaneous combustion equipment < 5 mmBtu/hr including dryers and ovens similar to rules adopted by SCAQMD and SJVUAPCD	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.4206	NO_X: 0.0291
	Mold Release Agents	None	Establish VOC limits on mold release agents similar to the control measure proposed by SCAQMD	Included in evaluation of attainment advancement	VOC: 0.69	VOC: 0
485	Municipal Landfill Gas	Landfill gas collection and control systems	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.6267	VOC: 0
	Oil and Natural Gas Production	Sources subject to California Oil and Gas Methane Regulation	No more stringent control strategies identify	Included in evaluation of attainment advancement	VOC: 0.2385	VOC: 0
407/501	Open Burning	Burning of certain materials prohibited; burn procedures to minimize smoke; burning is not allowed on days declared no-burn day	Reduce the types of allowable agricultural burns similar to SJVUAPCD requirements	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.0362 VOC: 0.0925	NO_X: 0 VOC: 0

Rule No.[13]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Paper, Fabric, and Film Coatings	None	Establish VOC limits on coatings similar to rule adopted by SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.0826	VOC: 0.0595
444	Petroleum Solvent Dry Cleaning	Emit no more than 3.5 kg of solvent per 100,000 articles dry cleaned or use a solvent recovery dryer	Expand applicability to include all non-halogenated solvents; require closed-loop machines for new installations	Included in evaluation of attainment advancement	VOC: 0.0503	VOC: 0.0125
	Plastic Parts Coating	None	Establish VOC limits on plastic parts coatings similar to rule adopted by SCAQMD	Included in evaluation of attainment advancement	VOC: 0.0104	VOC: 0.0065
465	Polyester Resin/Plastic Product Manufacturing	Limits on the monomer content of resin, use of vapor suppressants, use of close-mold systems, or emission capture and control system	Remove low-usage exemption, require non-atomizing equipment, and reduce monomer content similar to rules adopted by BAAQMD, SCAQMD, and SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.1164	VOC: 0.0114
	Polystyrene /Polymeric Cellular (Foam) Manufacturing	None	Require reduction of VOC emissions from Expanded Polystyrene (EPS) molding using an emission control device	No sources	VOC: 0	VOC: 0
	Portland Cement Manufacturing	None	Establish NO_X limits for Portland cement manufacturing	No sources	NO_X: 0	NO_X: 0
	Semiconductor Manufacturing	None	Establish VOC limits for semiconductor manufacturing	No sources	VOC: 0	VOC: 0
443	Synthetic Organic Chemical Manufacturing – Fugitive Leaks	Leak detection and repair program	Reduce VOC leak detection threshold	Included in evaluation of attainment advancement	VOC: 0.2084	VOC: 0

Rule No.[13]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Soil Decontamination	None	Establish VOC emission control standards for soil vapor extraction systems, similar to rules adopted by BAAQMD and VCAPCD; Establish work practices to minimize VOC emissions from soil aeration similar to rule adopted by SJVUAPCD	Not cost effective - Not included in evaluation of attainment advancement	VOC: 0.0119	VOC: 0.009
454/466	Solvent Cleaning	VOC limits on solvents, or use airtight/airless cleaning systems	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.8122	VOC: 0
413	Stationary Gas Turbines	NO_X emission limits on stationary gas turbines	Reduce NO_X emission limits to be as stringent as SCAQMD	Included in evaluation of attainment advancement	NO_X: 0.3365	NO_X: 0.0673
	Wastewater Separators	None	Require solid cover, floating pontoon cover; double-deck cover, or vapor recovery system similar to rule adopted by SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.0017	VOC: 0.0013
414	Water Heaters and Small Boilers	Point-of-sale NO_X emission standards on water heaters with rated heat input capacity less than 1 mmBtu/hr	No control strategies identified	Included in evaluation of attainment advancement	NO_X: 0.1820	NO_X: 0
463	Wood Products Coatings	VOC limits on coatings	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.5288	VOC: 0

D.2.5 El Dorado County Air Quality Management District (EDCAQMD)

Table D-2 EDCAQMD Stationary/Area Source Control Measures Considered

Rule No.[14]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
236	Adhesives and Sealants	VOC limits on adhesives and sealants	Reduce VOC limits on adhesives and sealants similar to rules adopted by SCAQMD and SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.051	VOC: 0.016
215	Architectural Coatings	VOC limits on coatings	Reduce the VOC limits on architectural coatings similar to the rules adopted by SCAQMD and SJVUAPCD and the 2019 and 2020 CARB SCMs	Not Recommended – SCM Evaluated for Attainment Advancement.	VOC: 0.037	VOC: 0.004
	Asphaltic Concrete	None	Establish NO_X emission standards for aggregate dryers similar to the rules adopted by SCAQMD and SJVUAPCD	No sources	NO_X: 0	NO_X: 0
230	Automotive Refinishing	VOC limits on coatings	Reduce the VOC limits on architectural coatings consistent with the SCM	Included in evaluation of attainment advancement	VOC: 0.116	VOC: 0.056
229	Boilers	NO_X limits on boiler/steam generators with a rated heat input capacity of 5 mmBtu/hr or greater	Expand applicability to units ≥ 2 mmBtu/hr and reduce NO_X limits similar to SCAQMD and SJVUAPCD requirements	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.002	NO_X: 0.0012

[14] A blank indicates no current rule in place for that type of stationary or area source.

Rule No.[14]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Brandy and Wine Aging	None	Establish VOC emissions standards to reduce evaporative VOC emissions from the fermentation process at distilleries and wineries similar to SJVUAPCD requirements	No sources subject to control	VOC: 0.015	VOC: 0
	Can Coating	None	Establish VOC limits on can coatings similar to rule adopted by SMAQMD	No sources	VOC: 0	VOC: 0
	Commercial Cooking	None	Establish standards to control VOC emissions from commercial charbroilers similar to SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0	VOC: 0
	Composting Operations	None	Establish work practice requirements to reduce VOC emissions from green waste composting similar to SCAQMD requirements	No sources subject to control	VOC: 0.019	VOC: 0
	Confined Animal Facilities	None	Establish work practice requirements to reduce VOC emissions from confined animal facilities	No sources	VOC: 0	VOC: 0
	Flares	None	Establish NO_X emission standards for flares similar to SJVUAPCD requirements	Included in evaluation of attainment advancement	NO_X: 0	NO_X: 0

Rule No.[14]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Furnaces (Residential)	None	Establish point-of-sale NO_X emissions standard for natural gas-fired central furnaces similar to SCAQMD and SJVUAPCD requirements	Included in evaluation of attainment advancement	NO_X: 0.042	NO_X: 0.009
	Further Control of High-Emitting Spray Booth Facilities	None	Require additional controls to reduce VOC emissions from spray booths at facilities emitting > 20 tons per year	No sources	VOC: 0	VOC: 0
216/244	Organic Liquid Storage, Loading, and Degassing of Tanks and Pipelines, Bulk Plant Terminals	VOC emission standards for organic liquid storage tanks; vapor-recovery requirements for loading at bulk plants and bulk terminals	Reduce VOC emission limits for gasoline loading at bulk plants and bulk terminals to be as stringent as BAAQMD; establish VOC emission standards for degassing storage tanks and pipelines similar to SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.183	VOC: 0
	Glass Melting Furnaces	None	Establish NO_X emission limits for glass melting furnaces	No sources	NO_X: 0	NO_X: 0
231	Graphic Arts	VOC limits on inks, coatings, adhesives or use emission control system	Reduce VOC limits for flexographic ink on porous substrates, extreme performance ink, and metallic ink to be as stringent as SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.047	VOC: 0.029
233	IC Engines	NO_X limits on IC Engines	Reduce NO_X limits for IC engines similar to SCAQMD requirements	No sources	NO_X: 0	NO_X: 0
464	Industrial Wastewater	None	Establish emission control standards for wastewater systems	No sources	VOC: 0	VOC: 0

Rule No.[14]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Metal Melting Furnaces	None	Establish NO_X emission limits for metal melting furnaces	No sources	NO_X: 0	NO_X: 0
	Metal Parts and Products Coating	None	Establish VOC limits on metal parts and products coating similar to SMAQMD and SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.018	VOC: 0.004
	Metal Working Fluids	None	Establish VOC limits on metalworking fluids and direct-contact lubricants similar to the rules adopted by SCAQMD and VCAPCD	Included in evaluation of attainment advancement	VOC: 0.024	VOC: 0.013
	Miscellaneous Coating	None	Establish VOC limits and application method requirements for coating operations not covered by other rules, similar to SCAQMD, SJVUAPCD, VCAPCD, and BAAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.098	VOC: 0.019
	Miscellaneous Combustion Sources	None	Establish NO_X emission limits on miscellaneous combustion equipment including dryers and ovens similar to rules adopted by SCAQMD and SJVUAPCD	No sources	NO_X: 0	NO_X: 0
	Mold Release Agents	None	Establish VOC limits on mold release agents similar to the control measure proposed by SCAQMD	Included in evaluation of attainment advancement	VOC: 0	VOC: 0

Rule No.[14]	**Title**	**Current Requirements**	**Opportunity for Strengthening**	**Conclusion**	**Total Inventory (tpd)**	**Potential Reduction (tpd)**
	Municipal Landfill Gas	None	Establish requirements for landfills including gas collection and control systems	Included in evaluation of attainment advancement	VOC: 0.023	VOC: 0
	Oil and Natural Gas Production	None	Establish requirements to inspect and maintain equipment to reduce fugitive VOC emissions	No sources	VOC: 0	VOC: 0
300	Open Burning	Burning of certain materials prohibited; burn procedures to minimize smoke; burning is not allowed on days declared no-burn day	Reduce the types of allowable agricultural burns similar to SJVUAPCD requirements	No sources	VOC: 0 NO_X: 0	VOC: 0 NO_X: 0
	Paper, Fabric, and Film Coatings	None	Establish VOC limits on coatings similar to rule adopted by SJVUAPCD	No sources	VOC: 0	VOC: 0
218	Petroleum Solvent Dry Cleaning	Emit no more than 0.6 kg of solvent per kg of wet waste or use a system that reduces waste losses below 0.01 kg per kg of clothes	Remove applicability threshold to include all dry cleaning solvents except for perchloroethylene and ban the use of open transfer systems	Included in evaluation of attainment advancement	VOC: 0	VOC: 0
	Plastic Parts Coating	None	Establish VOC limits on plastic parts coatings similar to rule adopted by SCAQMD	Included in evaluation of attainment advancement	VOC: 0.034	VOC: 0.021

Rule No.[14]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Polyester Resin/Plastic Product Manufacturing	None	Establish VOC standards on monomer content of resins and require vapor suppressants and use of close-mold systems similar to rules adopted by BAAQMD, SCAQMD, and SJVUAPCD	No sources	VOC: 0	VOC: 0
	Polystyrene /Polymeric Cellular (Foam) Manufacturing	None	Require reduction of VOC emissions from EPS molding using an emission control device	No sources	VOC: 0	VOC: 0
	Portland Cement Manufacturing	None	Establish NO_X limits for Portland cement manufacturing	No sources	NO_X: 0	NO_X: 0
	Semiconductor Manufacturing	None	Establish VOC limits for semiconductor manufacturing	No sources	VOC: 0	VOC: 0
	Synthetic Organic Chemical Manufacturing – Fugitive Leaks	None	Establish VOC emissions standards for leak detection and repair program	No sources	VOC: 0	VOC: 0
	Soil Decontamination	None	Establish VOC emission control standards for soil vapor extraction systems, similar to rules adopted by BAAQMD and VCAPCD; Establish work practices to minimize VOC emissions from soil aeration similar to rule adopted by SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0	VOC: 0

Rule No.[14]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
225/235	Solvent Cleaning	VOC limits on solvents	Reduce VOC limits of solvents similar to rules adopted by SMAQMD and PCAPCD.	Included in evaluation of attainment advancement	VOC: 0.086	VOC: 0.061
	Stationary Gas Turbines	None	Establish NO_X emission limits to be as stringent as SCAQMD	No sources	NO_X: 0	NO_X: 0
	Wastewater Separators	None	Require solid cover, floating pontoon cover; double-deck cover, or vapor recovery system similar to rule adopted by SJVUAPCD	No sources	VOC: 0	VOC: 0
239	Water Heaters and Small Boilers	Point-of-sale NO_X emission standards on water heaters with rated heat input capacity less than 75,000 Btu/hr	Expand point-of-sale emission standards to include units ≥ 75,000 Btu/hr and < 5 mmBtu/hr similar to rule adopted by SMAQMD	Included in evaluation of attainment advancement	NO_X: 0.077	NO_X: 0.033
237	Wood Products Coatings	VOC limits on coatings	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0	VOC: 0

D.2.6 Feather River Air Quality Management District (FRAQMD)

Table D-3 FRAQMD Stationary/Area Source Control Measures Considered

Rule No.[15]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Adhesives and Sealants	None	Establish VOC limits on adhesives and sealants similar to rules adopted by SCAQMD and SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.0076	VOC: 0.0076*
3.15	Architectural Coatings	VOC limits on coatings	Reduce the VOC limits on architectural coatings similar to the rules adopted by SCAQMD and SJVAPCD and the 2019 and 2020 CARB SCMs	Included in evaluation of attainment advancement	VOC: 0.0040	VOC: 0.0004
	Asphaltic Concrete	None	Establish NO_X standards similar to the rules adopted by SCAQMD/SJVUAPCD	No sources	NO_X: 0	NO_X: 0
3.19	Automotive Refinishing	VOC limits on coatings	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.0026	VOC: 0
3.21	Boilers	NO_X limits on boiler/steam generators with a rated heat input capacity of 1 mm Btu/hr or greater	Reduce NO_X limits similar to SCAQMD and SJVUAPCD requirements	No sources subject to control	NO_X: 0.0144	NO_X: 0
	Brandy and Wine Aging	None	Establish VOC emissions standards to reduce evaporative VOC emissions from the fermentation process at distilleries and wineries similar to SJVUAPCD requirements	No sources	VOC: 0	VOC: 0

[15] A blank indicates no current rule in place for that type of stationary or area source.

Rule No.[15]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Can Coating	None	Establish VOC limits on can coatings similar to rule adopted by SMAQMD	No sources	VOC: 0	VOC: 0
	Commercial Cooking	None	Establish standards to control VOC emissions from commercial charbroilers similar to SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.0008	VOC: 0.0008*
	Composting Operations	None	Establish work practice requirements to reduce VOC emissions from green waste composting similar to SCAQMD requirements	No sources	VOC: 0	VOC: 0
	Confined Animal Facilities	None	Establish work practice requirements to reduce VOC emissions from confined animal facilities	No sources	VOC: 0.0639	VOC: 0
	Flares	None	Establish NO_X emission standards for flares similar to SJVUAPCD requirements	No sources	NO_X: 0	NO_X: 0
	Furnaces (Residential)	None	Establish point-of-sale NO_X emissions standard for natural gas-fired central furnaces similar to SCAQMD and SJVUAPCD requirements	Included in evaluation of attainment advancement	NO_X: 0.0010	NO_X: 0
	Further Control of High-Emitting Spray Booth Facilities	None	Require additional controls to reduce VOC emissions from spray booths at facilities emitting > 20 tons per year	No sources	VOC: 0	VOC: 0

Rule No.[15]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
3.9	Gasoline Storage, Loading, and Degassing of Tanks and Pipelines	VOC emission standards for organic liquid storage tanks; vapor-recovery requirements for loading at bulk plants and bulk terminals	Reduce VOC emission limits for gasoline loading at bulk plants and bulk terminals to be as stringent as BAAQMD; establish VOC emission standards for degassing storage tanks and pipelines similar to SCAQMD requirements	No sources	VOC: 0	VOC: 0
	Glass Melting Furnaces	None	Establish NO_X emission limits for glass melting furnaces	No sources	NO_X: 0	NO_X: 0
	Graphic Arts	None	Establish VOC limits on inks, coatings, or adhesives for graphic arts similar to SJVUAPCD requirements	No sources	VOC: 0	VOC: 0
3.22	IC Engines	NO_X limits on IC Engines	Reduce NO_X limits for IC engines similar to SCAQMD requirements	No sources subject to control	NO_X: 0.0005	NO_X: 0
	Industrial Wastewater	None	Establish emission control standards for wastewater systems	No sources	VOC: 0	VOC: 0
	LPG Transfer and Dispensing	None	Establish standards to control VOC emissions from LPG transfer and dispensing similar to the rules adopted by SCAQMD and VCAPCD	Included in evaluation of attainment advancement	VOC: 0.05	VOC: 0.03
	Metal Melting Furnaces	None	Establish NO_X emission limits for metal melting furnaces	No sources	NO_X: 0	NO_X: 0

Rule No.[15]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Metal Parts and Products Coating	None	Establish VOC limits on metal parts and products coating similar to SMAQMD and SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.0003	VOC: 0.0003*
	Metal Working Fluids	None	Establish VOC limits on metalworking fluids and direct-contact lubricants similar to the rules adopted by SCAQMD and VCAPCD	Included in evaluation of attainment advancement	VOC: 0.009	VOC: 0.005
	Miscellaneous Coating	None	Establish VOC limits and application method requirements for coating operations not covered by other rules, similar to SCAQMD, SJVUAPCD, VCAPCD, and BAAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.0015	VOC: 0
	Miscellaneous Combustion Sources	None	Establish NO_X emission limits on miscellaneous combustion equipment including dryers and ovens similar to rules adopted by SCAQMD and SJVUAPCD	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.0195	NO_X: 0
	Mold Release Agents	None	Establish VOC limits on mold release agents similar to the control measure proposed by SCAQMD	Included in evaluation of attainment advancement	VOC: 0	VOC: 0
3.18	Municipal Landfill Gas	Landfill gas collection and control systems	No control strategies identified	No sources	VOC: 0	VOC: 0

Rule No.[15]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Oil and Natural Gas Production	None	Establish requirements to inspect and maintain equipment to reduce fugitive VOC emissions	No sources	VOC: 0	VOC: 0
Reg. II	Open Burning	Burning of certain materials prohibited; burn procedures to minimize smoke; burning is not allowed on days declared no-burn day	Reduce the types of allowable agricultural burns similar to SJVUAPCD requirements	Only the emission reductions for burning of pruning are cost effective, and are included in evaluation of attainment advancement	NO_X: 0.0870 VOC: 0.1194	NO_X: 0.0034 VOC: 0.0035
	Paper, Fabric, and Film Coatings	None	Establish VOC limits on coatings similar to rule adopted by SJVUAPCD	No sources	VOC: 0	VOC: 0
	Petroleum Solvent Dry Cleaning	None	Establish VOC limits on solvents used and ban the use of open transfer systems	No sources	VOC: 0	VOC: 0
	Plastic Parts Coating	None	Establish VOC limits on plastic parts coatings similar to rule adopted by SCAQMD	No sources	VOC: 0	VOC: 0
	Polyester Resin/Plastic Product Manufacturing	None	Establish VOC standards on monomer content of resins and require vapor suppressants and use of close-mold systems similar to rules adopted by BAAQMD, SCAQMD, and SJVUAPCD	No sources	VOC: 0	VOC: 0

Rule No.[15]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Polystyrene /Polymeric Cellular (Foam) Manufacturing	None	Require reduction of VOC emissions from EPS molding using an emission control device	No sources	VOC: 0	VOC: 0
	Portland Cement Manufacturing	None	Establish NO_X limits for Portland cement manufacturing	No sources	NO_X: 0	NO_X: 0
	Semiconductor Manufacturing	None	Establish VOC limits for semiconductor manufacturing	No sources	VOC: 0	VOC: 0
	Synthetic Organic Chemical Manufacturing – Fugitive Leaks	None	Establish VOC emissions standards for leak detection and repair program	No sources	VOC: 0	VOC: 0
	Soil Decontamination	None	Establish VOC emission control standards for soil vapor extraction systems, similar to rules adopted by BAAQMD and VCAPCD; Establish work practices to minimize VOC emissions from soil aeration similar to rule adopted by SJVUAPCD	No sources	VOC: 0	VOC: 0
3.14	Solvent Cleaning	VOC limits on solvents	Current rule meets RACM.	Included in evaluation of attainment advancement	VOC: 0.011	VOC: 0
	Stationary Gas Turbines	None	Establish NO_X emission limits to be as stringent as SCAQMD	No sources	NO_X: 0	NO_X: 0

Rule No.[15]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Wastewater Separators	None	Require solid cover, floating pontoon cover; double-deck cover, or vapor recovery system similar to rule adopted by SJVUAPCD	No sources	VOC: 0	VOC: 0
3.23	Water Heaters and Small Boilers	NOx limits on small boilers and water heaters above 75,000 Btu/hr	Establish point-of-sale emission standards for units < 75,000Btu/hr similar to rule adopted by SMAQMD	Included in evaluation of attainment advancement	NO_X: 0.0054	NO_X: 0.001
3.20	Wood Products Coatings	VOC limits on coatings	Adopt VOC content limits of SJVUAPCD Rule 4606 and SCAQMD Rule 1136.	Included in evaluation of attainment advancement	VOC: 0.0016	VOC: 0.0016*

* The emissions inventory for this category is minimal and reductions were not calculated. To be conservative in the RACM analysis, the entire emissions inventory was counted as a reduction.

D.2.7 Placer County Air Pollution Control District (PCAPCD)

Table D-4 PCAPCD Stationary/Area Source Control Measures Considered

Rule No.[16]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
235	Adhesives and Sealants	VOC limits on adhesives and sealants	Reduce VOC limits on adhesives and sealants similar to rules adopted by SCAQMD and SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.6574	VOC: 0.1744
218	Architectural Coatings	VOC limits on coatings	Reduce the VOC limits on architectural coatings similar to the rules adopted by SCAQMD and SJVAPCD and the 2019 and 2020 CARB SCMs	Included in evaluation of attainment advancement	VOC: 0.2682	VOC: 0.0318
	Asphaltic Concrete	None	Establish NO_X emission standards for aggregate dryers similar to the rules adopted by SCAQMD and SJVUAPCD	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.0651	NO_X: 0
234	Automotive Refinishing	VOC limits on coatings	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.2123	VOC: 0
233	Biomass Boilers	NO_X limits on biomass boilers	Establish NO_X emission standards for biomass boilers similar to the rules adopted by SJVUAPCD and YSAQMD	Included in evaluation of attainment advancement	NO_X: 0.3922	NO_X: 0

[16] A blank indicates no current rule in place for that type of stationary or area source.

Rule No.[16]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
231/247	Boilers	NO_X limits on boiler/steam generators with a rated heat input capacity of 5 mmBtu/hr or greater	Expand applicability to units ≥ 2 mmBtu/hr and reduce NO_X limits similar to SCAQMD and SJVUAPCD requirements	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.0825	NO_X: 0
	Brandy and Wine Aging	None	Establish VOC emissions standards to reduce evaporative VOC emissions from the fermentation process at distilleries and wineries similar to SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.0028	VOC: 0
	Can Coating	None	Establish VOC limits on can coatings similar to rule adopted by SMAQMD	No sources	VOC: 0	VOC: 0
	Commercial Cooking	None	Establish standards to control VOC emissions from commercial charbroilers similar to SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.0185	VOC: 0.0009
	Composting Operations	None	Establish work practice requirements to reduce VOC emissions from green waste composting similar to SCAQMD requirements	No sources	VOC: 0	VOC: 0

Rule No.[16]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Confined Animal Facilities	None	Establish work practice requirements to reduce VOC emissions from confined animal facilities	No sources subject to control	VOC: 1.084	VOC: 0
	Flares	None	Establish NO_X emission standards for flares similar to SJVUAPCD requirements	Included in evaluation of attainment advancement	NO_X: 0.0101	NO_X: 0.0101*
	Furnaces (Residential)	None	Establish point-of-sale NO_X emissions standard for natural gas-fired central furnaces similar to SCAQMD requirements	Included in evaluation of attainment advancement	NO_X: 0.1325	NO_X: 0.0298
	Further Control of High-Emitting Spray Booth Facilities	None	Require additional controls to reduce VOC emissions from spray booths at facilities emitting > 20 tons per year	No sources	VOC: 0	VOC: 0
212/215	Storage of Organic Liquids and Transfer of Gasoline into Tank Trucks, Trailers, and Railroad Tank Cars at Loading Facilities	VOC emission standards for organic liquid storage tanks; vapor-recovery requirements for loading at bulk plants and bulk terminals	Reduce VOC emission limits for gasoline loading at bulk plants and bulk terminals to be as stringent as BAAQMD; establish VOC emission standards for degassing storage tanks and pipelines similar to SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.0188	VOC: 0
	Glass Melting Furnaces	None	Establish NO_X emission limits for glass melting furnaces	No sources	NO_X: 0	NO_X: 0
239	Graphic Arts	VOC limits on inks, coatings, adhesives or use emission control system	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.0094	VOC: 0

Rule No.[16]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
242	IC Engines	NO_X emission limits on IC engines located at stationary sources of NO_X	Reduce NO_X limits to be stringent as SCAQMD	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.1513	NO_X: 0
	Industrial Wastewater	None	Establish emission control standards for wastewater systems	No sources	VOC: 0	VOC: 0
	LPG Transfer and Dispensing	None	Establish standards to control VOC emissions from LPG transfer and dispensing similar to the rules adopted by SCAQMD and VCAPCD	Included in evaluation of attainment advancement	VOC: 0.1419	VOC: 0.1012
	Metal Melting Furnaces	None	Establish NO_X emission limits for metal melting furnaces	No sources	NO_X: 0	NO_X: 0
245	Metal Parts and Products Coating	VOC limits on coatings, strippers, and solvent cleaner	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.048	VOC: 0

Rule No.[16]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Metal Working Fluids	None	Establish VOC limits on metalworking fluids and direct-contact lubricants similar to the rules adopted by SCAQMD and VCAPCD	Included in evaluation of attainment advancement	VOC: 0.0384	VOC: 0.0207
	Miscellaneous Coating	None	Establish VOC limits and application method requirements for coating operations not covered by other rules, similar to SCAQMD, SJVUAPCD, VCAPCD, and BAAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.3548	VOC: 0.0362
	Miscellaneous Combustion Sources	None	Establish NO_X emission limits on miscellaneous combustion equipment including dryers and ovens similar to rules adopted by SCAQMD and SJVUAPCD	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.1293	NO_X: 0.0194
	Mold Release Agents	None	Establish VOC limits on mold release agents similar to the control measure proposed by SCAQMD	No sources	VOC: 0	VOC: 0
	Municipal Landfill Gas	None	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.1304	VOC: 0
	Oil and Natural Gas Production	None	Establish requirements to inspect and maintain equipment to reduce fugitive VOC emissions	No sources	VOC: 0	VOC: 0

Rule No.[16]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
301-306	Open Burning	Burning of certain materials prohibited; burn procedures to minimize smoke; burning is not allowed on days declared no-burn day	Reduce the types of allowable agricultural burns similar to SJVUAPCD requirements	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.0337 VOC: 0.2153	NO_X: 0 VOC: 0
	Paper, Fabric, and Film Coatings	None	Establish VOC limits on coatings similar to rule adopted by SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.0008	VOC: 0.0008*
	Petroleum Solvent Dry Cleaning	None	Establish VOC limits on solvents used and ban the use of open transfer systems	Included in evaluation of attainment advancement	VOC: 0.0151	VOC: 0
249	Plastic Parts Coating	VOC limits on coatings	Reduce VOC limits on plastic parts coatings similar to rule adopted by SCAQMD	Included in evaluation of attainment advancement	VOC: 0.0532	VOC: 0.0332
243	Polyester Resin/Plastic Product Manufacturing	Limits on the monomer content of resin, use of vapor suppressants	Remove low-usage exemption, require non-atomizing equipment, and reduce monomer content similar to rules adopted by BAAQMD, SCAQMD, and SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.0057	VOC: 0.0057*
	Polystyrene /Polymeric Cellular (Foam) Manufacturing	None	Require reduction of VOC emissions from EPS molding using an emission control device	No sources	VOC: 0.001	VOC: 0
	Portland Cement Manufacturing	None	Establish NO_X limits for Portland cement manufacturing	No sources	NO_X: 0	NO_X: 0

Rule No.[16]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
244	Semiconductor Manufacturing	VOC limits on semiconductor manufacturing	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.0007	VOC: 0.0007*
	Synthetic Organic Chemical Manufacturing – Fugitive Leaks	None	Establish VOC emissions standards for leak detection and repair program	No sources	VOC: 0	VOC: 0
	Soil Decontamination	None	Establish VOC emission control standards for soil vapor extraction systems, similar to rules adopted by BAAQMD and VCAPCD; Establish work practices to minimize VOC emissions from soil aeration similar to rule adopted by SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0	VOC: 0
216/240	Solvent Cleaning	VOC limits on solvents	Reduce VOC limits for solvents similar to rule adopted by SCAQMD	Included in evaluation of attainment advancement	VOC: 1.0501	VOC: 0.42
250	Stationary Gas Turbines	NO_X limits on stationary gas turbines	No control strategies identified	Included in evaluation of attainment advancement	NO_X: 0.0057	NO_X: 0
	Wastewater Separators	None	Require solid cover, floating pontoon cover; double-deck cover, or vapor recovery system similar to rule adopted by SJVUAPCD	No sources	VOC: 0	VOC: 0

Rule No.[16]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
246	Water Heaters and Small Boilers	None	Establish point-of-sale NO_X emission standards on water heaters with rated heat input capacity less than 1 mmBtu/hr	Included in evaluation of attainment advancement	NO_X: 0.0825	NO_X: 0.0128
236	Wood Products Coatings	VOC limits on coatings	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.2274	VOC: 0

* The emissions inventory for this category is minimal and reductions were not calculated. To be conservative in the RACM analysis, the entire emissions inventory was counted as a reduction.

D.2.8 Yolo-Solano Air Quality Management District (YSAQMD)

Table D-5 YSAQMD Stationary/Area Source Control Measures Considered

Rule No.[17]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
2.33	Adhesives and Sealants	VOC limits on adhesives and sealants	Reduce VOC limits on adhesives and sealants similar to rules adopted by SCAQMD and SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.084	VOC: 0.043
2.14	Architectural Coatings	VOC limits on coatings	Reduce the VOC limits on architectural coatings similar to the rules adopted by SCAQMD and SJVAPCD and the 2019 and 2020 CARB SCMs	Included in evaluation of attainment advancement	VOC: 0.3490	VOC: 0.0411
	Asphaltic Concrete	None	Establish NO_X emission standards for aggregate dryers similar to the rules adopted by SCAQMD and SJVUAPCD	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.0793	NO_X: 0
2.26	Automotive Refinishing	VOC limits on coatings	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.2690	VOC: 0
2.27	Boilers	NO_X limits on boiler/steam generators with a rated heat input capacity of 5 mmBtu/hr or greater	Expand applicability to units ≥ 2 mmBtu/hr and reduce NO_X limits similar to SCAQMD and SJVUAPCD requirements	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.6720	NO_X: 0

[17] A blank indicates no current rule in place for that type of stationary or area source.

Rule No.[17]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
4695	Brandy and Wine Aging	None	Establish VOC emissions standards to reduce evaporative VOC emissions from the fermentation process at distilleries and wineries similar to SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.2040	VOC: 0.0820
	Can Coating	VOC limits on coatings	No control strategies identified	No sources	VOC: 0	VOC: 0
	Commercial Cooking	None	Establish standards to control VOC emissions from commercial charbroilers similar to SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.0253	VOC: 0.0003
	Composting Operations	None	Establish work practice requirements to reduce VOC emissions from green waste composting similar to SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 2.22	VOC: 0.16
11.2	Confined Animal Facilities	Implement VOC emission mitigation measures from a menu of options	Reduce animal-count applicability thresholds; increase number of mitigation measures, and control efficiency	Included in evaluation of attainment advancement	VOC: 0.6720	VOC: 0.0147
	Flares	None	Establish NO_X emission standards for flares similar to SJVUAPCD requirements	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.015	NO_X: 0

Rule No.[17]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
2.44	Furnaces (Residential)	NO_X limits from natural gas-fired, fan-type central furnaces	No control strategies identified	Included in evaluation of attainment advancement	NO_X: 0.0729	NO_X: 0.0152
	Further Control of High-Emitting Spray Booth Facilities	None	Require additional controls to reduce VOC emissions from spray booths at facilities emitting > 20 tons per year	No sources	VOC: 0	VOC: 0
2.21	Gasoline Storage, Loading, and Degassing of Tanks and Pipelines	VOC emission standards for organic liquid storage tanks; vapor-recovery requirements for loading at bulk plants and bulk terminals	Reduce VOC emission limits for gasoline loading at bulk plants and bulk terminals to be as stringent as BAAQMD; establish VOC emission standards for degassing storage tanks and pipelines similar to SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.503	VOC: 0.0016
	Glass Melting Furnaces	None	Establish NO_X emission limits for glass melting furnaces	No sources	NO_X: 0	NO_X: 0
2.29	Graphic Arts	VOC limits on inks, coatings, adhesives or use emission control system	Reduce VOC limits for flexographic ink on porous substrates, extreme performance ink, and metallic ink to be as stringent as SJVUAPCD requirements	Included in evaluation of attainment advancement	VOC: 0.0195	VOC: 0.0001
2.32	IC Engines	NO_X limits on IC engines located at stationary sources	Reduce NO_X limits to be stringent as SCAQMD	Included in evaluation of attainment advancement	NO_X: 0.459	NO_X: 0.0163

Rule No.[17]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
2.32	Landfill Gas Fired IC Engines	NO_X limits on IC engines located at stationary sources fired on landfill gas	Reduce NO_X limits to be stringent as SCAQMD	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.459	NO_X: 0
	Industrial Wastewater	None	Establish emission control standards for wastewater systems	Included in evaluation of attainment advancement	VOC: 0.0021	VOC: 0.0016
	LPG Transfer and Dispensing	None	Establish standards to control VOC emissions from LPG transfer and dispensing similar to the rules adopted by SCAQMD and VCAPCD	Included in evaluation of attainment advancement	VOC: 0.13	VOC: 0.07
	Metal Melting Furnaces	None	Establish NO_X emission limits for metal melting furnaces	No sources	NO_X: 0	NO_X: 0
2.25	Metal Parts and Products Coating	VOC limits on coatings, strippers, cleaning solvents	Reduce VOC limits for general one-component, extreme high gloss, and prefabricated architectural coatings, similar to SCAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.041	VOC: 0.0066
	Metal Working Fluids	None	Establish VOC limits on metalworking fluids and direct-contact lubricants similar to the rules adopted by SCAQMD and VCAPCD	Included in evaluation of attainment advancement	VOC: 0.204	VOC: 0.11

Rule No.[17]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
2.25-3	Miscellaneous Coating	None	Establish VOC limits and application method requirements for coating operations not covered by other rules, similar to SCAQMD, SJVUAPCD, VCAPCD, and BAAQMD requirements	Included in evaluation of attainment advancement	VOC: 0.279	VOC: 0.0423
	Miscellaneous Combustion Sources	None	Establish NO_X emission limits on miscellaneous combustion equipment including dryers and ovens similar to rules adopted by SCAQMD and SJVUAPCD	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.53	NO_X: 0
	Mold Release Agents	None	Establish VOC limits on mold release agents similar to the control measure proposed by SCAQMD	Included in evaluation of attainment advancement	VOC: 0.386	VOC: 0
2.38	Municipal Landfill Gas	Landfill gas collection and control systems	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.0586	VOC: 0
2.23	Oil and Natural Gas Production	Leak detection and repair standards for components used in natural gas production and processing	No control strategies identified	Included in evaluation of attainment advancement	VOC: 0.36	VOC: 0
6.0	Open Burning	Burning of certain materials prohibited; burn procedures to minimize smoke; burning is not allowed on days declared no-burn day	Reduce the types of allowable agricultural burns similar to SJVUAPCD requirements	Not cost effective - Not included in evaluation of attainment advancement	NO_X: 0.1255 VOC: 0.2003	NO_X: 0 VOC: 0

Rule No.[17]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
2.29-2	Paper, Fabric, and Film Coatings	None	Establish VOC limits on coatings similar to rule adopted by SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.0363	VOC: 0.0261
9.7	Petroleum Solvent Dry Cleaning	Use of closed-loop machine with primary control system; newer facilities must install close loop with both primary and secondary control systems	Expand applicability to include all non-halogenated solvents	Included in evaluation of attainment advancement	VOC: 0.0272	VOC: 0.0043
2.25-2	Plastic Parts Coating	None	Establish VOC limits on plastic parts coatings similar to rule adopted by SCAQMD	Included in evaluation of attainment advancement	VOC: 0.0418	VOC: 0
2.30	Polyester Resin/Plastic Product Manufacturing	Limits on the monomer content of resin, use of vapor suppressants, use of close-mold systems, or emission capture and control system	Remove low-usage exemption, require non-atomizing equipment, and reduce monomer content similar to rules adopted by BAAQMD, SCAQMD, and SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.194	VOC: 0.0714
2.41	Polystyrene /Polymeric Cellular (Foam) Manufacturing	VOC limits for the manufacturing of expanded polystyrene products	No control strategies identified	No sources	VOC: 0	VOC: 0
	Portland Cement Manufacturing	None	Establish NO_X limits for Portland cement manufacturing	No sources	NO_X: 0	NO_X: 0
	Semiconductor Manufacturing	None	Establish VOC limits for semiconductor manufacturing	No sources	VOC: 0	VOC: 0

Rule No.[17]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
	Synthetic Organic Chemical Manufacturing – Fugitive Leaks	None	Establish VOC emissions standards for leak detection and repair program	No sources	VOC: 0	VOC: 0
	Soil Decontamination	None	Establish VOC emission control standards for soil vapor extraction systems, similar to rules adopted by BAAQMD and VCAPCD; Establish work practices to minimize VOC emissions from soil aeration similar to rule adopted by SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.0147	VOC: 0.0026
2.31	Solvent Cleaning	VOC limits on solvents, or use airtight/airless cleaning systems	No control strategies identified	Included in evaluation of attainment advancement	VOC: 1.021	VOC: 0
2.34	Stationary Gas Turbines	NO_X limits on stationary gas turbines	Reduce NO_X emission limits to be as stringent as SCAQMD	Included in evaluation of attainment advancement	NO_X: 0.0002	NO_X: 0.0002*
	Wastewater Separators	None	Require solid cover, floating pontoon cover; double-deck cover, or vapor recovery system similar to rule adopted by SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.0021	VOC: 0.0016

Rule No.[17]	Title	Current Requirements	Opportunity for Strengthening	Conclusion	Total Inventory (tpd)	Potential Reduction (tpd)
2.37	Water Heaters and Small Boilers	Point-of-sale NO_X emission standards on water heaters with rated heat input capacity less than 1 mmBtu/hr	No control strategies identified	Included in evaluation of attainment advancement	NO_X: 0.1152	NO_X: 0
2.39	Wood Products Coatings	VOC limits on coatings	Reduce VOC limits on wood coatings similar to rules adopted by SCAQMD/SJVUAPCD	Included in evaluation of attainment advancement	VOC: 0.151	VOC: 0

* The emissions inventory for this category is minimal and reductions were not calculated. To be conservative in the RACM analysis, the entire emissions inventory was counted as a reduction.

D.3 RACM Analysis – SACOG

D.3.1 Introduction

On October 26, 2015, the U.S. Environmental Protection Agency (EPA) strengthened the National Ambient Air Quality Standards (NAAQS) for ground-level ozone to 70 parts per billion (ppb).[18] EPA designated the Sacramento region as serious nonattainment for the 2015 8-hour ozone NAAQS and will be acting on a request to redesignate the region to severe. For a nonattainment area classified as severe-15, the regulatory attainment deadline is 15 years after the effective date of initial designation, which means the Sacramento region must attain the 2015 standard by the end of 2032. And, since EPA requires three full years of clean data to demonstrate attainment, a new attainment year of 2032 must be modeled and addressed in both conformity and Reasonably Further Progress (RFP) demonstrations. The requirement to assess Reasonably Available Control Measures (RACM) per Clean Air Act (CAA) Section 172(c)(1) must be met as part of the SIP development process for an ozone nonattainment area. The CAA mandates that RACM analysis must be conducted in order to show that the Sacramento region has adopted all RACM to achieve attainment of the 2015 8-hour ozone standard as expeditiously as practicable.

This report provides a preliminary RACM analysis that was completed by the Sacramento Area Council of Governments (SACOG) in consultation with the Sacramento Metropolitan Air Quality Management District (SMAQMD), on behalf of the districts in the non-attainment area, in order to meet the 8-hour ozone standard state implementation plan (SIP) requirements. Specifically, this draft report summarizes ozone SIP RACM requirements, documents the transportation control measure (TCM) identification process, and also provides preliminary RACM determination specific to SACOG.

D.3.2 RACM Requirements

In order to demonstrate attainment of the federal ozone standard as expeditiously as practicable as required by the CAA, nonattainment areas “should consider all available measures, including those being implemented in other areas, and must adopt measures for an area only if those measures are economically and technologically feasible and will advance the attainment date or are necessary for RFP.”[19]

This RACM analysis focuses on transportation control measures (TCMs) or strategies that reduce travel and thereby achieve air quality benefits and that are specifically identified in a State Implementation Plan (SIP). Once TCMs are included in a SIP, SACOG is legally

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[18] EPA, 2015. National Ambient Air Quality Standards for Ozone. Final Rule. U.S. Environmental Protection Agency. Federal Register Vol. 80. FR 65292 (2015)

[19] EPA, 2018. Final Rule: Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements Federal Register, Volume 83, 6 December 2018.

bound to implement these measures in order to satisfy timely implementation demonstration requirements as part of the transportation planning process. If funds programmed for TCMs do not become available or if the schedule identified in a SIP cannot be met, the agency faces serious consequences, one of which could be a nonconforming Metropolitan Transportation Plan (MTP).

The criteria for identifying TCM projects and the requirements for timely implementation of these projects are defined in the EPA's Transportation Conformity Rule, 40 CFR Part 93:

> *A TCM is any measure that is specifically identified and committed to in the applicable implementation plan, including a substitute or additional TCM that is incorporated into the applicable SIP through the process established in CAA section 176(c)(8), that is either one of the types listed in CAA section 108, or any other measure for the purpose of reducing emissions or concentrations of air pollutants from transportation sources by reducing vehicle use or changing traffic flow or congestion conditions. Notwithstanding the first sentence of this definition, vehicle technology-based, fuel-based, and maintenance-based measures which control the emissions from vehicles under fixed traffic conditions are not TCMs for the purposes of this subpart.*

Furthermore, Clean Air Act Section 108(f)(1)(A) specifically identifies the following measures as TCMs for consideration in the RACM analysis:

i. Programs for improved use of public transit;

ii. 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;

iii. 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;

iv. Programs to control extended idling of vehicles;

v. Programs to reduce motor vehicle emissions, consistent with Title II of the Clean Air Act, which are caused by extreme cold start conditions;

vi. Employer-sponsored programs to permit flexible work schedules;

vii. 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;

viii. Programs for new construction and major reconstruction 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;

ix. Programs 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;

x. Restriction of certain roads or lanes to, or construction of such roads or lanes for use by, passenger buses or high occupancy vehicles;

xi. Employer-based transportation management plans, including incentives;

xii. Trip-reduction ordinances;

xiii. Traffic flow improvement programs that achieve emission reductions;

xiv. Fringe and transportation corridor parking facilities, serving multiple occupancy vehicle programs or transit service;

xv. Programs to limit or restrict vehicle use in downtown areas or other areas of emission concentration, particularly during periods of peak use; and

xvi. Programs for the provision of all forms of high-occupancy, including shared-ride services.

According to the EPA ozone RACM guidance[20], fulfillment of the RACM requirement is dependent on an assessment of candidate control measures that are economic and technological feasible, applicable to the region, and can be implemented shortly after adoption. More specifically, the evaluation criteria used in this analysis include:

- Technological feasibility
- Economically feasibility
- Does not cause "substantial widespread and long-term adverse impacts," or be "absurd, unenforceable, or impracticable"
- If considered collectively with all other control measures (point source, non-point source, mobile source, non-mobile source) advances the attainment date by at least one year.

In addition, measures identified by EPA in any related guidance documents and measures that have been suggested during a public comment period must be considered. TCMs may be voluntary or market-based programs, as long as they produce surplus, quantifiable, permanent, and enforceable emission reductions (i.e., are SIP-creditable).

[20] Seitz, John S., Office of Air Quality Planning and Standards, Guidance on the Reasonably Available Control Measures (RACM) Requirement and Attainment Demonstration Submissions for Ozone Nonattainment Areas, 1999. Available at: https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19991130_seitz_racm_guide_ozone.pdf.

D.3.3 TCM Identification Process

To meet the RACM requirements described above, this analysis was performed using the following steps. First was the assembly of a comprehensive list of control measures recently implemented in other California ozone nonattainment areas, as well as in other states. Measures identified in this review were then organized according to the 16 categories specified in Section 108(f)(1)(A) of the CAA. The next step was to identify candidate RACM by contrasting the list of TCMs with measures implemented in the Sacramento region, as well as any new projects that qualify as TCMs. TCMs committed to in the *Sacramento Regional 2008 NAAQS 8-Hour Ozone Attainment and Further Reasonable Progress Plan* were also reviewed, with a focus on their current implementation status. The last step was to provide a justification addressing the above-mentioned criteria for any of the TCMs that cannot be implemented in the Sacramento region.

Candidate RACM strategies were identified through a comprehensive review of implemented TCMs in California. SACOG relied on recent RACM analyses performed in the South Coast Air Basin and Ventura County for a comprehensive list of measures. Both regions have similar or higher non-attainment classifications. Section D.3.7 Table D-8 lists SIPs reviewed as part of South Coast and Ventura processes. SACOG additionally made use of the RACM analysis completed in 2016 by Sierra Research for the 2008 standard[21]; measures were reexamined in the context of their implementation status. Table D-9 lists SIPs reviewed as part of this process.

Additional measures were sought through a public outreach process. SACOG staff solicited ideas from local agencies, the public, and various partners through the Regional Planning Partnership. Appendix A Figure 1 contains this request for information.

D.3.4 TCMs Recommended for RACM

Out of nearly 200 control measures, programs and strategies identified in the course of the TCM review, only those strategies that are not currently implemented in the Sacramento region were selected for further RACM analysis.

The analysis produced only a small number of measures that are not being implemented in Sacramento. Reasoned justification was provided for not implementing a given measure based on the criteria identified in the EPA RACM guidance. The guidance indicates that measures could be rejected as not reasonably available based on local conditions. However, valid justification for rejecting a measure must be provided, which may include factors such as technological or economic infeasibility, or inability to help advance the attainment date.

[21] Sierra Research, Reasonably Available Control Measures Analysis for the Sacramento Area Council of Governments, 2015. Available at https://www.sacog.org/sites/main/files/file-attachments/8-racm.pdf

Table D-6 shows a complete listing of the measures evaluated for RACM determination and includes current SACOG TCMs as well as additional measures identified as part of this RACM analysis, with a brief justification provided if a control measure cannot be implemented. Additional details on the reasoning for not implementing a RACM strategy are provided in the next section.

Absent no formal guidance on how to organize TCMs, measures shown in Table D-6 are grouped into the 16 categories identified in Section 108(f)(1)(A) of the CAA.

Table D-6 Transportation Control Measures for Consideration in Sacramento

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 1. Programs for Improved Public Transit	1.1	Regional Express Bus Program	Purchase of buses to operate regional express bus services.	Yes	NA	Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.2	Light rail and other transit access to airports	Expand rail and bus service to airports	Yes	NA	Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.3	Accelerated bus retrofit	Accelerate installation of retrofits on diesel-powered buses	Yes	NA	Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.4	Major Expansion of Mass Transit	Major change to the scope and service levels.	No	Not economically feasible because there is not enough transit demand for order of magnitude increases in spending.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.5	Expansion of public transportation services	Provide additional rail and bus service	Yes	NA	Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.6	Transit service improvement including parking management	Install park-and-ride facilities near transit stations, improve bicycle and pedestrian access, install lights and real- time information systems	Yes	NA	Cities, Counties, Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.7	Free transit during special events	Provide free alternative transportation to special events	Yes	NA	Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.8	Require that government employees use transit for home to work trips, expand transit, and	Require all government employees to use transit a specified number of times per week.	No	No authority to implement.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
		encourage large businesses to promote transit use				
Section 108 (f) 1. Programs for Improved Public Transit	1.9	Expand regional transit connection ticket distribution	Provides interchangeability of transit ticket.	Yes	NA	Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.10	Bus Signal Priority	Wireless bus signal priority system on bus fleets for increased operation efficiency and travel time savings.	No	No authority to implement.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.11	Passenger rail improvements	Installation of additional platforms, double tracks, concrete ties, bridges, signal relocation.	Yes	NA	Cities, Counties, Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.12	Clean fuel buses	Purchase of alternative fuel buses	Yes	NA	Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.13	Intermodal Centers	Improved transit connection of various travel modes	Yes	NA	Cities, Counties, Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.14	Maglev	Construct regional low-speed magnetic levitation transit	No	Not economically feasible. High costs in lieu of relatively minor emission reductions	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.15	High Speed Rail	Construct high speed rail connecting large metropolitan centers in the state	No	No authority to implement.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.16	Public transit facility improvements and operating assistance	Construct and/or improve bus and rail terminals, stations, and maintenance facilities	Yes	NA	Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.17	Paratransit Service	Self-explanatory	Yes	NA	Transit Operators

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 1. Programs for Improved Public Transit	1.18	Express Busways/Dedicated Bus Lanes	Construct bus-only lanes	No	No authority to implement.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.19	Study Benefits of a Particulate Trap Retrofit Program	Examine potential to accelerate application of particulate traps on diesel- powered buses to achieve earlier compliance with State regulations.	Yes	NA	CARB/State requirement to replace vehicles with zero emissions. Active phase out by 2029.
Section 108 (f) 1. Programs for Improved Public Transit	1.20	Provide free public transit during episodes	Provide free transit rides during high level ozone episodes.	No	Difficult to quantify benefits; being limitedly applied for Clean Air Day	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.21	Half Price Fares on Feeder Bus Service	All local transit bus services to rail stations reduce fare by half.	No	No authority to implement. Unclear emission benefits.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.22	Real-Time Transit Information Systems	Provide real-rime information to transit riders to increase ridership and system efficiency	Yes	NA	Transit Operators
Section 108 (f) 1. Programs for Improved Public Transit	1.23	Shorter Distance from Buildings to Bus Stops	For existing buildings, re-route traffic to allow buses to come closer to the building. For new buildings, alter setback requirements to allow closer bus access.	No	Not economically feasible, however, some jurisdictions may already have existing requirements for new development.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.24	Vanpool program	Provide vanpool service for certain communities; purchase new vans	Yes	NA	TMAs
Section 108 (f) 1. Programs for Improved Public Transit	1.25	Consolidation of Public Transit Operators	Consolidate all public transit agencies in the County.	No	No authority to implement.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 1. Programs for Improved Public Transit	1.26	Transit voucher programs	Provide transit vouchers to certain population groups (e.g., elderly, minorities, homeless) to reduce transit costs	yes	NA	Transit Operators, TMA
Section 108 (f) 1. Programs for Improved Public Transit	1.27	Free rail-to-bus/bus-to-rail transfers	Vanpool and shuttle services at non-intermodal centers	No	Not economically feasible; difficult to quantify benefits	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.28	Bus queue jumps	Installing special lanes and signals to allow transit to get ahead in traffic	No	No authority to implement.	NA
Section 108 (f) 2. Restriction of Certain Roads or Lanes to, or Construction of Such Roads or Lanes for Use By, Passenger Buses or High Occupancy Vehicles	2.1	Update High Occupancy Vehicle (HOV) Lane Master Plan	Analysis of increased enforcement, increasing occupancy requirements, conversion of existing HOV lanes to bus only lanes and/or designation of any new carpool lanes as bus-only lanes; utilization of freeway shoulders for peak- period express bus use; commercial vehicle buy-in to HOV lanes; and appropriateness of HOV lanes for corridors that have considered congestion pricing or value pricing.	Yes	NA	SACOG, State
Section 108 (f) 2. Restriction of Certain Roads or Lanes to, or Construction of Such Roads or Lanes for Use By, Passenger Buses or High Occupancy Vehicles	2.2	Bus and carpool lanes on arterials	Provide fixed lanes for buses and carpools on arterial streets.	Yes	NA	Cities and Counties

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 2. Restriction of Certain Roads or Lanes to, or Construction of Such Roads or Lanes for Use By, Passenger Buses or High Occupancy Vehicles	2.3	HOV lanes	Construct additional high occupancy vehicle (HOV) lanes; allow use by alternative fuel vehicles.	Yes	NA	Caltrans, State
Section 108 (f) 2. Restriction of Certain Roads or Lanes to, or Construction of Such Roads or Lanes for Use By, Passenger Buses or High Occupancy Vehicles	2.4	Express toll lanes/High Occupancy Toll (HOT) Lanes	Self-explanatory.	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.1	Commute solutions	The federal Commuter Choice Program provides for benefits that employers can offer to employees to commute to work by methods other than driving alone.	Yes	NA	Employers, Transit Operators
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.2	Parking cash-out	State law requires certain employers who provide subsidized parking for their employees to offer a cash allowance in lieu of a parking space.	Yes	NA	Employer, CARB
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.3	Rideshare program	Provide rideshare service	Yes	NA	Cities, Counties, Employer

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.4	Implement Parking Charge Incentive Program	Evaluate feasibility of an incentive program for cities and employers that convert free public parking spaces to paid spaces. Review existing parking polices as they relate to new development approvals.	Yes	NA	Cities, Counties, Employer
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.5	Preferential parking for carpools and vanpools	Encourage employers to provide preferential parking for carpools and vanpools to reduce SOV trips	Yes	NA	Implemented through TDM Funding Program
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.6	Employee parking fees/parking study	Study to gauge benefits from increased parking fees at employment centers	Yes	NA	Implemented through TDM Funding Program
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.7	Merchant transportation incentives	Implement "non-work" trip reduction ordinances requiring merchants to offer customers mode shift travel incentives such as free bus passes and requiring owners/managers/developers of large retail establishments to provide facilities for non-motorized modes.	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.8	Purchase vans for vanpools	Encourage employers to purchase vans for employee commute travel	Yes	NA	Implemented through TDM Funding Program

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.9	Encourage regulated employers to subsidize the cost of transit for employees	Provide outreach and possible financial incentives to encourage local employers to provide transit passes or subsidies to encourage less individual vehicle travel.	Yes	NA	Implemented through TDM Funding Program
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.10	Compressed work weeks/flexible work schedules	Encourage employers to implement alternate work schedules to reduce travel	Yes	NA	Implemented through TDM Funding Program
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.11	Telecommuting	Encourage employers to allow employees to work from home	Yes	NA	Implemented through TDM Funding Program
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.12	Income tax credit to telecommuters	Self-explanatory	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.13	Extend parking cash-out rule to more employers	Self-explanatory	No	Requires State legislation.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.14	Bike to work month	Encourage biking to work during April bike awareness month	Yes	NA	SACOG

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.15	Off-days for ozone alerts just like sick days	On ozone alert days, notify employees through email that there is an ozone alert. Employees are given a pre-specified number of days they can decide not to come in to work on ozone forecast days.	No	No authority to implement. Not economically feasible.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.16	Pay for in-house meals on ozone action days	Employer pays for meals in-house on ozone alert days so that employees do not travel to off-site locations.	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.17	Voluntary business closures on ozone action days	A more expensive version of "off-days" for ozone alerts.	No	No authority to implement. Not economically feasible.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.18	Close government offices on ozone action days to serve as an example	Similar to voluntary business closures.	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.19	Mandatory compressed work weeks	Self-explanatory.	No	No authority to implement. Employer could decide individually if this measure is feasible for them.	NA
Section 108 (f) 3. Employer-Based Transportation	3.20	Adopt a Safe Routes to School Policy	Adopt policy to increase the number of students that walk/bike to school by removing	Yes	NA	Cities, Counties, School Districts, SACOG, Districts

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Management Plans, Including Incentives			barriers that prevent children and adults from doing so.			
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.21	Encourage students to bike or walk to school	Self-explanatory	Yes	NA	Implemented though Safe Routes to School
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.22	Showers and Lockers at Work	Provide showers and lockers to encourage walking and biking to work.	Yes	NA	Employers
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.23	Voluntary Employer Parking Cash-out Subsidy	Employers who provide free parking would voluntarily provide the cash equivalent of the parking subsidy to employees who do not drive to work.	Yes	NA	Cities, Counties, Employers, State
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.24	Satellite work centers	Employers open new remote offices near employees' residences	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.25	Proximity job swap	Encourage employers to give incentives to employees to move close to worksite	Yes	NA	Implemented through TDM Funding Program
Section 108 (f) 3. Employer-Based Transportation	3.26	Promote business closure on high ozone days	Self-explanatory	No	Not economically feasible.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Management Plans, Including Incentives						
Section 108(f) 4. Trip Reduction Ordinance	4	The state law prohibits mandatory employer-based trip reduction programs (California Health & Safety Code §40717.6). Instead, SACOG is involved in and provides funds for educational and outreach programs to educate employers of the environmental benefits of a variety of employer-based trip reduction options through the Transportation Demand Measure Funding Program.	NA	NA	NA	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.1	Intelligent Transportation Systems	Install ITS on freeways and arterials to increase traffic operations efficiency	Yes	NA	Caltrans, Cities, and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.2	Traffic Signal Synchronization/Traffic Signal Improvements	Install synchronized traffic signals, median dividers, turn lanes, and grade separations	Yes	NA	Caltrans, Cities, and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.3	Intersection Improvements	Installation of turn lanes, curbs, traffic signals	Yes	NA	Caltrans, Cities, and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.4	Site-specific transportation control measures	This measure could include geometric or traffic control improvements at specific congested intersections or at other substandard locations. Another example might be	Yes	NA	Caltrans, Cities, and Counties

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
			programming left turn signals at certain intersections to lag, rather than lead, the green time for through traffic.			
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.5	Removal of on-street parking	Require all commercial/industrial development to design and implement off-street parking.	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.6	Reversible lanes	Change direction of travel during special events or during congestion periods	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.7	One-way streets	Redesignate streets as one-way to improve traffic	Yes	NA	Cities and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.8	Removal of on-street parking	Self-explanatory	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.9	Bus pullouts in curbs for passenger loading	Provide bus pullouts in curbs, or queue jumper lanes for passenger loading and unloading.	Yes	NA	Cities and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.10	Freeway Service Patrol	Emergency services to clean up motor accidents in a timely fashion	Yes	NA	STA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.11	Fewer stop signs	Improve flow-through traffic by removing stop signs.	No	Not technologically feasible because the safety issue outweighs the	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
					potential small air quality benefit.	
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.12	Ban left turns	Banning all left turns would stop the creation of bottlenecks although slightly increase travel distances.	No	Left turns are not allowed in some heavy-traffic streets. No clear demonstration of emission reduction benefits.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.13	Changeable lane assignments	Increase number of one-way lanes in congested flow direction during peak traffic hours.	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.14	Adaptive traffic signals and signal timing	Self-explanatory.	Yes	NA	Cities and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.15	Freeway bottleneck improvements (add lanes, construct shoulders, etc.)	Identify key freeway bottlenecks and take accelerated action to mitigate them.	Yes	NA	Caltrans
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.16	Minimize the impact of construction on traveling public. Have contractors pay when lanes are closed as an incentive to keep lanes open.	Prohibit lane closures during peak hours, limit work to weekends and/or nights.	Yes	NA	Caltrans
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.17	Internet provided road and route information	Reduce travel on highly congested roadways by providing accessible information on congestion and travel.	Yes	NA	Caltrans, Cities, and Counties

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.18	Regional route marking systems to encourage underutilized capacity	Encourage travel on local roads and arterials by better route marking to show alternatives.	Yes	NA	Caltrans, Cities, and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.19	Congestion management field team to clear incidents	Self-explanatory.	Yes	NA	Freeway Service Patrol; Emergency Services
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.20	Use dynamic message signs to direct/smooth speeds during incidents	Self-explanatory.	Yes	NA	Caltrans
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.21	Get real-time traffic information to drivers	Self-explanatory.	Yes	NA	Caltrans, 511
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.22	Speed limit reduction	Reduce freeway speed limit to 55mph	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.23	Require 40 mph speed limit on all facilities	Self-explanatory.	No	The California Vehicle Code Sections 22357 and 22358 mandates a methodology for setting speed limits for local areas. This measure is not feasible until the statute is changed.	NA
Section 108 (f) 5. Traffic Flow Improvement	5.24	Require lower speeds during peak periods	Self-explanatory.	No	The California Vehicle Code Sections 22357 and 22358 mandates methodology for	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Programs That Achieve Emissions Reductions					setting speed limits for local areas. This measure is not feasible until the statute is changed.	
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.25	On-street parking restrictions	Restrict on-street parking where appropriate.	Yes	NA	Cities and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.26	Roundabouts at low traffic intersections	Construct roundabouts and remove stop sign as appropriate	Yes	NA	Cities and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.27	Eco-driving educational program	Education program to improve vehicle efficiency by improving driving habits	No	Difficult to quantify emission benefits.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.28	Reroute trucks on ozone action days	Self-explanatory.	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.29	Street Intersection Realignment	Realign skewed intersections to provide better traffic flow and safety.	Yes	NA	Cities and Counties
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.3	Road Hazard Reporting	Provide real-time traffic information to help drivers make decisions about when and where to travel.	Yes	NA	Caltrans
Section 108 (f) 5. Traffic Flow Improvement	5.31	Truck only lanes	Construct or convert lanes for use by heady-duty trucks only	No	No authority to implement.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Programs That Achieve Emissions Reductions						
Section 108 (f) 6. Fringe and Transportation Corridor Parking Facilities Serving Multiple Occupancy Vehicle Programs or Transit Service	6.1	Park-and-ride facilities	Construct park-and-ride lots near transit centers and transfer stations	Yes	NA	Cities, Counties, Transit Operators
Section 108 (f) 6. Fringe and Transportation Corridor Parking Facilities Serving Multiple Occupancy Vehicle Programs or Transit Service	6.2	Park-and-ride lots serving perimeter counties	Specific to a locality.	Yes	NA	Cities, Counties, Transit Operators
Section 108 (f) 6. Fringe and Transportation Corridor Parking Facilities Serving Multiple Occupancy Vehicle Programs or Transit Service	6.3	Regional Parking Regulation to Provide Incentives for alternative transportation modes	Regulation to provide parking facilities and designs to encourage carpools, vanpools, and bicycling.	Yes	NA	Cities and Counties
Section 108 (f) 6. Fringe and Transportation Corridor Parking Facilities Serving Multiple Occupancy Vehicle Programs or Transit Service	6.4	Preferential parking for vanpools, carpools	Self-explanatory	Yes	NA	Employers
Section 108 (f) 6. Fringe and Transportation Corridor Parking	6.5	Free parking near transit facilities	Self-explanatory	Yes	NA	Cities, Counties, Transit Operators

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Facilities Serving Multiple Occupancy Vehicle Programs or Transit Service						
Section 108 (f) 6. Fringe and Transportation Corridor Parking Facilities Serving Multiple Occupancy Vehicle Programs or Transit Service	6.6	Rail grade separation	Adjust road surface heights in line with rail to improve traffic flow	Yes	NA	Cities and Counties
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.1	Off-peak goods movement	Require trucks to operate during off-peak hours	No	No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.2	Truck restrictions during peak periods	Implement an ordinance to restrict truck travel during peak periods in order to minimize traffic congestion.	No	No authority to implement. Cities could decide individually if this measure is feasible for them.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration	7.3	Encourage students to bike or walk to school	Self-explanatory	Yes	Implemented though Safe Routes to School	SACOG, CARB

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Particularly During Periods of Peak Use						
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.4	Adjust school hours so they do not coincide with peak traffic periods and ozone seasons	Measure to reduce travel during peak periods and ozone-contributing periods in the early morning.	No	School hours are dictated by many variables, including overcrowding and year-round schooling. This measure is not feasible.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.5	Area-wide tax for parking	Reduce driving by limiting parking through implementation of pricing measures.	No	No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.6	Increase parking fees	Reduce driving by limiting parking spaces through pricing measures.	No	No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration	7.7	Graduate parking fees	Charge the most for parking in central business districts	Yes	NA	Cities

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Particularly During Periods of Peak Use						
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.8	Purchase parking lots and convert into other land uses	Limit parking by converting available parking to other land uses to discourage driving.	Yes	NA	Cities and Counties
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.9	Limit the number of parking spaces at airports to support mass transit	Reduce airport travel by limits on parking at airports.	No	Regulatory agencies do not have the legal authority to make local land use decisions. It is at the discretion of the regional or local airport authority to make local land use decisions pertaining to airports. Additionally, it is necessary to have significant mass transit available at airports before this measure can be implemented.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission	7.10	No CBD vehicles unless LEV, alternative fuel, or electric	Define high-use area and ticket any vehicles present unless they are low emitting, alternative fueled or electric.	No	No authority to implement. Ex., the Legislature significantly reduced authority of the	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Concentration Particularly During Periods of Peak Use					SOUTH COAST AQMD to implement indirect source control measures through revisions to the Health & Safety Code (40717.6, 40717.8, and 40717.9).	
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.11	Establish Auto Free Zones and Pedestrian Malls	Self-explanatory	Yes	NA	Cities and Counties
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.12	Incentives to increase density around transit centers	Lower travel by increasing residential and commercial density in areas near transit.	Yes	NA	Cities and Counties
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.13	Land use/air quality guidelines	Guidelines for developments that contribute to achieving air quality goals.	Yes	NA	CARB, Regional Air Districts

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Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.14	Cash incentives to foster jobs/housing balance	Specific to locality – encouraged by California Clean Air Plan.	Yes	NA	State, SACOG GMG program
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.15	Trip reduction oriented development	Land use decisions that encourage trip reductions.	Yes	NA	Cities and Counties
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.16	Transit-oriented/sustainable development	Encourage land-use planning that promote development near transit centers	Yes	NA	Implemented through Sustainable Communities Strategy
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.17	Sustainable development	Land use decisions that create equitable standards of living to satisfy the basic needs of all peoples, all while taking the steps to avoid further environmental degradation.	Yes	NA	Cities and Counties

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Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.18	Smart Parking Detection System	Utilize mobile communication devices to access the parking availability at multiple lots and provide real- time inventory of parking spaces.	Yes	NA	Cities
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.19	Programs to encourage goods movement by rail	Self-explanatory	Yes	NA	State
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.20	Divert trucks from nonattainment areas	Require pass-through trucks to choose routes away from Sacramento region	No	No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.21	Buy parking lots and convert to other land use	Limit parking by converting available parking to other land uses to discourage driving	Yes	NA	Cities and Counties

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Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.22	Incentives for cities with good development practices	Provide financial or other incentives to cities that practice air quality- sensitive development.	Yes	NA	CARB, SACOG, State Legislature
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.23	Increase fees for parking garages and meters during ozone episodes	Increase fees for parking garages to deter vehicle use during high ozone level days.	No	Not enforceable or economically feasible.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.24	Charge city-owned parking garage pass holders a fee for more than one entrance and exit each day	Extra charges for pass holders to deter additional vehicle use and vehicle trips.	No	Not economically feasible. No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.25	VMT Tax	Charge VMT tax per mile for all vehicles registered or garaged in the region.	No	Need state legislation.	NA

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Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.26	Increase parking fees	Self-explanatory	Yes	NA	Cities and Counties
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.27	Central business district vehicle restrictions	Restrict vehicle use in downtown areas	No	No authority to implement. Downtown Sacramento is surrounded by freeways, difficult to quantify, not economically feasible.	NA
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.1	Financial Incentives, including Zero-Bus Fares	Provide financial incentives or other benefits, such as free or subsidized bus passes and cash payments for not driving, in lieu of parking spaces for employees who do not drive to the workplace.	Yes	NA	Employers
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.2	Rideshare information systems and marketing	Self-explanatory	Yes	NA	SACOG and TMAs
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.3	Cash incentives for carpoolers	Self-explanatory	Yes	NA	TMAs

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.4	Employers provide vehicles to carpoolers for running errands or emergencies	Having vehicles available for workday errands makes it easier to go to work without one.	Yes	NA	SACOG TDM program and some employers
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.5	Subscription services	Free van services to provide transportation for the elderly, handicapped or other individuals who have no access to transportation.	Yes	NA	TMAs
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.6	School carpools	Self-explanatory and voluntary.	No	No authority to implement.	NA
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.7	"Guaranteed Ride Home" program	Provide vanpool service in emergency situations to transit riders	Yes	NA	TMAs
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.8	Transit voucher program	Provide transit vouchers to certain population groups (elderly, minorities, homeless) to reduce transit costs.	Yes	NA	Transit Operators
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.9	Rideshare and vanpool services	Non-employer based rideshare and vanpool option near transit stations.	Yes	NA	SACOG

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Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.10	Preferential parking for carpools and vanpools	Encourage employers to provide preferential parking for carpools and vanpools to reduce SOV trips	Yes	NA	Implemented through TDM Funding Program
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.11	Auto sharing Program	Fund incentives for new auto sharing customers (i.e., Zipcar, etc.).	Yes	NA	CARB, Regional Air Districts
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.12	Vanpool program	Provide vanpool service for certain communities; purchase new vans	Yes	NA	CARB, Regional Air Districts
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.13	Station cars	Provide vanpool service from transit stations to parking lots	Yes	NA	Cities and Counties
Section 108 (f) 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	9.1	Establish Auto Free Zones and Pedestrian Malls	Self-explanatory	Yes	NA	Cities and Counties
Section 108 (f) 9. Programs to Limit Portions of Road	9.2	Encouragement of pedestrian travel	This measure involves encouraging the use of pedestrian travel as an	Yes	NA	SACOG TDM program

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Surfaces or Certain Sections of the Metropolitan Area to the Use of Non-Motorized Vehicles or Pedestrian Use, Both as to Time and Place			alternative to automobile travel. Pedestrian travel is quite feasible for short shopping, business, or school trips.			
Section 108 (f) 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	9.3	Bicycle/Pedestrian Program	Fund high priority projects in countywide plans consistent with funding availability.	Yes	NA	SACOG ATP and Statewide program
Section 108 (f) 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	9.4	Close streets for special events for use by bikes and pedestrians when/where appropriate	Self-explanatory	Yes	NA	Cities and Counties
Section 108 (f) 9. Programs to Limit Portions of Road Surfaces or Certain Sections of the Metropolitan Area to the	9.5	Encourage bicycle travel	Promotion of bicycle travel to reduce automobile use and improve air quality. Bikeway system planning, routes for inter-city bike trips to help bicyclists avoid other, less safe	Yes	NA	SACOG, Cities, Counties, TMAs

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Use of Non-Motorized Vehicles or Pedestrian Use, Both as to Time and Place			facilities. Another area for potential actions is the development and distribution of educational materials, regarding bicycle use and safety.			
Section 108 (f) 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	9.6	Free bikes	Provide free bikes to transit users	No	Not economically feasible. Unclear emission benefits.	NA
Section 108 (f) 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	9.7	Cash rebates for bikes	Provide financial incentives to purchase bicycles and thereby encourage use.	No	No clear demonstration of emission reduction benefits.	NA
Section 108 (f) 9. Programs to Limit Portions of Road Surfaces or Certain Sections of the Metropolitan Area to the Use of Non-Motorized Vehicles or Pedestrian	9.8	Close streets for special events for bikes and pedestrians	Self-explanatory.	Yes	NA	Cities and Counties

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Use, Both as to Time and Place						
Section 108 (f) 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	9.9	Use condemned dirt roads for bike trails	Self-explanatory.	No	Not applicable because there are no condemned dirt roads in the region.	NA
Section 108 (f) 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	9.10	Safe Routes to School programs	Encourage educational and encouragement programs with families and schools and support policies to improve pedestrian and bicycle safety.	Yes	NA	Cities and Counties
Section 108 (f) 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	9.11	Bicycle/pedestrian overpasses	Construct bike and pedestrian bridges and/or tunnels over major highways	Yes	NA	Caltrans, Cities, and Counties

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Section 108 (f) 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	9.12	Bicycle/pedestrian facilities	Construct sidewalks, curbs, gutters, landscaping, lighting for bike and pedestrian pathways	Yes	NA	Cities and Counties
Section 108 (f) 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	9.13	Close roads for use of non-motorized traffic	Convert roadways to bike/pedestrian paths	No	No authority to implement. Unclear emission benefits.	NA
Section 108 (f) 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	10.1	Mandatory bike racks for worksites	Mandate that employers install bike racks at businesses	No	No authority to implement.	NA
Section 108 (f) 10. Programs for Secure Bicycle Storage Facilities and Other Facilities,	10.2	Bike racks on buses	South Coast, San Joaquin Valley, Washington DC	Yes	NA	Transit Operators

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Including Bicycle Lanes, for the Convenience and Protection of Bicyclists, in Both Public and Private Areas						
Section 108 (f) 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	10.3	Regional bike parking	Construct bike parking facilities at transit centers	Yes	NA	Cities, Counties, Transit Operators
Section 108 (f) 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	10.4	Bicycle facility improvements	Construct bike lanes, off-street bikeways, multi-use trails, route lighting, and street signage	Yes	NA	Cities and Counties
Section 108 (f) 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	10.5	Expedite bicycle projects from RTP/SCS	Build out active mode facilities at an accelerated rate to achieve benefits in advance of attainment deadline.	Yes	NA	SACOG, Cities, Counties, Special Districts

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Section 108 (f) 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	10.6	Provide bike/pedestrian facilities safety patrols	Self-explanatory.	No	Will not advance attainment. Emission benefits would be difficult to calculate/provide minimal emission reductions.	NA
Section 108 (f) 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	10.7	Inclusion of bicycle lanes on thoroughfare projects	Self-explanatory.	Yes	NA	Cities and Counties
Section 108 (f) 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	10.8	Bicycle lanes on arterial and frontage roads	Self-explanatory.	Yes	NA	Cities and Counties
Section 108 (f) 10. Programs for Secure Bicycle Storage Facilities and Other Facilities, Including Bicycle Lanes, for the Convenience and	10.9	Bicycle route lighting	Self-explanatory.	Yes	NA	Cities and Counties

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Protection of Bicyclists, in Both Public and Private Areas						
Section 108 (f) 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	10.10	Complete Streets	Install bicycle and pedestrian facilities, upgrade traffic control systems, urban design improvements, streetlights and transit connections.	Yes	NA	Cities, Counties, SACOG
Section 108 (f) 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	10.11	Bike share program	Implement bike share system and provide planning efforts for potential regional expansion of a Bike Share pilot program	Yes	NA	Cities, Counties, SACOG
Section 108 (f) 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	10.12	Bike Purchase Incentives	Cash incentives to transit riders to purchase collapsible or electric bikes.	No	No authority to implement.	NA
Section 108 (f) 10. Programs for Secure Bicycle Storage Facilities	10.13	Longer Bike Racks on Buses	Install or modify bike rack on transit buses to accommodate up to three bikes	Yes	NA	Transit Operators

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and Other Facilities, Including Bicycle Lanes, for the Convenience and Protection of Bicyclists, in Both Public and Private Areas						
Section 108 (f) 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	10.14	Greenway Network	Use riverbeds and other rights-of-way for bike and pedestrian paths to separate them from auto traffic	Yes	NA	Cities and Counties
Section 108 (f) 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	10.15	First Mile/Last Mile Program	Variety of strategies to encourage active transportation including wayfinding, sidewalk improvements, pedestrian priority signalization, and bike/pedestrian facilities near transit.	Yes	NA	SACOG
Section 108 (f) 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	10.16	Bike lockers at light rail stations, park& ride lots, other locations	Expand existing bike lockers at light rail stations; install bicycle storage spaces in parking lots.	Yes	NA	Cities, counties, Transit Operators

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.1	Limit excessive car dealership vehicle starts	Require car dealers to limit the starting of vehicles for sale on their lot(s) to once every two weeks. Presently, a number of new and used car dealers start their vehicles daily to avoid battery failure and assure smooth start-ups for customer test drives.	No	Not enforceable or practical	NA
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.2	Encourage limitations on vehicle idling	Encourage limitations to limit extended idling operations.	Yes	NA	State
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.3	Turn off engines while stalled in traffic	Public outreach or police-enforced program.	No	This measure raises safety and congestion concerns. No clear demonstration of emission reduction benefits.	NA
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.4	Outlaw idling in parking lots	Self-explanatory and police-enforced program.	No	Enforcement of idle restrictions is a low priority for police relative to their other missions. The cost effectiveness of this measure has not been demonstrated. It is not economically feasible. No clear demonstration of emission reduction benefits.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.5	Reduce idling at drive-throughs; ban drive-throughs	Mandate no idling or do not allow drive- through windows during ozone season.	No	No clear demonstration of emission reduction benefits.	NA
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.6	Promote use of pony engines	Use special battery engines to keep air conditioning and other truck systems working while truck not in use.	Yes	NA	State
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.7	Idle restrictions at airport curbsides	Self-explanatory and police-enforced.	Yes	NA	Airport authorities
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.8	Truck stop electrification	Self-explanatory	Yes	NA	Businesses
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.9	Idle reduction	Prohibit idling at schools	Yes	NA	CARB
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.10	Restrict idling	Require idle limits for trucks.	Yes	NA	Cities and Counties
Section 108 (f) 12. Program to Reduce Motor Vehicle Emissions Consistent with Title II, Which Are Caused by Extreme Cold Start Conditions	12	Not Applicable	NA	NA	NA	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 13. Employer- sponsored programs to permit flexible work schedules	13.1	Compressed work weeks/flexible work schedules	Encourage employers to implement alternate work schedules to reduce travel	Yes	NA	Implemented through TDM Funding Program
Section 108 (f) 13. Employer- sponsored programs to permit flexible work schedules	13.2	Modifications of work schedules	Implement alternate work schedules that flex the scheduled shift time for employees. Encourage the use of flexible or staggered work hours to promote off- peak driving and accommodate the use of transit and carpooling.	Yes	NA	Employers
Section 108 (f) 13. Employer- sponsored programs to permit flexible work schedules	13.3	Telecommunications-Telecommuting/Teleconferencing	Encourage telecommuting and use of telecommuting/teleconferencing equipment in place of motor vehicle use where appropriate. Set-up satellite work centers closer to where employees live to reduce motor vehicle use where appropriate.	Yes	NA	Employers
Section 108 (f) 13. Employer- sponsored programs to permit flexible work schedules	13.4	Telecommuting	Encourage employers to allow employees to work from home	Yes	NA	Implemented through TDM Funding Program
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for	14.1	Spare the air program	Voluntary no-drive days during high ozone season	Yes	NA	SMAQMD and Regional Air Districts

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
single-occupant vehicle travel, as part of transportation planning and development efforts						
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.2	Special event controls	This measure would require new and existing owners/operators of the special event centers to reduce mobile source emissions generated by their events. A list of optional strategies would be available that reduce mobile source emissions.	Yes	NA	Counties, Cities, Special Event Operators
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.3	Blueprint vision	Implementation and technical assistance with programs to encourage land-use patterns and development near transit centers that decrease urban sprawl and reduce overall travel	Yes, implemented trough Su	NA	SACOG
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and	14.4	Spare the air program	Voluntary no-drive days during high ozone season	Yes	NA	SMAQMD and Regional Air Districts

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts						
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.5	New Development Air Quality Impact Evaluation	Evaluate air quality impacts of new development and recommend or require mitigation for significant adverse impacts.	Yes	NA	Cities, County, SMAQMD
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.6	Transportation for Livable Communities (TLC)/Housing Incentive program	Program provides planning grants, technical assistance, and capital grants to help cities and Nonprofit agencies define and implement transportation projects that support community plans including increased housing near transit.	Yes	NA	SACOG, State

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.7	Incentives to increase density around transit centers	Lower travel by increasing residential and commercial density in areas near transit.	Yes	NA	Cities and Counties
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.8	Incentives for cities with good development practices	Provide financial or other incentives to local cities that practice air quality- sensitive development.	Yes	NA	Cities, Counties, SACOG, State
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle	14.9	Increase State gas tax	Self-explanatory.	No	Need state legislation. State gas tax has been increased by SB 1.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
travel, as part of transportation planning and development efforts						
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.10	Pay-As-You-Drive Insurance	Charge insurance fees based on driving patters	No	No implementation authority; would require changes to state law	NA
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.11	Spare the air program	Voluntary no-drive days during high ozone season	Yes	NA	SMAQMD and Regional Air Districts
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass	14.12	Display air quality data on billboards	Self-explanatory.	Yes	NA	SMAQMD Spare the Air Program

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts						
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.13	Sell clean air license plate to fund air quality programs	Self-explanatory.	No	Need state legislation. No clear demonstration of air quality benefits.	NA
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.14	Government Action Days (spare the air day, ozone action day)	Declare a Spare The Air day when ozone levels reach episodic thresholds so that the public is informed and encouraged to scale back activities generating pollutants.	Yes	NA	SMAQMD and Regional Air Districts
Section 108 (f) 14. Programs and Ordinances to facilitate	14.15	Vehicle tax for two or more vehicles per household	Initiate legislation to put a vehicle tax on household with two or more vehicles.	No	Need state legislation. No clear demonstration of air	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts					quality benefits. Not economically feasible.	
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.16	Development of rural-urban connections strategy and create best practices toolkit	Develop best practices to promote environmentally sustainable land use in economically viable rural areas for landowners and local governments	Yes	NA	SACOG
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.17	Traffic reduction strategies	Public awareness and education programs to encourage carpooling and the use of public transportation	Yes	NA	SACOG and TMAs

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.18	Buy parking lots and convert to land use	Self-explanatory	Yes	NA	Cities and Counties
Section 108 (f) 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 commercially feasible and in the public interest	15.1	Require inclusion of paved shoulders adequate for bicycle use on state or federally funded reconstruction or widening of federal collectors	Require paved shoulders on state and federally funded roads that require reconstruction or widening.	No	No authority to implement. Not economically feasible.	NA
Section 108 (f) 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 commercially	15.2	Bicycle/pedestrian facilities	Construct sidewalks, curbs, gutters, landscaping, lighting for bike and pedestrian pathways	Yes	NA	Cities and Counties

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
feasible and in the public interest						
Section 108 (f) 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	16.1	Counties assess ten dollar license plate fee to fund repair/replacement program for high- emitters	Self-explanatory.	No	Not enforceable or economically feasible.	NA
Section 108 (f) 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	16.2	Offer incentives for retirement and replacement of vehicles for participants meeting specific requirements	Self-explanatory.	Yes	NA	State
Section 108 (f) 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	16.3	Demolish impounded vehicles that are high emitters	Self-explanatory.	No	Not enforceable or economically feasible.	NA
Section 108 (f) 16. Program to encourage the voluntary removal from use and the marketplace of pre-1980 model year light duty	16.4	Do whatever is necessary to allow cities to remove the engines of high emitting vehicles (pre-1980) that are abandoned and to be auctioned	Self-explanatory.	No	Not enforceable or economically feasible.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
vehicles and pre-1980 model light duty trucks						
Section 108 (f) 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	16.5	Accelerated retirement program	Identify high-emitting vehicle age groups and develop a program to remove them from use.	Yes	Not enforceable or economically feasible.	State
Section 108 (f) 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	16.6	Buy vehicles older than 1975	Self-explanatory.	No	Not enforceable or economically feasible.	NA
Section 108 (f) 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	16.7	Accelerate retirements of trucks/buses	Replace high mileage trucks and buses	Yes	NA	CARB, Regional Air Districts
17. Other	17.1	Truck-Only Lanes	Self-explanatory.	Yes	NA	Caltrans
17. Other	17.2	Promote business closures on high ozone days	Non-employer-based strategy to require local business to close on bad air quality days, thereby reducing travel.	No	No authority to implement; not economically feasible	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for infeasible Measure	Implementing Agency or Agencies
17. Other	17.3	Clean Fleet Vehicles for Government Employees	Provide alternative fuel vehicles for government employees.	Yes	NA	CARB, Regional Air Districts
17. Other	17.4	Increase bike commuting and transit use to reduce congestion and the number of SOVs	Utilize a form of secure bike parking at park and ride lots within El Dorado County.	NA	NA	See Measure 10.16
17. Other	17.5	US Highway 50 Corridor At-Grade Temporary Freeway Conversion: "Trip to Green" Interim Technology and Infrastructure Project	Use innovation and technology to solve interregional recreation and tourism related congestion on US 50.	NA	NA	See Measure 5.1
17. Other	17.6	Placerville Drive Bicycle and Pedestrian Facilities Project	Construct Class IV bikeways and sidewalks along Placerville Drive from west of the US 50 undercrossing to the Placerville Drive / Green Valley Road / Ray Lawyer Drive / intersection and Class II bicycle facilities and sidewalks on Green Valley Road from Placerville Drive to Mallard Lane.	NA	NA	See Measure 10.5
17. Other	17.7	Encouraging Work from Home and electric vehicles for the Sacramento Region.	Self-explanatory	NA	NA	See Measure 3.11,
17. Other	17.8	Encouraging electric vehicles for the Sacramento Region	Self-explanatory	Yes	NA	CARB

D.3.5 **RACM Evaluation**

A small number of control measures identified during the TCM review, which were not yet implemented in the Sacramento region. These control measures were advanced for further RACM analysis and assessed based on the criteria specified in the 2015 Ozone Implementation Rule and EPA's RACM guidance. Factors considered included technical and economic feasibility, enforceability, local applicability, and ability to provide emission reductions before attainment deadline (advancement of attainment). Table D-7 is a collective list of measures reviewed, including reasoned justification for not implementing them in the Sacramento region at this time based upon reasoning described in sections D.3.5.1, D.3.5.2, and D.3.5.3 below.

D.3.5.1 Feasibility-Technical/Economic

Several of TCMs listed below, although technologically feasible, were disqualified based on their high costs in lieu of the relatively minor emission reductions they would produce. As an example, measures that offer transportation equipment were viewed as not cost-effective. For instance, a "free bikes" TCM is not deemed economically feasible because such a program would need to be extended to a large population group to provide significant emission benefits thereby resulting in high costs. In addition, enforcement and quantification of emission benefits would not be possible given that bikes could be resold for profit, stolen, or not used by the public. Table D-7 shows measures that were deemed economically infeasible and provides a detailed explanation of why they could not be implemented in the Sacramento region.

D.3.5.2 Implementation Authority

Some measures discussed in this section were not considered to be RACM because SACOG and its jurisdictions do not have the implementation authority needed to deploy and enforce them. A new TCM must have evidence of adequate personnel, and funding and authority under state or local law to implement, monitor and enforce. In some cases, implementation would require changes to state law. If a transportation agency, like SACOG, does not have the authority to implement and enforce a TCM, it cannot be credited in a SIP, and therefore cannot be considered as RACM. Table D-7 shows measures that cannot be implemented at this time.

D.3.5.3 Advancement of Attainment

Several of the TCMs shown below were viewed as not capable of advancing attainment due to the small emission benefits they would generate. Measures with emission reductions that would be difficult or impossible to quantify were also included in this grouping. As considered within this analysis, TCMs must be fully funded and in use/implemented in advance of the attainment demonstration year; and not included within other transportation emission assumptions accounted for within the MTP. Only emission reductions generated between measure implementation and the 1-year advancement threshold can be credited within the SIP. Additionally, their inclusion as RACM is dependent on the findings of the regional air districts who collectively review control measures for point source, non-point source, and non-mobile sources. A RACM finding of advancing attainment by a year will be determined by the SFNA air districts.

D.3.6 Conclusions

Out of the approximately 200 candidate TCMs identified as candidate RACM, none were found to meet the criteria for RACM implementation. Based on a comprehensive review of TCM projects in other nonattainment areas, it was determined that the TCMs being implemented in the Sacramento region represent all RACM. None of the candidate measures reviewed herein, and determined to be infeasible, meet the criteria for RACM implementation.

Table D-7 RACM: Economic Feasibility, Advancement of Attainment, Implementation Authority

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Section 108 (f) 1. Programs for Improved Public Transit	1.4	Major Expansion of Mass Transit	Major change to the scope and service levels.	No	Not economically feasible because there is not enough transit demand for order of magnitude increases in spending.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.8	Require that government employees use transit for home to work trips, expand transit, and encourage large businesses to promote transit use	Require all government employees to use transit a specified number of times per week.	No	No authority to implement.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.10	Bus Signal Priority	Wireless bus signal priority system on bus fleets for increased operation efficiency and travel time savings.	No	No authority to implement.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.14	Maglev	Construct regional low-speed magnetic levitation transit	No	Not economically feasible. High costs in lieu of relatively minor emission reductions	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.15	High Speed Rail	Construct high speed rail connecting large metropolitan centers in the state	No	No authority to implement.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.18	Express Busways/Dedicated Bus Lanes	Construct bus-only lanes	No	No authority to implement.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.20	Provide free public transit during episodes	Provide free transit rides during high level ozone episodes.	No	Difficult to quantify benefits; being limitedly applied for Clean Air Day	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.21	Half Price Fares on Feeder Bus Service	All local transit bus services to rail stations reduce fare by half.	No	No authority to implement. Unclear emission benefits.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Section 108 (f) 1. Programs for Improved Public Transit	1.23	Shorter Distance from Buildings to Bus Stops	For existing buildings, re-route traffic to allow buses to come closer to the building. For new buildings, alter setback requirements to allow closer bus access.	No	Not economically feasible, however, some jurisdictions may already have existing requirements for new development.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.25	Consolidation of Public Transit Operators	Consolidate all public transit agencies in the County.	No	No authority to implement.	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.27	Free rail-to-bus/bus-to-rail transfers	Vanpool and shuttle services at non-intermodal centers	No	Not economically feasible; difficult to quantify benefits	NA
Section 108 (f) 1. Programs for Improved Public Transit	1.28	Bus queue jumps	Installing special lanes and signals to allow transit to get ahead in traffic	No	No authority to implement.	NA
Section 108 (f) 2. Restriction of Certain Roads or Lanes to, or Construction of Such Roads or Lanes for Use By, Passenger Buses or High Occupancy Vehicles	2.4	Express toll lanes/High Occupancy Toll (HOT) Lanes	Self-explanatory.	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.7	Merchant transportation incentives	Implement “non-work” trip reduction ordinances requiring merchants to offer customers mode shift travel incentives such as free bus passes and requiring owners/managers/developers of large retail establishments to provide facilities for non-motorized modes.	No	No authority to implement.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.12	Income tax credit to telecommuters	Self-explanatory	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.13	Extend parking cash-out rule to more employers	Self-explanatory	No	Requires State legislation.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.15	Off-days for ozone alerts just like sick days	On ozone alert days, notify employees through email that there is an ozone alert. Employees are given a pre-specified number of days they can decide not to come in to work on ozone forecast days.	No	No authority to implement. Not economically feasible.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.16	Pay for in-house meals on ozone action days	Employer pays for meals in-house on ozone alert days so that employees do not travel to off-site locations.	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.17	Voluntary business closures on ozone action days	A more expensive version of “off-days” for ozone alerts.	No	No authority to implement. Not economically feasible.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.18	Close government offices on ozone action days to serve as an example	Similar to voluntary business closures.	No	No authority to implement.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.19	Mandatory compressed work weeks	Self-explanatory.	No	No authority to implement. Employer could decide individually if this measure is feasible for them.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.24	Satellite work centers	Employers open new remote offices near employees' residences	No	No authority to implement.	NA
Section 108 (f) 3. Employer-Based Transportation Management Plans, Including Incentives	3.26	Promote business closure on high ozone days	Self-explanatory	No	Not economically feasible.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.5	Removal of on-street parking	Require all commercial/industrial development to design and implement off-street parking.	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.6	Reversible lanes	Change direction of travel during special events or during congestion periods	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.8	Removal of on-street parking	Self-explanatory	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.11	Fewer stop signs	Improve flow-through traffic by removing stop signs.	No	Not technologically feasible because the safety issue outweighs the potential small air quality benefit.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.12	Ban left turns	Banning all left turns would stop the creation of bottlenecks although slightly increase travel distances.	No	Left turns are not allowed in some heavy-traffic streets. No clear demonstration of emission reduction benefits.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.13	Changeable lane assignments	Increase number of one-way lanes in congested flow direction during peak traffic hours.	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.22	Speed limit reduction	Reduce freeway speed limit to 55mph	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.23	Require 40 mph speed limit on all facilities	Self-explanatory.	No	The California Vehicle Code Sections 22357 and 22358 mandates a methodology for setting speed limits for local areas. This measure is not feasible until the statute is changed.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.24	Require lower speeds during peak periods	Self-explanatory.	No	The California Vehicle Code Sections 22357 and 22358 mandates methodology for setting speed limits for local areas. This measure is not feasible until the statute is changed.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.27	Eco-driving educational program	Education program to improve vehicle efficiency by improving driving habits	No	Difficult to quantify emission benefits.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.28	Reroute trucks on ozone action days	Self-explanatory.	No	No authority to implement.	NA
Section 108 (f) 5. Traffic Flow Improvement Programs That Achieve Emissions Reductions	5.31	Truck only lanes	Construct or convert lanes for use by heady-duty trucks only	No	No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.1	Off-peak goods movement	Require trucks to operate during off-peak hours	No	No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.2	Truck restrictions during peak periods	Implement an ordinance to restrict truck travel during peak periods in order to minimize traffic congestion.	No	No authority to implement. Cities could decide individually if this measure is feasible for them.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.4	Adjust school hours so they do not coincide with peak traffic periods and ozone seasons	Measure to reduce travel during peak periods and ozone-contributing periods in the early morning.	No	School hours are dictated by many variables, including overcrowding and year-round schooling. This measure is not feasible.	NA
Section 108 (f) 7. Programs to Limit or	7.5	Area-wide tax for parking	Reduce driving by limiting parking through	No	No authority to implement.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use			implementation of pricing measures.			
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.6	Increase parking fees	Reduce driving by limiting parking spaces through pricing measures.	No	No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.9	Limit the number of parking spaces at airports to support mass transit	Reduce airport travel by limits on parking at airports.	No	Regulatory agencies do not have the legal authority to make local land use decisions. It is at the discretion of the regional or local airport authority to make local land use decisions pertaining to airports. Additionally, it is necessary to have significant mass transit available at airports before this measure can be implemented.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission	7.10	No CBD vehicles unless LEV, alternative fuel, or electric	Define high-use area and ticket any vehicles present unless they are low emitting, alternative fueled or electric.	No	No authority to implement. Ex., the Legislature significantly reduced authority of the SOUTH COAST AQMD to	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Concentration Particularly During Periods of Peak Use					implement indirect source control measures through revisions to the Health & Safety Code (40717.6, 40717.8, and 40717.9).	
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.20	Divert trucks from nonattainment areas	Require pass-through trucks to choose routes away from Sacramento region	No	No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.23	Increase fees for parking garages and meters during ozone episodes	Increase fees for parking garages to deter vehicle use during high ozone level days.	No	Not enforceable or economically feasible.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.24	Charge city-owned parking garage pass holders a fee for more than one entrance and exit each day	Extra charges for pass holders to deter additional vehicle use and vehicle trips.	No	Not economically feasible. No authority to implement.	NA
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission	7.25	VMT Tax	Charge VMT tax per mile for all vehicles registered or garaged in the region.	No	Need state legislation.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Concentration Particularly During Periods of Peak Use						
Section 108 (f) 7. Programs to Limit or Restrict Vehicle Use in Downtown Areas or Other Areas of Emission Concentration Particularly During Periods of Peak Use	7.27	Central business district vehicle restrictions	Restrict vehicle use in downtown areas	No	No authority to implement. Downtown Sacramento is surrounded by freeways, difficult to quantify, not economically feasible.	NA
Section 108 (f) 8. Programs For the Provision of All Forms of High- Occupancy, Shared-Ride Services	8.6	School carpools	Self-explanatory and voluntary.	No	No authority to implement.	NA
Section 108 (f) 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	9.6	Free bikes	Provide free bikes to transit users	No	Not economically feasible. Unclear emission benefits.	NA
Section 108 (f) 9. Programs to Limit Portions of Road Surfaces or Certain Sections of the Metropolitan Area to the Use of Non-Motorized Vehicles or Pedestrian	9.7	Cash rebates for bikes	Provide financial incentives to purchase bicycles and thereby encourage use.	No	No clear demonstration of emission reduction benefits.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
Use, Both as to Time and Place						
Section 108 (f) 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	9.9	Use condemned dirt roads for bike trails	Self-explanatory.	No	Not applicable because there are no condemned dirt roads in the region.	NA
Section 108 (f) 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	9.13	Close roads for use of non-motorized traffic	Convert roadways to bike/pedestrian paths	No	No authority to implement. Unclear emission benefits.	NA
Section 108 (f) 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	10.1	Mandatory bike racks for worksites	Mandate that employers install bike racks at businesses	No	No authority to implement.	NA
Section 108 (f) 10. Programs for Secure Bicycle Storage Facilities	10.6	Provide bike/pedestrian facilities safety patrols	Self-explanatory.	No	Will not advance attainment. Emission benefits would be difficult	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
and Other Facilities, Including Bicycle Lanes, for the Convenience and Protection of Bicyclists, in Both Public and Private Areas					to calculate/provide minimal emission reductions.	
Section 108 (f) 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	10.12	Bike Purchase Incentives	Cash incentives to transit riders to purchase collapsible or electric bikes.	No	No authority to implement.	NA
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.1	Limit excessive car dealership vehicle starts	Require car dealers to limit the starting of vehicles for sale on their lot(s) to once every two weeks. Presently, a number of new and used car dealers start their vehicles daily to avoid battery failure and assure smooth start-ups for customer test drives.	No	Not enforceable or practical	NA
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.3	Turn off engines while stalled in traffic	Public outreach or police-enforced program.	No	This measure raises safety and congestion concerns. No clear demonstration of emission reduction benefits.	NA
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.4	Outlaw idling in parking lots	Self-explanatory and police-enforced program.	No	Enforcement of idle restrictions is a low priority for police relative to their other missions. The cost	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
					effectiveness of this measure has not been demonstrated. It is not economically feasible. No clear demonstration of emission reduction benefits.	
Section 108 (f) 11. Programs to Control Extended Idling of Vehicles	11.5	Reduce idling at drive-throughs; ban drive-throughs	Mandate no idling or do not allow drive- through windows during ozone season.	No	No clear demonstration of emission reduction benefits.	NA
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.9	Increase State gas tax	Self-explanatory.	No	Need state legislation. State gas tax has been increased by SB 1.	NA
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation	14.10	Pay-As-You-Drive Insurance	Charge insurance fees based on driving patters	No	No implementation authority; would require changes to state law	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
planning and development efforts						
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.13	Sell clean air license plate to fund air quality programs	Self-explanatory.	No	Need state legislation. No clear demonstration of air quality benefits.	NA
Section 108 (f) 14. Programs and Ordinances to facilitate Non- automotive travel, provision to and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts	14.15	Vehicle tax for two or more vehicles per household	Initiate legislation to put a vehicle tax on household with two or more vehicles.	No	Need state legislation. No clear demonstration of air quality benefits. Not economically feasible.	NA
Section 108 (f) 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	15.1	Require inclusion of paved shoulders adequate for bicycle use on state or federally funded reconstruction or widening of federal collectors	Require paved shoulders on state and federally funded roads that require reconstruction or widening.	No	No authority to implement. Not economically feasible.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
when commercially feasible and in the public interest						
Section 108 (f) 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	16.1	Counties assess ten dollar license plate fee to fund repair/replacement program for high- emitters	Self-explanatory.	No	Not enforceable or economically feasible.	NA
Section 108 (f) 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	16.3	Demolish impounded vehicles that are high emitters	Self-explanatory.	No	Not enforceable or economically feasible.	NA
Section 108 (f) 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	16.4	Do whatever is necessary to allow cities to remove the engines of high emitting vehicles (pre-1980) that are abandoned and to be auctioned	Self-explanatory.	No	Not enforceable or economically feasible.	NA
Section 108 (f) 16. Program to encourage the voluntary removal from use and the marketplace of pre-1980 model year light duty	16.6	Buy vehicles older than 1975	Self-explanatory.	No	Not enforceable or economically feasible.	NA

Code Category	Measure No.	Measure Title	Description	Has it been implemented or	Reasoned Justification for unfeasible Measure	Implementing Agency or Agencies
vehicles and pre-1980 model light duty trucks						
17. Other	17.2	Promote business closures on high ozone days	Non-employer-based strategy to require local business to close on bad air quality days, thereby reducing travel.	No	No authority to implement; not economically feasible	NA

D.3.7 Additional References

Table D-8 Non-Attainment Area SIPs Reviewed in the South Coast 2021/2022 RACM Process*

Region	Designation	Applicable SIP
Chicago-Naperville, Illinoi-Indiana-Wisconsin	Serious	Draft Redesignation Request and Maintenance Plan for the Illinois Portion of the Chicago Ozone Nonattainment Area for the 2008 Ozone Standard
Coachella Valley, California	Severe 15	Final 2016 Air Quality Management Plan
Dallas-Fort Worth, Texas	Serious	Dallas-Fort Worth Serious Classification Attainment Demonstration State Implementation Plan Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard
Denver-Boulder-Greeley-Ft, Colorado	Serious	Serious State Implementation Plan for the Denver Metro and North Front Range Ozone Nonattainment Area, December 18, 2020
Eastern Kern, California	Severe 15	2017 Ozone Attainment Plan For 2008 Federal 75 ppb 8-Hour Ozone Standard
Houston-Galveston-Brazoria, Texas	Serious	Houston-Galveston-Brazoria Serious Classification Attainment Demonstration State Implementation Plan Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard
New York-Northern New Jersey- Long Island, Connecticut	Serious	Revision to Connecticut's State Implementation Plan Ozone Attainment Demonstration for Areas Classified Serious Nonattainment for the 2008 Ozone Standards, October 20218-Hour Ozone Attainment Demonstration for the Connecticut Portion of the New York-Northern New Jersey-Long Island (NY-NJ-CT) Nonattainment Area Technical Support Document
New York-Northern New Jersey- Long Island, New York	Serious	New York State Implementation Plan for the 2008 Ozone National Ambient Air Quality Standards – New York-N. New Jersey-Long Island, NY-NU-CT Serious Nonattainment Areas, 2021
San Diego, California	Severe 15	2020 Plan for Attaining the National Ambient Air Quality Standards for Ozone in San Diego County
San Joaquin Valley, California	Extreme	2016 Ozone Plan for 2008 8-Hour Ozone Standard
Ventura, California	Serious	Final 2016 Ventura County Air Quality Management Plan; *Additional review by SACOG staff 8/15/22 http://www.vcapcd.org/pubs/Planning/2022-RASM-List-for-Appendix-F-AQMP- B.pdf
Western Mojave	Severe 15	MDAQMD Federal 75 ppb Ozone Attainment Plan (Western Mojave Desert Nonattainment Area)
Western Nevada County, California	Serious	Ozone Attainment Plan, Western Nevada County, State Implementation Plan for the 2008 Primary Federal 8-Hour Ozone Standard of .075 ppm, 2018
*SCAG's Regional Transportation Strategy and Control Measures, 2022. Table VI-C-4 *8-Hour Ozone Standard Nonattainment Areas Review for RACM.* Available at http://www.aqmd.gov/docs/default-source/clean-air- plans/air-quality-management-plans/2022-air-quality-management-plan/combine-appendix-iv-c.pdf?sfvrsn=8		

Table D-9 1997 8-Hour Ozone Standard Nonattainment Areas Reviewed in the SACOG 2016 RACM Process*

Region	Designation	Applicable SIP
South Coast, CA (including Riverside and W. Mojave Desert)	Severe/ Extreme	Air Quality Management Plan, South Coast Air Quality Management District, 2012
San Joaquin Valley, CA	Extreme	San Joaquin Valley 2007 Ozone Plan
Ventura, CA	Serious	Ventura County Air Quality Management Plan, 2007
Washington DC	Moderate	State Implementation Plan for 8-Hour Ozone Standard for the Washington DC-DV-MA Nonattainment Area, 2007
Baltimore, MD	Serious	Baltimore Serious Nonattainment Area 0.08 ppm 8- Hour Ozone Implementation Plan, 2013
Maricopa, Arizona	Moderate	MAG Eight-Hour Ozone Resignation Request and Maintenance Plan for the Maricopa Nonattainment Area, February, 2009
Denver-Boulder, Colorado	Marginal	Denver Metro Area & North Front Range Ozone Action Plan Including Revisions to the State Implementation Plan, 2008
Boston-Manchester, NH	Moderate	Revision to the New Hampshire State Implementation Plan Request for Redesignation of the Boston- Manchester-Portsmouth (SE), NH 8-Hour Ozone (1997 Standard) Nonattainment Area, 2012
Philadelphia- Wilmington, PA	Moderate	State Implementation Plan Revision: Attainment Demonstration and Base Year Inventory Bucks, Chester, Delaware, Montgomery, and Philadelphia Counties located in the Philadelphia-Wilmington-Atlantic City, PA-NJ-DE Eight-Hour Ozone Nonattainment Area, 2007
Houston-Galveston, TX	Severe	Houston-Galveston-Brazoria Reasonable Further Progress State Implementation Plan Revision for the1997 Eight-Hour Ozone Standard, 2010
Dallas-Fort Worth, TX	Serious	Dallas-Fort Worth 1997 Eight-Hour Ozone Standard Nonattainment Area Plan, 2011
New York-New Jersey, NY	Moderate	New Jersey Department of Environmental Protection State Implementation Plan (SIP) Revision for the Attainment and Maintenance of Ozone NAAQS, 2007
*Sierra Research, Reasonably Available Control Measures Analysis for the Sacramento Area Council of Governments, 2015. Available at https://www.sacog.org/sites/main/files/file- attachments/8-racm.pdf		

D.4 Sensitivity Analysis (for the RACM Analysis)

In the photochemical modeling, CARB conducted an additional sensitivity modeling analysis to determine how the changes of each ozone anthropogenic precursor in the attainment year will change the ozone DV at a particular monitoring site. This analysis was conducted by reducing NO_X or VOC by 10% in the SFNA from the 2032 forecasted emission inventories. Table D-10 shows the results of the sensitivity analysis.

The Auburn Monitoring Station is the peak DV site (for 2019, 2020, and 2021) with a future DV of 68.3 ppb in 2032. A 10% cut in NO_X emissions in SFNA would reduce the future ozone concentration to 67.2 ppb, a reduction of approximately 0.33 ppb per ton of NO_X reduced. A 10% cut in VOC would reduce the future ozone concertation to 68.2 ppb, a reduction of less than 0.01 ppb per ton of VOC reduced. These results show that NO_X reductions are more effective in reducing ambient ozone concentrations than VOC reductions and confirm that the SFNA is a NO_X-limited area. These sensitivity results are also converted into VOC to NO_X trading ratio by dividing the results from the NO_X sensitivity analysis over the results of the VOC sensitivity analysis. This VOC to NO_X trading ratio is used to determine the ozone reduction potential for any control measure. For this plan, this ratio is used in the Reasonably Available Control Measures (RACM) analysis.

Table D-10 Sensitivity Analysis Results

Site	DV 2032	DV 2032 (10% SFNA NO_X Emissions Reduction)	Change of DV per ton of SFNA NO_X reduction	DV 2032 (10% SFNA VOC Emissions Reduction)	Change of DV per ton of SFNA VOC reduction	VOC to NO_X trading ratio
North Highlands	64.8	64.0	0.256335	64.7	0.009993	25.6523
Davis-UCD	56.5	56.1	0.102859	56.4	0.009849	10.4433
Del Paso Manor	62.4	61.6	0.233085	62.3	0.010507	22.1836
Roseville	64.2	63.3	0.279116	64.1	0.005567	50.1348
Elk Grove	61.8	61.6	0.065749	61.8	0.001647	39.9304
Colfax	69.8	68.8	0.298058	69.7	0.001018	292.823
Sac T Street	60.0	59.6	0.143804	59.9	0.012094	11.8904
Placerville	69.6	68.5	0.345354	69.6	0.003065	112.692
Folsom	64.7	63.8	0.300444	64.6	0.008395	35.7895
Cool	68.2	67.3	0.293580	68.2	0.001987	147.742
Sloughhouse	62.1	61.4	0.226203	62.0	0.008671	26.0879
Woodland	58.4	57.8	0.185698	58.3	0.007300	25.4371
Vacaville	58.2	58.1	0.055940	58.2	0.003113	17.9687
Auburn	68.3	67.2	0.333253	68.2	0.007948	41.9269

APPENDIX E
Contingency Measures

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E. CONTINGENCY MEASURES

E.1. CARB's Assessment of Potential Contingency Measures

California Air Resources Board (CARB) has evaluated potential options for a contingency measure within each of CARB's regulations using criteria to determine its feasibility given the contingency measure requirements under the Clean Air Act, recent court decisions, and United States Environmental Protection Agency draft guidance (EPA, 2023). The evaluation results are summarized in Table E-1.

Table E-1 Assessment of Potential CARB Contingency Measures

Emission Source	Regulatory Programs	Latest Amendment Requirements	Contingency Options	Trigger Feasibility	Technological Feasibility
Light-Duty Passenger Vehicles and Light-Duty Trucks	Advanced Clean Cars Program (I and II), including the Zero Emission Vehicle (ZEV) Regulation	Amended 8/25/22 Requires 100% ZEV new vehicle sales by 2035 and increasingly stringent standards for gasoline cars and passenger trucks.	Pulling compliance timelines forward. Setting more stringent standards.	No; standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard or manufacturing requirements within 60 days and achieve reductions within one year.	No; current standards and requirements are technology forcing and most stringent in the nation, including a zero-emission requirement. Further stringency would not be feasible.
	Clean Miles Standard	Adopted 5/20/21 Set eVMT (electric miles traveled) and greenhouse gas (GHG) requirements for Transportation Network Companies (TNCs).	Pulling forward timeline to achieve 100% eVMT.	No; standards and fleet requirements need lead time to be implemented; infeasible to implement new standard or purchasing requirements within 60 days and achieve reductions within one year.	No; zero-emissions technology requirement is most stringent standard; TNCs are only a small portion of on-road vehicles, depending on area, may not achieve many reductions.
	On Board Diagnostics II (OBD)	Amended July 22, 2021 Required updates to program to address cold start emissions and diesel particulate matter (PM) monitoring. Many of the regulatory changes included phase-ins that are	Removing or pulling phase-in timelines forward. Setting more stringent OBD requirements.	No; OBD requirements need significant lead time to be developed, adopted, and implemented; infeasible to fully implement new requirements within 60 days and achieve similar reductions within one year.	No; the OBD requirements require sufficient lead time to implement with significant development time needed for hardware/ software changes and verification/validation testing.

		not 100% until 2027.			
	California Smog Check Program	Amended 2010 via legislation Smog Check Program enhancements, including new technologies and test methods.	Change the exemptions from 8 to 7 and/or 6 model years. Require annual Smog Check. Require annual Smog Check for only high mileage vehicles.	Yes (changing the exemptions) because it is not a regulatory change; No (other options); Smog Check requirements need significant lead time to be developed, adopted, and implemented; infeasible to fully implement new requirements within 60 days and achieve similar reductions within one year.	Yes (changing the exemptions) and would not have disproportionate impacts; Yes (other options), but would disproportionately impact low-income populations and disadvantaged communities.
	Reformulated Gasoline	Amended May 2003 Required removal of methyl tert-butyl ether (MTBE) and included refinery limits and cap limits.	Require more stringent standards. Change cap limits and refinery limits.	No; fuel standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard within 60 days and achieve reductions within one year.	No; current standards and requirements are some of most stringent in the world; not feasible to require further stringency of specifications and develop or manufacture in a compressed timeline.
Motorcycles	On-Road Motorcycle Regulation*	Proposed hearing: 2023 May require exhaust emissions standards (harmonize with European standards), evaporative emissions standards, and Zero Emission Motorcycle sales thresholds.	Pulling compliance timelines forward. Require more stringent emissions standards.	No; standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard within 60 days and achieve reductions within one year.	No; Any increase to the stringency of proposed standards would require an additional 1 to 2 years of lead time for 1) CARB staff to evaluate feasibility, and 2) manufacturers to develop and certify compliant motorcycles.

Medium Duty-Trucks	Clean Diesel Fuel	Amended 2013 Established more stringent standards for diesel fuel.	Require more stringent fuel standard.	No; fuel standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard within 60 days and achieve reductions within one year.	No; infeasible to require more stringent standards in compressed timeline.
	Heavy-Duty Engine and Vehicle Omnibus Regulation	Adopted 8/27/20 Established new low NO_X and lower PM tailpipe standards and lengthened the useful life and emissions warranty of in-use heavy-duty diesel engines.	Require more stringent standard, make optional idling standard required. Update testing requirements or corrective action procedures.	No; standards need years of lead time to be implemented; infeasible to implement new sales requirement within 60 days and achieve reductions within one year.	No; infeasible to require more stringent standards in compressed timeline.
	Advanced Clean Trucks Regulation	Adopted 6/25/20 Established manufacturer zero-emission truck sales requirement and company and fleet reporting.	Move up timeline for ZEV sales requirement. Reduce threshold for compliance.	No; manufacturer sales requirements need years of lead time to be implemented; infeasible to implement new sales requirement within 60 days. Sales requirement would not happen immediately or within one year of trigger; infeasible to achieve reductions within one year.	No; current sales requirement is technology forcing and most stringent in the nation.
	Advanced Clean Cars Program (I and II), including the Zero Emission Vehicle Regulation	Amended 8/25/22 Requires 100% ZEV new vehicle sales by 2035 and increasingly stringent standards for gasoline cars and passenger trucks.	Pulling compliance timelines forward. Setting more stringent standards.	No; standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard or manufacturing requirements within 60 days and achieve reductions within one year.	No; current standards and requirements are technology forcing and most stringent in the nation, including a zero-emission requirement. Further stringency would not be feasible.

	Advanced Clean Fleets Regulation	Adopted 4/27/23 Establishes zero-emission purchasing requirements for medium- and heavy-duty vehicle fleets (including state and local agencies, and drayage fleets, high priority, and federal fleets); would also require 100% zero-emission new vehicle sales starting 2040.	Pulling compliance timelines forward. Reduce threshold for compliance.	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing requirements within 60 days. Purchasing requirement and turnover would not happen immediately; infeasible to achieve reductions within one year. Because of near term compliance deadlines, moving forward deadlines would not result in many reductions.	No; current fleet requirements are technology forcing and most stringent in the nation, eventually requiring zero-emissions only.
Heavy-Duty Trucks	Heavy-Duty Low NO_X Engine Standards	See Omnibus.	More stringent standards were set with Omnibus Regulation.	No; engine standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard or purchasing requirements within 60 days and achieve reductions within one year.	No; infeasible to require more stringent technology forcing standards in compressed timeline if technology/ alternatives are not widely available.
	Optional Low-NO_X Standards for Heavy-Duty Diesel Engines	Amended 8/27/20 as a part of Omnibus to lower the optional low NO_X emission standards for on-road heavy-duty engines.	Make option required.	No; engine standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard or purchasing requirements within 60 days and achieve reductions within one year.	No; infeasible to require more stringent technology forcing standards in compressed timeline if technology/ alternatives are not widely available.
	Heavy-Duty Inspection and Maintenanc e Regulation	Adopted 12/9/21 Requires periodic vehicle emissions testing and reporting on nearly all heavy-duty vehicles operating in California.	Increase frequency of testing.	No; increased I/M requirements need significant lead time to be developed, adopted, and implemented; infeasible to fully implement new	Yes, but costs would disproportionally impact small businesses and low-income populations.

				requirements within 60 days and achieve similar reductions within one year.	
	Heavy-Duty OBD	Amended July 22, 2021 Required updates to program to address cold start emissions and diesel PM monitoring. Many of the regulatory changes included phase-ins that are not 100% until 2027.	Removing or pulling phase-in timelines forward. Setting more stringent OBD requirements.	No; OBD requirements need significant lead time to be developed, adopted, and implemented; infeasible to fully implement new requirements within 60 days and achieve similar reductions within one year.	No; the OBD requirements require sufficient lead time to implement with significant development time needed for hardware/ software changes and verification/validation testing.
	Heavy-Duty Engine and Vehicle Omnibus Regulation	Adopted 8/27/20 Established new low NO_X and lower PM Standards and lengthened the useful life and emissions warranty of in-use heavy-duty diesel engines.	Require more stringent standard, make optional idling standard required. Update testing requirements or corrective action procedures.	No; standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard or sales requirements within 60 days and achieve reductions within one year.	No; infeasible to require more stringent technology forcing standards in compressed timeline.
	Cleaner In-Use Heavy-Duty Trucks (Truck and Bus Regulation)	Adopted 12/17/10 Requires heavy-duty diesel vehicles that operate in California to reduce exhaust emissions. By January 1, 2023, nearly all trucks and buses will be required to have 2010 or newer model year engines to reduce PM and NO_X.	None	-	-

	Zero-Emission Powertrain Certification Regulation	Adopted 12/6/19 Establishes certification requirements for zero-emission powertrains.	None	-	-
	Advanced Clean Trucks Regulation	Adopted 6/25/20 Established manufacturer zero-emission truck sales requirement and company and fleet reporting.	Move up timeline for ZEV sales requirement. Reduce threshold for compliance.	No; manufacturer sales requirements need years of lead time to be implemented; infeasible to implement new sales requirement within 60 days. Sales requirement would not happen immediately or within one year of trigger; infeasible to achieve reductions within one year.	No; current sales requirement is technology forcing and most stringent in the nation.
	Advanced Clean Fleets Regulation	Adopted 4/27/23 Establishes zero-emission purchasing requirements for medium- and heavy-duty vehicle fleets (including state and local agencies, and drayage fleets, high priority, and federal fleets); would also require 100% zero-emission new vehicle sales starting 2040.	Pulling compliance timelines forward. Reduce threshold for compliance.	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing requirements within 60 days. Purchasing requirement and turnover would not happen immediately; infeasible to achieve reductions within one year. Because of near term compliance deadlines, moving forward deadlines would not result in many reductions.	No; current fleet requirements are technology forcing and most stringent in the nation, eventually requiring zero-emissions only.
Heavy-Duty Urban Buses	Innovative Clean Transit	Adopted 12/14/2018 Requires all public transit agencies to gradually transition to a 100% zero-emission bus fleet.	Move compliance timelines forward. Remove various exemptions or compliance options.	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing requirements within 60 days. Purchasing requirement and turnover would not happen immediately; infeasible to achieve	No; current requirements are technology forcing and most stringent (zero-emission requirement). Further stringency is not possible; expediting timelines would not be feasible.

				reductions within one year.	
	Advanced Clean Fleets Regulation	Adopted 4/27/23 Establishes zero-emission purchasing requirements for medium- and heavy-duty vehicle fleets (including state and local agencies, and drayage fleets, high priority, and federal fleets); would also require 100% zero-emission new vehicle sales starting 2040.	Pulling compliance timelines forward. Reduce threshold for compliance.	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing requirements within 60 days. Purchasing requirement and turnover would not happen immediately; infeasible to achieve reductions within one year. Because of near term compliance deadlines, moving forward deadlines would not result in many reductions.	No; current fleet requirements are technology forcing and most stringent in the nation, eventually requiring zero-emissions only.
Other Buses, Other Buses – Motor Coach	Zero-Emission Airport Shuttle Regulation	Adopted 6/27/19 Requires airport shuttles to transition to zero-emission fleet.	Pull compliance timelines forward. Remove reserve airport shuttle exemption.	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing requirements within 60 days. Purchasing requirement and turnover would not happen immediately; infeasible to achieve reductions within one year.	No; current requirements are technology forcing and most stringent (zero-emission requirement). Further stringency is not possible. Not many shuttles in area, would not achieve many reductions.
	Advanced Clean Fleets Regulation	Adopted 4/27/23 Establishes zero-emission purchasing requirements for medium- and heavy-duty vehicle fleets (including state and local agencies, and drayage fleets,	Pulling compliance timelines forward. Reduce threshold for compliance.	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing requirements within 60 days. Purchasing requirement and turnover would not happen immediately;	No; current fleet requirements are technology forcing and most stringent in the nation, eventually requiring zero-emissions only.

		high priority, and federal fleets); would also require 100% zero-emission new vehicle sales starting 2040.		infeasible to achieve reductions within one year. Because of near term compliance deadlines, moving forward deadlines would not result in many reductions.	
Commercial Harbor Craft	Commercial Harbor Craft (CHC) Regulation	Amended 3/24/22 Established more stringent standards, all CHC required to use renewable diesel, expanded requirements, and mandates zero-emission and advanced technologies.	Set more stringent standards. Pull compliance timelines forward.	No; Technology requirements and standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard or requirements within 60 days and achieve reductions within one year.	No; standards set are technology forcing and most stringent; not technologically feasible to require increased stringency in compressed timeline.
Recreational Boats	Spark-Ignition Marine Engine Standards*	Proposed hearing: 2029 Would establish catalyst-based emission standards and percentage of zero-emission technologies for certain applications.	Set more stringent standard.	No; standards need years of lead time to be developed, certified, and implemented; infeasible to implement new standard within 60 days and achieve reductions within one year.	No; standards being set will be most stringent feasible, including zero-emission requirement); would not save a more stringent standard for contingency
Transport Refrigeration Units	Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRUs) (Parts I and II*)	Amended 2/24/22 (Part I), Part II proposed CARB hearing in 2025 Requires diesel-powered truck TRUs to transition to zero-emission, PM emission standard for newly manufactured non-truck TRUs. Part II would establish zero-emission options for non-truck TRUs.	Set more stringent standards. Pull compliance timelines forward	No; standards and fleet requirements need years of lead time to be implemented; infeasible to implement new standard or purchasing requirements within 60 days and achieve reductions within one year.	No; current requirements are technology forcing and most stringent (zero-emission requirement). Further stringency is not possible; expediting timelines would not be feasible; would not save a more stringent standard for contingency

Industrial Equipment	Large Spark-Ignition (LSI) Engine Fleet Requirements Regulation	Amended July 2016 Extended recordkeeping requirements, established labeling, initial reporting, and annual reporting requirements.	Set more stringent performance standards	No; standards and fleet requirements need years of lead time to be implemented; infeasible to implement new standard or purchasing requirements within 60 days and achieve reductions within one year.	No; Infeasible to require further stringency within one year given timeline for technology development and certification. See Zero-Emission Forklifts below.
	Off-Road Regulation	Amended 11/17/22 Requires phase out of oldest and highest-emitting engines, restricts addition of Tier 3 and 4i engines, mandates renewable diesel for all fleets.	Pull phase-out or compliance timelines forward	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing and turnover requirements within 60 days and achieve reductions within one year.	No; Infeasible to require further stringency within one year given timeline for technology development and certification.
	Zero-Emission Forklifts*	Proposed CARB hearing in 2023. Would require model-year phase-out and reporting requirements and manufacturer sales restrictions.	Pull phase-out or compliance timelines forward	No; standards requirements need years of lead time to be developed, certified, and implemented; infeasible to implement new standard within 60 days and achieve reductions within one year.	No; standards being set will be technology forcing and most stringent feasible, including zero-emission requirement; would not save a more stringent standard for contingency
	Off-Road Zero-Emission Targeted Manufacturer Rule*	Proposed CARB hearing in 2027. Would require manufacturers of off-road equipment and/or engines to produce for sale zero-emission equipment and/or powertrains as a percentage of their annual statewide sales volume.	Pull forward compliance timelines or increase percentage sales requirements	No; Manufacturing and sales requirements need years of lead time to be implemented; infeasible to pull forward standards within 60 days and achieve reductions within one year.	No; standards being set will be technology forcing and most stringent feasible, including zero-emission requirement; would not save a more stringent standard for contingency

Construction and Mining	Off-Road Zero-Emission Targeted Manufacturer Rule*	Proposed CARB hearing in 2027. Would require manufacturers of off-road equipment and/or engines to produce for sale zero-emission equipment and/or powertrains as a percentage of their annual statewide sales volume.	Pull forward compliance timelines or increase percentage sales requirements	No; Manufacturing and sales requirements need years of lead time to be implemented; infeasible to pull forward standards within 60 days and achieve reductions within one year.	No; standards being set will be technology forcing and most stringent feasible, including zero-emission requirement; would not save a more stringent standard for contingency
	Off-Road Regulation	Amended 11/17/22 Requires phase out of oldest and highest-emitting engines, restricts addition of Tier 3 and 4i engines, mandates renewable diesel for all fleets.	Pull phase-out or compliance timelines forward	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing and turnover requirements within 60 days and achieve reductions within one year.	No; Infeasible to require further stringency within one year given timeline for technology development and certification.
Airport Ground Support Equipment	Zero-Emission Forklifts*	Proposed CARB hearing in 2023. Would require model-year phase-out and reporting requirements and manufacturer sales restrictions.	Pull phase-out or compliance timelines forward	No; standards requirements need years of lead time to be developed, certified, and implemented; infeasible to implement new standard within 60 days and achieve reductions within one year.	No; standards being set will be technology forcing and most stringent feasible, including zero-emission requirement; would not save a more stringent standard for contingency
	Large Spark-Ignition (LSI) Engine Fleet Requirements Regulation	Amended July 2016 Extended recordkeeping requirements, established labeling, initial reporting, and annual reporting requirements.	Set more stringent performance standards	No; standards and fleet requirements need years of lead time to be implemented; infeasible to implement new standard or purchasing requirements within 60 days and achieve reductions within one year.	No; Infeasible to require further stringency within one year given timeline for technology development and certification.

	Off-Road Regulation	Amended 11/17/22. Requires phase out of oldest and highest-emitting engines, restricts addition of Tier 3 and 4i engines, mandates renewable diesel for all fleets.	Pull phase-out or compliance timelines forward	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing and turnover requirements within 60 days and achieve reductions within one year.	No; Infeasible to require further stringency within one year given timeline for technology development and certification.
Port Operations and Rail Operations	Cargo Handling Equipment Regulation*	Proposed CARB hearing in 2025. Amendments to transition to zero-emission technology.	None	No; Standards requirements need years of lead time to be developed, certified, and implemented; infeasible to implement new standard within 60 days and achieve reductions within one year. Fully implemented in 2017 and relies on other engine standards, making it infeasible to trigger without regulatory process changing other standards.	No; Considering regulation to move towards zero-emissions. Currently assessing availability of technologies.
	Off-Road Zero-Emission Targeted Manufacturer Rule*	Proposed CARB hearing in 2027. Would require manufacturers of off-road equipment and/or engines to produce for sale zero-emission equipment and/or powertrains as a percentage of their annual statewide sales volume.	Pull forward compliance timelines or increase percentage sales requirements	No; Manufacturing and sales requirements need years of lead time to be implemented; infeasible to pull forward standards within 60 days and achieve reductions within one year.	No; standards being set will be technology forcing and most stringent feasible, including zero-emission requirement; would not save a more stringent standard for contingency
Lawn and Garden	Small Off-Road Engine (SORE) Regulation	Amended 12/9/21 Requires most newly manufactured SORE to meet emission standards of zero	Move up implementation deadlines	No; Standards requirements need years of lead time to be implemented; infeasible to pull forward standards within 60 days. Purchasing would not	No; current standards and requirements are a technology forcing zero-emission certification requirement. Further stringency would not be possible.

		starting in model year (MY) 2024.		happen immediately or within one year of trigger; infeasible to achieve reductions within one year.	
Ocean-Going Vessels	At Berth Regulation	Amended 8/27/20 Expands requirements to roll-on roll-off vessels and tankers, smaller fleets, and new ports and terminals.	Remove option to use alternate control technology or set more stringent alternate control technology requirements. Reduce threshold for 'low activity terminals' exemption.	No; control technology requirements need years of lead time to be implemented; infeasible to pull forward standards within 60 days and achieve reductions within one year.	No; regulation already requires use of shorepower or alternate control technology for every visit.
	Ocean-going Vessel Fuel Regulation	Amended 2011 Extended clean fuel zone and included exemption window.	Set more stringent requirements	No; fleet requirements need years of lead time to be implemented; infeasible to implement new purchasing and turnover requirements within 60 days and achieve reductions within one year.	No; not feasible to require further stringency in a compressed timeline.
Locomotives	In-Use Locomotive Regulation	Adopted 4/27/23, Requires each operator to deposit funds into spending account for purchasing cleaner locomotive technology, sets idling limits, and requires registration and reporting. Starting in 2030, only locomotives less than 23 years old can operate in the state. Newly built passenger, switch,	Move up implementation deadlines. Set stricter idling requirements.	No; Fleet requirements need years of lead time to be implemented; infeasible to pull forward standards within 60 days and reductions within one year. No, for idling requirements.	No; current standards and requirements are technology forcing, include a zero-emission requirement. Further stringency would not be possible. No, for idling requirements, CARB is committing to re-evaluate the requirement during next assessment.

		and industrial locomotives must operate in a zero-emission configuration, and in 2035 newly built freight line haul locomotives.			
Areawide Sources	Zero-Emission Standard for Space and Water Heaters	Proposed CARB hearing in 2025. Beginning in 2030, 100% of sales of new space heaters and water heaters would need to meet a zero-emission standard.	Set trigger for more stringent standards or timelines.	No; Standards requirements need years of lead time to be implemented; infeasible to pull forward standards within 60 days. Purchasing would not happen immediately or within one year of trigger; infeasible to achieve reductions within one year.	No; current standards and requirements are a technology forcing zero-emission certification requirement. Further stringency would not be possible.

E.2. SFNA Contingency Measures Commitment

Contingency Measure Number – SFNA 001
Contingency Measure Title: Architectural Coatings

E.2.1. Contingency Measure Description

The architectural coatings rules regulate the volatile organic compound (VOC) content of coatings applied to stationary structures and their appurtenances. Coating types include general use flat and non-flat coatings as well as specialty coatings such as industrial maintenance coatings, lacquers, floor coatings, roof coatings, stains, and many others. VOCs in the coatings are emitted as the coatings dry.

The air districts of the Sacramento Federal Nonattainment Area (SFNA) commit to amend their existing architectural coatings rules to add contingency provisions. The contingency provisions will incorporate the CARB 2019 Suggested Control Measure for Architectural Coatings (SCM). If triggered, these amendments would become effective within 60 days of a United States Environmental Protection Agency (EPA) finding that the SFNA has failed to attain the 2015 8-hour ozone National Ambient Air Quality Standard (NAAQS) by 2032, failed to meet reasonable further progress requirements, or failed to meet any applicable milestone. Once amended, these rules will help fulfill the State Implementation Plan (SIP) contingency measure requirements.

In the SFNA, each air district has an Architectural Coatings rule that regulates the VOC content of architectural coatings that are manufactured, sold, and used in their respective counties. The rule for each district is shown in Table E-2.

Table E-2: SFNA Architectural Coatings Rules

District	Rule	Title	Last Amended	2007 SCM?
EDAQMD	215	Architectural Coatings	8/25/2020	Yes
FRAQMD	3.15	Architectural Coatings	8/4/2014	Yes
PCAPCD	218	Architectural Coatings	10/14/2010	Yes
SMAQMD	442	Architectural Coatings	9/24/15	Yes
YSAQMD	2.14	Architectural Coatings	10/12/2016	Yes

Each of these architectural coating rules were previously amended to be consistent with CARB's 2007 SCM for Architectural Coatings. CARB amended the SCM in 2019 to further reduce VOC content limits for specific categories and add VOC limits for colorants.

E.2.2. CARB's 2019 Architectural Coatings Suggested Control Measure

The proposed contingency measure commitments are based on CARB's SCM for Architectural Coatings. The SCM is a model rule that CARB encourages local districts to adopt as a formal regulation. The purpose of the SCM is to promote uniformity among district rules, improve enforceability, and achieve additional reductions of VOC emissions from the application of architectural coatings.

In 2019, CARB amended the Architectural Coatings SCM to further reduce VOC limits for specific categories and to add VOC limits for colorants. CARB estimated that the 2019 SCM will achieve a 7.83% overall reduction in VOC emissions from architectural coatings (excluding emissions from thinning and cleanup solvents) for districts with rules based on the previous 2007 SCM. Each of the air districts in the SFNA has an existing architectural coating rule based on CARB'S 2007 SCM.

The contingency measures provisions will incorporate CARB's 2019 SCM for Architectural Coatings. The following is a summary of proposed changes that would take effect upon triggering the contingency measures:

1. Add, amend, or eliminate certain coating categories, consistent with CARB's 2019 SCM for architectural coatings
2. Establish VOC limits for colorants added to coatings at the point of sale, excluding industrial maintenance coatings and wood coatings
3. Reduce the VOC limits for nine coating categories
4. Eliminate the nonflat – high gloss specialty coating category. These coatings will become subject to the nonflat coatings limits
5. Establish a one-year sell-through period for products manufactured prior to the contingency measure trigger date

The contingency measure will be adopted by each air district and will be submitted to CARB and EPA for approval and incorporation into the California SIP.

E.2.3. Emissions Impact

The total amount of reductions depends on if or when the contingency measures are triggered. Because the contingency measures will include a one-year sell-through period, emission reductions will begin in the second year after the measure is triggered. Table E-3 shows the VOC emissions inventory for each SFNA air district, and Table E-4 shows the estimated emissions reductions for each air district's contingency measure commitment if it were triggered in the potential milestone years or attainment year[1].

[1] The contingency measure for each District could potentially be triggered in the milestone years, 2026 and 2029, or the year of the attainment date, 2033 (based on air quality monitoring data collected in 2030, 2031, and 2032). VOC emission reductions would begin in the second year after the measure is triggered: 2028, 2031, or 2035.

E.2.4. Summary of District Emission Inventory – Year 2028, 2031, 2035

Table E-3: Architectural Coating Emissions Inventory

District	VOC Emission Inventory for Contingency Measure (tons per summer day)[a]		
	2028	**2031**	**2035**
EDAQMD	0.0332	0.0341	0.0348
FRAQMD	0.0041	0.0042	0.0043
PCAPCD	0.0527	0.0548	0.0569
SMAQMD	1.5228	1.5638	1.6090
YSAQMD	0.3498	0.3582	0.3696
Total SFNA Contingency Measure Emission Inventory	**1.9625**	**2.0151**	**2.0746**

[a] Excluding thinning and cleanup solvents.

E.2.5. Emission Reductions – Year 2028, 2031, 2035

Reductions are based on the 2019 SCM estimated overall reduction of VOC emissions by 7.83%. The overall reduction is not applicable to the Emission Inventory Codes (EICs) for thinning or cleanup solvents, or additives.

Table E-4: Contingency Measure Commitments Emission Reductions

District	VOC Emission Reductions (tons per summer day)		
	2028	**2031**	**2035**
EDCAQMD	0.0026	0.0027	0.0027
FRAQMD	0.0003	0.0003	0.0003
PCAPCD	0.0041	0.0043	0.0045
SMAQMD	0.1192	0.1224	0.1260
YSAQMD	0.0274	0.0280	0.0289
Total SFNA Contingency Measure Emission Reductions	**0.1537**	**0.1578**	**0.1624**

Below is each district's architectural coating inventory by EICs subject to the contingency measure.

E.2.6. EDAQMD Emission Inventory –Year 2028, 2031, 2035

District	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
EDAQMD	520-520-9100-0000	9100-OIL BASED (ORGANIC SOLVENT BASED) COATINGS (UNSPECIFIED)	0.000	0.000	0.000
EDAQMD	520-520-9105-0000	9105-OIL BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.000	0.000	0.000
EDAQMD	520-520-9106-0000	9106-OIL BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.000	0.000	0.000
EDAQMD	520-520-9108-0000	9108-OIL BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.000	0.000	0.000
EDAQMD	520-520-9109-0000	9109-OIL BASED BITUMINOUS ROOF PRIMER	0.000	0.000	0.000
EDAQMD	520-520-9112-0000	9112-OIL BASED SANDING SEALERS	0.000	0.000	0.000
EDAQMD	520-520-9113-0000	9113-OIL BASED WATERPROOFING SEALERS	0.001	0.001	0.001
EDAQMD	520-520-9118-0000	9118-OIL BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.001	0.002	0.002
EDAQMD	520-520-9122-0000	9122-OIL BASED FAUX FINISHING	0.000	0.000	0.000
EDAQMD	520-520-9124-0000	9124-OIL BASED MASTIC TEXTURE	0.000	0.000	0.000
EDAQMD	520-520-9126-0000	9126-OIL BASED RUST PREVENTATIVE	0.001	0.001	0.001
EDAQMD	520-520-9131-0000	9131-OIL BASED STAINS - CLEAR/SEMITRANSPARENT	0.004	0.004	0.004
EDAQMD	520-520-9136-0000	9136-OIL BASED STAINS - OPAQUE	0.001	0.001	0.001
EDAQMD	520-520-9141-0000	9141-OIL BASED VARNISH - CLEAR/SEMITRANSPARENT	0.003	0.004	0.004
EDAQMD	520-520-9153-0000	9153-OIL BASED QUICK DRY ENAMEL COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9157-0000	9157-OIL BASED LACQUERS (UNSPECIFIED)	0.000	0.000	0.000
EDAQMD	520-520-9159-0000	9159-OIL BASED FLAT COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9160-0000	9160-OIL BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.001	0.001	0.001
EDAQMD	520-520-9161-0000	9161-OIL BASED HIGH GLOSS NONFLAT COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9164-0000	9164-OIL BASED BITUMINOUS ROOF COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9165-0000	9165-OIL BASED CONCRETE CURING COMPOUNDS	0.000	0.000	0.000
EDAQMD	520-520-9166-0000	9166-OIL BASED DRY FOG COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9169-0000	9169-OIL BASED FLOOR COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9170-0000	9170-OIL BASED FORM RELEASE COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9171-0000	9171-OIL BASED HIGH TEMPERATURE COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9172-0000	9172-OIL BASED INDUSTRIAL MAINTENANCE COATINGS	0.003	0.003	0.003
EDAQMD	520-520-9173-0000	9173-OIL BASED METALLIC PIGMENTED COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9174-0000	9174-OIL BASED ROOF COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9176-0000	9176-OIL BASED TRAFFIC COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9177-0000	9177-OIL BASED WOOD PRESERVATIVES	0.001	0.001	0.001
EDAQMD	520-520-9200-0000	9200-WATER BASED COATINGS (UNSPECIFIED)	0.001	0.001	0.001
EDAQMD	520-520-9205-0000	9205-WATER BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.002	0.002	0.002
EDAQMD	520-520-9206-0000	9206-WATER BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.000	0.000	0.000
EDAQMD	520-520-9208-0000	9208-WATER BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.000	0.000	0.000
EDAQMD	520-520-9209-0000	9209-WATER BASED BITUMINOUS ROOF PRIMER	0.000	0.000	0.000
EDAQMD	520-520-9212-0000	9212-WATER BASED SANDING SEALERS	0.000	0.000	0.000
EDAQMD	520-520-9213-0000	9213-WATER BASED WATERPROOFING SEALERS	0.000	0.000	0.000
EDAQMD	520-520-9218-0000	9218-WATER BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.000	0.000	0.000
EDAQMD	520-520-9222-0000	9222-WATER BASED FAUX FINISHING	0.000	0.000	0.000
EDAQMD	520-520-9223-0000	9223-WATER BASED FORM RELEASE COMPOUNDS	0.000	0.000	0.000
EDAQMD	520-520-9224-0000	9224-WATER BASED MASTIC TEXTURE	0.000	0.000	0.000
EDAQMD	520-520-9226-0000	9226-WATER BASED RUST PREVENTATIVE	0.000	0.000	0.000
EDAQMD	520-520-9231-0000	9231-WATER BASED STAINS - CLEAR/SEMITRANSPARENT	0.000	0.000	0.000
EDAQMD	520-520-9236-0000	9236-WATER BASED STAINS - OPAQUE	0.000	0.000	0.000
EDAQMD	520-520-9241-0000	9241-WATER BASED VARNISHES - CLEAR/SEMITRANSPARENT	0.001	0.001	0.001
EDAQMD	520-520-9257-0000	9257-WATER BASED LACQUERS (UNSPECIFIED)	0.000	0.000	0.000
EDAQMD	520-520-9259-0000	9259-WATER BASED FLAT COATINGS	0.002	0.002	0.003
EDAQMD	520-520-9260-0000	9260-WATER BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.003	0.003	0.003
EDAQMD	520-520-9261-0000	9261-WATER BASED HIGH GLOSS NONFLAT COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9264-0000	9264-WATER BASED BITUMINOUS ROOF COATINGS	0.001	0.001	0.001
EDAQMD	520-520-9265-0000	9265-WATER BASED CONCRETE CURING COMPOUNDS	0.001	0.001	0.001
EDAQMD	520-520-9266-0000	9266-WATER BASED DRY FOG COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9269-0000	9269-WATER BASED FLOOR COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9272-0000	9272-WATER BASED INDUSTRIAL MAINTENANCE COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9273-0000	9273-WATER BASED METALLIC PIGMENTED COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9274-0000	9274-WATER BASED ROOF COATINGS	0.000	0.000	0.000
EDAQMD	520-520-9276-0000	9276-WATER BASED TRAFFIC COATINGS	0.001	0.001	0.001

District	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
EDAQMD	520-520-9277-0000	9277-WATER BASED WOOD PRESERVATIVES	0.000	0.000	0.000
EDAQMD	520-520-9281-0000	9281-COLORANT - EXCLUDING IM COATINGS (50 G/L)	0.001	0.001	0.001
EDAQMD	520-520-9282-0000	9282-COLORANT - SOLVENT BASED IM COATINGS	0.000	0.000	0.000
		Total	0.0332	0.0341	0.0348

E.2.7. FRAQMD Emission Inventory –Year 2028, 2031, 2035

District	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
FRAQMD	520-520-9100-0000	9100-OIL BASED (ORGANIC SOLVENT BASED) COATINGS (UNSPECIFIED)	0.0000	0.0000	0.0000
FRAQMD	520-520-9105-0000	9105-OIL BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.0000	0.0000	0.0000
FRAQMD	520-520-9106-0000	9106-OIL BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.0000	0.0000	0.0000
FRAQMD	520-520-9108-0000	9108-OIL BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.0000	0.0000	0.0000
FRAQMD	520-520-9109-0000	9109-OIL BASED BITUMINOUS ROOF PRIMER	0.0000	0.0000	0.0000
FRAQMD	520-520-9112-0000	9112-OIL BASED SANDING SEALERS	0.0000	0.0000	0.0000
FRAQMD	520-520-9113-0000	9113-OIL BASED WATERPROOFING SEALERS	0.0001	0.0001	0.0001
FRAQMD	520-520-9118-0000	9118-OIL BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.0002	0.0002	0.0002
FRAQMD	520-520-9122-0000	9122-OIL BASED FAUX FINISHING	0.0000	0.0000	0.0000
FRAQMD	520-520-9124-0000	9124-OIL BASED MASTIC TEXTURE	0.0000	0.0000	0.0000
FRAQMD	520-520-9126-0000	9126-OIL BASED RUST PREVENTATIVE	0.0001	0.0001	0.0001
FRAQMD	520-520-9131-0000	9131-OIL BASED STAINS - CLEAR/SEMITRANSPARENT	0.0005	0.0005	0.0005
FRAQMD	520-520-9136-0000	9136-OIL BASED STAINS - OPAQUE	0.0001	0.0001	0.0002
FRAQMD	520-520-9141-0000	9141-OIL BASED VARNISH - CLEAR/SEMITRANSPARENT	0.0004	0.0004	0.0004
FRAQMD	520-520-9153-0000	9153-OIL BASED QUICK DRY ENAMEL COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9157-0000	9157-OIL BASED LACQUERS (UNSPECIFIED)	0.0000	0.0000	0.0000
FRAQMD	520-520-9159-0000	9159-OIL BASED FLAT COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9160-0000	9160-OIL BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.0001	0.0001	0.0001
FRAQMD	520-520-9161-0000	9161-OIL BASED HIGH GLOSS NONFLAT COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9164-0000	9164-OIL BASED BITUMINOUS ROOF COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9165-0000	9165-OIL BASED CONCRETE CURING COMPOUNDS	0.0000	0.0000	0.0000
FRAQMD	520-520-9166-0000	9166-OIL BASED DRY FOG COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9169-0000	9169-OIL BASED FLOOR COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9170-0000	9170-OIL BASED FORM RELEASE COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9171-0000	9171-OIL BASED HIGH TEMPERATURE COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9172-0000	9172-OIL BASED INDUSTRIAL MAINTENANCE COATINGS	0.0004	0.0004	0.0004
FRAQMD	520-520-9173-0000	9173-OIL BASED METALLIC PIGMENTED COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9174-0000	9174-OIL BASED ROOF COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9176-0000	9176-OIL BASED TRAFFIC COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9177-0000	9177-OIL BASED WOOD PRESERVATIVES	0.0001	0.0001	0.0001
FRAQMD	520-520-9200-0000	9200-WATER BASED COATINGS (UNSPECIFIED)	0.0001	0.0001	0.0002
FRAQMD	520-520-9205-0000	9205-WATER BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.0002	0.0002	0.0002
FRAQMD	520-520-9206-0000	9206-WATER BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.0000	0.0000	0.0000
FRAQMD	520-520-9208-0000	9208-WATER BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.0000	0.0000	0.0000
FRAQMD	520-520-9209-0000	9209-WATER BASED BITUMINOUS ROOF PRIMER	0.0000	0.0000	0.0000
FRAQMD	520-520-9212-0000	9212-WATER BASED SANDING SEALERS	0.0000	0.0000	0.0000
FRAQMD	520-520-9213-0000	9213-WATER BASED WATERPROOFING SEALERS	0.0000	0.0000	0.0000
FRAQMD	520-520-9218-0000	9218-WATER BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.0001	0.0001	0.0001
FRAQMD	520-520-9222-0000	9222-WATER BASED FAUX FINISHING	0.0000	0.0000	0.0000
FRAQMD	520-520-9223-0000	9223-WATER BASED FORM RELEASE COMPOUNDS	0.0000	0.0000	0.0000
FRAQMD	520-520-9224-0000	9224-WATER BASED MASTIC TEXTURE	0.0000	0.0000	0.0000
FRAQMD	520-520-9226-0000	9226-WATER BASED RUST PREVENTATIVE	0.0000	0.0000	0.0000
FRAQMD	520-520-9231-0000	9231-WATER BASED STAINS - CLEAR/SEMITRANSPARENT	0.0000	0.0000	0.0000
FRAQMD	520-520-9236-0000	9236-WATER BASED STAINS - OPAQUE	0.0000	0.0000	0.0000
FRAQMD	520-520-9241-0000	9241-WATER BASED VARNISHES - CLEAR/SEMITRANSPARENT	0.0001	0.0001	0.0001
FRAQMD	520-520-9257-0000	9257-WATER BASED LACQUERS (UNSPECIFIED)	0.0000	0.0000	0.0000
FRAQMD	520-520-9259-0000	9259-WATER BASED FLAT COATINGS	0.0003	0.0003	0.0003
FRAQMD	520-520-9260-0000	9260-WATER BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.0004	0.0004	0.0004
FRAQMD	520-520-9261-0000	9261-WATER BASED HIGH GLOSS NONFLAT COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9264-0000	9264-WATER BASED BITUMINOUS ROOF COATINGS	0.0001	0.0001	0.0001

District	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
FRAQMD	520-520-9265-0000	9265-WATER BASED CONCRETE CURING COMPOUNDS	0.0001	0.0001	0.0001
FRAQMD	520-520-9266-0000	9266-WATER BASED DRY FOG COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9269-0000	9269-WATER BASED FLOOR COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9272-0000	9272-WATER BASED INDUSTRIAL MAINTENANCE COATINGS	0.0001	0.0001	0.0001
FRAQMD	520-520-9273-0000	9273-WATER BASED METALLIC PIGMENTED COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9274-0000	9274-WATER BASED ROOF COATINGS	0.0000	0.0000	0.0000
FRAQMD	520-520-9276-0000	9276-WATER BASED TRAFFIC COATINGS	0.0001	0.0001	0.0001
FRAQMD	520-520-9277-0000	9277-WATER BASED WOOD PRESERVATIVES	0.0000	0.0000	0.0000
FRAQMD	520-520-9281-0000	9281-COLORANT - EXCLUDING IM COATINGS (50 G/L)	0.0001	0.0001	0.0001
FRAQMD	520-520-9282-0000	9282-COLORANT - SOLVENT BASED IM COATINGS	0.0000	0.0000	0.0000
		Total	0.0041	0.0042	0.0043

E.2.8. PCAPCD Emission Inventory –Year 2028, 2031, 2035

District	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
PCAPCD	520-520-9100-0000	9100-OIL BASED (ORGANIC SOLVENT BASED) COATINGS (UNSPECIFIED)	0.0005	0.0005	0.0005
PCAPCD	520-520-9105-0000	9105-OIL BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.0001	0.0001	0.0001
PCAPCD	520-520-9106-0000	9106-OIL BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.0000	0.0000	0.0000
PCAPCD	520-520-9108-0000	9108-OIL BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.0013	0.0013	0.0014
PCAPCD	520-520-9109-0000	9109-OIL BASED BITUMINOUS ROOF PRIMER	0.0002	0.0002	0.0002
PCAPCD	520-520-9112-0000	9112-OIL BASED SANDING SEALERS	0.0000	0.0000	0.0000
PCAPCD	520-520-9113-0000	9113-OIL BASED WATERPROOFING SEALERS	0.0014	0.0014	0.0015
PCAPCD	520-520-9118-0000	9118-OIL BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.0029	0.0030	0.0031
PCAPCD	520-520-9122-0000	9122-OIL BASED FAUX FINISHING	0.0001	0.0001	0.0001
PCAPCD	520-520-9124-0000	9124-OIL BASED MASTIC TEXTURE	0.0001	0.0001	0.0001
PCAPCD	520-520-9126-0000	9126-OIL BASED RUST PREVENTATIVE	0.0020	0.0021	0.0022
PCAPCD	520-520-9131-0000	9131-OIL BASED STAINS - CLEAR/SEMITRANSPARENT	0.0054	0.0056	0.0058
PCAPCD	520-520-9136-0000	9136-OIL BASED STAINS - OPAQUE	0.0015	0.0016	0.0016
PCAPCD	520-520-9141-0000	9141-OIL BASED VARNISH - CLEAR/SEMITRANSPARENT	0.0056	0.0058	0.0060
PCAPCD	520-520-9153-0000	9153-OIL BASED QUICK DRY ENAMEL COATINGS	0.0000	0.0000	0.0000
PCAPCD	520-520-9157-0000	9157-OIL BASED LACQUERS (UNSPECIFIED)	0.0007	0.0007	0.0008
PCAPCD	520-520-9159-0000	9159-OIL BASED FLAT COATINGS	0.0001	0.0001	0.0001
PCAPCD	520-520-9160-0000	9160-OIL BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.0009	0.0009	0.0010
PCAPCD	520-520-9161-0000	9161-OIL BASED HIGH GLOSS NONFLAT COATINGS	0.0004	0.0004	0.0004
PCAPCD	520-520-9164-0000	9164-OIL BASED BITUMINOUS ROOF COATINGS	0.0002	0.0002	0.0002
PCAPCD	520-520-9165-0000	9165-OIL BASED CONCRETE CURING COMPOUNDS	0.0000	0.0000	0.0000
PCAPCD	520-520-9166-0000	9166-OIL BASED DRY FOG COATINGS	0.0000	0.0000	0.0000
PCAPCD	520-520-9169-0000	9169-OIL BASED FLOOR COATINGS	0.0003	0.0003	0.0003
PCAPCD	520-520-9170-0000	9170-OIL BASED FORM RELEASE COATINGS	0.0001	0.0001	0.0001
PCAPCD	520-520-9171-0000	9171-OIL BASED HIGH TEMPERATURE COATINGS	0.0001	0.0001	0.0001
PCAPCD	520-520-9172-0000	9172-OIL BASED INDUSTRIAL MAINTENANCE COATINGS	0.0041	0.0043	0.0045
PCAPCD	520-520-9173-0000	9173-OIL BASED METALLIC PIGMENTED COATINGS	0.0003	0.0003	0.0003
PCAPCD	520-520-9174-0000	9174-OIL BASED ROOF COATINGS	0.0000	0.0000	0.0000
PCAPCD	520-520-9176-0000	9176-OIL BASED TRAFFIC COATINGS	0.0001	0.0001	0.0001
PCAPCD	520-520-9177-0000	9177-OIL BASED WOOD PRESERVATIVES	0.0008	0.0009	0.0009
PCAPCD	520-520-9200-0000	9200-WATER BASED COATINGS (UNSPECIFIED)	0.0015	0.0016	0.0016
PCAPCD	520-520-9205-0000	9205-WATER BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.0032	0.0033	0.0035
PCAPCD	520-520-9206-0000	9206-WATER BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.0000	0.0000	0.0000
PCAPCD	520-520-9208-0000	9208-WATER BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.0000	0.0000	0.0000
PCAPCD	520-520-9209-0000	9209-WATER BASED BITUMINOUS ROOF PRIMER	0.0000	0.0000	0.0000
PCAPCD	520-520-9212-0000	9212-WATER BASED SANDING SEALERS	0.0000	0.0000	0.0000
PCAPCD	520-520-9213-0000	9213-WATER BASED WATERPROOFING SEALERS	0.0005	0.0005	0.0005
PCAPCD	520-520-9218-0000	9218-WATER BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.0010	0.0010	0.0011
PCAPCD	520-520-9222-0000	9222-WATER BASED FAUX FINISHING	0.0001	0.0001	0.0001
PCAPCD	520-520-9223-0000	9223-WATER BASED FORM RELEASE COMPOUNDS	0.0001	0.0001	0.0001
PCAPCD	520-520-9224-0000	9224-WATER BASED MASTIC TEXTURE	0.0000	0.0000	0.0000
PCAPCD	520-520-9226-0000	9226-WATER BASED RUST PREVENTATIVE	0.0000	0.0000	0.0000
PCAPCD	520-520-9231-0000	9231-WATER BASED STAINS - CLEAR/SEMITRANSPARENT	0.0001	0.0001	0.0001
PCAPCD	520-520-9236-0000	9236-WATER BASED STAINS - OPAQUE	0.0004	0.0004	0.0004

District	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
PCAPCD	520-520-9241-0000	9241-WATER BASED VARNISHES - CLEAR/SEMITRANSPARENT	0.0008	0.0008	0.0008
PCAPCD	520-520-9257-0000	9257-WATER BASED LACQUERS (UNSPECIFIED)	0.0001	0.0001	0.0001
PCAPCD	520-520-9259-0000	9259-WATER BASED FLAT COATINGS	0.0053	0.0055	0.0057
PCAPCD	520-520-9260-0000	9260-WATER BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.0050	0.0052	0.0054
PCAPCD	520-520-9261-0000	9261-WATER BASED HIGH GLOSS NONFLAT COATINGS	0.0005	0.0005	0.0005
PCAPCD	520-520-9264-0000	9264-WATER BASED BITUMINOUS ROOF COATINGS	0.0007	0.0007	0.0007
PCAPCD	520-520-9265-0000	9265-WATER BASED CONCRETE CURING COMPOUNDS	0.0014	0.0015	0.0016
PCAPCD	520-520-9266-0000	9266-WATER BASED DRY FOG COATINGS	0.0002	0.0002	0.0002
PCAPCD	520-520-9269-0000	9269-WATER BASED FLOOR COATINGS	0.0002	0.0002	0.0002
PCAPCD	520-520-9272-0000	9272-WATER BASED INDUSTRIAL MAINTENANCE COATINGS	0.0005	0.0006	0.0006
PCAPCD	520-520-9273-0000	9273-WATER BASED METALLIC PIGMENTED COATINGS	0.0000	0.0000	0.0000
PCAPCD	520-520-9274-0000	9274-WATER BASED ROOF COATINGS	0.0000	0.0000	0.0000
PCAPCD	520-520-9276-0000	9276-WATER BASED TRAFFIC COATINGS	0.0007	0.0008	0.0008
PCAPCD	520-520-9277-0000	9277-WATER BASED WOOD PRESERVATIVES	0.0000	0.0000	0.0000
PCAPCD	520-520-9281-0000	9281-COLORANT - EXCLUDING IM COATINGS (50 G/L)	0.0011	0.0011	0.0011
PCAPCD	520-520-9282-0000	9282-COLORANT - SOLVENT BASED IM COATINGS	0.0002	0.0002	0.0002
		Total	0.0527	0.0548	0.0569

E.2.9. SMAQMD Emission Inventory –Year 2028, 2031, 2035

District	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
SMAQMD	520-520-9100-0000	9100-OIL BASED (ORGANIC SOLVENT BASED) COATINGS (UNSPECIFIED)	0.0164	0.0168	0.0173
SMAQMD	520-520-9105-0000	9105-OIL BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.0019	0.0019	0.0020
SMAQMD	520-520-9106-0000	9106-OIL BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.0002	0.0002	0.0002
SMAQMD	520-520-9108-0000	9108-OIL BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.0089	0.0091	0.0094
SMAQMD	520-520-9109-0000	9109-OIL BASED BITUMINOUS ROOF PRIMER	0.0059	0.0060	0.0062
SMAQMD	520-520-9112-0000	9112-OIL BASED SANDING SEALERS	0.0014	0.0014	0.0014
SMAQMD	520-520-9113-0000	9113-OIL BASED WATERPROOFING SEALERS	0.0440	0.0452	0.0466
SMAQMD	520-520-9118-0000	9118-OIL BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.0676	0.0695	0.0716
SMAQMD	520-520-9122-0000	9122-OIL BASED FAUX FINISHING	0.0019	0.0020	0.0020
SMAQMD	520-520-9124-0000	9124-OIL BASED MASTIC TEXTURE	0.0014	0.0015	0.0015
SMAQMD	520-520-9126-0000	9126-OIL BASED RUST PREVENTATIVE	0.0337	0.0346	0.0356
SMAQMD	520-520-9131-0000	9131-OIL BASED STAINS - CLEAR/SEMITRANSPARENT	0.1927	0.1981	0.2040
SMAQMD	520-520-9136-0000	9136-OIL BASED STAINS - OPAQUE	0.0537	0.0552	0.0569
SMAQMD	520-520-9141-0000	9141-OIL BASED VARNISH - CLEAR/SEMITRANSPARENT	0.1594	0.1638	0.1687
SMAQMD	520-520-9153-0000	9153-OIL BASED QUICK DRY ENAMEL COATINGS	0.0004	0.0005	0.0005
SMAQMD	520-520-9157-0000	9157-OIL BASED LACQUERS (UNSPECIFIED)	0.0073	0.0075	0.0077
SMAQMD	520-520-9159-0000	9159-OIL BASED FLAT COATINGS	0.0039	0.0040	0.0041
SMAQMD	520-520-9160-0000	9160-OIL BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.0293	0.0301	0.0310
SMAQMD	520-520-9161-0000	9161-OIL BASED HIGH GLOSS NONFLAT COATINGS	0.0112	0.0115	0.0118
SMAQMD	520-520-9164-0000	9164-OIL BASED BITUMINOUS ROOF COATINGS	0.0012	0.0012	0.0013
SMAQMD	520-520-9165-0000	9165-OIL BASED CONCRETE CURING COMPOUNDS	0.0002	0.0002	0.0003
SMAQMD	520-520-9166-0000	9166-OIL BASED DRY FOG COATINGS	0.0001	0.0001	0.0001
SMAQMD	520-520-9169-0000	9169-OIL BASED FLOOR COATINGS	0.0046	0.0048	0.0049
SMAQMD	520-520-9170-0000	9170-OIL BASED FORM RELEASE COATINGS	0.0044	0.0045	0.0046
SMAQMD	520-520-9171-0000	9171-OIL BASED HIGH TEMPERATURE COATINGS	0.0023	0.0023	0.0024
SMAQMD	520-520-9172-0000	9172-OIL BASED INDUSTRIAL MAINTENANCE COATINGS	0.1486	0.1528	0.1574
SMAQMD	520-520-9173-0000	9173-OIL BASED METALLIC PIGMENTED COATINGS	0.0081	0.0083	0.0086
SMAQMD	520-520-9174-0000	9174-OIL BASED ROOF COATINGS	0.0000	0.0000	0.0000
SMAQMD	520-520-9176-0000	9176-OIL BASED TRAFFIC COATINGS	0.0027	0.0027	0.0028
SMAQMD	520-520-9177-0000	9177-OIL BASED WOOD PRESERVATIVES	0.0305	0.0314	0.0323
SMAQMD	520-520-9200-0000	9200-WATER BASED COATINGS (UNSPECIFIED)	0.0537	0.0551	0.0568
SMAQMD	520-520-9205-0000	9205-WATER BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.0809	0.0831	0.0856
SMAQMD	520-520-9206-0000	9206-WATER BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.0008	0.0008	0.0008
SMAQMD	520-520-9208-0000	9208-WATER BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.0010	0.0011	0.0011
SMAQMD	520-520-9209-0000	9209-WATER BASED BITUMINOUS ROOF PRIMER	0.0000	0.0000	0.0000
SMAQMD	520-520-9212-0000	9212-WATER BASED SANDING SEALERS	0.0008	0.0008	0.0008
SMAQMD	520-520-9213-0000	9213-WATER BASED WATERPROOFING SEALERS	0.0162	0.0166	0.0171

District	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
SMAQMD	520-520-9218-0000	9218-WATER BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.0209	0.0214	0.0221
SMAQMD	520-520-9222-0000	9222-WATER BASED FAUX FINISHING	0.0037	0.0038	0.0039
SMAQMD	520-520-9223-0000	9223-WATER BASED FORM RELEASE COMPOUNDS	0.0035	0.0036	0.0037
SMAQMD	520-520-9224-0000	9224-WATER BASED MASTIC TEXTURE	0.0015	0.0016	0.0016
SMAQMD	520-520-9226-0000	9226-WATER BASED RUST PREVENTATIVE	0.0011	0.0012	0.0012
SMAQMD	520-520-9231-0000	9231-WATER BASED STAINS - CLEAR/SEMITRANSPARENT	0.0036	0.0037	0.0038
SMAQMD	520-520-9236-0000	9236-WATER BASED STAINS - OPAQUE	0.0133	0.0137	0.0141
SMAQMD	520-520-9241-0000	9241-WATER BASED VARNISHES - CLEAR/SEMITRANSPARENT	0.0274	0.0282	0.0290
SMAQMD	520-520-9257-0000	9257-WATER BASED LACQUERS (UNSPECIFIED)	0.0027	0.0028	0.0029
SMAQMD	520-520-9259-0000	9259-WATER BASED FLAT COATINGS	0.1114	0.1145	0.1179
SMAQMD	520-520-9260-0000	9260-WATER BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.1395	0.1434	0.1476
SMAQMD	520-520-9261-0000	9261-WATER BASED HIGH GLOSS NONFLAT COATINGS	0.0148	0.0152	0.0156
SMAQMD	520-520-9264-0000	9264-WATER BASED BITUMINOUS ROOF COATINGS	0.0231	0.0237	0.0245
SMAQMD	520-520-9265-0000	9265-WATER BASED CONCRETE CURING COMPOUNDS	0.0520	0.0535	0.0551
SMAQMD	520-520-9266-0000	9266-WATER BASED DRY FOG COATINGS	0.0035	0.0035	0.0037
SMAQMD	520-520-9269-0000	9269-WATER BASED FLOOR COATINGS	0.0072	0.0074	0.0076
SMAQMD	520-520-9272-0000	9272-WATER BASED INDUSTRIAL MAINTENANCE COATINGS	0.0196	0.0201	0.0207
SMAQMD	520-520-9273-0000	9273-WATER BASED METALLIC PIGMENTED COATINGS	0.0000	0.0000	0.0000
SMAQMD	520-520-9274-0000	9274-WATER BASED ROOF COATINGS	0.0003	0.0004	0.0004
SMAQMD	520-520-9276-0000	9276-WATER BASED TRAFFIC COATINGS	0.0254	0.0261	0.0269
SMAQMD	520-520-9277-0000	9277-WATER BASED WOOD PRESERVATIVES	0.0002	0.0002	0.0002
SMAQMD	520-520-9281-0000	9281-COLORANT - EXCLUDING IM COATINGS (50 G/L)	0.0450	0.0450	0.0450
SMAQMD	520-520-9282-0000	9282-COLORANT - SOLVENT BASED IM COATINGS	0.0060	0.0060	0.0060
		Total	1.5228	1.5638	1.6090

E.2.10. YSAQMD Emission Inventory –Year 2028, 2031, 2035

	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
YSAQMD	520-520-9100-0000	9100-OIL BASED (ORGANIC SOLVENT BASED) COATINGS (UNSPECIFIED)	0.0038	0.0039	0.0040
YSAQMD	520-520-9105-0000	9105-OIL BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.0004	0.0004	0.0005
YSAQMD	520-520-9106-0000	9106-OIL BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.0000	0.0000	0.0001
YSAQMD	520-520-9108-0000	9108-OIL BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.0020	0.0021	0.0022
YSAQMD	520-520-9109-0000	9109-OIL BASED BITUMINOUS ROOF PRIMER	0.0013	0.0014	0.0014
YSAQMD	520-520-9112-0000	9112-OIL BASED SANDING SEALERS	0.0003	0.0003	0.0003
YSAQMD	520-520-9113-0000	9113-OIL BASED WATERPROOFING SEALERS	0.0101	0.0104	0.0107
YSAQMD	520-520-9118-0000	9118-OIL BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.0155	0.0159	0.0164
YSAQMD	520-520-9122-0000	9122-OIL BASED FAUX FINISHING	0.0004	0.0005	0.0005
YSAQMD	520-520-9124-0000	9124-OIL BASED MASTIC TEXTURE	0.0003	0.0003	0.0003
YSAQMD	520-520-9126-0000	9126-OIL BASED RUST PREVENTATIVE	0.0077	0.0079	0.0082
YSAQMD	520-520-9131-0000	9131-OIL BASED STAINS - CLEAR/SEMITRANSPARENT	0.0442	0.0453	0.0468
YSAQMD	520-520-9136-0000	9136-OIL BASED STAINS - OPAQUE	0.0123	0.0126	0.0131
YSAQMD	520-520-9141-0000	9141-OIL BASED VARNISH - CLEAR/SEMITRANSPARENT	0.0366	0.0375	0.0387
YSAQMD	520-520-9153-0000	9153-OIL BASED QUICK DRY ENAMEL COATINGS	0.0001	0.0001	0.0001
YSAQMD	520-520-9157-0000	9157-OIL BASED LACQUERS (UNSPECIFIED)	0.0017	0.0017	0.0018
YSAQMD	520-520-9159-0000	9159-OIL BASED FLAT COATINGS	0.0009	0.0009	0.0009
YSAQMD	520-520-9160-0000	9160-OIL BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.0067	0.0069	0.0071
YSAQMD	520-520-9161-0000	9161-OIL BASED HIGH GLOSS NONFLAT COATINGS	0.0026	0.0026	0.0027
YSAQMD	520-520-9164-0000	9164-OIL BASED BITUMINOUS ROOF COATINGS	0.0003	0.0003	0.0003
YSAQMD	520-520-9165-0000	9165-OIL BASED CONCRETE CURING COMPOUNDS	0.0001	0.0001	0.0001
YSAQMD	520-520-9166-0000	9166-OIL BASED DRY FOG COATINGS	0.0000	0.0000	0.0000
YSAQMD	520-520-9169-0000	9169-OIL BASED FLOOR COATINGS	0.0011	0.0011	0.0011
YSAQMD	520-520-9170-0000	9170-OIL BASED FORM RELEASE COATINGS	0.0010	0.0010	0.0011
YSAQMD	520-520-9171-0000	9171-OIL BASED HIGH TEMPERATURE COATINGS	0.0005	0.0005	0.0006
YSAQMD	520-520-9172-0000	9172-OIL BASED INDUSTRIAL MAINTENANCE COATINGS	0.0341	0.0350	0.0361
YSAQMD	520-520-9173-0000	9173-OIL BASED METALLIC PIGMENTED COATINGS	0.0019	0.0019	0.0020
YSAQMD	520-520-9174-0000	9174-OIL BASED ROOF COATINGS	0.0000	0.0000	0.0000
YSAQMD	520-520-9176-0000	9176-OIL BASED TRAFFIC COATINGS	0.0006	0.0006	0.0006
YSAQMD	520-520-9177-0000	9177-OIL BASED WOOD PRESERVATIVES	0.0070	0.0072	0.0074
YSAQMD	520-520-9200-0000	9200-WATER BASED COATINGS (UNSPECIFIED)	0.0123	0.0126	0.0130

	EIC codes	Description	VOC Emission Inventory for Contingency Measure (tpd)		
			2028	2031	2035
YSAQMD	520-520-9205-0000	9205-WATER BASED PRIMERS_SEALERS_AND_UNDERCOATERS	0.0186	0.0190	0.0197
YSAQMD	520-520-9206-0000	9206-WATER BASED QUICK DRY PRIMERS_SEALERS_AND_UNDERCOATERS	0.0002	0.0002	0.0002
YSAQMD	520-520-9208-0000	9208-WATER BASED SPECIALTY PRIMER_SEALER_AND_UNDERCOATER	0.0002	0.0002	0.0003
YSAQMD	520-520-9209-0000	9209-WATER BASED BITUMINOUS ROOF PRIMER	0.0000	0.0000	0.0000
YSAQMD	520-520-9212-0000	9212-WATER BASED SANDING SEALERS	0.0002	0.0002	0.0002
YSAQMD	520-520-9213-0000	9213-WATER BASED WATERPROOFING SEALERS	0.0037	0.0038	0.0039
YSAQMD	520-520-9218-0000	9218-WATER BASED WATERPROOFING CONCRETE/MASONRY SEALERS	0.0048	0.0049	0.0051
YSAQMD	520-520-9222-0000	9222-WATER BASED FAUX FINISHING	0.0008	0.0009	0.0009
YSAQMD	520-520-9223-0000	9223-WATER BASED FORM RELEASE COMPOUNDS	0.0008	0.0008	0.0009
YSAQMD	520-520-9224-0000	9224-WATER BASED MASTIC TEXTURE	0.0004	0.0004	0.0004
YSAQMD	520-520-9226-0000	9226-WATER BASED RUST PREVENTATIVE	0.0003	0.0003	0.0003
YSAQMD	520-520-9231-0000	9231-WATER BASED STAINS - CLEAR/SEMITRANSPARENT	0.0008	0.0008	0.0009
YSAQMD	520-520-9236-0000	9236-WATER BASED STAINS - OPAQUE	0.0031	0.0031	0.0032
YSAQMD	520-520-9241-0000	9241-WATER BASED VARNISHES - CLEAR/SEMITRANSPARENT	0.0063	0.0064	0.0067
YSAQMD	520-520-9257-0000	9257-WATER BASED LACQUERS (UNSPECIFIED)	0.0006	0.0006	0.0007
YSAQMD	520-520-9259-0000	9259-WATER BASED FLAT COATINGS	0.0256	0.0262	0.0271
YSAQMD	520-520-9260-0000	9260-WATER BASED NONFLAT - LOW GLOSS/MEDIUM GLOSS	0.0320	0.0328	0.0339
YSAQMD	520-520-9261-0000	9261-WATER BASED HIGH GLOSS NONFLAT COATINGS	0.0034	0.0035	0.0036
YSAQMD	520-520-9264-0000	9264-WATER BASED BITUMINOUS ROOF COATINGS	0.0053	0.0054	0.0056
YSAQMD	520-520-9265-0000	9265-WATER BASED CONCRETE CURING COMPOUNDS	0.0119	0.0122	0.0126
YSAQMD	520-520-9266-0000	9266-WATER BASED DRY FOG COATINGS	0.0008	0.0008	0.0008
YSAQMD	520-520-9269-0000	9269-WATER BASED FLOOR COATINGS	0.0017	0.0017	0.0018
YSAQMD	520-520-9272-0000	9272-WATER BASED INDUSTRIAL MAINTENANCE COATINGS	0.0045	0.0046	0.0048
YSAQMD	520-520-9273-0000	9273-WATER BASED METALLIC PIGMENTED COATINGS	0.0000	0.0000	0.0000
YSAQMD	520-520-9274-0000	9274-WATER BASED ROOF COATINGS	0.0001	0.0001	0.0001
YSAQMD	520-520-9276-0000	9276-WATER BASED TRAFFIC COATINGS	0.0058	0.0060	0.0062
YSAQMD	520-520-9277-0000	9277-WATER BASED WOOD PRESERVATIVES	0.0000	0.0001	0.0001
YSAQMD	520-520-9281-0000	9281-COLORANT - EXCLUDING IM COATINGS (50 G/L)	0.0105	0.0105	0.0105
YSAQMD	520-520-9282-0000	9282-COLORANT - SOLVENT BASED IM COATINGS	0.0014	0.0014	0.0014
		Total	0.3498	0.3582	0.3696

E.2.11. Technological And Economic Feasibility

The technological and economic feasibility for the architectural contingency measure can be considered when determining the timeline for emission reductions. Coatings that comply with the 2019 SCM are already available. The cost effectiveness of the 2019 SCM was estimated by CARB to be $1.85 per pound of VOC reduced ($3,700 per ton) in 2019 dollars. This estimate can now be considered a conservative upper bound because manufacturers have already developed coatings for sale in South Coast Air Quality Management District and other air districts that have adopted the SCM limits.

In the draft contingency measures guidance, EPA provides additional interpretation of the Clean Air Act requirements for contingency measures that allow for emissions reductions to occur within two years from the triggering event. To meet the draft contingency measure timeline requirements and to allow coating manufacturers, distributors and retail outlets time to comply, a one-year sell-through period is being proposed, starting 60 days after the contingency measure is triggered. This compliance timeline is necessary to begin achieving emission reductions in the second year after the triggering event. In the event that the contingency measure triggers, the districts of the SFNA will conduct public outreach prior to the 60-day trigger implementing the requirements.

E.2.12. Adoption Schedule

The contingency measures will be implemented by amending the architectural coating rules of each district. Each air district will take its amended rule to its respective air district board for adoption by the proposed adoption deadline shown in Table E-5. Once adopted, each district will submit its contingency measure to CARB and EPA for review and approval.

Table E-5: Contingency Measure Adoption Deadlines

District	Rule	Deadline
EDAQMD	215	May 2024
FRAQMD	3.15	June 2024
PCAPCD	218	May 2024
SMAQMD	442	May 2024
YSAQMD	2.14	May 2024

E.2.13. Conclusion

The SFNA districts are proposing commitments to amend the identified architectural coating rules as contingency measures to be submitted as part of the 2015 SFNA Ozone SIP.

E.2.14. References

CARB. *2019 California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings.* Sacramento, CA. May [2019]. < https://ww2.arb.ca.gov/sites/default/files/2020-05/10602_scm_final.pdf >

---. *Staff Report for Proposed Updates to the Suggested Control Measure for Architectural Coatings.* Sacramento, CA. 19 April [2019]. < https://ww2.arb.ca.gov/sites/default/files/2020-06/Staff_Report_4-19-2019_complete_remediated.pdf >

EPA, *Draft: Guidance on the Preparation of State Implementation Plan Provisions that Address the Nonattainment Area Contingency Measure Requirements for Ozone and Particulate Matter.* Research Triangle Park, NC. Office of Air Quality Planning and Standards. 16 March [2023]. < https://www.federalregister.gov/documents/2023/03/23/2023-06010/draft-guidance-on-the-preparation-of-state-implementation-plan-provisions-that-address-the >

APPENDIX F
Weight of Evidence (WOE)

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F. Weight of Evidence (WOE)

F.1. Introduction

The air districts of the Sacramento Federal Ozone Nonattainment Area (SFNA) are the Sacramento Metropolitan Air Quality Management District (SMAQMD), Yolo-Solano Air Quality Management District (YSAQMD), Placer County Air Pollution Control District (PCAPCD), El Dorado County Air Quality Management District (EDCAQMD), and Feather River Air Quality Management District (FRAQMD). Each district manages the part of the nonattainment area that lies within its jurisdiction. Because the area could not meet the attainment date for the serious classification, as part of this State Implementation Plan (SIP), the SFNA air districts requested to voluntarily reclassify to a severe nonattainment area for the 0.070 parts per million (ppm) federal 8-hour ozone standard (0.070 ppm standard) with a 2032 attainment deadline (CARB, 2022). For areas classified as moderate nonattainment or above, photochemical modeling is a required element of the SIP to ensure that existing and planned control strategies provide the reductions needed to meet the 0.070 ppm standard by the attainment deadline.

To address the uncertainties inherent to modeling assessments, the United States Environmental Protection Agency (EPA) guidance, *Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone,* $PM_{2.5}$*, and Regional Haze (EPA, 2018),* recommends that supplemental analyses accompany all modeled attainment demonstrations. Accordingly, to supplement the regional photochemical modeling analyses, the SFNA air districts and California Air Resources Board (CARB) prepared the following Weight of Evidence (WOE) demonstration, which includes area description, a conceptual model with detailed analyses of anthropogenic emissions, monitored ambient ozone data and concentration trends, and population exposure trends. Analyses of the number of exceedances on weekends versus weekdays and meteorological patterns coincidence with elevated ozone in three subregions within the SFNA are also presented.

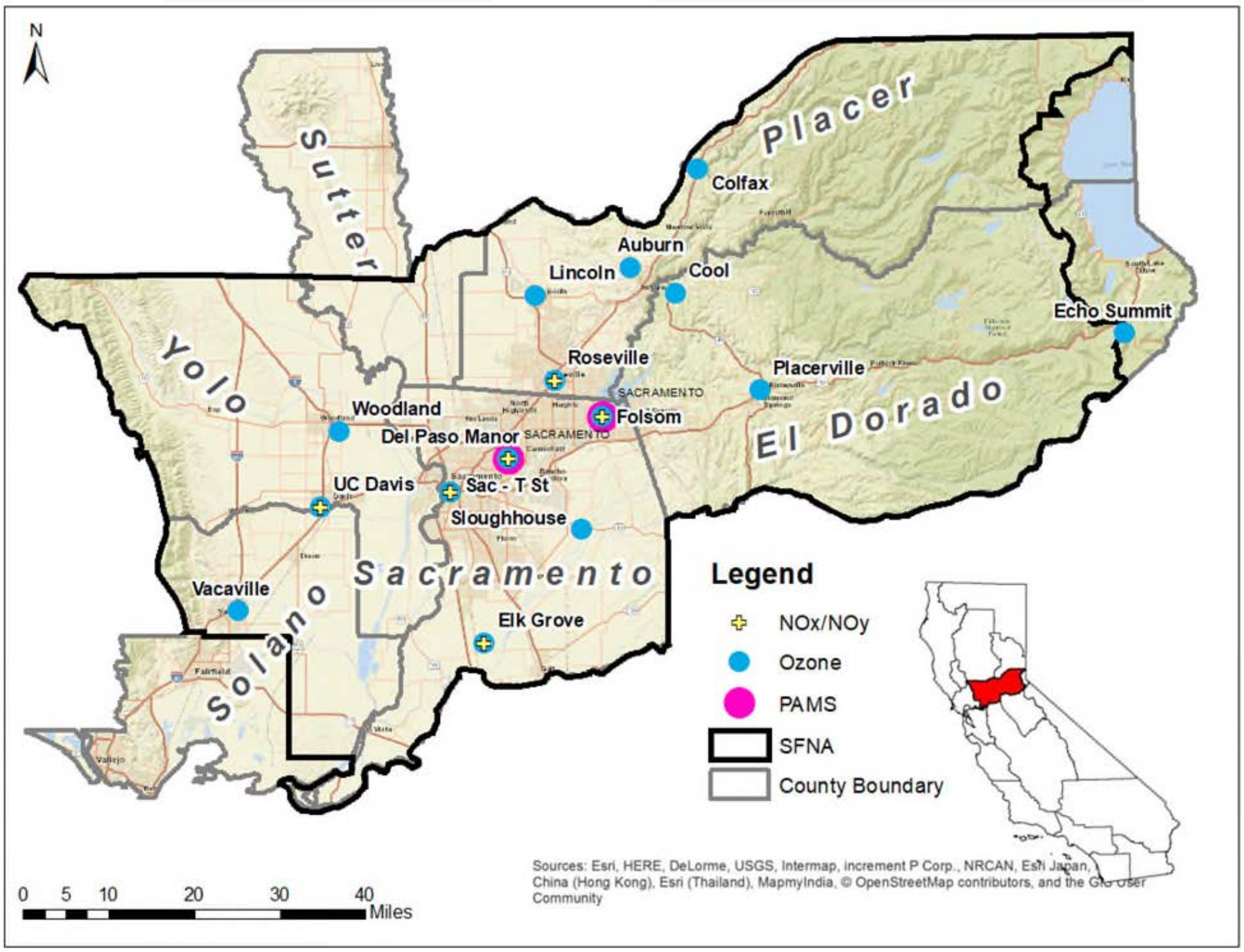
In 2021, as shown in Table F-1, data indicate that 6 out of 16 monitoring sites in the SFNA were in attainment with the 0.070 ppm standard and the design values exceeded the 0.070 ppm standard at the remaining monitoring sites by 1 to 17 percent. Photochemical modeling analyses conducted by the CARB demonstrate that control measures currently in place and the proposed measures in the 2022 State SIP Strategy are adequate for all sites in the SFNA to meet the 0.070 ppm standard by the 2032 attainment deadline.

Analyses of air quality data from the past 22 years show that progress is being made at all monitoring sites in the Sacramento region. However, the extent of progress varies considerably by site and by indicator. The presence of varied terrain, persistent summertime climatological patterns, and diverse precursor emission sources highlights the complex nature of the ozone problem in the SFNA and underscores the utility of examining multiple indicators.

F.2. Area Description

The SFNA encompasses all of Sacramento and Yolo Counties; the northeastern half of Solano County, the southern portion of Sutter County, and large portions of Placer and El Dorado Counties on the eastern side of the region (Figure F-1[1]). Topographically, the SFNA is located at the southern end of the north-to-south running Sacramento Valley and stretches from the Coastal Range Mountains in the west to the crest of the Sierra Nevada Mountains in the east. The SFNA encompasses an area of nearly 7,000 square miles, with elevations ranging from near sea level in the southwestern Sacramento River Delta (the Delta) portion of the region to over 7,000 feet above sea level in the east.

Figure F-1 Location of Monitoring Sites in the SFNA as of 2021



The SFNA is home to nearly 2.5 million people, based on the 2020 U.S. Census, and is located at the intersection of three major highways in northern California, namely Interstate 80, Interstate 5, and State Route 99. Consequently, the movement of goods and people is a significant source of emissions in the region. As shown in Figure F-1, the

[1] Figures F-1 and F-2 display monitoring stations that were active.

SFNA hosts a few major freeways to accommodate the millions of vehicle miles driven in the region each year.

Beyond the developed city areas within the SFNA, a large portion of the area contains substantial agricultural operations consisting of numerous crop types that use a wide range of fossil-fueled equipment throughout the year. Much of the undeveloped land area also allows for off-road recreation vehicle use, while the numerous lakes and rivers allow for the use of motorboats.

Most of the population and anthropogenic emissions are concentrated in the central portion of the SFNA, which is bounded by mountains on two sides. In addition, semi-permanent high-pressure systems over the eastern Pacific Ocean and western U.S. lead to stable weather patterns, sunny skies, and limited wind flow during the late spring, summer, and early fall months. These conditions are highly conducive to the accumulation of emissions and subsequent photochemical production of ozone. A regional, thermally driven sea breeze pattern between the Pacific Ocean and Sacramento also promotes a large gradient in ozone concentrations across the SFNA. The lowest concentrations are typically measured at the upwind sites on the western and southwestern side of the region and the highest concentrations are typically measured in eastern Sacramento County and at the foothill sites in El Dorado and Placer Counties. To characterize ozone air quality, CARB, SMAQMD, YSAQMD, and PCAPCD share monitoring responsibilities across the SFNA through the operation of an extensive monitoring network that included 16 ozone monitoring sites in 2021. These monitoring sites are shown in Figure F-1 and listed in Table F-1.

Because the SFNA consists of distinct topographic features; a varied distribution of population; and a predominant wind flow direction from southwest to northeast in the summer months, it is logical to subdivide the SFNA for analytical and discussion purposes as shown in Figure F-2.

F.3. Conceptual Model

Local anthropogenic emissions, varied terrain, and favorable meteorological conditions for the formation of ozone contribute to the ozone air quality challenges in the SFNA.

F.3.1. Emissions

Ozone is a secondary pollutant that is produced in the atmosphere through a complex series of photochemical reactions involving oxides of nitrogen (NO_X) and reactive organic gases (ROG). The concentrated population in the central portion of the SFNA, the extensive use of automobiles and agricultural equipment, and the availability of biogenic ROG produced by plants and trees in the foothills of the eastern portion of the region provide a setting in which the suite of anthropogenic emissions and biogenic emissions is quite favorable for ozone formation.

Table F-1 Recent Ozone Design Values at Sites in the SFNA

	Site Name	AQS ID	County	2021 Design Value (ppm)	Percent of 0.070 ppm Standard	2021 Design Value Meets Standard
Western	Elk Grove-Bruceville Rd.	060670011	SAC	0.070	100%	Yes
	Vacaville-Ulatis Dr.*	060953003	SOL	0.065	93%	Yes
	Davis-UCD Campus	061130004	YOL	0.065	93%	Yes
	Woodland-Gibson Rd.	061131003	YOL	0.067	96%	Yes
Central	Roseville-N Sunrise Ave.	060610006	PLA	0.070	100%	Yes
	Lincoln-Moore Rd.*	060612002	PLA	0.075	107%	No
	North Highlands-Blackfoot Way[1]	060670002	SAC	0.071	101%	No
	Sacramento-Del Paso Manor	060670006	SAC	0.075	107%	No
	Sacramento- T St.	060670010	SAC	0.066	94%	Yes
	Folsom-Natoma St.[2]	060670012	SAC	n/a	n/a	n/a
	Sloughhouse	060675003	SAC	0.071	101%	No
Eastern	Auburn-Atwood Rd.*	060610003	PLA	0.082	117%	No
	Colfax-City Hall	060610004	PLA	0.076	109%	No
	Placerville-Gold Nugget Way	060170010	ELD	0.077	110%	No
	Echo Summit (seasonal)[3]	060170012	ELD	0.071	101%	No
	Cool (seasonal)	060170020	ELD	0.076	109%	No

* Some of the monitoring sites were combined in this document as follows:
- Vacaville-Elmira Rd. (2001-2003) and Vacaville-Ulatis Dr. (2003- present)
- Lincoln-L St. (2012), Lincoln-1445 1st St. (2012-2017) and Lincoln-Moore Rd. (2018-present)
- Auburn-Dewitt Ave. (2001-2011) and Auburn-Atwood Rd. (2011- present)

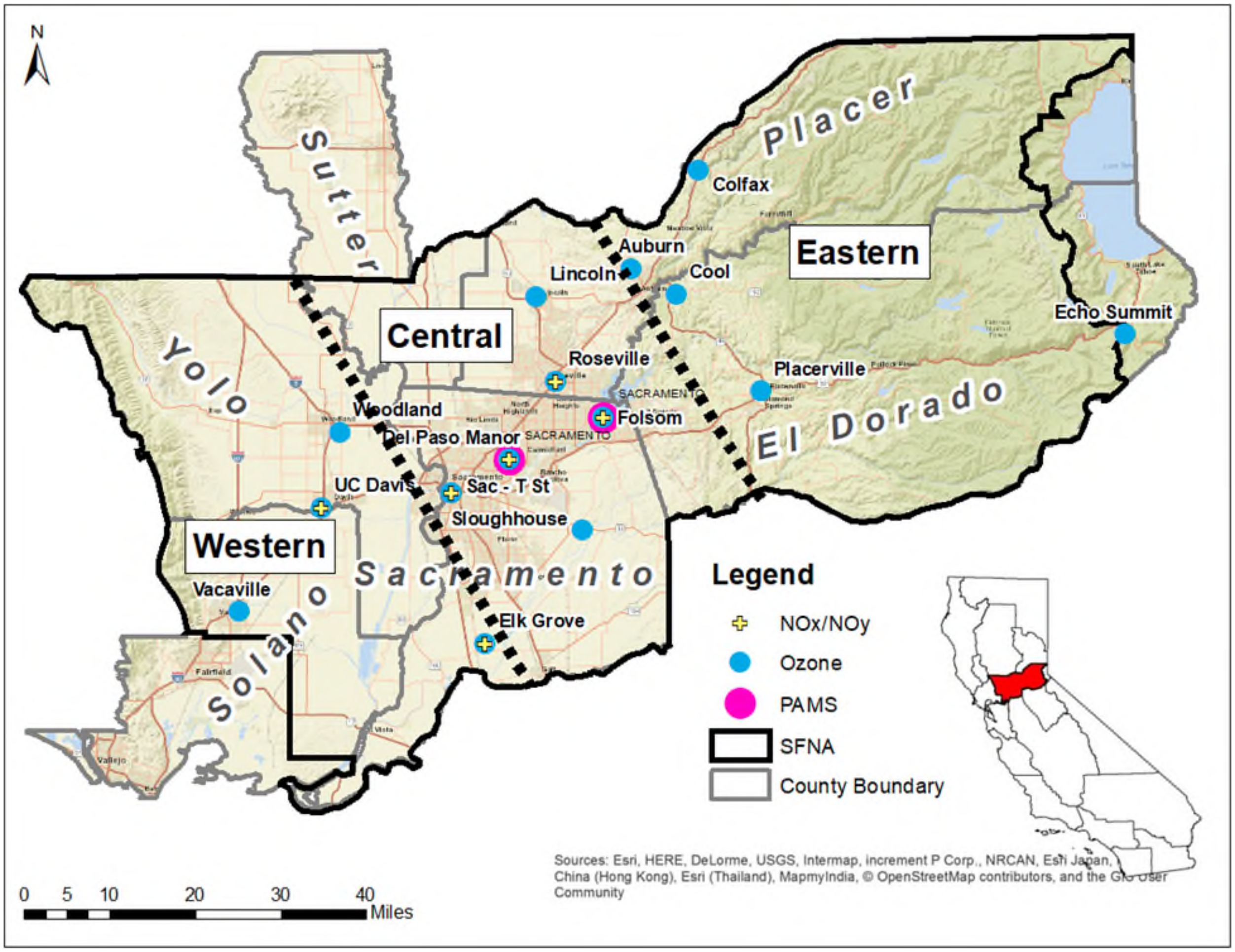
1 North Highlands-Blackfoot Way site closed in July 2022

2 Folsom-Natoma St. was shut down on 7/22/2019 for renovation; operations resumed on12/10/2020

3 Echo Summit did not operate in 2015-2017

Note: Sacramento-Airport Rd. site operated during 2001-2008 and Sacramento-Goldenland Ct. site operated during 2008-2017. They are not included in this table.

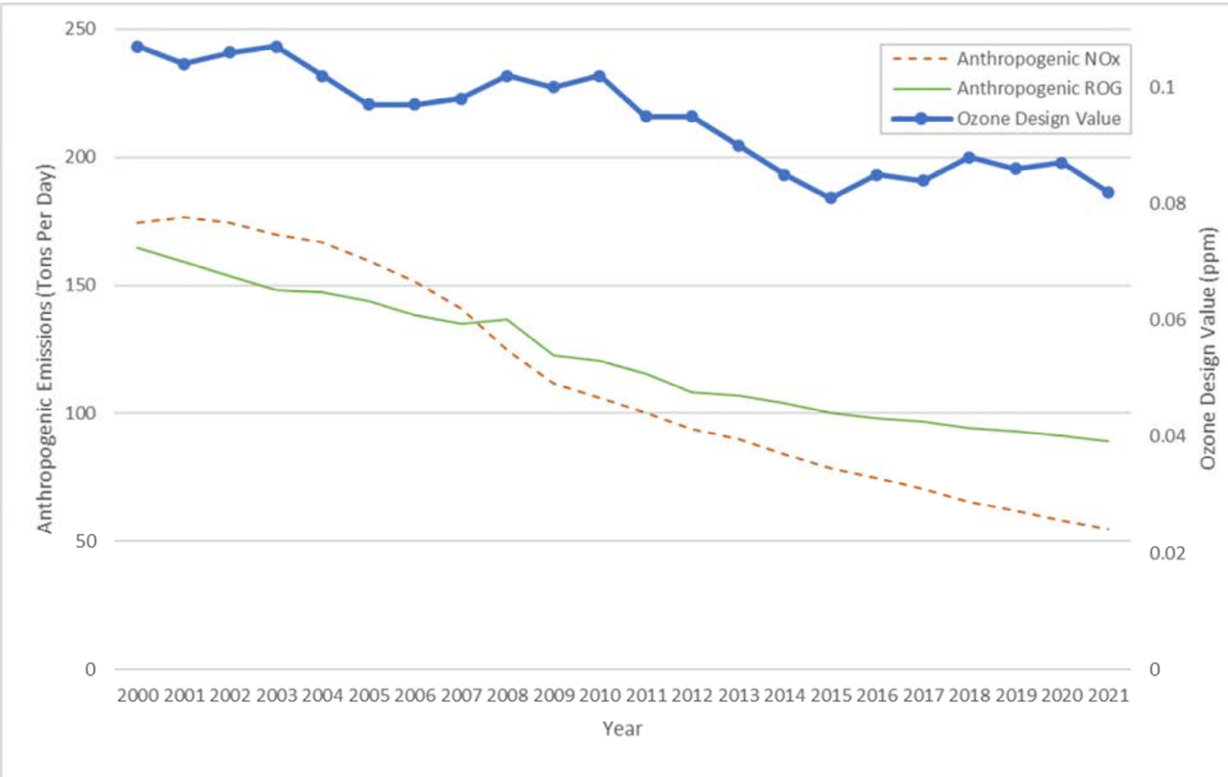
Figure F-2 Map of Subregions within the SFNA



Anthropogenic ozone precursors in the SFNA are largely derived from mobile source emissions, which include passenger vehicles, heavy-duty diesel trucks, recreational boats, and off-road and agricultural equipment, as well as consumer products, which include hair spray, personal fragrance, and all-purpose cleaners. Stationary sources are scattered throughout the SFNA, and all but a few are classified as minor sources. Controlling emissions in the SFNA demands a coordinated, multi-faceted approach at the local, state, and federal levels.

A combination of federal, state, and local emission control programs has significantly reduced emissions in the SFNA during the past 22 years. As shown in Figure F-3, ozone design values have persistently declined in response to precursor emissions reductions. The SFNA is not typical of most urban areas with high ozone concentrations, which tend to have abundant NO_X emission sources and limited ROG emissions. This region has abundant anthropogenic NO_X emissions and abundant ROG emissions from biogenic sources. Biogenic ROG emissions are more than 1.5 times the anthropogenic ROG emissions in the SFNA during the ozone season (May-October) of 2018. Much of the land in the eastern portion of SFNA consists of forest land that contributes to these biogenic emissions. This mixture of sources, some of which can be controlled (anthropogenic) and others which cannot (biogenic), creates a challenging scenario for reducing ozone concentrations.

Figure F-3 SFNA Precursor Emissions and Ozone Design Values



As the SFNA has progressed towards attainment, the quantity and composition of precursors has changed. In recent years, NO_X has become the primary focus of control efforts. State of the art photochemical modeling assessments are necessary to understand the current and future mechanisms of ozone formation in the SFNA. The most recent modeling indicates that the dominant precursor controlling ozone production is NO_X, which means a NO_X-focused control strategy for the SFNA will be the most influential and effective to achieve the 0.070 ppm standard by the attainment year of 2032.

F.3.2. Meteorology and Complex Terrain

F.3.2.I. Statewide Weather Patterns

The weather throughout most of California is dominated by an extensive area of high pressure over the eastern Pacific Ocean, which generally produces mild weather year-round. Along the California coast, daily sea breezes and a marine layer are common occurrences. Summer days in the inland portions of the State tend to experience clear skies, light winds, cool morning, and warm afternoon temperatures, and limited vertical mixing due to persistent temperature inversions. Occasionally, the Pacific High will weaken or move to the south, allowing the storm track to shift over California, producing cloudy skies, moderate-to-strong winds, rain, and thorough mixing of the atmosphere.

The stormy periods tend to last not more than a few days and typically occur between the months of October and March.

During the transitional spring and fall months, another pattern often develops, lasting for one to three days, which is defined primarily by northerly winds that tend to be strong and gusty. The winds are produced by storm systems passing California to the north and swinging down into the Great Basin, east of California. Under this pattern, skies tend to be clear, and the atmosphere is well mixed, but wind-blown dust, wildland fires, and smoke can be an issue. While these broad, generalized weather patterns are relevant to most of the State, localized weather features and topography play a critical role in the air quality within the SFNA.

F.3.2.II. SFNA Weather Patterns

As previously discussed, the SFNA is directly bounded by mountains to the west and east, and to a lesser extent, to the north at the northern end of the Sacramento Valley by the Cascade Mountains near Redding. The mountain ranges act as large barriers to wind flow in the west-to-east direction and have a profound impact on vertical mixing within the lower levels of the atmosphere and the buildup and transport of air pollution within the SFNA. The terrain constrains air flow within the SFNA to either winds from the south, which flow northward or northeastward from the Delta (Delta breeze), or winds from the north that travel southward through the SFNA toward the Delta. As a result, even under moderate wind speeds, pollutants tend to remain within the SFNA and are transported between the various counties in the nonattainment area. In particular, the Delta breeze weather phenomenon, occurring more prominently from late spring to early fall, transports emissions toward the eastern portion of the SFNA, where the highest ozone concentrations have been observed during the past 22 years.

The Coastal Range on the western side of the SFNA prevents the cooler, humid, ocean air from flowing freely into the region, resulting in hot temperatures in the summer that are conducive to ozone formation. However, the lack of a mountain barrier at the southern end of the region enables ocean air to flow into the Sacramento area via the Carquinez Strait under certain weather patterns, allows for Delta breeze ventilation within the SFNA. Due to the frequent separation of the SFNA from the marine influence and prevailing upper-level high pressure producing general sinking motion and clear skies over California, the SFNA experiences low relative humidity and large diurnal temperature swings during much of the year.

Another key meteorological factor for air quality in the SFNA is the formation of ground-based temperature inversions, which are indicated by temperatures warming with height in the atmosphere rather than the expected cooling with height. Since warmer air is above cooler air in this situation, the atmosphere is very stable, and vertical mixing is limited. In the summer, the inversions extend up to around 1,500 feet above ground level and are typically strong and persistent, preventing vertical mixing on most hot summer days and allowing pollutant concentrations to build underneath them.

During the summer days, pollutant emissions within the SFNA react in plentiful sunlight to form ozone, which becomes trapped under a temperature inversion on most days.

During the afternoons, the light Delta breeze helps mix the atmosphere under the inversion while transporting the emissions and ozone into the eastern portion of the region, where there are fewer fresh NO_X emissions available for breaking down ozone and more ROG from biogenic sources to enhance ozone production. Soon after sundown, the Delta breeze usually weakens and the air in the foothills begins to cool, causing the air to flow back down into the Sacramento area and making the pollutants available for increased ozone formation potential and higher concentrations the next day.

Both wind flow patterns can be observed in Figure F-4, where 24-hour backward trajectories were prepared for 51 days in 2018 through 2020 during which the Placerville-Gold Nugget Way monitor exceeded 0.070 ppm standard (September 12, 2020, is missing due to model data not being available). The trajectories were run at the end height of 500 meters (m) to represent air within the boundary layer and typically below the temperature inversion during hot, stagnant days. The trajectories coming from the southwest are the Delta breeze days and the looping in trajectories to the north and south of Placerville indicate the recirculation pattern along the Sierra Mountains. The trajectories to the north indicate that high ozone concentrations are possible on days with light northerly wind flow as well.

The upslope/downslope recirculation pattern is very pronounced in the Sacramento area and is a key factor during multi-day, high ozone concentration episodes. The recirculation is also a key mechanism in the transport of pollutants such as wildfire smoke from the foothills down into the valley floor during overnight periods. This can be an issue since wildfire smoke can contain large amounts of ozone precursor emissions.

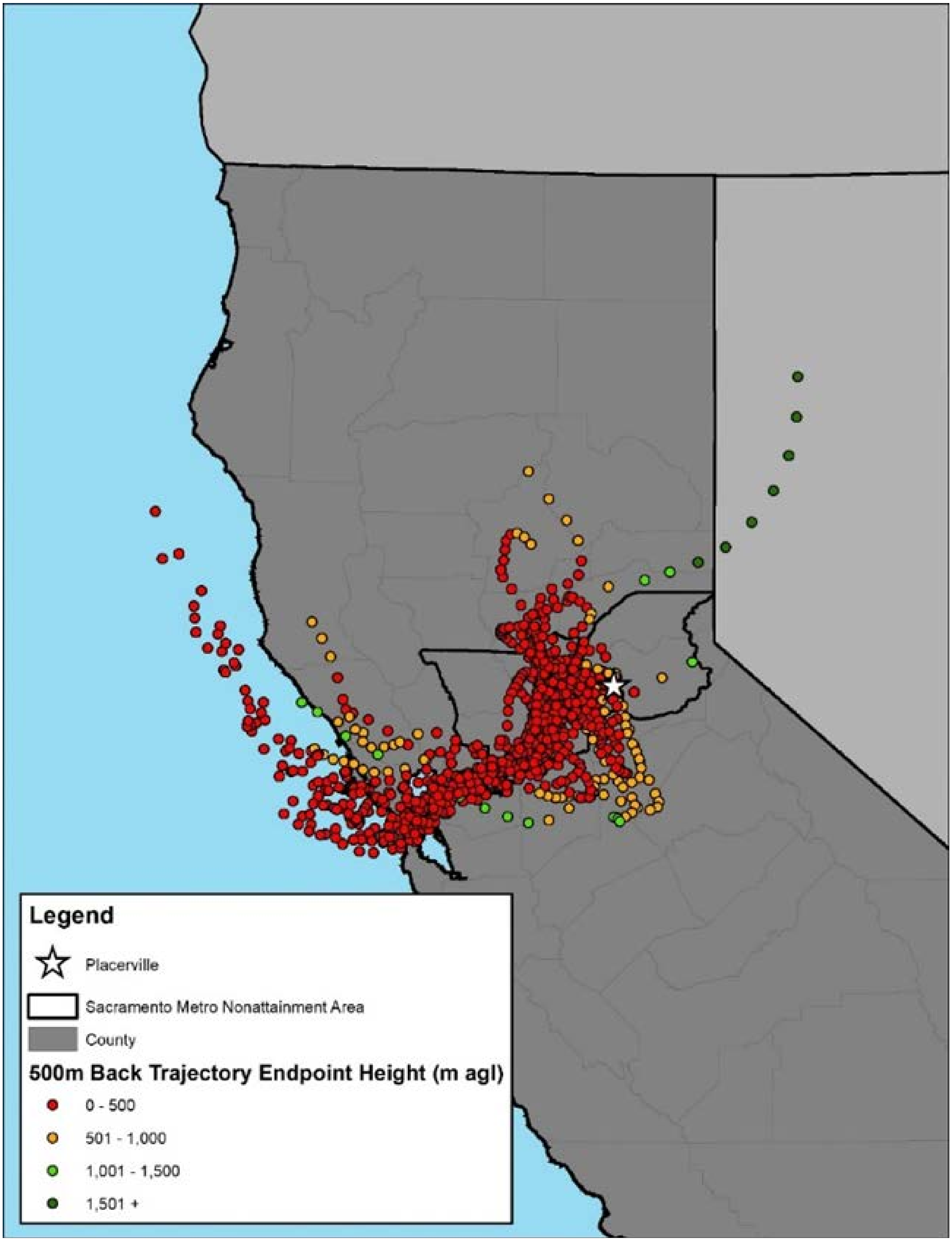
F.3.2.III. Diurnal Ozone Patterns

The diurnal ozone patterns for the three Sacramento subregions are discussed in this section. The typical diurnal (midnight to midnight) pattern in ozone concentrations measured at individual locations provides additional insight into the general processes that contribute to ozone air quality in the SFNA.

Diurnal patterns at monitoring sites in large urban core areas, which are densely populated, are often characterized by narrow periods of peak concentrations coincident with peak solar insolation. Nighttime/early morning minimum concentrations are typically at, or near, zero due to the availability of NO_X for titration, or the breakdown of ozone, thereby suppressing ozone concentrations. In suburban and rural locations, peak concentrations are typically higher than in urban core areas, occur later in the day, and persist for an extended period resulting in a broader peak. The nighttime/early morning minimum concentrations are dependent on each monitoring site’s distance from the urban core and other site characteristics, but do not typically reach zero in suburban/rural areas.

The SFNA is comprised of a few small urban cores and many suburban and rural communities. Therefore, most of the monitoring sites exhibit suburban/rural site characteristics. However, under certain meteorological conditions and emission patterns, even those sites could have short-term, nighttime NO_X concentrations near zero.

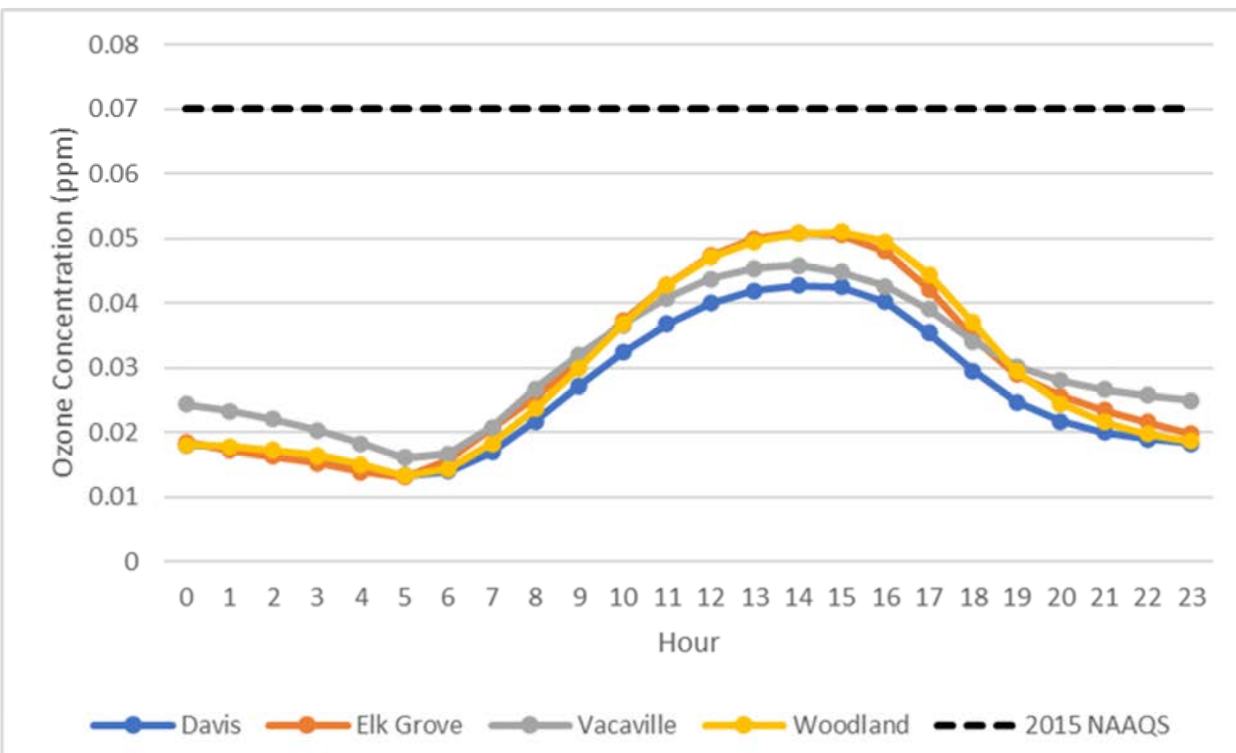
Figure F-4 24-hour Back Trajectories on Ozone Exceedance Days in 2018 through 2020 at the Placerville-Gold Nugget Way Site



In an effort to represent the current state of air quality dynamics in the SFNA, as well as maintain a large sample size to compensate for inter-annual variability, the six-year period of 2016 through 2021 was selected for evaluation. Furthermore, the hourly data were limited to ozone months of May through October for those same years to focus the analyses presented here on periods when high ozone concentrations typically occur.

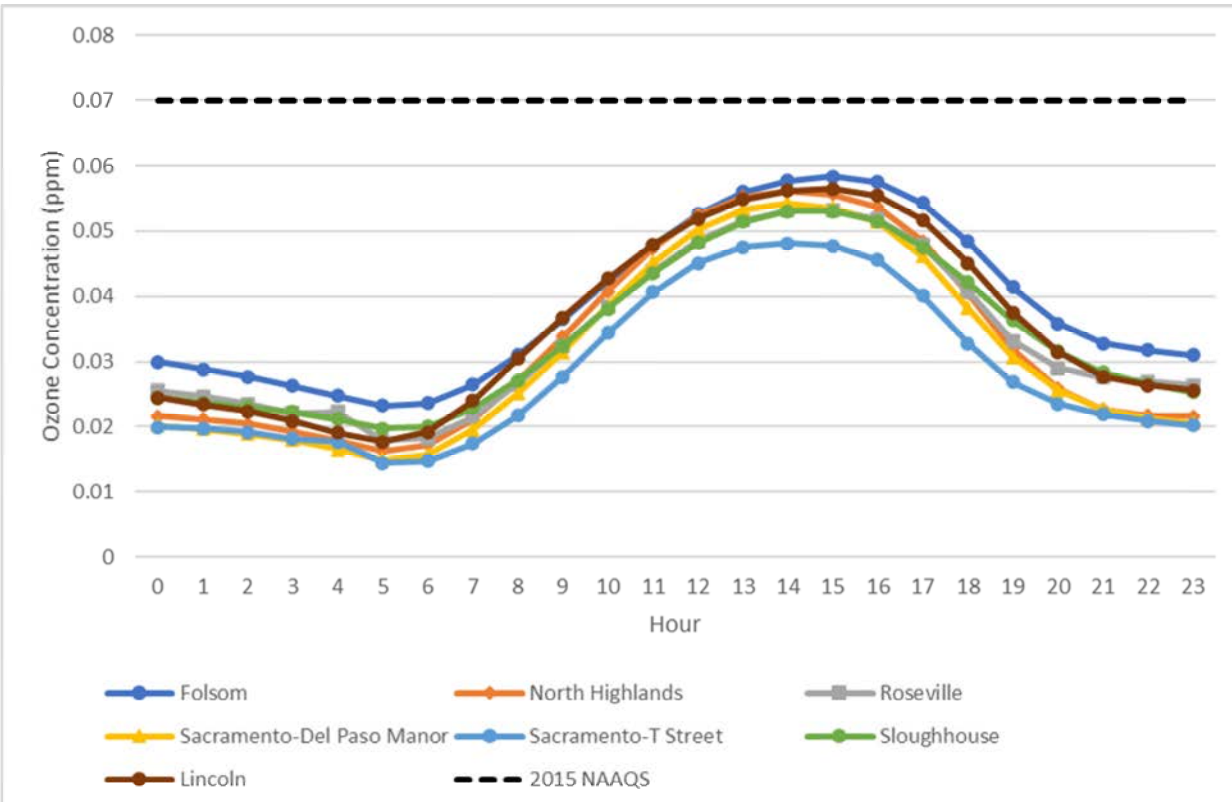
In the western portion of the SFNA, the average diurnal profiles were similar among sites and were characterized by broad peaks between 1400 and 1500 Pacific Standard Time (PST) that included maxima ozone ranging from 0.043 ppm to 0.051 ppm (Figure F-5). Among monitoring sites, the average nighttime minima decreased with distance from the Suisun and San Pablo Bays in the Delta, but remained above zero, on average, at all sites. The western subregion is largely rural with isolated suburban centers and the overall profile of the peaks is somewhat broad, as expected for non-urban core locations. Due to the western subregion's proximity to the coastal bays and limited emission sources, more frequent Delta breezes suppress peak temperatures and disperse pollutants, limiting ozone buildup. It also shows that the further inland sites have relatively higher peaks, indicating the contribution of ozone precursor emissions from the Bay Area to ozone formation in the downwind Sacramento Area.

Figure F-5 Average Diurnal Profiles for 1-Hour Ozone Concentrations at Western Subregion Sites (May-October 2016-2021)



In the central portion of the SFNA, the average diurnal profiles were generally similar among sites and were characterized by broad peaks between 1300 and 1600 PST that included maxima ozone ranging from 0.048 ppm to 0.058 ppm (Figure F-6). Among monitoring sites, the average nighttime minima increased with distance from the Delta region but remained above zero at all sites. In addition, the large Sacramento urban and suburban area were characterized by a profile of lower ozone peaks on the western edge and higher, time-delayed peaks in the north and northeastern portion. This spatial distribution is borne out by Sacramento-T Street's (western edge) peak ozone concentration of 0.048 ppm, North Highlands' (to the north) peak ozone of 0.056 ppm, Roseville's (to the northeast) peak ozone of 0.053 ppm, and Folsom's (to the northeast) peak ozone of 0.058 ppm.

Figure F-6 Average Diurnal Profiles for 1-Hour Ozone Concentrations at Central Subregion Sites (May-October 2016-2021)

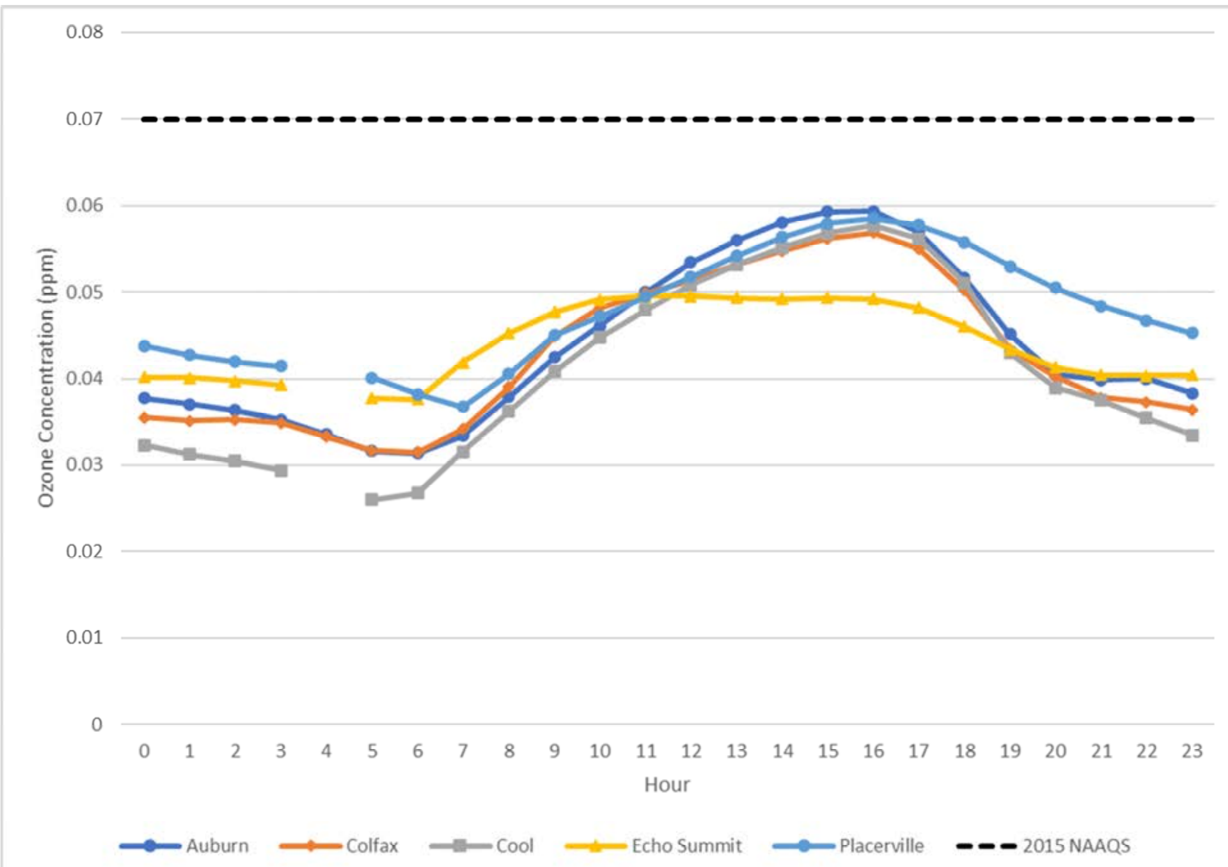


The increasing ozone concentrations from the western edge to the northeastern portion of this subregion demonstrate the role of meteorology in the diurnal ozone cycle. The daily summertime Carquinez to Sacramento Valley Delta breeze transports the region's highest ozone precursor emissions, located within Sacramento's central business district, to the north and east. Additional emissions along the urban transport path enhance the downwind ozone concentrations. Finally, ozone concentrations are enhanced by higher temperatures downwind due to the greater distance from the moderating effect of the ocean, coastal bays, and Delta, as well as substantial biogenic ROG emissions associated with the foothills on the eastern side, which increase as temperature increases.

In the eastern portion of the SFNA, the diurnal profiles differ from those in the other two subregions. The eastern sites were characterized by very broad peaks between 1400 and

1600 PST and included maximum ozone concentrations ranging from 0.049 ppm to 0.059 ppm (Figure F-7). In addition, they were characterized by slower growing mid-day profiles than the central subregion sites. Among the eastern sites, the average nighttime minimum increased with distance downwind of Sacramento on the Highway 50 corridor (Placerville and Echo Summit), while remaining flat along the I-80 corridor (Auburn, Cool, and Colfax). The nighttime minimum remained above zero, on average, at all sites. The mid-afternoon peak profiles were characteristic of downwind rural areas impacted by ozone transport and highlight the significant role of transport within the SFNA.

Figure F-7 Average Diurnal Profiles for 1-Hour Ozone Concentrations at Eastern Subregion Sites (May-October 2016-2021)

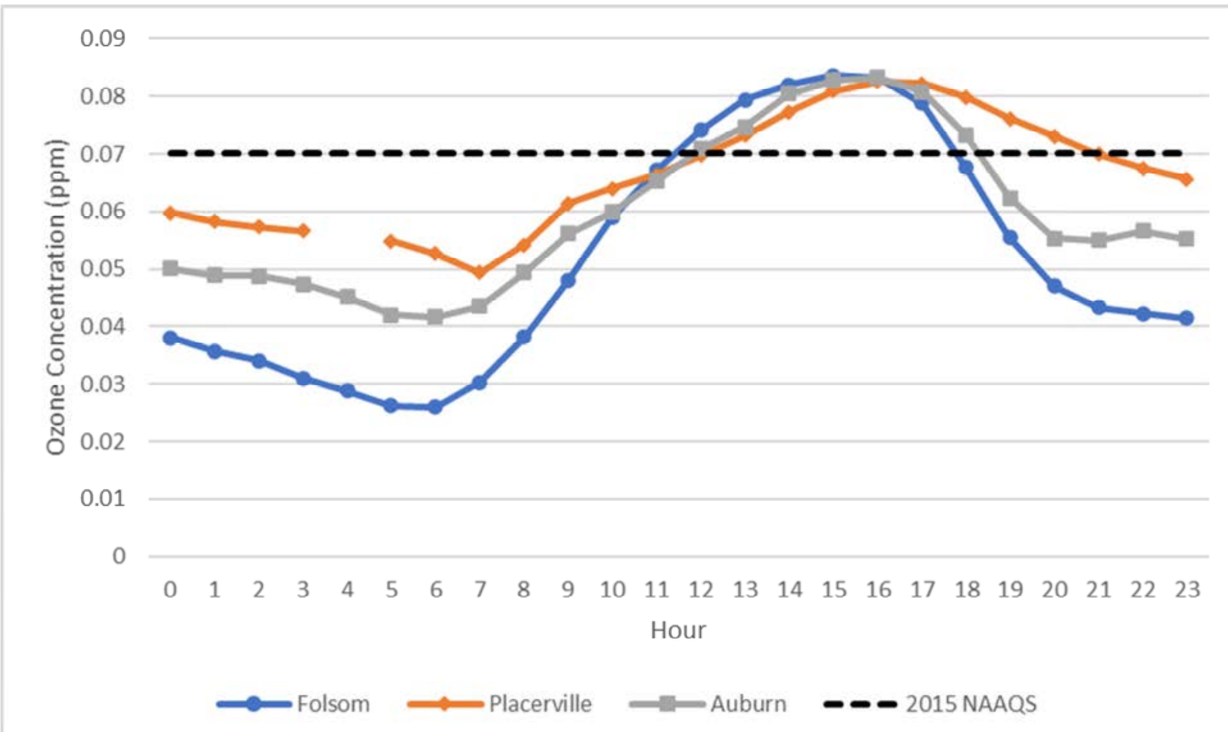


Note: Invalidated data at Auburn and Colfax Stations in 2016 to 2018 were used to calculate the average diurnal concentrations. More information on these data can be found in Section 6.1.I.

The average diurnal profiles were consistent among sites, except for Echo Summit, which exhibits much lower ozone concentrations and a very broad peak compared to the other sites in the subregion. This result is largely due to the site's location far downwind of urban and suburban areas at a relatively high elevation of 7,382 feet. The Echo Summit site is closer in proximity to the Lake Tahoe Air Basin and was sited to intercept transport entering the Lake Tahoe Air Basin.

The central and eastern subregion monitoring sites of Folsom, Placerville, and Auburn, in particular, pose a key challenge for attainment due to their high late night/early morning ozone concentrations, especially at Placerville, and the number of hours that ozone concentrations frequently persist above the 0.070 ppm standard on high ozone days (Figure F-8). All three sites have six or more hours with ozone concentrations above 0.070 ppm, which will need to be reduced for these sites to attain the standard. Folsom, the previous design site from 2003-2014, has seen a much more rapid decline in design values than Placerville and Auburn. (Design value trends are discussed later in this document). Due to the rapid progress at Folsom, either Placerville or Auburn has been the design site since 2015 and is anticipated to remain among the highest ozone sites in the SFNA as the area approaches attainment.

Figure F-8 Average Diurnal Profiles for 1-Hour Ozone Concentrations at Folsom, Auburn, and Placerville on Days with Peak 8-Hour Ozone Concentrations > 0.070 ppm (May-October 2016-2021)



Note: Invalidated data at the Auburn Station in 2016 to 2018 were used to calculate the average diurnal concentrations. More information on these data can be found in Section 6.1.I.

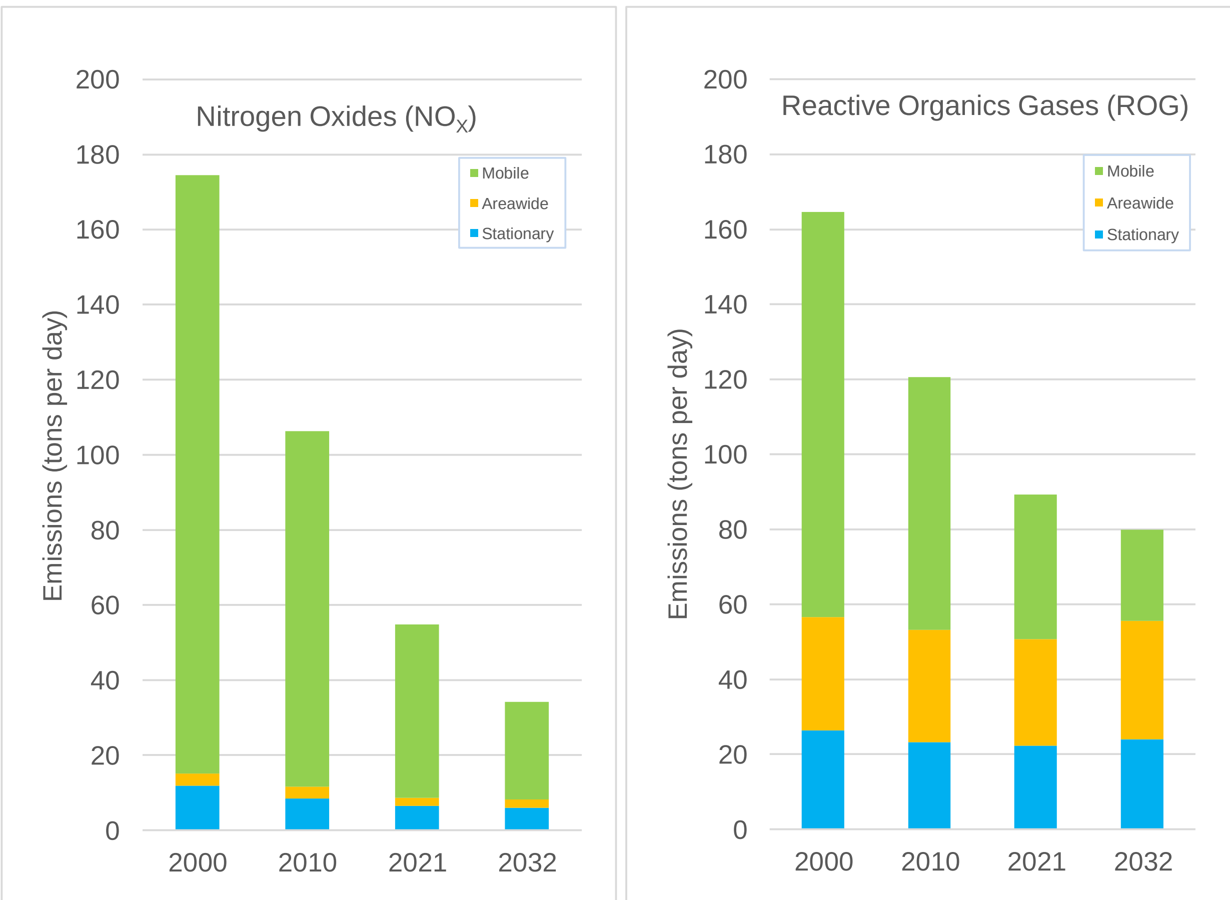
F.3.3. Conceptual Model Summary

Meeting the 0.070 ppm standard is a complex challenge in the SFNA. A diverse suite of precursor emissions results from central urban core surrounded by heavily traveled highways and major agricultural activities. The area is characterized by varied terrain, which limits dispersion and effectively traps emissions in the region. Furthermore, meteorological conditions are dominated by a semi-permanent high-pressure system, which enhances the trapping effect of the local terrain; and a thermally driven afternoon Delta breeze wind and a nighttime, downslope drainage flow recirculation pattern, which serves to routinely transport emissions from the central portion of the region up into the foothills in the eastern portion during the day and then back down toward the valley floor overnight. State-of-the-art photochemical modeling, supported by extensive monitoring and research efforts, indicates that the path towards attainment of the 0.070 ppm standard is with a NO_X-focused control strategy.

F.4. Anthropogenic Emissions

Data from the CARB's California Emissions Projection Analysis Model (CEPAM), 2019 Sacramento SIP Ozone Nonattainment Area Ver 1.04, were used to evaluate trends in anthropogenic emissions of ozone precursors, NO_X, and ROG. Federal, State, and local programs have yielded significant overall reductions in emissions of ozone precursors in the SFNA. From year 2000 to 2021 total summer emissions of NO_X have decreased by approximately 69 percent with ROG abated by 46 percent. The decreasing trend is expected to continue to 2032 as shown in Figure F-9.

Figure F-9 Summer Ozone Precursor Emissions Inventory in SFNA



According to Figure F-9, mobile sources dominate the emission inventories of ozone precursors; the emissions inventory indicates that mobile sources accounted for 84 percent of NO_X emissions and 43 percent of anthropogenic ROG emissions in 2021. In 2032, mobile sources are still expected to be the largest contributing source of NO_X emissions (76 percent), followed by stationary (17 percent) then areawide (6 percent) sources. In contrast, for ROG emissions, areawide will make up the largest contributing source (40 percent); and mobile and stationary will contribute equally to ROG emissions (about 30 percent each).

On a subregional scale, the Sacramento County portion of the area accounts for the largest portion of anthropogenic NO_X and ROG emissions, followed by the SFNA portion of Placer County, Yolo County, and the SFNA portions of Solano, El Dorado, and Sutter Counties. As shown in Figures F-10 and F-11, Sacramento County NO_X emissions remain more than two times greater than other SFNA counties in 2032, and ROG emissions are more than triple those in other SFNA counties. However, NO_X and ROG emissions decline in all counties between 2000 and 2032; and the magnitude of decline was largest in El Dorado for NO_X and Sutter for ROG.

As discussed earlier, prevailing southwesterly winds provide a persistent mechanism by which emissions from these areas are routinely transported eastward into the foothills, disproportionately promoting elevated ozone at sites downwind of these peak emission areas.

F.5. Ambient Ozone Precursor Concentrations

Ambient air measurements of the primary ozone precursors, NO_X and ROG, are gathered at a special-purpose network of Photochemical Assessment Monitoring Stations (PAMS). The PAMS network is operated during the summer ozone months (typically from July through October). In addition to hourly NO_X and meteorological measurements, multiple three-hour ROG samples are collected every three to six days. The ROG 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. ROG and NO_X data at PAMS sites in the SFNA are analyzed where available from 2000 to 2021.

The ROG and NO_X data analysis are restricted to only two sites due to the limited ROG data availability. 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 F-12 and F-13 show the ROG and NO_X ambient concentrations from 2000 to 2021 at Folsom Natoma St[2] and Sacramento Del Paso Manor[3]. In these figures, each data point represents an average of all available morning (5 am-8 am) ROG and NO_X concentrations from July to September for each year. The ROG concentration is from the

[2] Figures F-12 and F-13 include NO_X data ranging from 7/6/2015-8/28/2015, 9/5/2015-9/11/2015, 9/19/2015-9/27/2015 from Folsom that are currently under review and may be invalidated.

[3] Figures F-12 and F-13 include NO_X data ranging from 4/28/2014-5/30/2014, 6/3/2015-6/17/2015, 1/1/2016-10/14/2016, 2/2/2017-2/10/2017, 3/10/2017-3/26-2017, 7/24/2018-12/31/2018, 1/1/2019-4/3/2019, 20/3/2019-12/31/2019, 1/1/2020-12/21/2020, and 1/1/2021-11/29/2021 from Del Paso Manor that are currently under review and may be invalidated.

three-hour canister samples collected during 5 am to 8 am, and the daily value of NO_X concentrations is the average of hourly measurements of NO_X covering the same three-hour period.

Both sites show downward trends in ROG and NO_X concentrations from 2000 to 2021 despite year-to-year variations. These trends are due to the result of successful ROG and NO_X emission control measures. For example, at the Folsom Natoma St. site, the ROG concentration decreased by 56 percent from 2000 to 2019, while the NO_X concentration decreased by 73 percent from 2000 to 2021 (2020 ROG and NO_X data are not available due to a temporary site closure; 2021 ROG data are not available due to instrument malfunction). At the Sac-Del Paso Manor site, the ROG and NO_X concentrations decreased by 16 percent and 65 percent, respectively, from 2000 to 2020. (2021 data are not available due to instrument malfunction). The fact that the NO_X concentrations declined more rapidly than the ROG concentrations is most likely due to more NO_X-focused control strategies being advanced in recent years.

Figure F-10 County-Level Anthropogenic NO_X Emissions in the SFNA

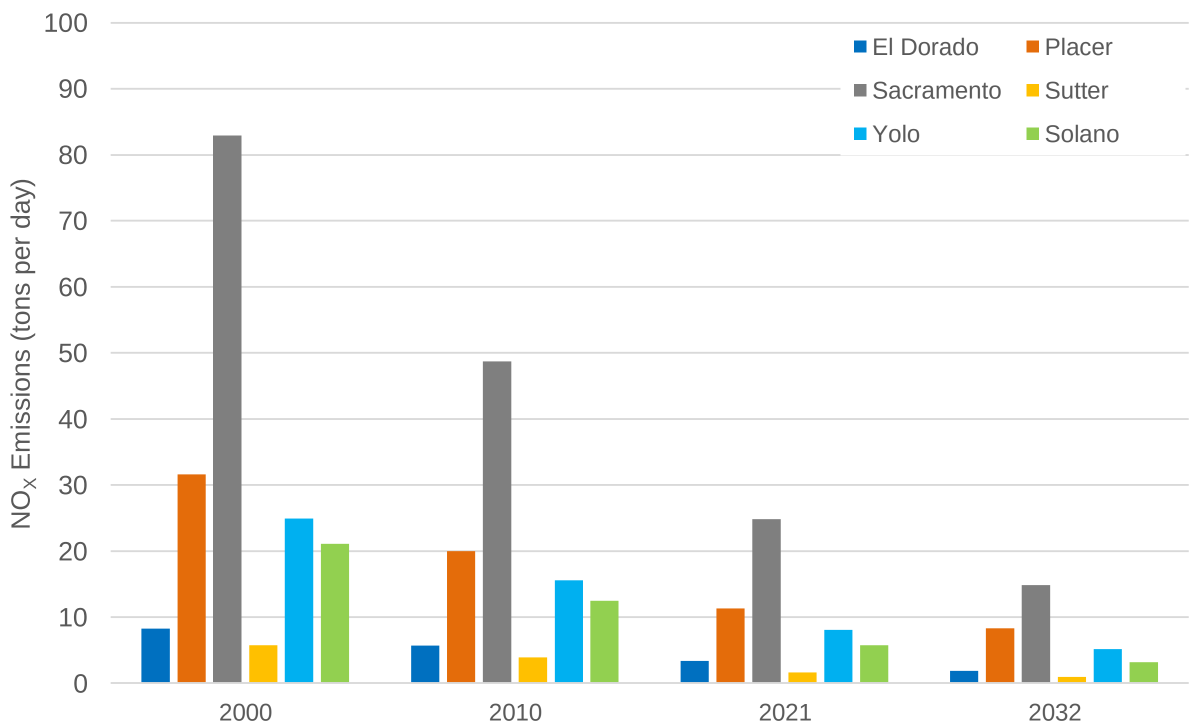


Figure F-11 County-Level Anthropogenic ROG Emissions in the SFNA

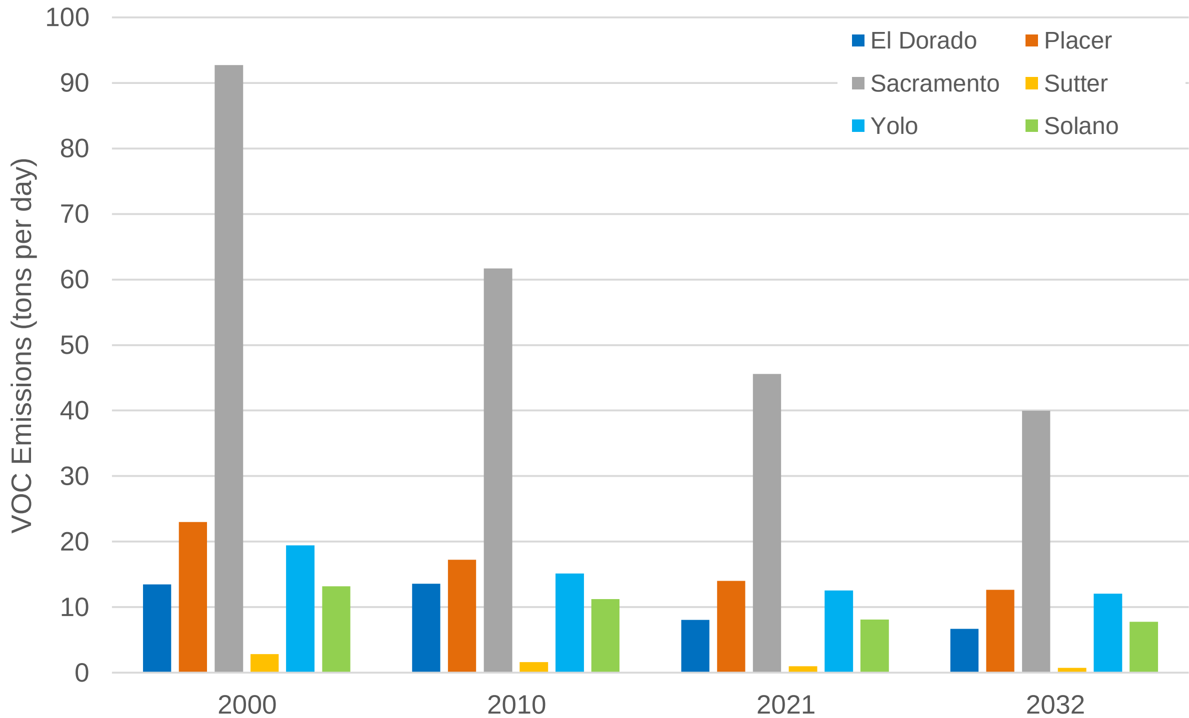


Figure F-12 July-September Averages of ROG and NO_X at Folsom Natoma St. (5 am-8 am)

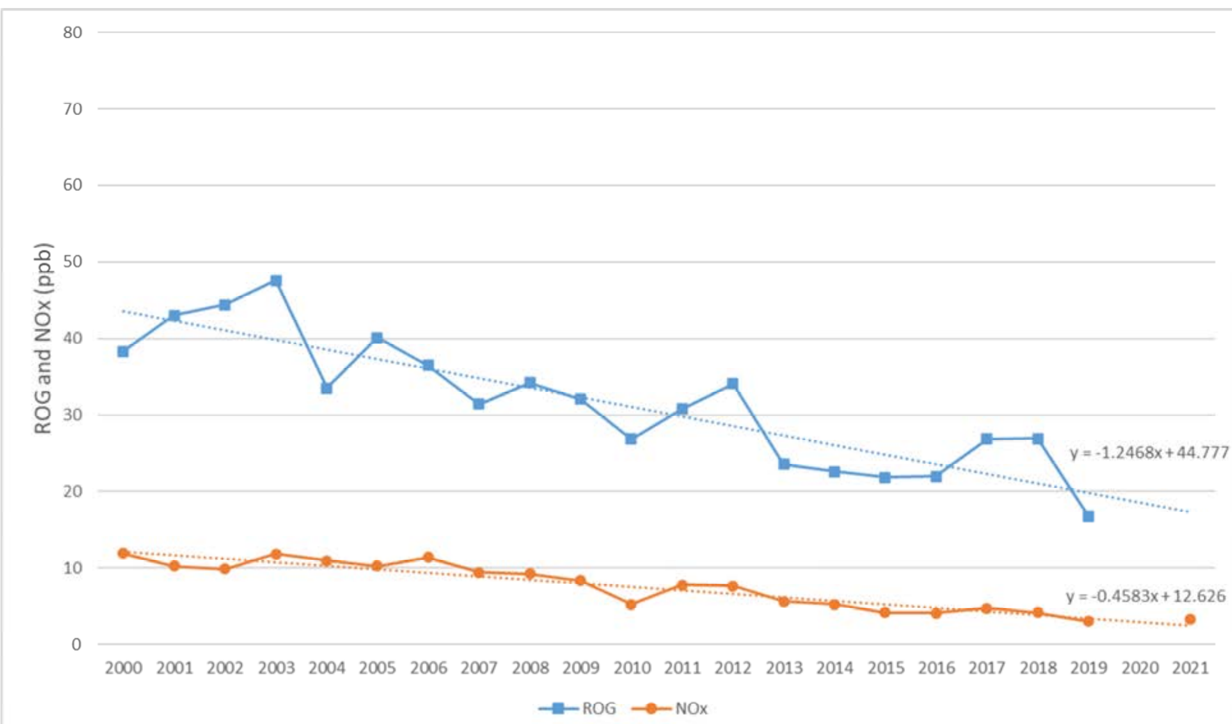
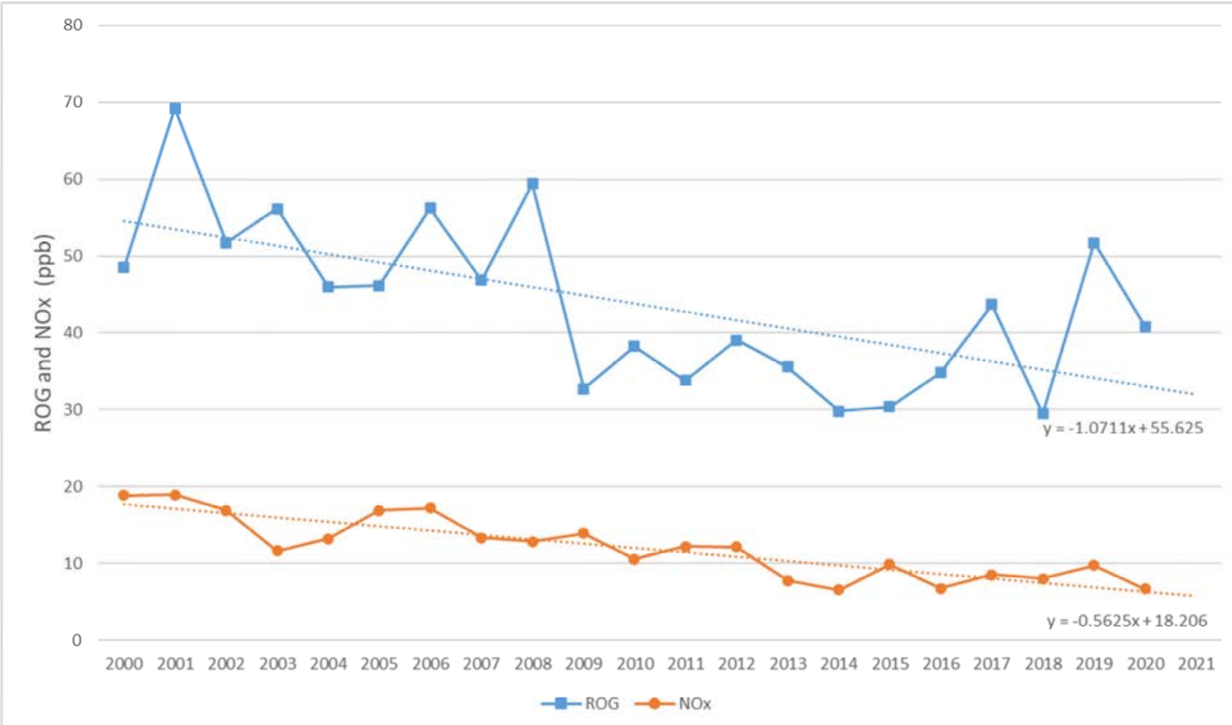


Figure F-13 July-September Averages of ROG and NO_X at Sac-Del Paso Manor (5 am-8 am)



F.6. Ozone Air Quality

The design value is the key metric for assessing the state of ozone air quality in a nonattainment area, and it can be directly compared to the federal ozone standard for the purpose of determining attainment status. The design value is computed as the three-year average of the fourth-highest daily maximum 8-hour average ozone concentration from each year and is determined for each monitoring site. The ozone design values are then collectively evaluated, and a region-wide design value is determined based on the highest design value across all sites within the SFNA.

Ozone air quality within the SFNA has significantly improved for the past 22 years. As shown in Figure F-14, the SFNA's ozone design value decreased by 20 percent between 2000 and 2021, from 0.107 ppm to 0.082 ppm despite significant wildfire impacts to ozone levels in the SFNA in recent years, such as in 2018. During this same period, the annual fourth-highest daily maximum 8-hour ozone concentration decreased by 17 percent, from 0.103 ppm in 2000, to 0.085 ppm in 2021. Total number of exceedance days across all monitoring stations in the region decreased by 35 percent from the year 2000, when the 0.070 ppm standard was exceeded on 81 days, to the year 2021, when there were 52 exceedance days. The substantial reductions in design values, fourth-highest concentrations, and exceedance days demonstrate that the nonattainment area is well on its way towards attainment of the 0.070 ppm standard. However, there have been different rates of progress in the western, central, and eastern subregions.

The following sections focus on long-term trends in design value concentrations throughout the Sacramento subregion and briefly discuss year-to-year variability in meteorology and wildfire impacts on design values. In addition, the spatial variability of air quality and population exposure is examined to provide insight on the extent of progress towards attainment.

F.6.1. Ozone Design Values

As previously discussed, ozone air quality in the SFNA varies between the western, central, and eastern subregions. In the western subregion, the 2021 design values at all four sites met the 0.070 ppm standard with values ranging from 0.065 to 0.070 ppm. In the central subregion, the 2021 design values met the 0.070 ppm standard at some sites but exceeded the 0.070 ppm standard at other sites with values ranging from 0.066 ppm to 0.075 ppm. In the eastern subregion, the 2021 design values at all sites exceeded the 0.070 ppm standard with values ranging from 0.071 to 0.082 ppm.

Figure F-14 Ozone Air Quality in the SFNA

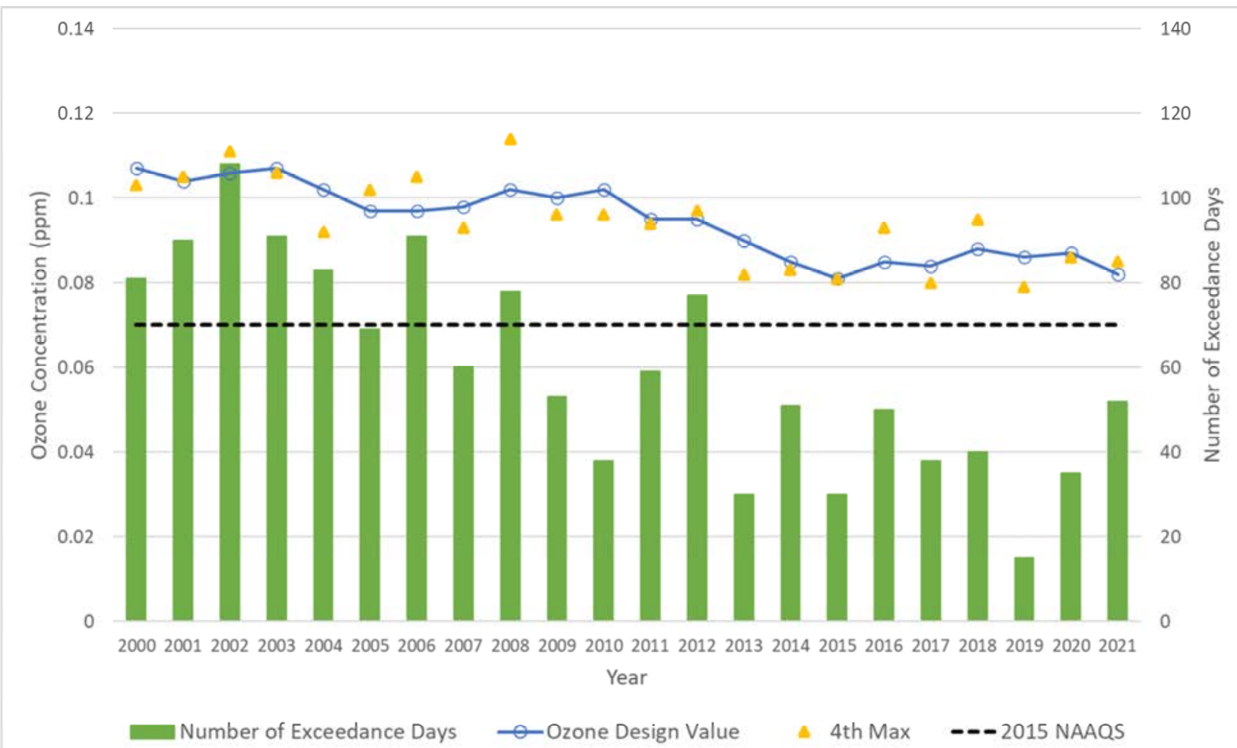
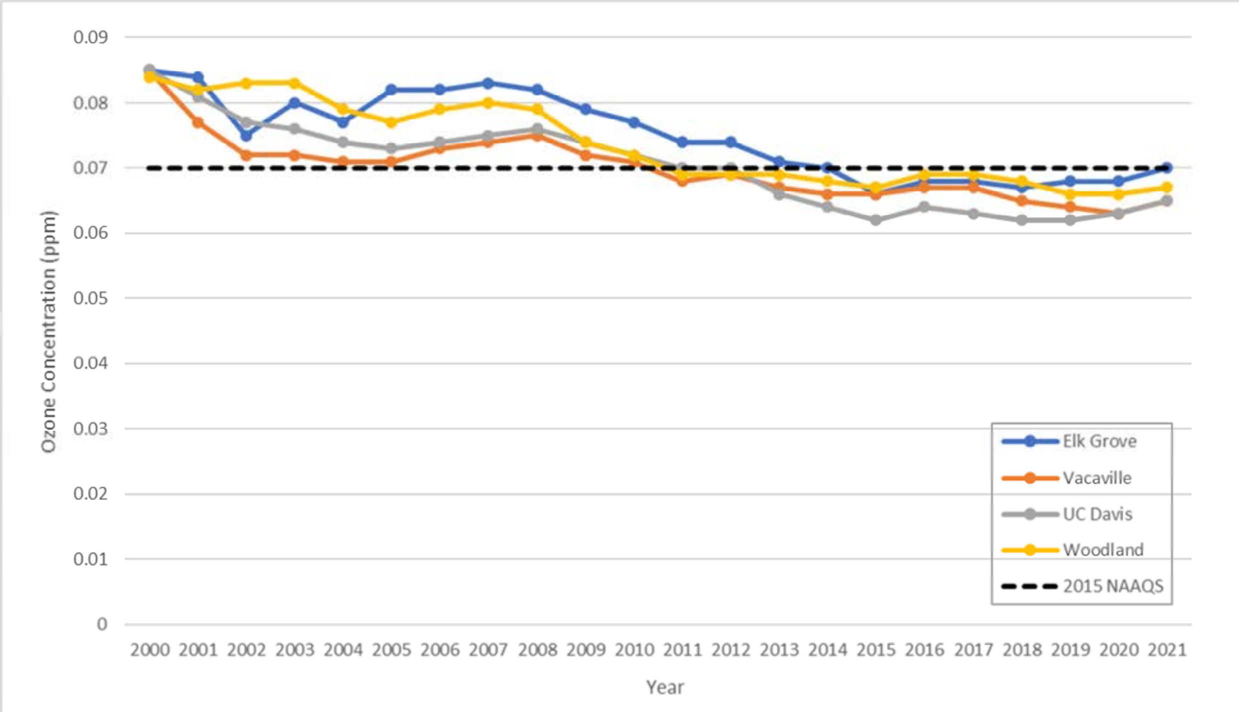


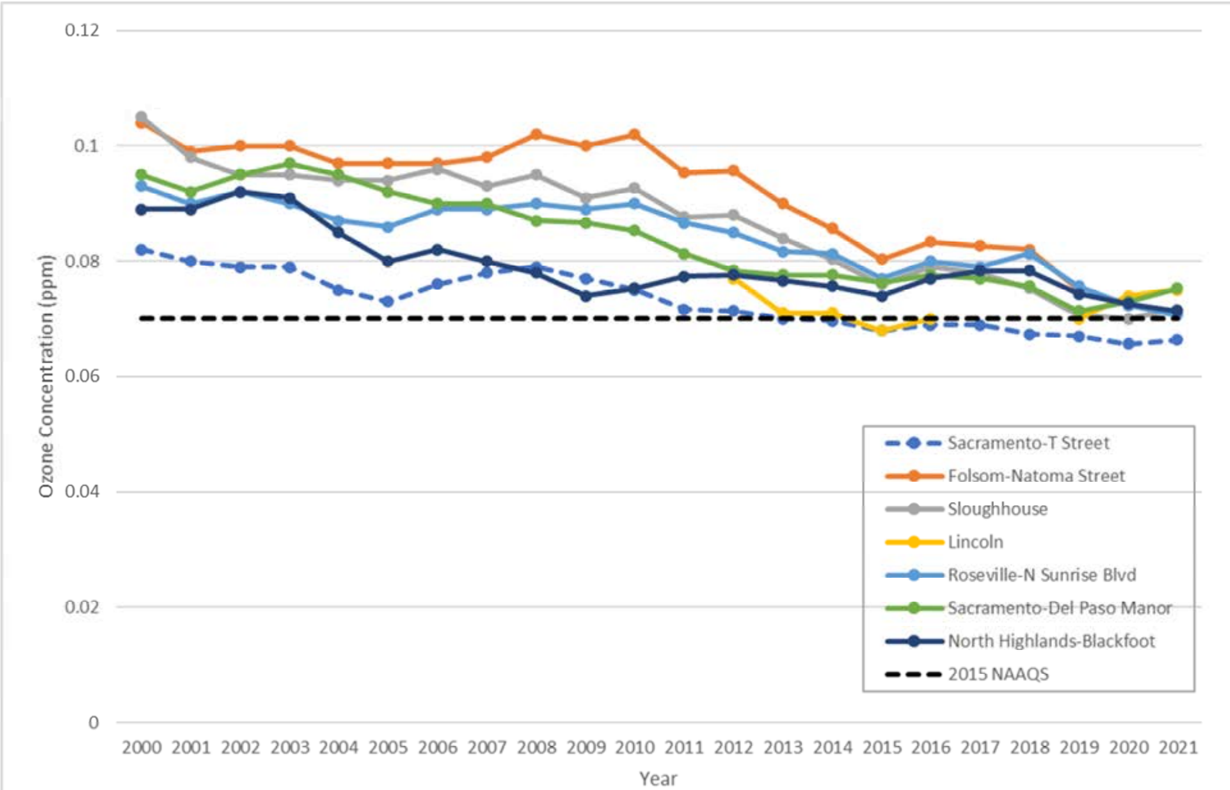
Figure F-15 2000-2021 Design Values at Sites in the Western Subregion



In the western subregion, the downward trend of design values at all four sites was significant from 2000 to 2021 (Figure F-15). The design value trends remained relatively flat from 2000 to 2008, then decreased more rapidly until 2015. Since 2016 the downward trend slowed down again and leveled off. Vacaville, Davis, and Woodland sites have remained in attainment for the 0.070 ppm standard since 2011 and Elk Grove site since 2014.

In the central subregion, ozone design values have declined since 2000, but similar to the western subregion, the most rapid decreases have occurred between 2010 and 2015 (Figure F-16). Most notably, Folsom, the design site for many years, showed rapid progress with a 26 percent decline in the design value since 2010. Other high ozone concentrations sites in the central subregion also showed similar progress, including Sloughhouse (24 percent) and Roseville-N Sunrise (20 percent). Most of the monitoring sites in the central region are close to meeting the 0.070 ppm standard. The Sacramento-T Street site has remained in attainment for the 0.070 ppm standard since 2013.

Figure F-16 2000-2021 Design Values at Sites in the Central Subregion

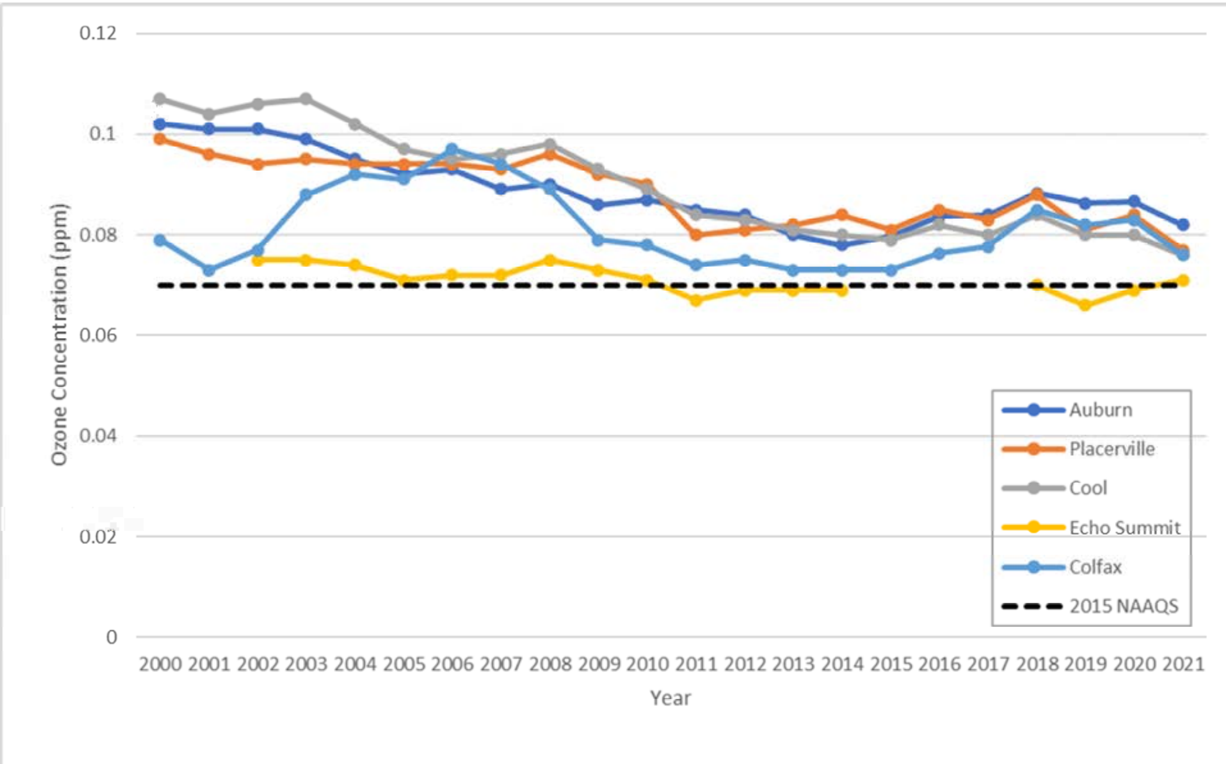


In the eastern subregion, ozone data monitored during January 2015 through May 2019 period at the Colfax, Auburn and Lincoln sites in the Placer County were invalidated as a result of an EPA technical systems audit (TSA) finding. This WOE used those invalidated monitoring data in the analyses. More detailed information and rationale for utilization of the data can be found in the following section, Section F.6.1.I.

Ozone design values at all sites in the eastern subregion except Colfax showed a significant downward trend from 2000 until 2014, then have remained relatively flat or have slightly increased during recent 6 years (Figure F-17). The ozone design value at Colfax site increased until 2006 then decreased rapidly until 2011, then followed the same trend with other sites in the eastern subregion.

The downward trend slowed and leveled off, likely because of variations in large-scale meteorological patterns during the summer months. Some of the variability in the design values during the past six years can be attributed to two of the cleanest years recorded for ozone in the SFNA in 2013 and 2015, when large-scale weather patterns for both years favored moderate to strong Delta breezes, cooler temperatures, and increased dispersion of emissions. However, in 2014 and 2016, broad high-pressure systems over the western U.S. limited vertical mixing in the atmosphere, weakened the Delta breeze, and increased temperatures, which led to more stagnation and extended high ozone episodes. For instance, half of the exceedance days in 2016 were concentrated during a five-day period in July and an 11-day period in mid-August. These two periods resulted in that summer having higher than average number of exceedances, which combined with the cleaner 2013 dropping out of the three-year design value calculation, caused the 2016 design values to increase at most of the sites in the SFNA. Furthermore, massive wildfires in 2018 impacted most of the monitoring sites in the eastern region and contributed to elevated ozone concentrations (The following section discusses wildfire impact on ozone concentration in more detail).

Figure F-17 2000-2021 Design Values at Sites in the Eastern Subregion



Based on Figures F-15, F-16, and F-17 above, it is evident that not all sites experience progress during the same years or the same rate. For example, Folsom and Placerville are significantly different beginning in 2011, when Folsom began a steep decline in design values while Placerville maintained a fairly flat line. However, Placerville experienced a significant decrease in the design value during the few years prior to 2011, while Folsom was flat at that time.

Since 2010, the SFNA has seen rapid progress in the central subregion, with slower progress in the eastern subregion. The higher biogenic emissions in the SFNA, which are concentrated in the eastern portion of the area, add a much greater challenge to attainment. In addition, as described above, there is considerable year-to-year variability, especially pronounced in the eastern region, due to yearly meteorological differences, which impact the amount of transport into the eastern subregion from the other parts of the nonattainment area.

F.6.1.I. Invalidated Data at the Colfax, Auburn and Lincoln Sites

Ozone data collected from January 2015 through May 2019 at the Colfax, Auburn, and Lincoln monitoring sites in Placer County were invalidated as a result of an EPA technical systems audit (TSA) finding that the calibration procedures did not fully meet EPA's data quality regulations. Since Auburn and Colfax are two of the high ozone sites in the SFNA, it is important to look at their air quality trends to make sure these two sites will also attain the 0.070 ppm ozone standard by 2032. The SFNA districts believe that using the invalidated data with additional analyses outlined in the WOE is the most conservative and most health protective approach. Therefore, WOE used those invalidated monitoring data in the analyses. The analysis described below provides evidence for this determination.

Correlations were examined between 3 invalidated sites and nearby sites in the central and eastern subregions using all the concentration data. As shown in Table F-2, all three invalidated sites showed strong correlations with nearby sites except Echo Summit. Echo Summit is located in a remote area and has consistently shown one of the lowest design values in the SFNA. However, when only ozone observations in the peak ozone season are selected for the analyses, the correlations become much less significant.

Table F-2 Correlations (Pearson Correlation Coefficients) Among Central and Eastern Subregion Sites During Summer Ozone Months

	Auburn	Colfax	Lincoln
Auburn	1		
Colfax-City Hall	0.95	1	
Lincoln	0.95	0.91	1
Cool (seasonal)	0.92	0.86	0.85
Echo Summit	0.46	0.56	0.45
Folsom-Natoma Street	0.93	0.87	0.93
North Highlands	0.92	0.87	0.95
Placerville-Gold Nugget Way	0.91	0.90	0.87
Roseville-N Sunrise Blvd	0.92	0.87	0.94
Sacramento-Goldenland	0.88	0.82	0.91
Sacramento-Del Paso Manor	0.89	0.83	0.91
Sacramento-T Street	0.85	0.80	0.88
Sloughhouse	0.85	0.79	0.87

Although there could be some uncertainties due to the relatively poor correlations for high ozone concentrations, design values at the Auburn and Colfax sites were estimated based on the regression analyses using ozone concentrations at nearby sites, and then those design values were compared to design values calculated from the invalidated ozone data.

Cool and Placerville sites were selected to determine linear regression equations for ozone design values at the Auburn and Colfax sites, respectively. As shown in Table F-3, ozone design values calculated using observed but invalidated data are about 9 percent and 12 percent higher at the Auburn and Colfax sites, respectively, than using the estimated data based on the regression analyses. These results suggest that utilizing observed invalidated data for the trend analysis is more conservative.

Table F-3 Ozone Design Values at Auburn and Colfax

	Using Observed Data		Using Regression Data	
	Auburn	Colfax	Auburn	Colfax
2015	0.079	0.073	0.078	0.072
2016	0.083	0.076	0.081	0.076
2017	0.084	0.077	0.080	0.075
2018	0.088	0.085	0.084	0.079
2019	0.086	0.082	0.079	0.073

Note: Lincoln site was not included due to insufficient data to determine design values.

F.6.1.II. Invalidated Placer County Ozone data between January 01, 2015, and September 21, 2019

A spreadsheet "Appendix F-6-1-II.xls" is available separately and included all observed data which were invalidated by EPA as discussed above.

Tab	Description
Colfax-3002	Hourly 8-hour ozone data for 2015. 2008, and 1997 O_3 Standards at Colfax monitoring site between 01/01/2015 and 09/21/2019
Auburn-3789	Hourly 8-hour ozone data for 2015. 2008, and 1997 O_3 Standards at Auburn monitoring site between 01/01/2015 and 09/21/2019
Lincoln-3796	Hourly 8-hour ozone data for 2015. 2008, and 1997 O_3 Standards at Lincoln – 1st St monitoring site between 01/01/2015 and 09/30/2017
Lincoln-3841	Hourly 8-hour ozone data for 2015. 2008, and 1997 O_3 Standards at Lincoln – 2885 Moore Road monitoring site between 10/07/2018 and 09/21/2019
Site	Monitoring Site information
Ozonedailysite	Detailed ozone data for the invalidated sites
Column def	Column definition for the ozonedailysite tab

F.6.2. Wildfire Emission Impacted Days and Ozone Design Values

F.6.2.I. Wildfire Information

In the SFNA, a significant number of days were impacted by the 2018 wildfires as shown in Table F-4. Although not all wildfires impacted each monitor on any given day, all these fires contributed to the accumulating smoke layers that overlayed California, making identification of the impact of just one particular wildfire difficult. Most of these fires, including all large megafires, occurred on wildland or in the urban/wildland interface.

For the model to project the future ozone design value and designation status, a baseline ozone design value is needed. In the ideal modeling scenario, the baseline ozone design value would represent the true ozone concentrations in the county without influence from exceptional events such as wildfires. While wildfires certainly impacted ozone values on many more days and at multiple sites, this WOE focused on the Auburn and Colfax sites, which are two sites located in Eastern subregion of the SFNA and monitors for ozone and fine particulate matter ($PM_{2.5}$).

The Table F-5 lists those impacted days and daily maximum ozone concentrations on those days at the Auburn and Colfax sites[4]. Additional details on the impact of 2018 wildfires on ozone air quality in Northern California can be found in the "Exceptional Events Demonstration for Ozone Exceedances: Northern California July-August 2018 Wildfire Events". This document can be accessed on the CARB website at *https://ww2.arb.ca.gov/sites/default/files/2021-09/2018_Northern_California_EE_Full_Demo_2.pdf* .

Table F-4 Major Wildfires Active during July 26-August 10, 2018 Events

Fire	Start	Containment	Latitude	Longitude	Total Acres
Ferguson	7/13/18	11/28/18	37.655	-119.886	96,901
Natchez	7/15/18	1/4/19	41.951	-123.546	38,134
Klondike	7/16/18	11/28/18	42.369	-123.86	175,528
Taylor Creek	7/16/18	10/11/18	42.528	-123.571	52,389
Carr	7/23/18	8/30/18	40.654	-122.624	229,651
Mendocino Complex (Ranch)	7/27/18	9/19/18	39.243	-123.103	410,203
Mendocino Complex (River)	7/27/18	8/10/18	39.047	-123.120	48,920
Butte	7/31/18	8/2/18	39.186	-121.793	1,200

4 The modeling discussed in Chapter 6 and Appendix B excluded the wildfire impacted days from the Auburn site; the wildfire-impacted days from the Colfax site were not included because the modeling showed that with and without the wildfire-impacted days, the 2032 design value at the Colfax site will be below 70 ppb.

Donnell	8/1/18	1/4/19	38.349	-119.929	36,450

Table F-5 Summary of Wildfire Impacted Days at Auburn and Colfax

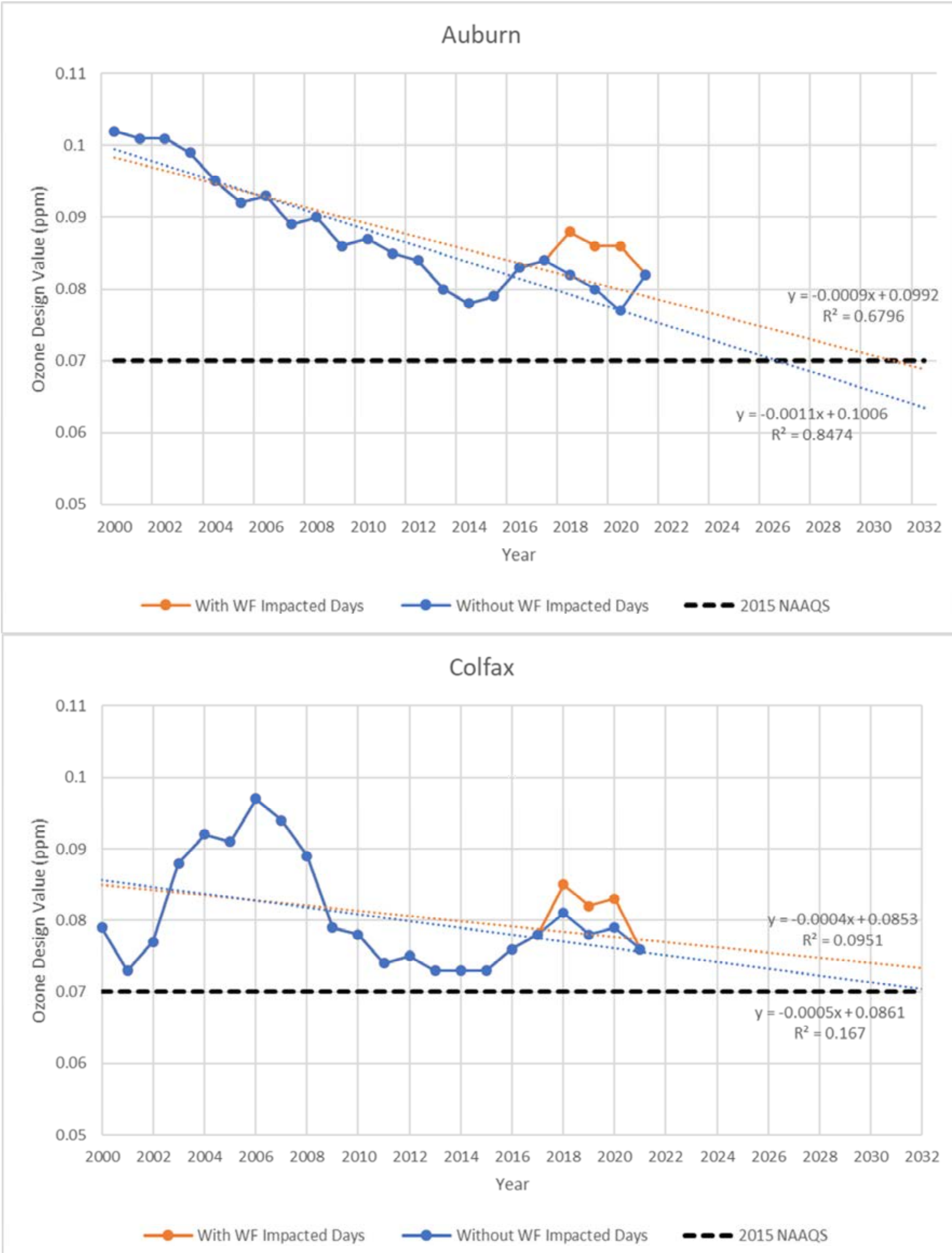
Date	8-Hour Ozone Concentration (ppm) at Auburn	8-Hour Ozone Concentration (ppm) at Colfax
7/31/2018	0.107	0.108
8/1/2018	0.106	0.086
8/2/2018	0.115	0.114
8/8/2018	0.097	0.103
8/9/2018	0.098	0.097
8/10/2018	0.092	0.090

F.6.2.II. Excluding Wildfire Impacted Days

As demonstrated above, all the sites in the SFNA have shown downward trends of ozone design values from 2000 to 2021. Excluding wildfire impacted days would bring down design value further. Wildfires are considered natural events, which are not reasonably controllable using techniques that may be implemented by state or local air districts. The days impacted by wildfires can be excluded to avoid imposing any unreasonable planning requirements on air quality agencies related to violations of the federal standards. Therefore, it is rational to evaluate the air quality impact of wildfires - on an area's ability to meet the 0.070 ppm ozone standard and whether the nonattainment area could meet the standard if no wildfires had affected the area.

Figure F-18 shows 8-hour ozone design value trends with and without wildfire impacted days listed in Table F-5 for the Auburn and Colfax sites. With wildfire impacted days, the trendlines in Figure F-18 indicate that the Auburn site will attain the 2015 ozone standard by 2032 while Colfax will not. Excluding wildfire impacted days in 2018, the trendlines show both Auburn and Colfax will attain the standard by 2032. This demonstrates the significance of accounting for impacts of wildfires to design value calculations. Note that the trendlines below are estimations of the future design values based on the historical ozone design values at the monitors. They provide additional support to the photochemical modeling results and are not a glide path for the attainment projection.

Figure F-18 8-hour ozone design values at Auburn and Colfax



F.6.2.III. Evidence of Wildfire Impacts Based on $PM_{2.5}$ Observations

Winds can transport wildfire smoke and ozone precursors to a certain area and cause simultaneous increases in ozone and $PM_{2.5}$ concentration. Elevated $PM_{2.5}$ concentrations recorded at a site could support the presence of wildfire smoke in the areas.

Unusually high daily average $PM_{2.5}$ at Auburn and Colfax sites were examined for days impacted by wildfires and co-occurrence with ozone increases in July and August in 2018. Figure F-19 shows daily average $PM_{2.5}$ and daily maximum 8-hour ozone concentrations from April 1 to September 30 in 2018. Unusual high daily average $PM_{2.5}$ days are shaded to identify days on which wildfire emissions likely impacted the ozone monitors. From Figure F-19, it is evident that many of the 8-hour ozone exceedance days in 2018 were likely impacted by wildfire emissions.

F.6.3. Exceedance Days

Significant progress has occurred in reducing the frequency, magnitude, and spatial extent of 8-hour ozone exceedance days in the SFNA over the past 20 years, even with wildfire impacts. The analysis for this section includes data potentially impacted by wildfires. In terms of frequency, the 3-year average of annual number of exceedance days for all 16 SFNA monitoring sites decreased by 76 percent from the period of 2000-2002 to the more recent period of 2019-2021. On a subregion basis, all three subregions saw a dramatic decrease in exceedance days:

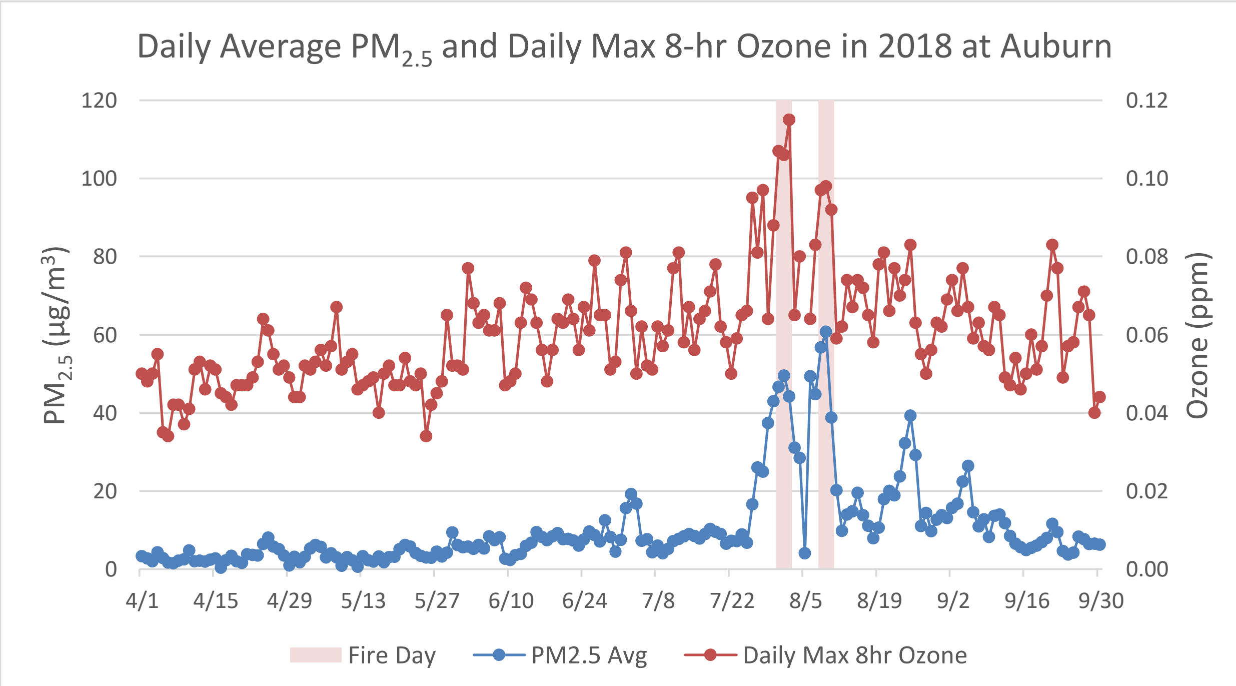
- Western: 3-year average of annual number of exceedance days for 2000-2002 ranged from 5 (Vacaville) to 15 (Woodland) but decreased to 1 (Woodland) to 7 days (Elk Grove) for 2019-2021.
- Central: 3-year average of annual number of exceedance days for 2000-2002 ranged from 10 (Sacramento T Street) to 48 (Folsom) but decreased to 2 (Sacramento T Street) to 10 (Folsom) for 2019-2021.
- Eastern: 3-year average of annual number of exceedance days for 2000-2002 ranged from 18 (Echo Summit) to 78 (Cool) but decreased to 4 (Echo Summit) to 22 (Auburn) for 2019-2021.

Figure F-20 illustrates the dramatic progress made in reducing the number of exceedance days and the magnitude of ozone concentrations on those days. During the most recent 3 years, there were only 7 exceedances in the western subregion, with declines of two-thirds or more in the other two subregions, as discussed earlier. Besides, the magnitude of exceedance days has declined significantly with the majority of ozone exceedances falling below the 0.085 ppm level.

For all SFNA sites, in 2000-2002, the magnitude of the three-year average of annual peak ozone concentrations ranged from 0.080 ppm (Vacaville) to 0.120 ppm (Cool), as shown in Table F-4. Comparatively, the magnitude of the three-year average for 2019-2021 ranged from 0.071 ppm (Davis) to 0.094 ppm (Auburn). The elevated concentration averages at the stations located in the eastern subregion are likely impacted by wildfire events that occurred in 2018. Moreover, for 2000-2002, nine SFNA sites had an annual peak 8-hour ozone concentration greater than 0.095 ppm. However, by the period 2019-

2021, there were only four SFNA sites with a peak 8-hour ozone concentration greater than 0.095 ppm (Table F-4).

Figure F-19 Daily $PM_{2.5}$ and Maximum 8-Hour Ozone Concentration in 2018 in Auburn and Colfax



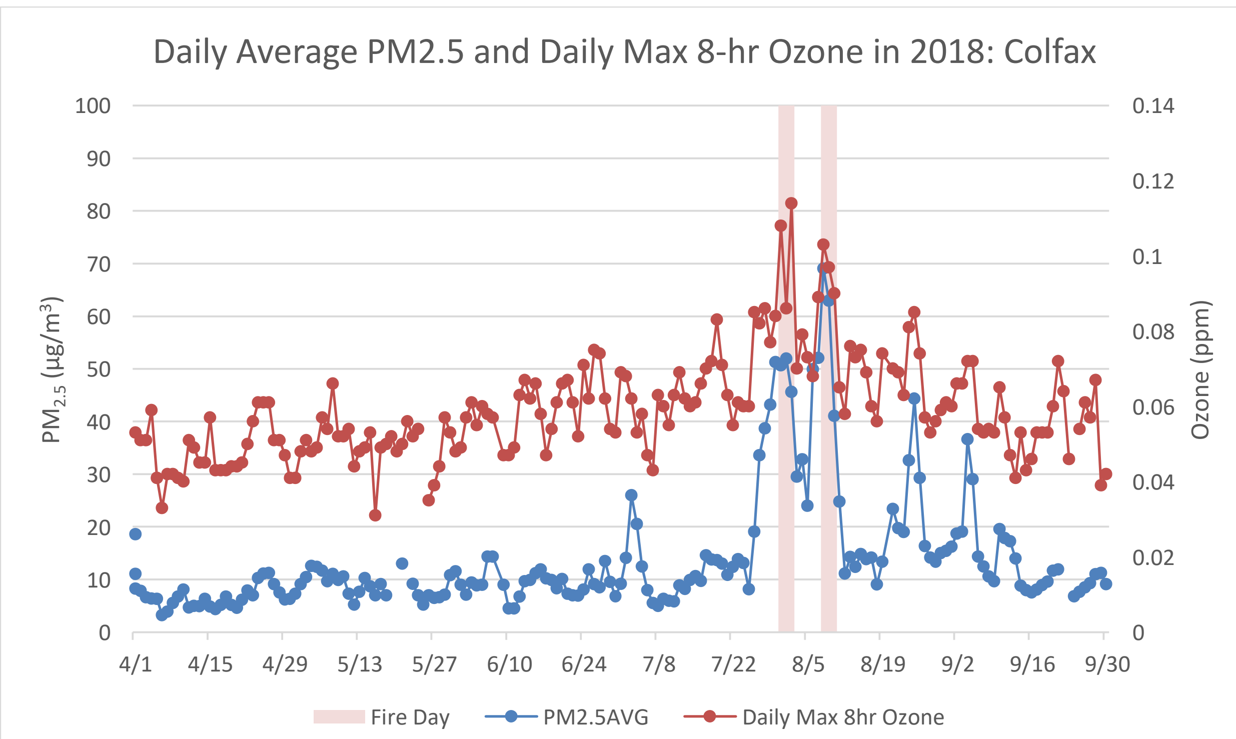
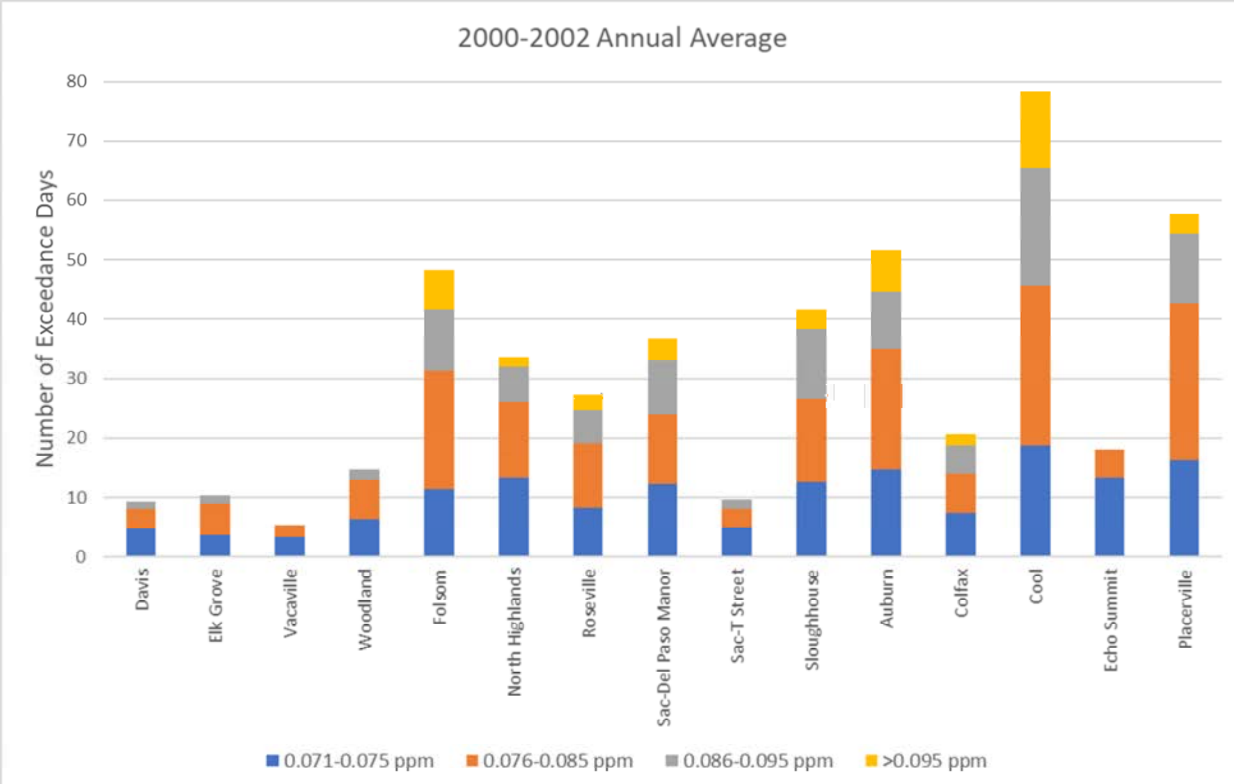


Figure F-20 Average Annual Number of 8-hour Ozone Exceedance Days



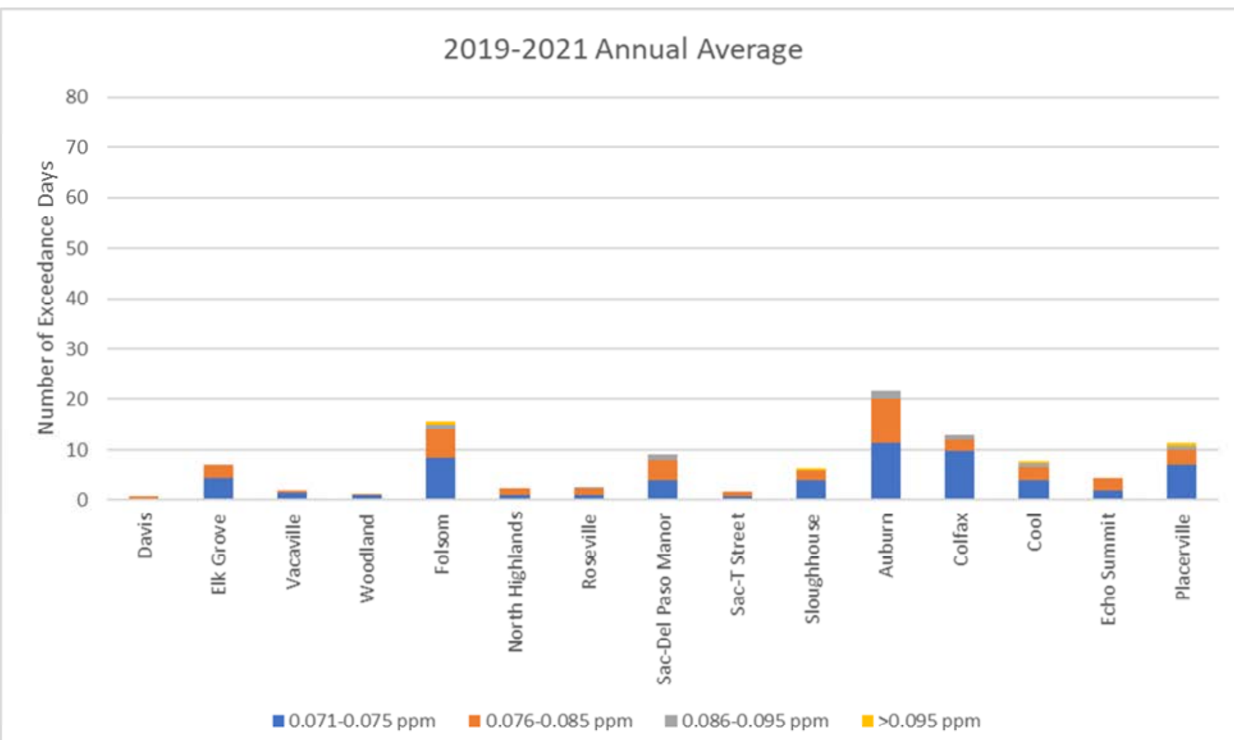


Table F-6 Annual Peak 8-hour Ozone Concentrations

	Site Name	2000	2001	2002	2000-2002 Average	2019	2020	2021	2019-2021 Average
Western	Elk Grove-Bruceville Rd.	0.094	0.092	0.082	0.089	0.077	0.082	0.080	0.080
	Vacaville	0.081	0.081	0.077	0.080	0.069	0.073	0.078	0.073
	Davis-UCD Campus	0.089	0.093	0.088	0.090	0.066	0.068	0.081	0.072
	Woodland-Gibson Rd.	0.083	0.089	0.091	0.088	0.067	0.075	0.082	0.075
Central	Roseville-N Sunrise Blvd.	0.100	0.102	0.105	0.102	0.076	0.080	0.090	0.082
	Lincoln-1445 1st St.	--	--	--	--	0.075	0.088	0.087	0.083
	North Highlands-Blackfoot Way	0.100	0.094	0.101	0.098	0.082	0.085	--	0.084
	Sacramento-Del Paso Manor	0.100	0.107	0.114	0.107	0.069	0.085	0.091	0.082
	Sacramento- T St.	0.079	0.094	0.091	0.088	0.074	0.076	0.080	0.077
	Folsom-Natoma St. [5]	0.102	0.108	0.120	0.110	0.072	0.036	0.096	0.068
	Sloughhouse	0.108	0.097	0.105	0.103	0.071	0.077	0.097	0.082
Eastern	Auburn	0.107	0.107	0.115	0.110	0.081	0.089	0.094	0.088
	Colfax-City Hall	0.058	0.088	0.113	0.086	0.077	0.092	0.083	0.084
	Placerville-Gold Nugget Way	0.100	0.100	0.111	0.104	0.075	0.101	0.080	0.085
	Echo Summit	0.076	0.084	0.079	0.080	0.063	0.079	0.085	0.076
	Cool	0.113	0.109	0.137	0.120	0.077	0.096	0.091	0.088

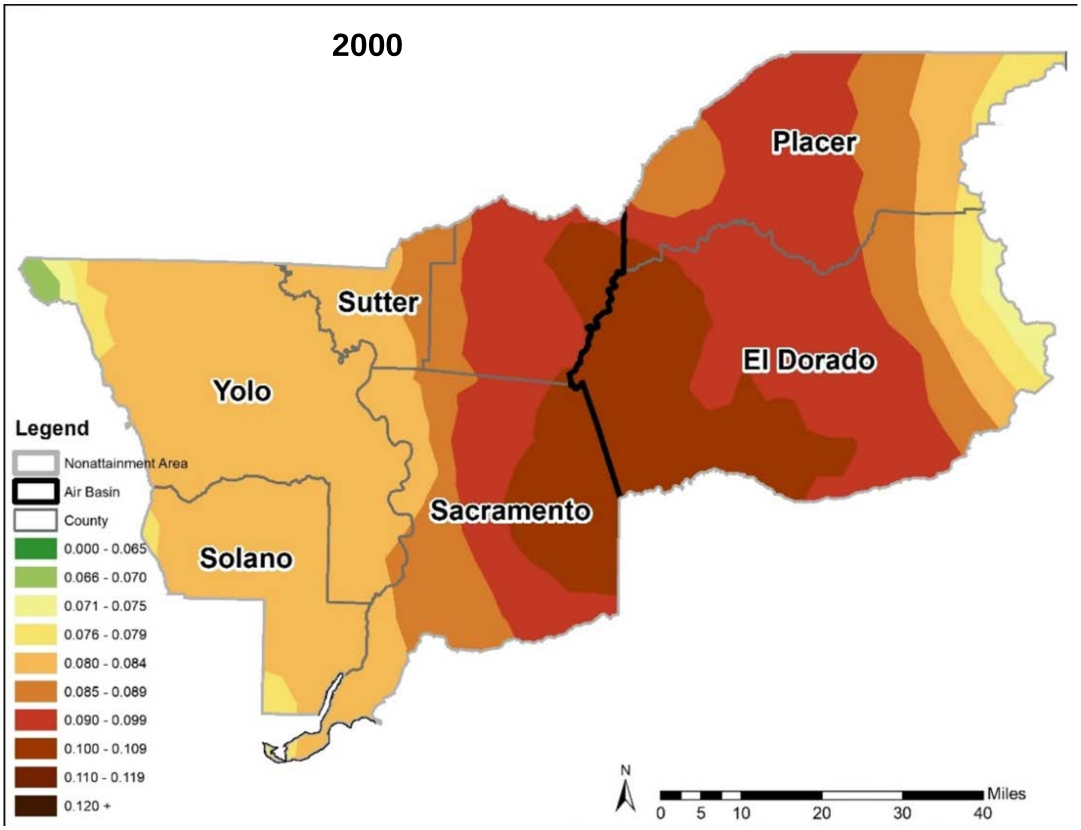
"--" indicates that no data were available

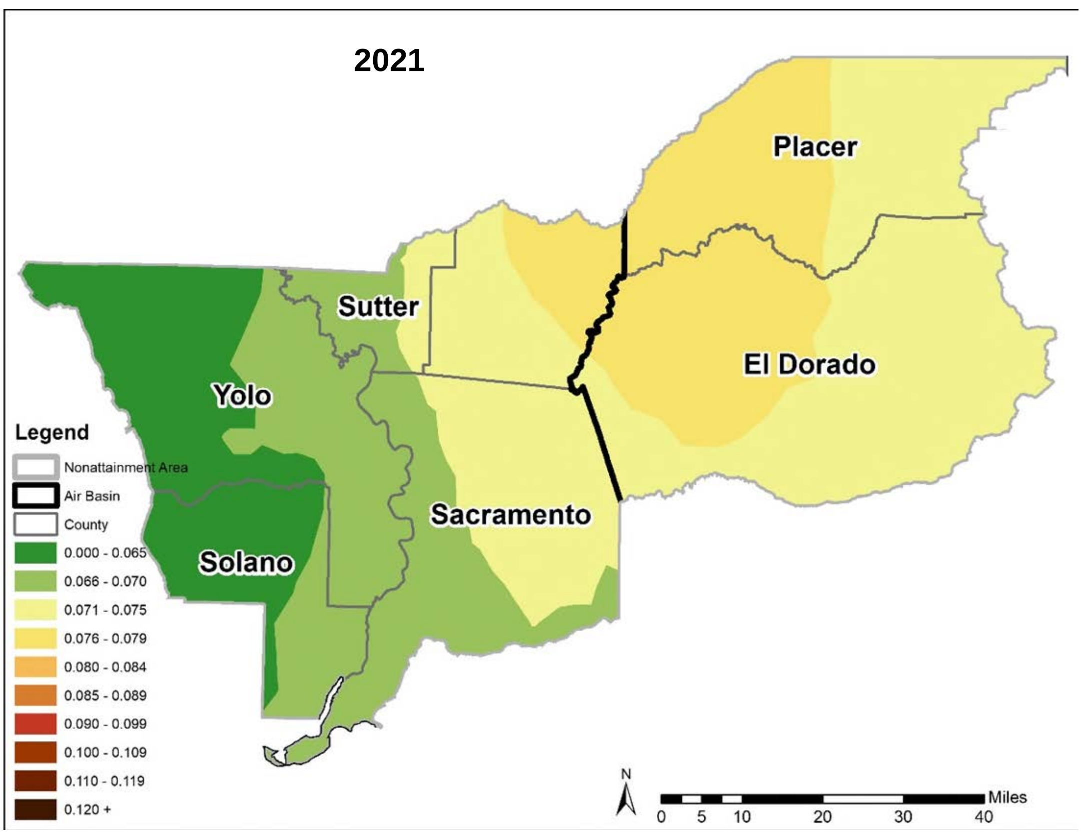
F.6.4. Population Exposure

To spatially and temporally evaluate ozone air quality across the SFNA, maps showing interpolated 8-hour average ozone design values for the years 2000 and 2021 were produced using an inverse distance weighting (IDW) method for the contouring (Figure F-21). In 2000, the entire SFNA exceeded the 0.070 ppm ozone standard, with a majority of the most populated areas of the region also exceeding the prior 0.075 ppm federal 8-hour ozone standard.

Figure F-21 Contour Maps of Design Values in the SFNA

5 The Folsom-Natoma Street monitor was undergoing major renovation between July 21, 2019, and Dec 10, 2020. The 2019 and 2020 annual peak 8-hour concentrations do not cover the entire ozone seasons.

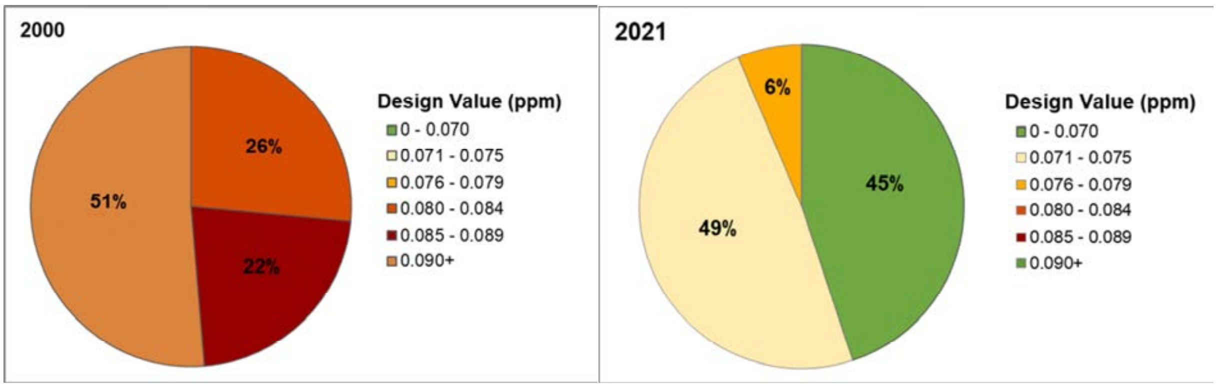

2000
Placer
Sutter
El Dorado
Yolo
Sacramento
Solano
Legend
Nonattainment Area
Air Basin
County
0.000 - 0.065
0.066 - 0.070
0.071 - 0.075
0.076 - 0.079
0.080 - 0.084
0.085 - 0.089
0.090 - 0.099
0.100 - 0.109
0.110 - 0.119
0.120 +
N
Miles
0 5 10 20 30 40


2021
Placer
Sutter
El Dorado
Yolo
Sacramento
Solano
Legend
Nonattainment Area
Air Basin
County
0.000 - 0.065
0.066 - 0.070
0.071 - 0.075
0.076 - 0.079
0.080 - 0.084
0.085 - 0.089
0.090 - 0.099
0.100 - 0.109
0.110 - 0.119
0.120 +
N
Miles
0 5 10 20 30 40

In contrast, by 2021, ozone air quality dramatically improved as evident by the entire western subregion area below the 0.070 ppm ozone standard. Areas where the ozone design values were greater than 0.080 ppm were mostly limited to eastern Sacramento County and the foothill areas of Placer and El Dorado counties, with only one localized area an 8-hour ozone design value slightly above 0.084 ppm.

Interpolated design values derived using IDW were overlaid with U.S. 2021 population census data to provide the quantitative estimates of population exposure in the SFNA (Figure F-22). In 2000, none of the people within the SFNA lived in areas where the ozone design values were at or below 0.070 ppm. However, by 2021, the percentage of the population living in areas with ozone design values below 0.070 ppm increased to 45 percent, indicating a major improvement in ozone air quality during the 21-year period.

Figure F-22 Population Exposure to Ozone in the SFNA



Analysis of design values provides significant insight into the compliance status of a region as well as specific monitoring sites. However, design values are limited in their ability to assess all aspects of ozone air quality progress within a large area, such as Sacramento, that has terrain and complex, localized meteorological patterns which impact ozone formation and buildup. Thus, looking beyond the design values provides a more thorough evaluation of the nature of progress and the factors that contribute to exceedances of ozone air quality standards in a region.

F.6.5. Summary of Ozone Air Quality

The assessment of long-term design value trends between 2000 and 2021 indicated a major improvement in ozone air quality across the entire SFNA. While a few site-specific design values indicate a near-term slowing in progress, the overall trends during the past 20 years are downward. To examine the trends beyond the design values, additional indicators were considered to provide further insight into ozone air quality in the SFNA.

Decreases in the number of annual exceedance days and, the magnitude of ozone concentrations on exceedance days were consistent with the decreases in design values and confirmed that the design value trends were reflective of the improvement in overall ozone air quality.

F.7. Weekend/Weekday Differences

The ozone weekend effect is the occurrence of higher ozone concentrations on weekends than on weekdays (California Air Resources Board, 2003). These differences have been documented in many urban areas and have been extensively studied and discussed in the scientific literature for decades. Emissions data show that NO_X emissions are usually lower on the weekend due to less heavy-duty diesel vehicle activity. However, historical data in the 1990s showed that more ozone exceedance days were observed on weekends. Peer-reviewed scientific studies conducted within the SFNA and downwind Mountain Counties Air Basin (MCAB) indicated the presence of the weekend effect in the 1985 to 2002 period (Blanchard and Fairley 2001; Marr and Harley 2002; Murphy et al. 2006; Murphy et al. 2007) and concluded that the SFNA was a VOC limited regime during that time. Regulations in the 1990s focused on reducing VOC emissions, which led to significant reductions in VOC emissions. These regulations prompted the Sacramento region to shift away from the VOC limited regime towards a NO_X limited regime. For example, implementation of the California Phase 2 Reformulated Gasoline in 1996 resulted in about 50% more reductions in VOC emissions compared to NO_X emissions (CARB 2003; Austin and Tran 1999), decreasing the VOC to NO_X ratio. More recent analyses indicate that the weekend/weekday differences have diminished and that there is no discernible difference in the SFNA (Wolff et al. 2013). A study on Central California Ozone in 2009 found that the SFNA demonstrated NO_X-limiting behavior (BAAQMD 2009), and a more recent smog chamber study in Sacramento observed ozone production to experience higher sensitivity to changes in NO_X concentrations during both the weekdays and weekends in the summertime months when biogenic VOC emissions are expected to be the greatest (Wu et al. 2022). In fact, in the following analysis, data from all sites that were evaluated showed more ozone exceedances on weekdays than on the weekends, following the behavior of NO_X concentrations. Furthermore, as the SFNA sees more significant reductions in NO_X concentrations due to control measures along with smaller reductions in VOC concentrations, the VOC to NO_X ratio will continue to increase and the ozone production rate will become more NO_X-limited. This supports the efficacy of NO_X emissions controls in reducing ambient ozone concentrations in SFNA.

F.7.1. Weekday/Weekend Trends

F.7.1.I. Day of the Week: Exceedance Days

In this WOE, the distribution of the day of the week on which exceedance days occurred was examined to evaluate weekend/weekday differences. The focus was on the central and eastern subregions because these areas potentially drive attainment demonstration in the SFNA. In addition, there were too few exceedances at a few of the central subregion sites (Sacramento-T Street, Sacramento-Goldenland, and Lincoln) and in the western subregion to evaluate monitors for differences. The period considered was 2016 to 2021, which had a similar design value trend for many of the sites in the SFNA.

As shown in Figures F-23 and F-24 below, in general, exceedance days in the central and eastern subregions occurred more frequently on weekdays than weekends. This is believed to be caused by significantly lower NO_X emissions during the weekend, indicating that NO_X emission reduction is effective in reducing ozone in the SFNA.

Figure F-23 Distribution of Exceedance Days by Day of the Week at Sites in the Central Sacramento Subregion (2016-2021)

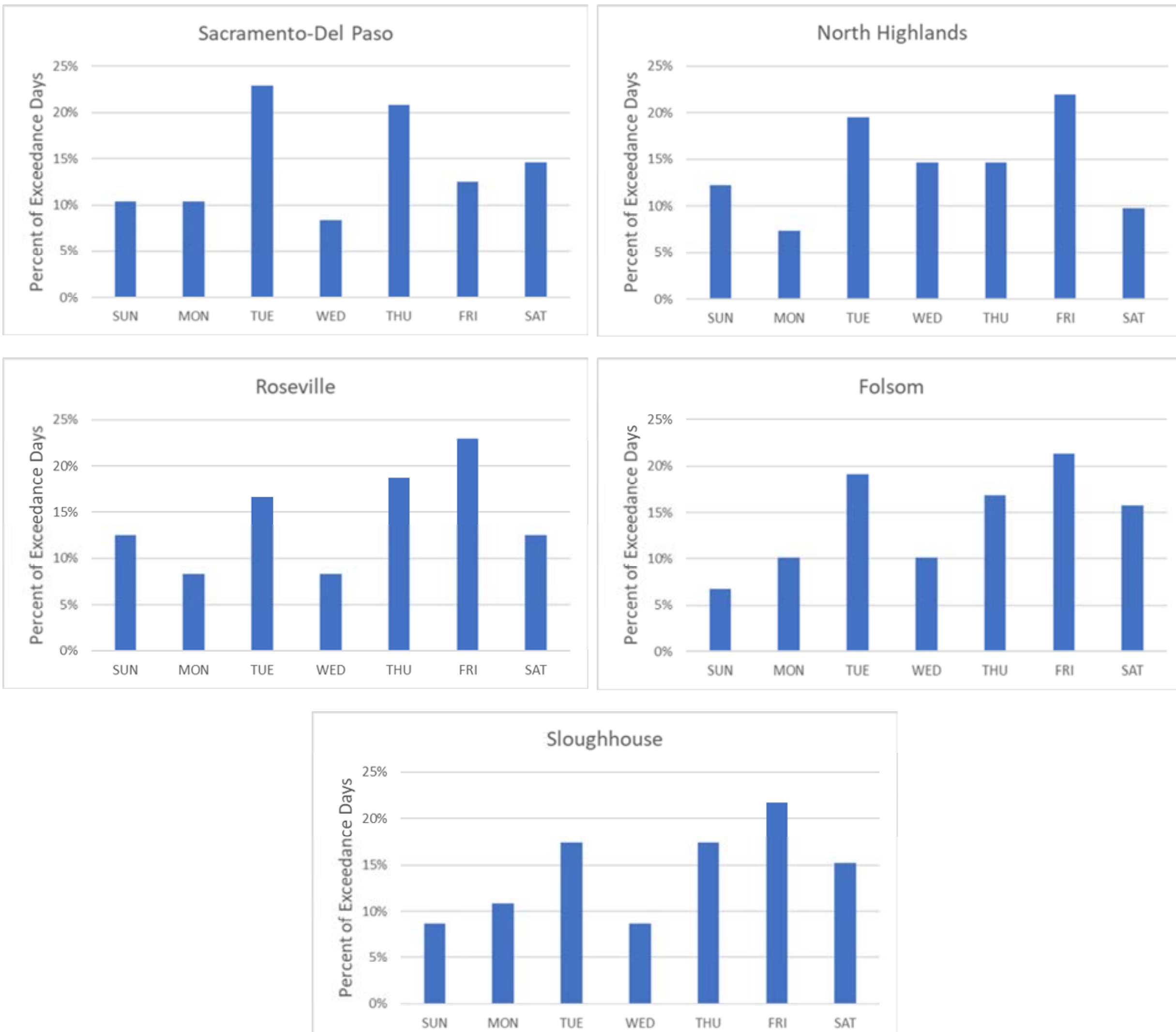
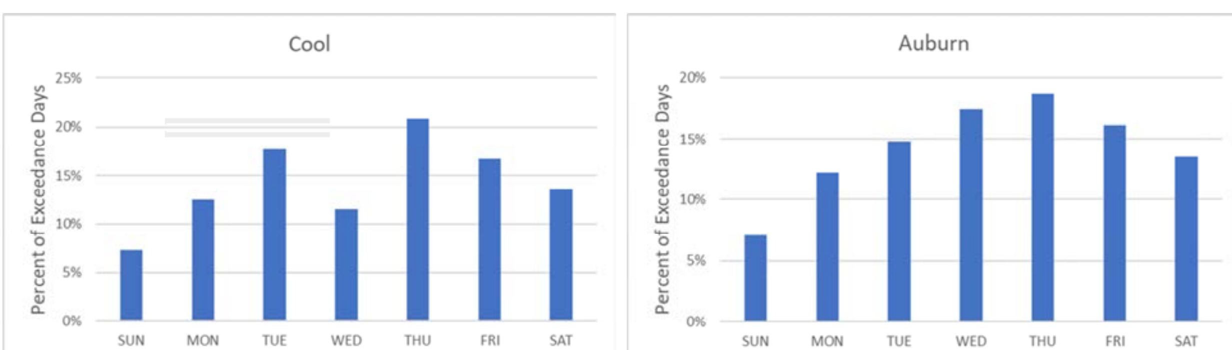
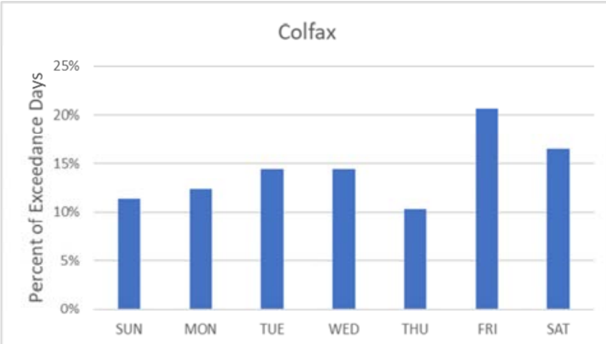
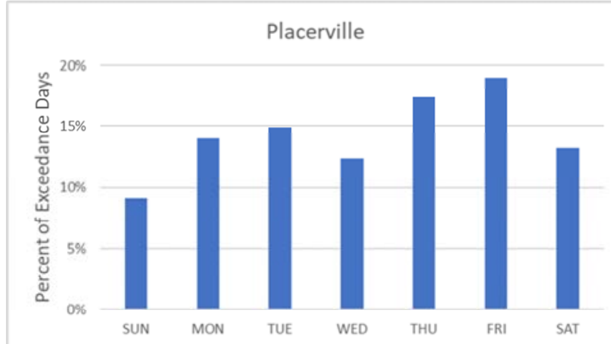


Figure F-24 Distribution of Exceedance Days by Day of the Week at Sites in the Eastern Sacramento Subregion (2016-2021)



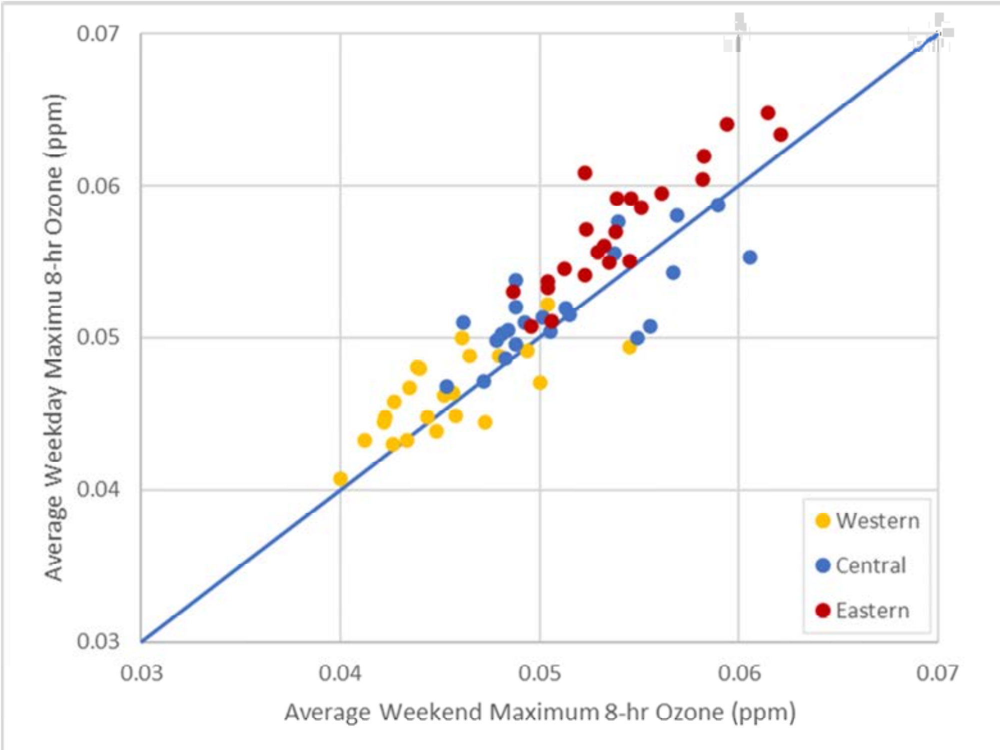




F.7.1.II. Weekday vs. Weekend Concentration

The day-of-week dependence of ozone in the Sacramento area was also investigated using the average weekday (Tuesday and Thursday) and weekend (Sunday) maximum 8-hour ozone concentrations observed in the ozone season (May through October) from 2000-2021. As shown in Figure F-25, for most of the past 22 years, daily maximum 8-hour ozone concentrations were generally higher on weekdays than on weekends, an indication that the SFNA no longer experiences the weekend effect. The occasional shift in weekday/weekend ozone levels near the 1:1 line and crossing over the line is likely due to inter-annual variability in meteorological conditions and its impact on the regional transport patterns and local biogenic VOC emissions. NO_X concentrations in the SFNA follow similar patterns to the ozone trends displayed in Figures F-23, F-24, and F-25, with elevated concentrations during weekdays compared to the weekend, demonstrating a notable correlation. A study found that NO_X concentrations in the SFNA were significantly lower on the weekend whereas VOC concentrations were not significantly different between the weekdays and the weekend (Murphy et al. 2006). Figure F-9 shows greater NO_X reductions compared to VOC reductions during 2000-2021 demonstrating that long-term control strategies are proving to substantially reduce NO_X. Continued current and future emissions controls are expected to decrease NO_X concentrations faster than VOC concentrations, thereby increasing the VOC to NO_X ratio and reinforcing the SFNA as a NO_X limited regime. This supports the conclusion that the SFNA no longer yields a weekend effect and NO_X control strategies serve as an important role in regulating ozone production.

Figure F-25 Average Weekday and Weekend daily Maximum 8-Hour Average Ozone for Each Year from 2000 to 2021



F.8. Attainment Projections

As discussed in this WOE, ozone production is a non-linear process, and the drivers of production can vary over relatively short spatial and temporal scales. The rate of historical ozone air quality improvements has varied over time in response to the change in composition and quantity of NO_X and ROG emissions across the SFNA. Both photochemical modeling and the air quality analysis presented in this WOE demonstrate that the path to attainment in the SFNA is a NO_X-focused control strategy. Therefore, it is expected that the ozone air quality will keep improving as controls are implemented within a NO_X-limited ozone production regime. Photochemical modeling and air quality data analysis presented in this WOE document both project that all sites will be able to meet the 0.070 ppm ozone standard by the attainment year of 2032.

F.9. Conclusions

The SFNA has requested to be a severe ozone nonattainment area with an attainment date of 2032 for the 0.070 ppm ozone standard. The SFNA has faced several challenges that impact ozone and ozone precursor concentrations, but analyses demonstrate that the SFNA will be able to achieve attainment by the 2032 attainment deadline. This WOE evaluated ambient air quality and emission trends along with photochemical modeling analyses to assess progress and demonstrate that the SFNA will be able to meet the 2032 deadline with the currently adopted control measures and commitment to reduce NO_X emission from mobile sources.

The SFNA is characterized by varied terrain, which limits dispersion and effectively traps emissions. Meteorological conditions in the SFNA are dominated by a semi-permanent high-pressure system that enhances the trapping effect of the local terrain, a thermally driven afternoon Delta breeze, and a nighttime downslope drainage flow recirculation pattern that routinely transports emissions between the central region and the foothills in the eastern region of the SFNA. The SFNA is also home to nearly 2.5 million people and the intersection of three major highways, and consequently, the movement of people and goods is a significant source of emissions. These meteorological, topographical, and population characteristics lead to effectively trapped pollutants in the region.

Despite these features, concentrations of ozone precursors, NO_X and ROG, and ozone have declined substantially over the past two decades with a significant reduction in exceedance days. Between 2000-2021, total NO_X emissions in the SFNA decreased by 67 percent and total ROG emissions by 44 percent. In 2021, 6 of the 16 monitoring stations met the ozone standard with the remaining sites within 17 percent of the standard. Long term ozone trends show that the design value and the annual fourth highest ozone concentration decreased by 20 and 18 percent, respectively, during the same period. The frequency of exceedance days and the magnitude of concentrations on exceedance days, which are measures of population exposure, have improved dramatically. The annual average number of exceedance days declined by 76 percent from the period 2000-2002 to the period 2019-2021. In addition, an estimated 45 percent of the population, as of 2021, live in areas that meet the standard, compared to 0 percent in 2000.

Prior studies conducted within the SFNA, and downwind Mountain Counties Air Basin have indicated differences in the number of exceedances occurring on weekends versus weekdays between 1985 and 2002 (Blanchard and Fairley 2001, Marr and Harley 2002, Murphy et al 2006, and Murphy et al 2007); however, more recent analyses indicate that there is no notable weekend/weekday difference in the SFNA. Photochemical modeling, supported by extensive monitoring and research efforts, indicate that the SFNA has transitioned to be in a NO_X-limited regime in recent years and the path towards attainment of the 0.070 ppm ozone standard is with NO_X-focused control strategies.

Air quality analyses included in this WOE indicate that substantial progress has been made in the SFNA, and all sites within the region are expected to meet the 0.070 ppm ozone standard by the attainment deadline of 2032.

F.10. References

CARB. *The Ozone Weekend Effect in California.* Air Resources Board Staff Report, Planning and Technical Support Division and Research Division. [2003].

---. 2022. SFNA Reclassification Transmittal Letter. Executive. Air Quality Planning and Science Division. September 6, 2022. Print.

BAAQMD. Planning, Rules and Research Division. “Ozone Modeling and Data Analysis During CCOS”, (2009). Web. 25 May 2023. < *https://sj-admin.s3-us-west-2.amazonaws.com/2009_0900_BAAQMD_OzoneModeling.pdf* >

Blanchard, Charles L, and David Fairley. “Spatial Mapping of VOC and NOx-Limitation of Ozone Formation in Central California.” *Atmospheric Environment*, vol. 35, no. 22, 2001, pp. 3861–3873, *https://doi.org/10.1016/s1352-2310(01)00153-4*.

EPA. *Modeling Guidance for Demonstrating Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze*. Office of Air Quality Planning and Standards, Air Quality Assessment Division. [2018] Web. 04 January 2023. < *https://www.epa.gov/sites/default/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf* >

Marr, Linsey C., and Robert A. Harley. “Spectral Analysis of Weekday–Weekend Differences in Ambient Ozone, Nitrogen Oxide, and Non-Methane Hydrocarbon Time Series in California.” *Atmospheric Environment*, vol. 36, no. 14, 2002, pp. 2327–2335, *https://doi.org/10.1016/s1352-2310(02)00188-7*.

Murphy, J. G., et al. “The Weekend Effect within and Downwind of Sacramento: Part 2. Observational Evidence for Chemical and Dynamical Contributions.” *Atmos. Chem. Phys. Discuss*, vol. 6, 2006, pp. 11971–12019, *https://doi.org/10.5194/acpd-6-11971-2006*.

---. “The Weekend Effect within and Downwind of Sacramento – Part 1: Observations of Ozone, Nitrogen Oxides, and VOC Reactivity.” *Atmospheric Chemistry and Physics*, vol. 7, no. 20, 2007, pp. 5327–5339, *https://doi.org/10.5194/acp-7-5327-2007*.

Wolff, George T., et al. “The Vanishing Ozone Weekday/Weekend Effect.” *Journal of the Air & Waste Management Association*, vol. 63, no. 3, 2013, pp. 292–299, *https://doi.org/10.1080/10962247.2012.749312*.

Wu, Shenglun, et al. “Direct Measurements of Ozone Response to Emissions Perturbations in California.” *Atmospheric Chemistry and Physics*, vol. 22, no. 7, 2022, pp. 4929–4949, *https://doi.org/10.5194/acp-22-4929-2022*.

APPENDIX G
VMT Emissions Offset Demonstration

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G. VMT EMISSIONS OFFSET DEMONSTRATION

G.1. Introduction

Within two years after the adoption of a national ambient air quality standard (standard), the Clean Air Act (CAA) requires states to submit enforceable transportation control strategies (TCSs) and transportation control measures (TCMs) to offset any growth in volatile organic compounds (VOC) emissions due to increases in vehicle miles traveled (VMT) and the number of vehicle trips from the base year to the attainment year of the state implementation plan (SIP) for severe and extreme nonattainment areas. The Sacramento Federal Nonattainment Area (SFNA) was originally classified as moderate and subsequently was reclassified to serious for the 70 parts per billion (ppb) 8-hour ozone standard. The SIP for the 70 ppb 8-hour ozone standard for the SFNA now includes a request to be reclassified to severe. Accordingly, the California Air Resources Board (CARB) analyzed the change in VOC emissions related to growth in VMT and whether additional TCSs and TCMs are needed for the SFNA to meet the 70 ppb 8-hour ozone standards for the severe classification, as required by Section 182(d)(1)(A) and in accordance with United State Environment Protection Agency (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” (“2012 guidance”).[1]

G.2. EPA guidance on VMT offset requirement

In its 2012 guidance, EPA indicated that improvements in vehicle technology, motor vehicle fuels, and other transportation control strategies could be used to offset emission increases from VMT. The guidance also set forth a methodology for demonstrating whether existing TCSs and TCMs adequately offset any increase in VOC emissions from VMT growth. For example, if the projected attainment year emissions, assuming no new control measures and no VMT growth, are less than the projected actual attainment year emissions, including new control measures and VMT growth, then no additional TCMs or TCSs are 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 70 ppb 8-hour ozone standard.

G.3. Transportation Control Strategies and Transportation Control Measures

Generally, TCSs consist of strategies such as motor vehicle emission standards,

[1] 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

inspection and maintenance programs, alternative fuel programs, and other technology-based measures. On the other hand, TCMs are strategies that reduce emissions or concentration of air pollutants by reducing the number of vehicle trips or VMT or improving traffic flow. The CAA §182(d)(1)(A) differentiates between TCSs and TCMs in more detail, 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 EPA's 2012 guidance.

With respect to TCSs, since 1990, when this requirement was established, the State has adopted a substantial number of enforceable TCSs—more than enough to meet the requirement to offset increased emissions from VMT growth. Attachment A-1 provides a list of the State's mobile source TCSs that CARB has adopted since 1990 and for which the benefits are included in this analysis.

TCMs are generally adopted at the regional scale as part of a regional transportation plan (RTP). For the SFNA, the Sacramento Area Council of Governments (SACOG) is designated under federal law as the metropolitan planning organization (MPO) and under State law as a regional transportation planning agency and a council of governments for the region and is therefore responsible for adopting TCMs. On September 15, 2022, SACOG adopted the 2020 Metropolitan Transportation Improvement Program (Amendment #2), which contains their adopted TCMs.

G.4. Methodology

The following calculations are based on EPA's 2012 guidance. For the 70 ppb 8-hour ozone standard for the severe area, 2017 and 2032 are the base and attainment years, respectively.

This analysis uses California's motor vehicle emissions model, EMission FACtor (EMFAC).[2] On August 15, 2019, EPA approved EMFAC2017 for use in SIPs and to demonstrate transportation conformity.[3] The EMFAC model estimates the emissions from two combustion processes – running exhaust and start exhaust – and from 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. Therefore, emissions from these processes are directly related to vehicle starts and VMT. These processes are included in calculating 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 vehicle travel occurs on a given day.

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2 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

3 84 FR 41717 https://www.federalregister.gov/d/2019-17476

To calculate on-road emission inventories in the SFNA, EMFAC combines VMT and speed distributions from the 2020 MTIP (Amendment #2). The number of vehicles starts per day is based on household travel surveys, and vehicle population data are from the California Department of Motor Vehicles with corresponding emission rates from EMFAC to calculate emissions. The number of vehicle trips per day is based on data provided by SACOG's 2020 MTIP (Amendment #2).

G.5. VMT Offset Analysis

CARB staff compared target-year VOC emissions under three VMT and emission control scenarios in a two-step process.

G.5.1. Step 1. Provide the emissions levels for the 2017 base year.

Table G-1 shows the SFNA VOC emissions for the calendar year 2017 from the EMFAC2017 model.

Table G-1 SFNA Base Year (2017) VMT and Emissions

Description	VMT (miles/day)	VOC (tons/day)
2017 Vehicle Miles Traveled and On-Road Emissions	60,106,548	15.0

G.5.2. Step 2. Calculate three emission 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 would represent the emissions in the attainment year if TCSs and TCMs were not implemented after 2017.

(2) Calculate emissions levels with the motor vehicle control program frozen at 2017 levels and assuming VMT does not increase from 2017 levels. In other words, this would represent the emissions in the attainment year if TCSs and TCMs were not implemented after 2017 and VMT levels remained at 2017 levels.

(3) Calculate an emissions level that represents emissions of projected VMT in the attainment year with full implementation of all TCSs and TCMs since 2017. In other words, this would represent the emissions in the attainment year if TCSs and TCMs were implemented after 2017 and show the necessity of TCSs and TCMs in offsetting VMTs for the region.

G.5.3. Calculation 1. Calculate the emissions in the attainment year assuming growth in VMT and no new control measures since the base year.

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 emission levels in 2032 without the benefits of the post-2017 control programs. As a result, the projected VOC emissions are 8.4 tons per day for 2032. In comparison, the base year of 2017 VOC emissions were 15.0 tons per day.

G.5.4. Calculation 2. Calculate the emissions with no growth in VMT.

EMFAC2017 allows the user to input different VMT values. CARB ran EMFAC2017 for the calendar year 2032 with the 2017 VMT level of 60,106,548 miles per day without the benefits of the post-2017 control programs. The VOC emissions associated with the 2017 VMT level are 7.3 tons per day for 2032.

G.5.5. 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 6.9 tons per day for 2032.

VOC emissions for the calculations described above are provided in Table G-2.

Table G-2 SFNA VOC Emissions Calculations for the 2032 Attainment Year (70-ppb severe plan)

Calculation Number	Description	VMT year	Vehicle Control Program year	VMT (miles/day)	VOC (tons/day)
1	Emissions with motor vehicle control program frozen at 2017 levels (VMT at 2032 projected levels)	2032	2017	67,090,959	8.4
2	Emissions with motor vehicle control program frozen at 2017 levels (VMT at 2017 levels)	2017	2017	60,106,548	7.3
3	Emissions with a full motor vehicle control program in place (VMT at 2032 projected levels)	2032	2032	67,090,959	6.8

As provided in the 2012 EPA guidance, to determine compliance with CAA §182(d)(1)(A), Calculation 3 emissions levels should be less than or equal to the Calculation 2 emissions levels:

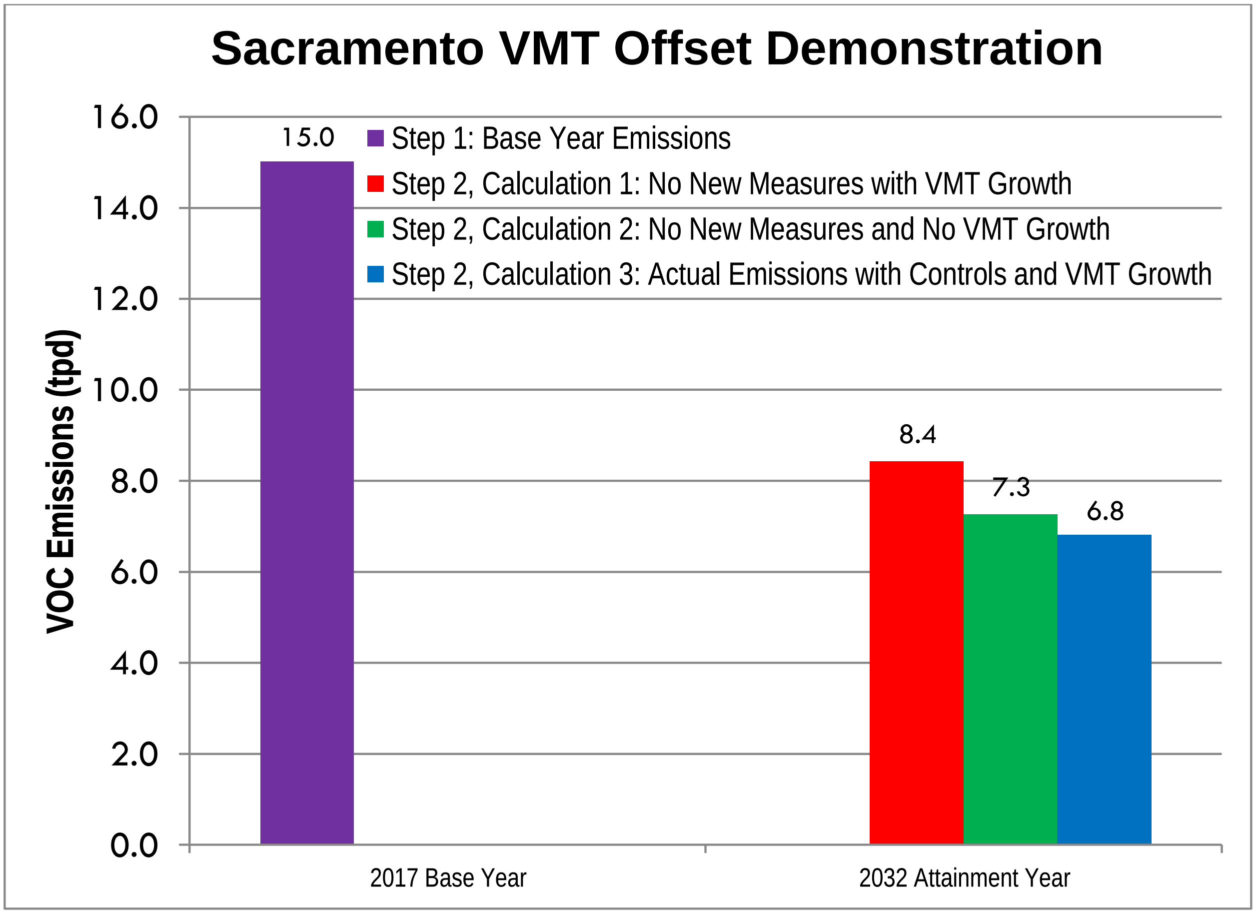
VOC: 6.8 < 7.3 tons per day for the 70 ppb severe plan

Since the estimated attainment year emissions in Calculation 3 are less than the VMT Offset ceiling (Calculation 2), additional TCMs and TCSs will not be needed.

G.6. Summary

To further illustrate the demonstration, Figure G-1 graphically displays the emissions benefits of the motor vehicle control programs in offsetting VOC emissions resulting from VMT increases in the SFNA. For the 70 ppb 8-hour ozone severe nonattainment standard, the left-most bar (in purple) shows the emissions in the 2017 base year. The three bars on the right show the emission levels in the attainment year 2032. The red bar on the right represents the emissions if there are no further motor vehicle controls after the base year (2017 level) and with projected VMT increases (2032 level). The green bar represents the emissions if VMT does not increase from the 2017 base year and there are no new TCSs or TCMs after the base year. Finally, the blue bar represents the emission levels with all the existing motor vehicle control programs in place with projected VMT increases.

Figure G-1 SFNA VMT Offset Demonstration for the 70 ppb 8-hour Ozone Standard*



* Does not include resting or diurnal loss emissions

G.7. Conclusion

The previous sections provide an analysis to demonstrate compliance with CAA §182(d)(1)(A). Based on the 2012 EPA guidance, since emissions with the existing control measures and VMT are less than or equal to emissions with no new measures and no VMT growth, no additional TCSs and TCMs will be needed to offset the growth in emissions.

G.8. References

EPA, *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).* Washington, D.C. Office of Transportation and Air Quality. [2012]. Web 10 August 2023. < https://nepis.epa.gov/Exe/ZyPDF.cgi/P100EZ4X.PDF?Dockey=P100EZ4X.PDF >

---. (84 FR 41717-41720) *Official Release of EMFAC201 Motor Vehicle Emission Factor Model for Use in the State of California*. Federal Register, Volume 84, 15 August

2019, p. 41717-41720. Web 10 August 2023. < https://www.govinfo.gov/content/pkg/FR-2019-08-15/pdf/2019-17476.pdf >

G.9. Attachment: State of California Motor Vehicle Control Program (1990-Present)

Table G-3 Transportation Control Strategies Adopted by the California Air Resources Board since 1990

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
Heavy Duty Diesel Engine Standards for 2007 and Later. T 13, CCR, 1956.8 and incorporated test procedures	10/25/2001	On-Road

Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	**Hearing Date**	**Category**
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	Fuels
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
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

Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	**Hearing Date**	**Category**
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	Fuels
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
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

Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	**Hearing Date**	**Category**
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
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