Northern Sierra Air Quality Management District

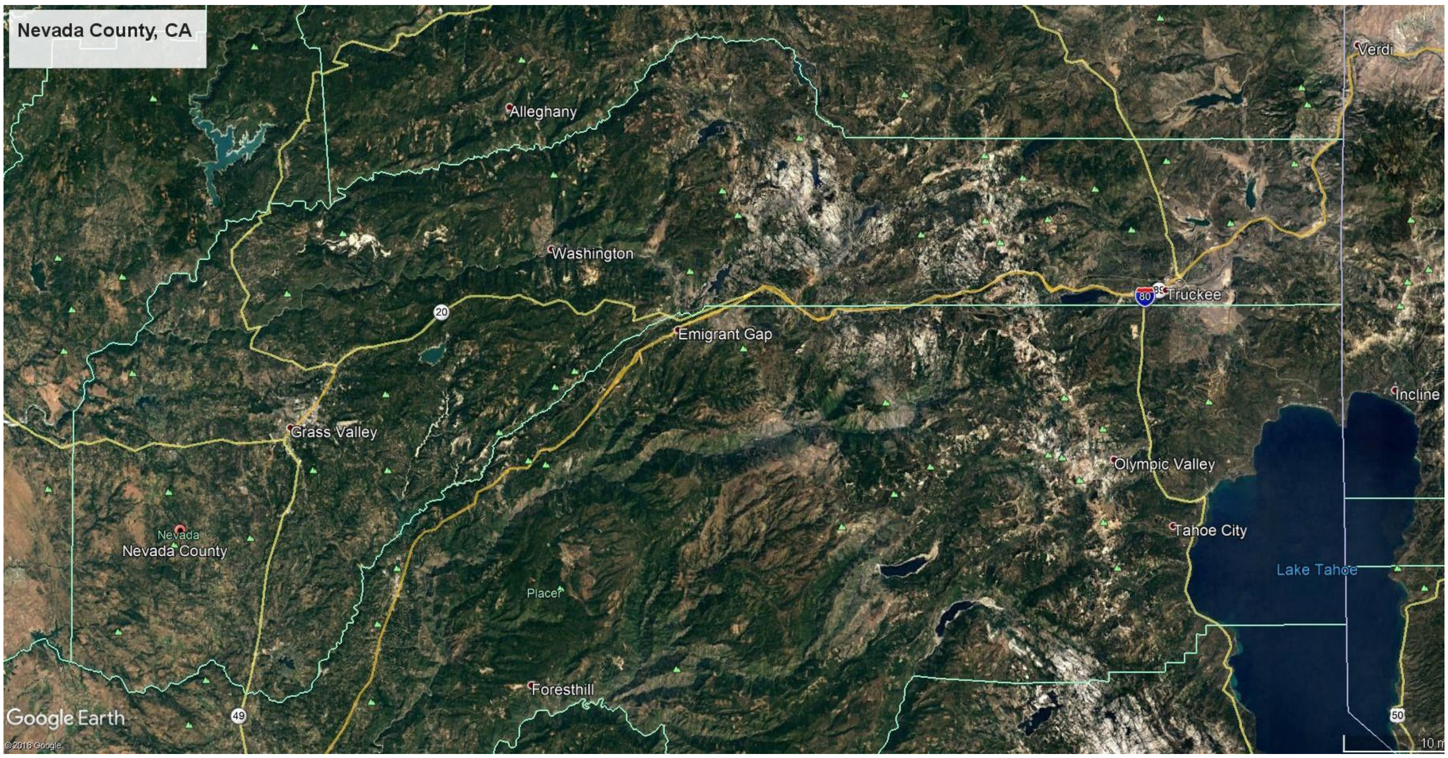

Image from Google Earth, 8/28/18

Ozone Attainment Plan for Western Nevada County

State Implementation Plan for the 2015 70 ppb Ozone Standard

Adopted: 2/27/2023

by Northern Sierra Air Quality Management District

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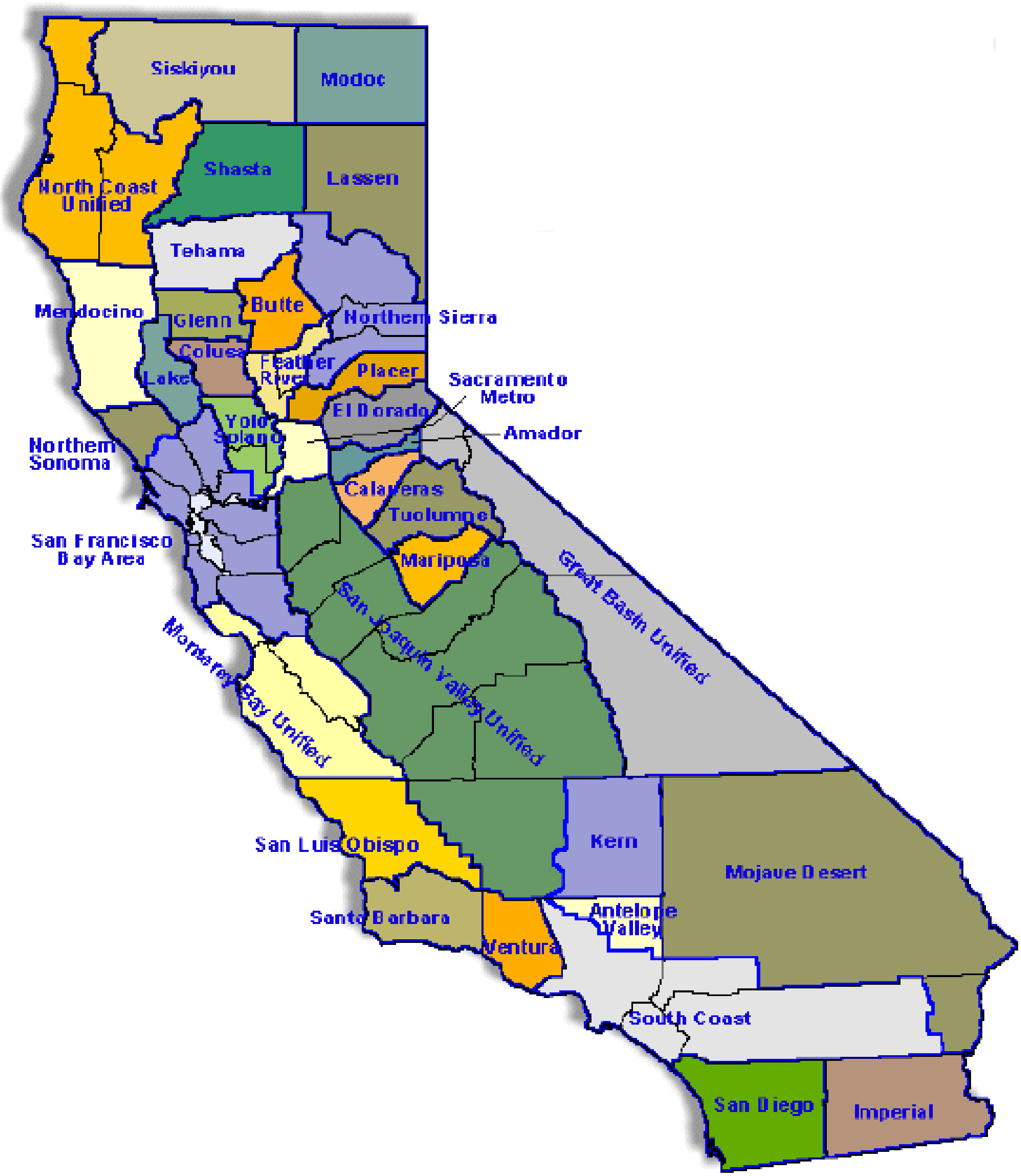

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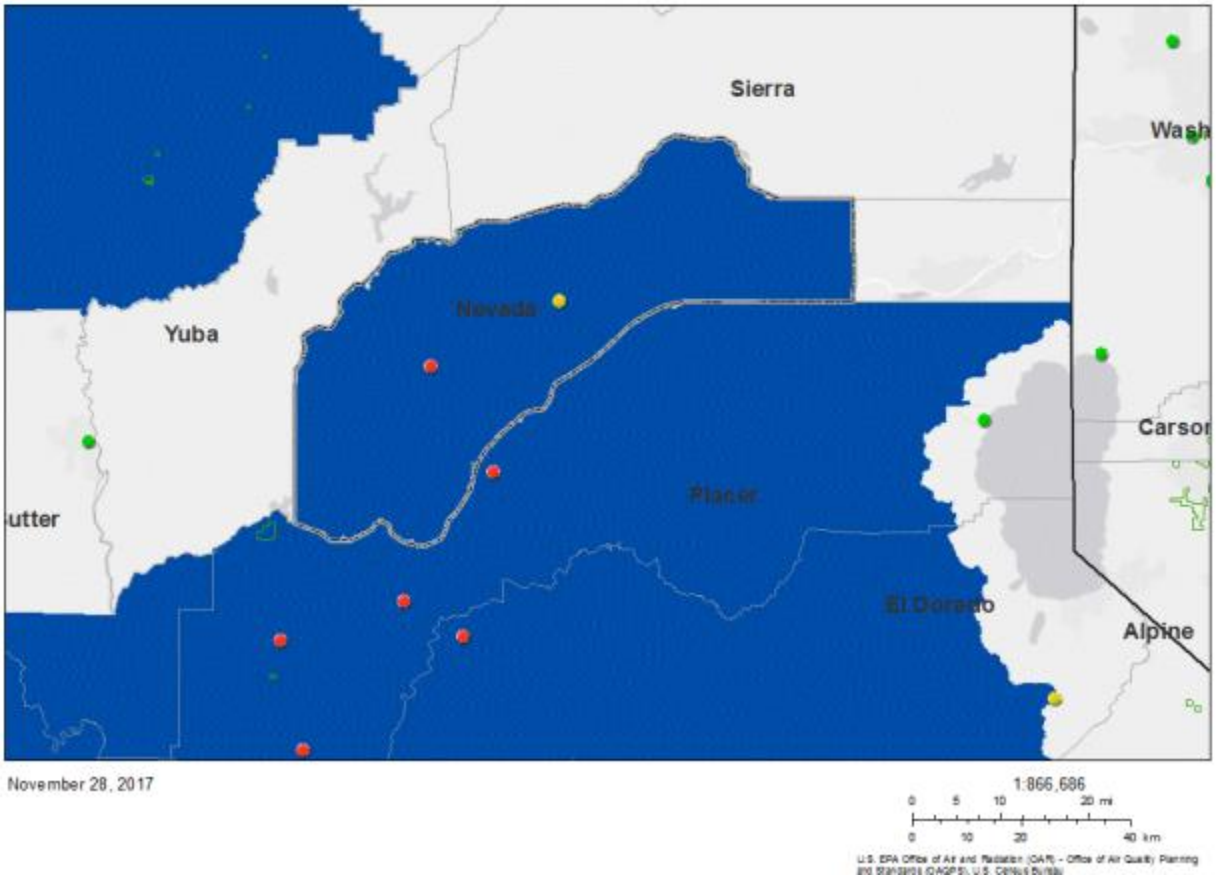

Source: CALIFORNIA Intended Area Designations for the 2015 Ozone National Ambient Air Quality Standards Technical Support Document (TSD) (Western part), EPA[1]

[1] https://www.epa.gov/sites/default/files/2017-12/documents/ca_120d_tsd_combined_final.pdf, page 148

EXECUTIVE SUMMARY

This State Implementation Plan (SIP) revision is being submitted by the Northern Sierra Air Quality Management District (District or NSAQMD) to the U.S. Environmental Protection Agency (EPA) to fulfill requirements under the federal Clean Air Act (CAA) that result from Western Nevada County being designated as nonattainment for the 2015 8-hour Ozone National Ambient Air Quality Standards (NAAQS). The Northern Sierra Air Quality Management District includes the California counties of Nevada, Sierra and Plumas. In 2018, the Western Nevada County portion of the District was designated nonattainment and classified "moderate" for the 2015 8-hour NAAQS of 0.070 ppm. On October 28, 2021, the area was reclassified to serious nonattainment (effective November 29, 2021).

The California Air Resources Board (CARB) has conducted photochemical modeling, along with supplemental analyses, to find out when the Western Nevada County Nonattainment Area (WNNA) could attain the 2015 Ozone NAAQS. The results indicated that the area could attain the 0.070 ppm standard by the Serious nonattainment area deadline of August 3, 2027 (based on 2024-2026 data).

This ozone attainment plan addresses all required Serious level elements, emissions reductions, and control measures necessary to demonstrate attainment with the 2015 8-hour Ozone NAAQS as expeditiously as practicable and no later than August 3, 2027.

I. INTRODUCTION

A. Ozone

Stratospheric ozone occurs naturally and is beneficial in the upper atmosphere, shielding the earth from harmful ultraviolet radiation from the sun. However, ground-level (tropospheric) ozone (O_3) is a highly reactive, strongly oxidizing, colorless gas that can damage living tissues, vegetation and man-made materials upon contact.

O_3 is not directly emitted from sources but is formed in the air by reactions of O_3 precursor emissions—volatile organic compounds (VOC) and oxides of nitrogen (NOx)—in the presence of sunlight and heat. Accordingly, peak O_3 levels occur during the sunnier, warmer times of the year, typically May through October.

Health effects of O_3 are focused on the respiratory tract. When inhaled, O_3 can irritate and inflame the lining of the lungs, much like sunburn damage on skin. Potential health impacts include aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illnesses like pneumonia and bronchitis. Individuals with compromised respiratory function are most vulnerable to O_3, but outdoor activities on "high" O_3 days can affect people who are normally healthy.

B. Background

The Federal Clean Air Act (FCAA) of 1970 requires the United States Environmental Protection Agency (EPA) to develop health-based National Ambient Air Quality Standards (NAAQS) for several categories of air pollutants, including ozone (O_3). EPA periodically reviews the NAAQS and associated scientific basis in determining appropriate revisions. Accordingly, EPA establishes new standards in response to advances in scientific understanding of ozone and its health effects.

Section 110 (a)(1) of the Federal Clean Air Act Amendments (FCAAA) of 1977 required EPA to divide the United States into "Planning Areas" and designate these areas "attainment," "nonattainment" or "unclassified." In late 2018 EPA finalized an "implementation" rule for the 2015 8-hour ozone NAAQS (also called the SIP Requirements Rule) [2], effective February 4, 2019, designed to assist states with plan development. Under the Implementation Rule, affected regions are required to address planning and emission control requirements in their implementation plan.

The FCAAA of 1990 gave states the primary responsibility for achieving the NAAQS. The principal mechanism for complying with the FCAAA was developing and adopting a State Implementation Plan (SIP). A SIP outlines programs, actions, and commitments a state will carry out to implement its responsibilities under the FCAAA. The EPA must approve all SIPs before they can be implemented by state and local governments. Once approved by the EPA, a

[2] Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements; Final Rule. 83 Fed. Reg., No. 234. Pp. 62998-63036. (Dec. 6, 2018). https://www.govinfo.gov/app/details/FR-2018-12-06/2018-25424 extracted 1/26/22.

SIP becomes a legally binding document under both state and federal law and may be enforced by either governmental body.

All nonattainment areas classified Moderate Nonattainment and higher, including Western Nevada County, are subject to the general planning and emission control requirements of Subpart 2 (Title I, Part D) of the FCAA, which include an emission inventory, a New Source Review rule and an Emissions Statements Rule.

Attainment is achieved when: "3-year average" of "annual 4^{th} highest daily maximum" 8-hour average O_3 concentration, called "Design Value", is no greater than 0.070 ppm at each EPA-approved O_3 air monitor in the District. The "3-year & 4^{th} highest" are statistical values that provide stability to the standard, moderating the influence of extreme meteorological conditions (over which an area has no control).

C. Nevada County Split

Nevada County spans the Sierra Nevada mountain range. The Town of Truckee is near the eastern boundary, east of the Sierra crest, and has vastly different weather from Western Nevada County. Historical ozone data from Grass Valley (in Western Nevada County) and Truckee show that there is no clear connection between conditions on the east side and the west side of the Sierras, with ozone concentrations almost always being much lower on the east side. Therefore, EPA limited its nonattainment designation to the western portion of the County. The dividing line runs north/south near the Sierra crest, less than a mile east of the town of Soda Springs.

The District worked with CARB to separate the Nevada County emissions inventory into an eastern and western portion, along the Nonattainment Area boundary. More than 80% of the County's population and emissions is in the western, nonattainment portion to which this SIP revision applies.

D. 1997 8-Hour NAAQS

The NAAQS was revised in 1997 to an 8-hour O_3 concentration of 0.08 ppm. The 8-hour averaging time was selected to address the impacts of exposure to longer periods of elevated O_3. The 0.08 ppm O_3 standard is attained when: Each monitor in a region shows a three-year O_3 concentration average, of the annual fourth-highest daily 8-hour average, no greater than 0.084 ppm (based on the rounding convention dictated in federal regulation)[3]. Three years of O_3 concentrations are averaged due to the impacts of year-to-year variations in meteorology on O_3 formation.

The Western Nevada County portion of the District was designated in 2004 by EPA as a Nonattainment Area for the national 1997 NAAQS of 0.080 parts per million (ppm), pursuant to the CAA. By 2011, the Design Value[4] of the District's Ozone Nonattainment Area had dropped from 0.098 ppm (2003 level) to 0.079 ppm. On December 3, 2012, EPA published a

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[3] Appendix I to 40 CFR 50, "Interpretation of the Eight-Hour Primary and Secondary National Ambient Air Quality Standards for Ozone."

[4] The three year average of the fourth highest 8-hour ozone value for the target year and the two preceding years is the design value for that year. To determine attainment that design value is compared to the Ozone NAAQS.

Determination of Attainment for the WNNA for the 1997 8-hour O_3 NAAQS.[5] With this finding, effective January 2, 2013, Western Nevada County was deemed to have "clean data" with respect to the 1997 standard, which suspended numerous CAA planning requirements for that standard.

E. 2008 8-Hour Standard

In 2008 EPA adopted a more stringent 8-hour ozone NAAQS of 0.075 ppm[6]. Although Western Nevada County showed a significant reduction in O_3 levels through data meeting the 1997 O_3 NAAQS, the area was designated nonattainment in 2012 and was reclassified to Serious nonattainment in 2019 (84 FR 44238, August 23, 2019).

The District worked with CARB and EPA to prepare an attainment plan SIP for the 2008 standard. At 86 FR 27524 (May 21, 2021), EPA approved all the SIP elements except for the contingency measure's component, which was conditionally approved.

At (October 20, 2022), EPA issued a notice of final rule making, finalizing approval to determine that Nevada County (western portion), attained the 2008 ozone NAAQS by the July 20, 2022 attainment date.[7] Further, because of this proposed attainment, EPA proposed that the requirement for the state to have contingency measures for Reasonable Further Progress (RFP) and attainment for the 2008 ozone NAAQS will no longer apply, because the contingency measures would never be needed given the attainment of the NAAQS.

F. 2015 8-Hour Standard

In 2015 EPA adopted a yet more stringent 8-hour ozone NAAQS of 0.070 ppm. In 2018, the Western Nevada County portion of the District was designated nonattainment and classified "moderate" for the 2015 8-hour NAAQS of 0.070 ppm. On October 28, 2021, the area was reclassified to Serious nonattainment (effective November 29, 2021)[8]. Accordingly, this SIP revision addresses Serious level nonattainment requirements and demonstrates expected attainment as early as reasonably practicable but no later than the Serious area deadline of August 3, 2027 (based on 2024 – 2026 data).

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[5] 77 FR 71551-71555; December 3, 2012.
[6] 73 FR 16436; 40 CFR 50.15, "National Primary & Secondary Ambient Air Quality Standards for Ozone."
[7] 87 FR 63698; October 20, 2022.
[8] 86 FR 59648-59651; October 28, 2021.

II. CHALLENGES

A. Meteorology

The predominant wind direction in Western Nevada County, especially during the summer months, is from southwest to northeast. This pattern is conducive to transport of pollutants from the Bay Area and the Sacramento Area into Nevada County. On most summer mornings the "delta breeze" moves from the Carquinez strait northeast towards Sacramento and then veers northward and continues into the northern Sacramento Valley and into the foothills of the northern Sierra Nevada, including Western Nevada County. High ozone days are typically associated with light to moderate winds blowing from the direction of Sacramento. In the absence of a significant weather system affecting the area, summertime winds in Nevada County typically flow up-slope in the daytime and down-slope at night (referred to as diurnal flow).

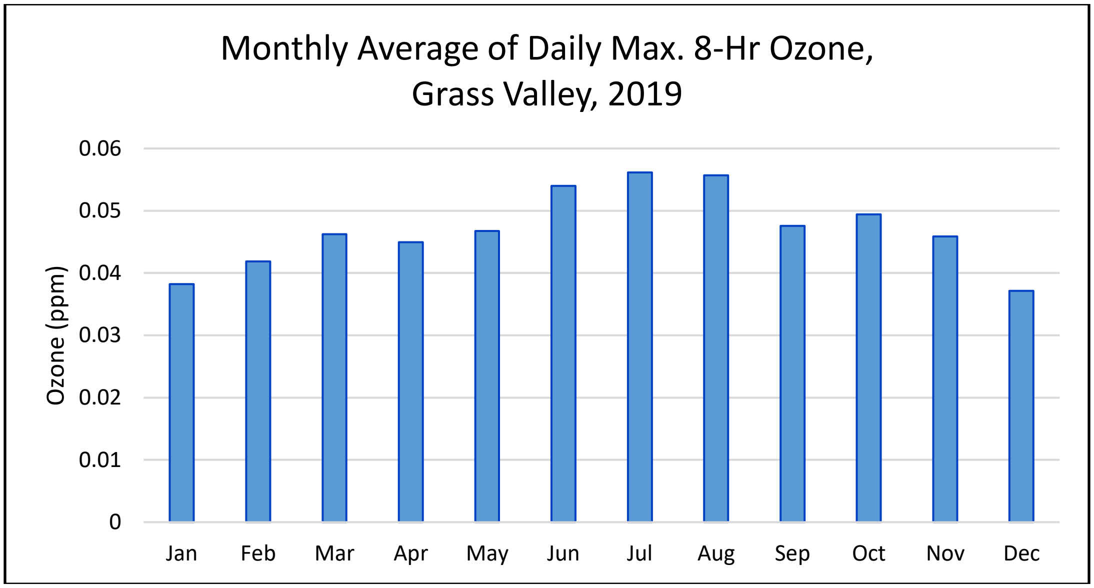
Most ozone exceedances happen on hot, dry, clear afternoons and evenings. High summer temperatures and low relative humidity play a big role in O_3 formation. Sunlight is another factor, with exceedance days being relatively concentrated in the long, clear days of June through August. The combination of a hot, dry summer and little to no cloud cover favor photochemical O_3 formation.

As a result of conditions encouraging ozone formation and the transport of both ozone and ozone precursors from upwind metropolitan areas, O_3 concentrations tend to be the highest in July and August.

Figure 3 shows the monthly average of daily maximum 8-Hr Average O_3 concentration during 2019, measured at the District's Grass Valley[9] air monitoring site. O_3 concentrations gradually rise from the beginning of the year toward the summer where levels peak in July and August when temperatures are usually the hottest, then decline during the fall.

[9] Data from NSAQMD maintained Ozone monitoring site at 200 Litton Dr., Grass Valley via AQS.

Figure 3: Monthly Average of Daily 8-hour Ozone Maximums, Grass Valley, 2019.



B. Geography

The Western Nevada County Nonattainment Area is located in northern California's Sierra Nevada foothills. Although the Nonattainment Area is relatively small (802.41 square miles), it rises from near 300 feet AMSL in the west to over 9,000 feet AMSL near the eastern boundary. The eastern boundary is a line running north/south that more or less follows rugged mountain tops that form the "Sierra Crest." The line crosses I-80 slightly east of the town of Soda Springs. The Nonattainment Area is bordered on the north by the Middle Yuba River and is bisected by the South Yuba River. Most of the southern border is defined by the Bear River. The massive scenic canyons created by these rivers run predominantly east/west and are more than 2,000 feet deep in some places.

The WNNA ozone monitor is located at an elevation of approximately 2,860 feet, in the City of Grass Valley. Only 5 miles northwest of the monitor (along the South Yuba River) the elevation is 1,725 feet lower, and 12 miles south (along the North Fork of the American River) the elevation is 1,700 feet lower. Much of the western edge of the WNNA is below 500', a difference of 2,300 vertical feet from the monitor. 1.5 miles NW of the monitor, the elevation is 700 feet lower. Fewer than 5 miles NE of the monitor, on Banner Mountain, the elevation climbs another 1,000 feet. Downtown Grass Valley, the WNNA's biggest city (2020 Census Bureau estimated population 13,624), is approximately 1 mile SW from the monitor and 400 feet lower. This complex topography can cause unpredictable air movement as different slopes warm and cool at different rates. The river canyons' profound effects on tropospheric air flow have historically introduced significant uncertainty into dispersion modeling.

Western Nevada County is northeast and generally downwind from the Sacramento Nonattainment Area. To the north is the unmistakably rural County of Sierra (2020 census population: 3,236). To the south is Placer County, and to the immediate west is largely agricultural Yuba County.

C. Pollutant Transport and Scavenging

It is common for air pollutants to be transported by wind between air basins. The District's air quality is overwhelmingly impacted by O_3 and its precursor emissions being transported from the Sacramento Nonattainment Area (classified Severe Nonattainment) and to a lesser extent from the San Francisco Bay Area. Transport can take place from the surface up to several thousand feet elevation. Transport occurs when winds are of sufficient magnitude, direction, and duration. Atmospheric chemistry also determines how transported pollutants may affect downwind O_3 concentrations.

Nevada County has approximately 102,000 people, but in Western Nevada County, the population is approximately 85,000 people (not including Truckee in the Eastern part of Nevada County). The WNNA's population is relatively dispersed, with approximately 106.8 people per square mile (5.99 acres per person).

Analyses of wind and ozone data from the Sacramento area and Western Nevada County demonstrate that O_3 and its precursors transport to the District when prevailing wind originates from consistently high O_3 concentration areas, and wind is persistent with high enough velocity to move emissions from upwind areas. Data also demonstrate elevated O_3 concentrations in the District coinciding with high upwind O_3 levels. **Figure 4** illustrates regional transport corridors and wind flow patterns[10].

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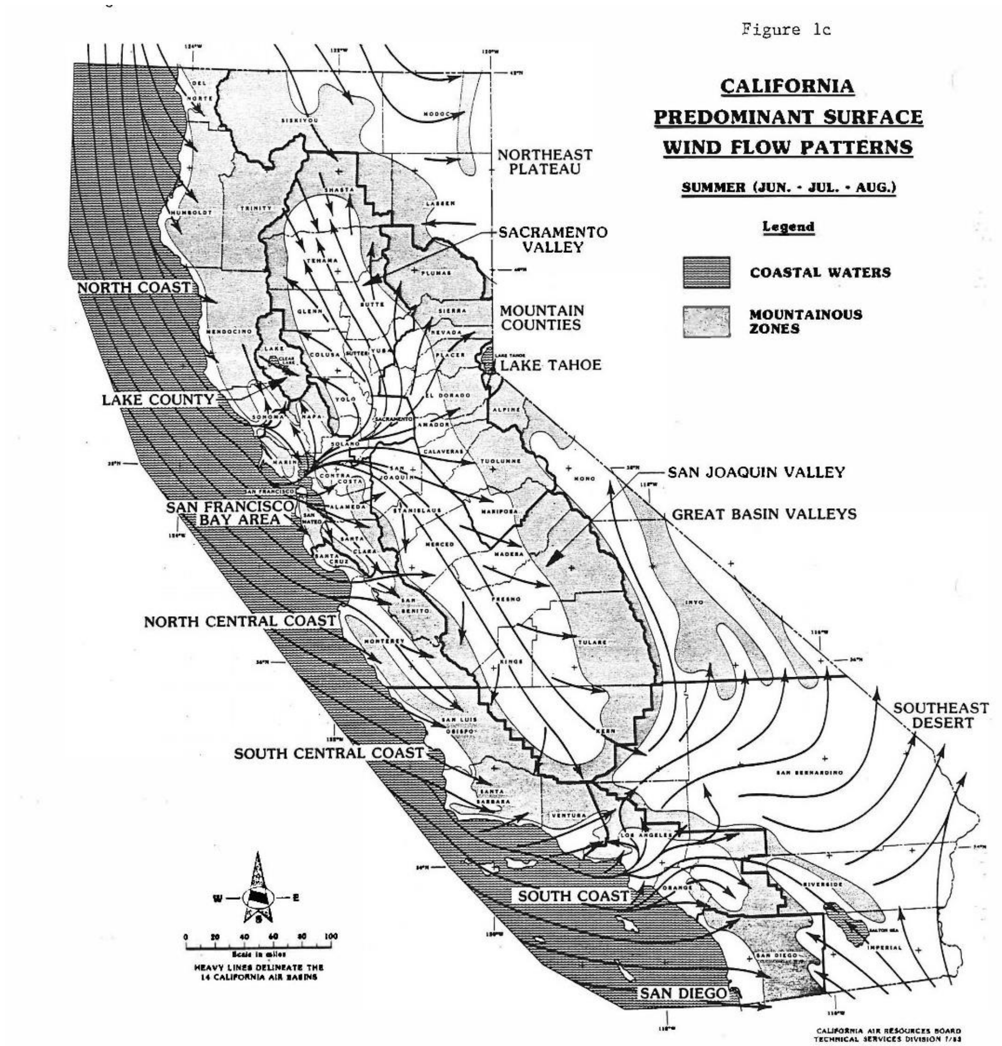
[10] From Hayes, T.P., J.J. Kinney, and N.J. Wheeler, 1984. California Surface Wind Climatology, 1984. Published by the California Air Resources Board. https://www.arb.ca.gov/research/apr/reports/l013.pdf

Figure 4: Transport Corridors & Wind Flow Patterns.

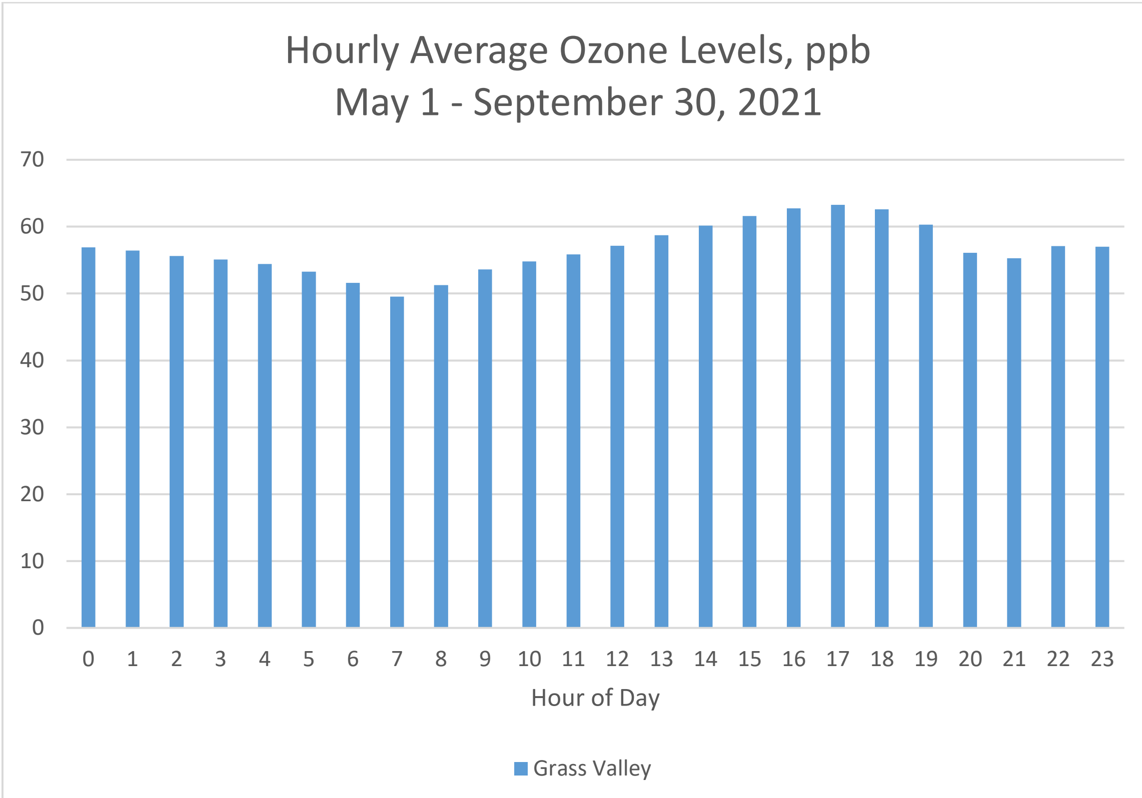


A widely accepted concept in ozone science is "nighttime NOx scavenging." In the absence of sunlight, new ozone is not formed, and NOx molecules are able to react with ozone and steal one of its oxygen atoms, resulting in an oxidized NOx molecule and normal, relatively unreactive oxygen (O_2).

NOx scavenging is thought to be largely responsible for the typical sharp drop-off of ozone concentrations in urban areas when the sun goes down. Urban areas generally have substantial NOx emissions after dark, primarily from motor vehicles and industrial processes. However, Western Nevada County has relatively little traffic after dark and no significant stationary nighttime NOx sources.

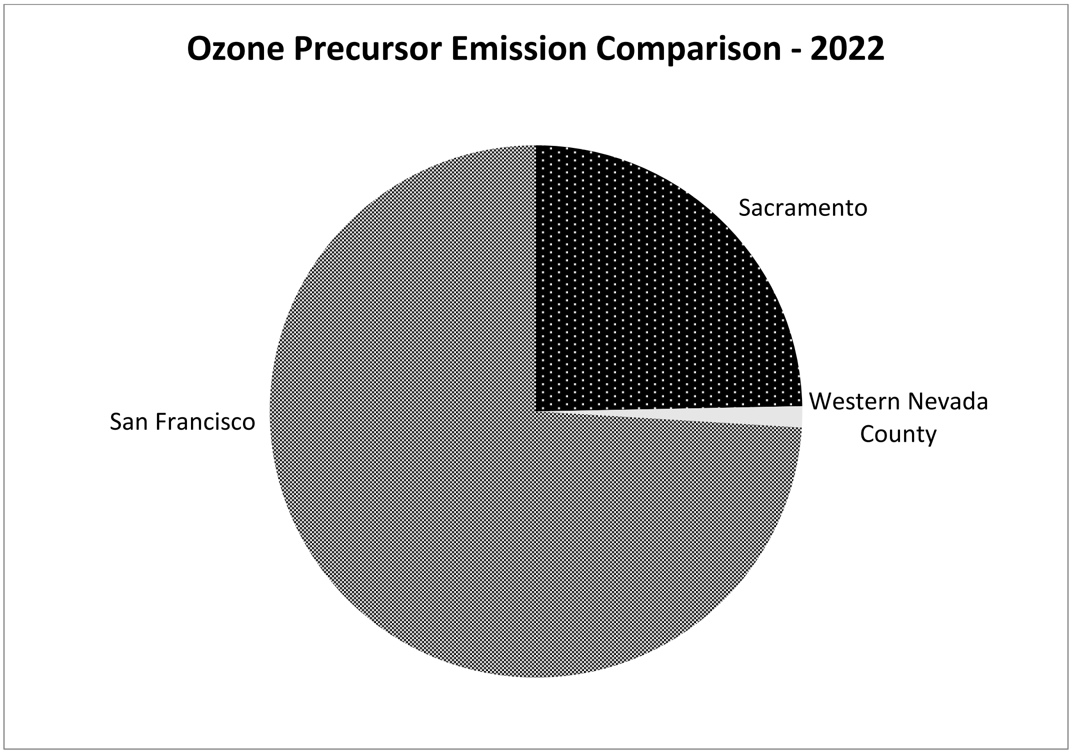
Figure 5 illustrates 2021 ozone values by time of day. It is apparent that the drop in ozone overnight is not substantial.

Figure 5: Grass Valley Ozone Concentrations by Hour of Day, May 1 – September 30, 2021.



The sheer quantity of emissions in the upwind metropolitan areas compared to Western Nevada County works with the transport mechanisms to overwhelm the latter (see **Figure 6**). Western Nevada County's summer emission inventory is miniscule (less than 8 tons per day of ozone precursors, with well under a ton of that coming from stationary sources, according to the most recent CEPAM 2019 inventory data from CARB). The area is a rural, downwind receptor of ozone and ozone precursors generated in upwind major metropolitan areas (primarily the Sacramento Nonattainment Area with 140 tons per day and the San Francisco Bay Area with 418 tons per day). **Figure 6** provides perspective regarding ozone precursor emissions in the upwind major metropolitan areas and in Western Nevada County.

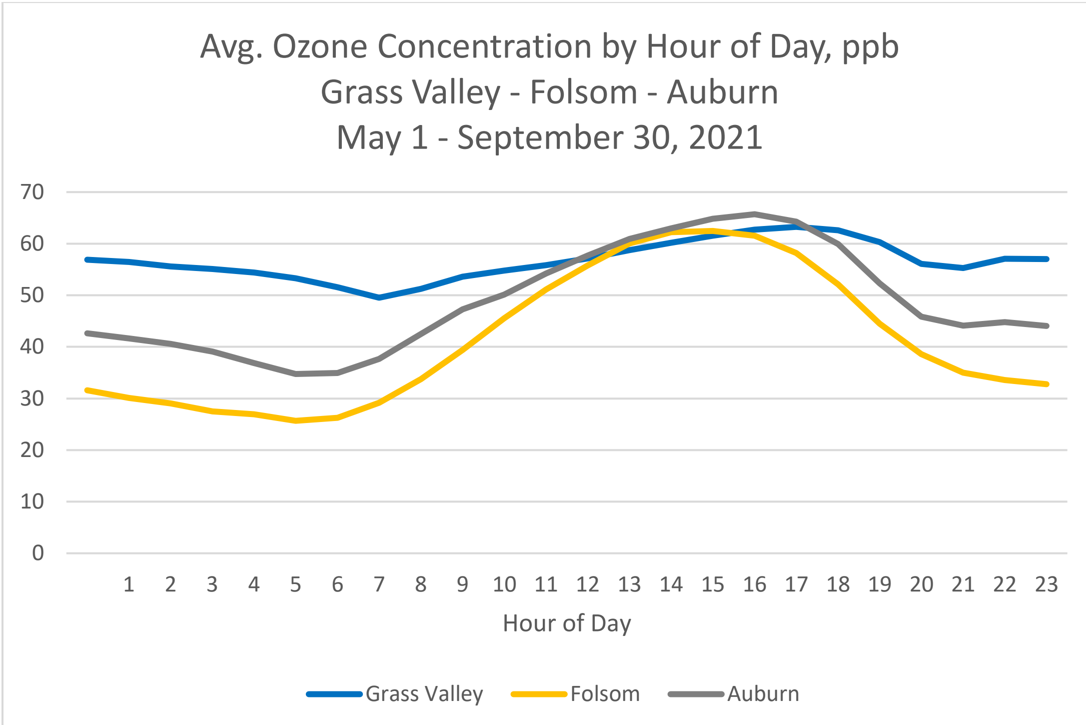
Figure 6: Summer Ozone Precursor Emissions – Western Nevada County, San Francisco Bay Area and Sacramento Nonattainment Area.



Source: CEPAM Version 1.04

The combination of minimal nighttime NOx scavenging and the gradual transport during the evening hours of ozone formed in upwind areas during the day frequently results in high nighttime ozone concentrations in Western Nevada County that sometimes persist until well after sunrise (see **Figure 7**). **Figure 7** also illustrates the delayed effect of ozone transport from upwind areas. Auburn is approximately half-way between the Folsom-Natoma Street monitor in the Sacramento metropolitan area and Grass Valley.

Figure 7: Ozone Concentrations by Hour of Day, May-September 2021.

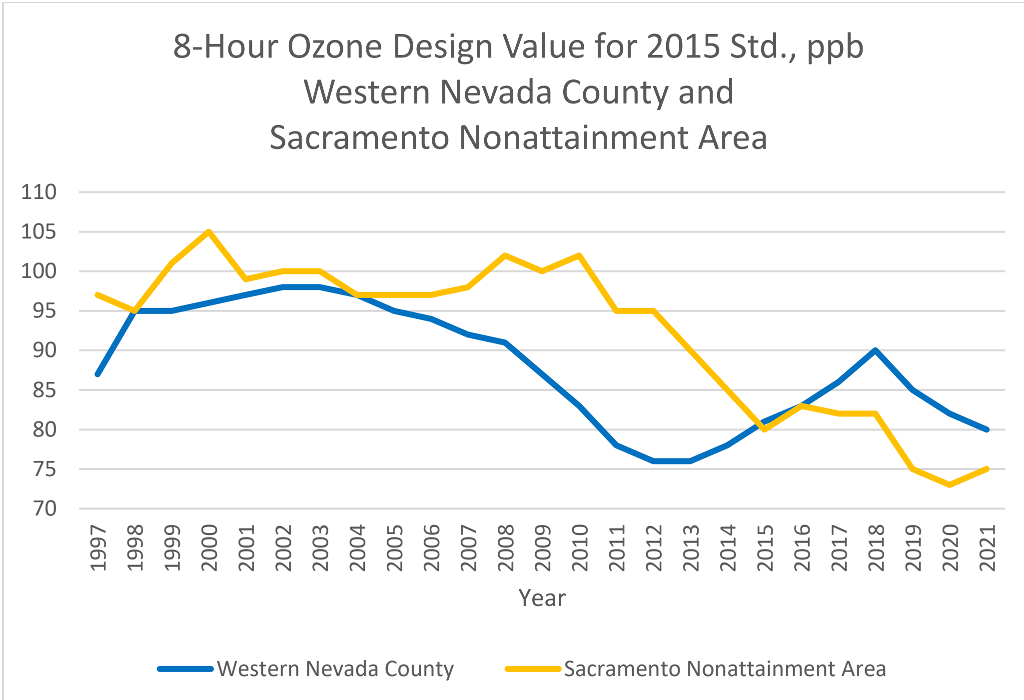


D. Ozone Trends

Western Nevada County's ozone concentrations have decreased considerably since the early 2000's. There has been a slight increase in the past few years, which is thought to be at least partially due to ozone precursor emissions from increased wildfire activity that has coincided with massive tree mortality due to California's bark beetle epidemic. Wildfires emit both VOCs and NOx in great quantities. Many of the highest ozone days have been accompanied by a light haze from numerous relatively small wildfires throughout the region – fires that are not large enough to yield clear determinations of exceptional events, but large enough to bump the concentrations up slightly.

Also, although the Sacramento area has been improving their local air quality and reducing O_3 and its precursor emissions, it has not yet attained the 2015 8 hour Ozone NAAQS. Concurrently, the District has been improving its air quality to the extent of attaining the 1997 8-Hour Ozone NAAQS of 0.08 ppm and the 2008 8-Hour Ozone NAAQS of 0.075 ppm. **Figure 8** compares the 8-Hour Ozone Design Value data for 1997-2021 for Western Nevada County and the Sacramento Nonattainment Area.

Figure 8: Federal 8-Hour Ozone Design Values.



E. Biogenic Emission Inventory

The total summer 2020 ROG emission inventory for all of Nevada County from anthropogenic sources (mobile, stationary and area-wide) is estimated at 6.6 tons per day. In contrast, biogenic emissions (natural emissions from vegetation) for the same area are estimated at 215.6 tons per day[11].

Western Nevada County has very few emission inventory categories from which to reasonably reduce emissions. Stationary source emissions are relatively miniscule. The largest category of ROG emissions, as reflected in the emissions inventory for 2005 through 2020, is Recreational Boats. Consumer Products is the next largest category, and California already has an extremely aggressive statewide regulatory framework for minimizing emissions from consumer products.

F. Progress

As reflected in the emission inventory[12], for the period 2017 through 2022, Western Nevada County reduced summer emissions of NOx by 24.3% and ROG by 6.9%. During the same period, the upwind Sacramento Nonattainment Area reduced summer emissions of NOx by

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[11] CARB California Emissions Projection Analysis Model (CEPAM) emissions inventory, Version 1.03 at https://ww2.arb.ca.gov/applications/cepam2019v103-standard-emission-tool

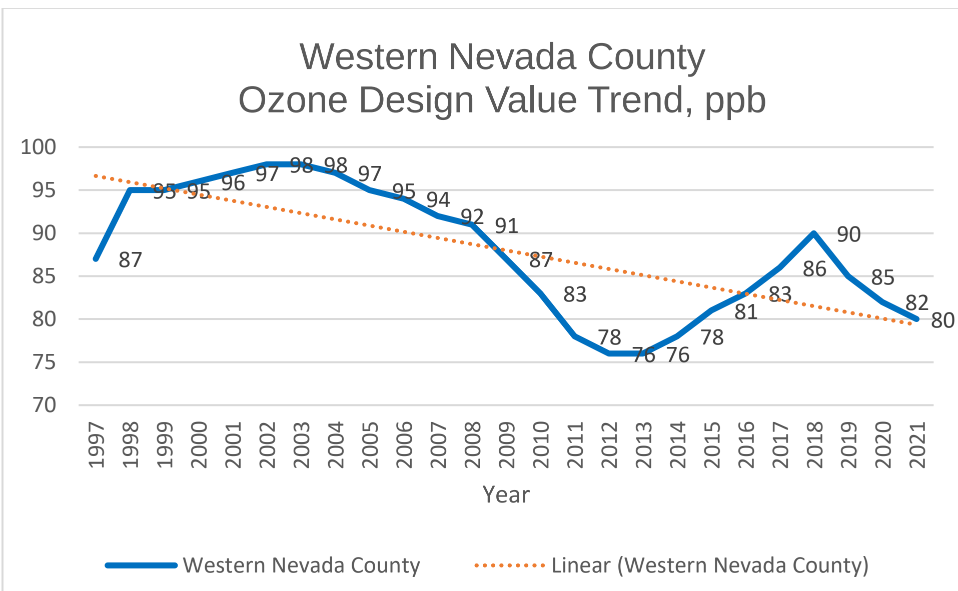
[12] CEPAM emissions inventory, 2019 Version 1.04 at https://www.arb.ca.gov/app/emsinv/2019ozsip/cepam_emssumcat_query_v4.php

27.7% and ROG by 8.9%. For the period 2005 through 2017, Western Nevada County reduced summer emissions of total ozone precursors (NOx + ROG) by 51.8% while the Sacramento Nonattainment Area reduced summer emissions of total ozone precursors by 44.2%. Both areas have made substantial strides in recent years at reducing summer ozone precursor emissions.

Figure 9 illustrates the downward trend in Western Nevada County's ozone Design Value (3-year average of 4th highest annual value). In general, ozone concentrations have decreased significantly in this region with the exception of a few years where ozone trends slightly increased. This increase is likely due to variations in large-scale meteorological patterns during the summer months and the increased number of wildfires throughout northern California in recent years, however anthropogenic emissions have continued to decline in both Western Nevada County and the upwind Sacramento region.

During 2018-2021, ozone levels decreased again, with the exception of days likely influenced by wildfire emissions. Precursor emissions from several enormous wildfire are or will likely be the subject of Exceptional Event demonstrations for much of northern and central California. Wildfire effects on ozone concentration in the Western Nevada nonattainment area is discussed more in Appendix G, and more detailed analyses can also be found in the CARB Exceptional Events Demonstration for Ozone Exceedances report. It is important to note that **Figure 9** includes the effect on ozone values from wildfires recent years. For instance, when excluding wildfire impacted days, the projected design value of 2020 at Grass Valley drops to 0.071 ppm from 0.082 ppm.

Figure 9: Western Nevada County Design Value Trend, 1997 – 2021.



Minimal-impact development planning (such as the Sacramento area's Blueprint project), improving technologies and ongoing enforcement of existing rules and regulations will keep reducing O_3 precursor emissions for the foreseeable future. Furthermore, development and application of new lower emissions control technology at older, higher-emitting sources in the upwind Sacramento Region and the San Francisco Bay Area will continue to improve air quality in Western Nevada County.

Collectively, the air quality analyses indicate that substantial progress has been accomplished in Western Nevada County; and that the current control measures implemented in the nonattainment area and in the upwind urban areas should lead the region to attain the 8-hour ozone standard of 0.070 ppm by the serious attainment deadline of 2026.

III. 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.[13] 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 Western Nevada County 70 ppb 8-Hour Ozone SIP, which encompasses the area managed by the Northern Sierra Air Quality Management District (District).

A. 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 the District have developed a comprehensive current emissions inventory consistent with the requirements set forth in Section 182(a)-(f) of the federal Clean Air Act[14]. 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 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.

The United States Environmental Protection Agency (U.S. EPA) regulations require that the emissions inventory for an Ozone SIP contain emissions data for the two precursors to ozone formation: oxides of nitrogen (NOx) and volatile organic compounds (VOC)[15]. The inventory included in this plan substitutes VOC with reactive organic gases (ROG), which, in general, represent a slightly broader group of compounds than those in U.S. EPA's list of VOCs.

[13] Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; (40 CFR part 51 Subpart AA; see also https://www.epa.gov/ground-level-ozone-pollution/implementation-2008-national-ambient-air-quality-standards-naaqs-ozone).
[14] 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
[15] 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

B. 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)[16], 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[17].

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.

C. 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[18].

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 Western Nevada County 70 ppb Ozone SIP is modeled by the California Emission Projection Analysis Model (CEPAM), 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 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 models or, where not available, CARB's OFFROAD2007. CEPAM integrates the emission projections derived from these mobile source models to develop

[16] 40 CFR 51.1315(a). https://www.govinfo.gov/content/pkg/CFR-2021-title40-vol2/pdf/CFR-2021-title40-vol2-sec51-1315.pdf.

[17] 40 CFR 51.1310(b). https://www.govinfo.gov/content/pkg/CFR-2020-title40-vol2/pdf/CFR-2020-title40-vol2-sec51-1310.pdf.

[18] 40 CFR 51.114. https://www.govinfo.gov/content/pkg/CFR-2000-title40-vol2/pdf/CFR-2000-title40-vol2-sec51-114.pdf.

a comprehensive forecasted emission inventory. As with stationary sources, the mobile source models include control algorithms that account for adopted regulatory actions.

D. 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)[19]. 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).

E. Geographic Scope

The Nevada County (Western part) NAA is split into a region not defined by county, air basin, or district boundaries. Because of this, the portion of emissions in the NAA was estimated using category-specific factors based on the spatial distribution of population and other activity parameters within the nonattainment region. These fractions were developed by CARB and the District. The special split allocation method of each subcategory is shown in **Table 1** below.

Table 1: Subcategory Allocation Method for Nevada County (Western Part) NAA

Subcategory	Allocation Method
FOOD AND AGRICULTURAL PROCESSING	AGRICULTURAL AREA
SERVICE AND COMMERCIAL	HUMAN POPULATION
OTHER (FUEL COMBUSTION)	HUMAN POPULATION
INCINERATORS	HUMAN POPULATION
DEGREASING	HUMAN POPULATION
COATINGS AND RELATED PROCESS SOLVENTS	HUMAN POPULATION
PRINTING	HUMAN POPULATION
ADHESIVES AND SEALANTS	HUMAN POPULATION
PETROLEUM MARKETING	HUMAN POPULATION
CHEMICAL	HUMAN POPULATION
FOOD AND AGRICULTURE	FARM TYPES AND AREA
MINERAL PROCESSES	LAND AREA
CONSUMER PRODUCTS	HUMAN POPULATION
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	HUMAN POPULATION
PESTICIDES/FERTILIZERS	AGRICULTURAL AREA
ASPHALT PAVING / ROOFING	LAND AREA
RESIDENTIAL FUEL COMBUSTION	HUMAN POPULATION
FARMING OPERATIONS	AGRICULTURAL AREA
FIRES	HUMAN POPULATION
MANAGED BURNING AND DISPOSAL	LAND AREA
COOKING	HUMAN POPULATION
LIGHT DUTY PASSENGER (LDA)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA

[19] 40 CFR 51.1315(c). https://www.govinfo.gov/content/pkg/CFR-2021-title40-vol2/pdf/CFR-2021-title40-vol2-sec51-1315.pdf.

LIGHT DUTY TRUCKS - 1 (LDT1)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
LIGHT DUTY TRUCKS - 2 (LDT2)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
MEDIUM DUTY TRUCKS (MDV)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
MEDIUM HEAVY DUTY GAS TRUCKS (MHDV)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
HEAVY HEAVY DUTY GAS TRUCKS (HHDV)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
MOTORCYCLES (MCY)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
HEAVY DUTY DIESEL URBAN BUSES (UB)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
OTHER BUSES - GAS (OBG)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
OTHER BUSES - MOTOR COACH - DIESEL (OBC)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
ALL OTHER BUSES - DIESEL (OBD)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
MOTOR HOMES (MH)	SPECIAL EMFAC2017 RUN FOR WEST NEVADA
AIRCRAFT	AIRCRAFT ACTIVITY
TRAINS	TRACK LENGTH
RECREATIONAL BOATS	BOATABLE WATER AREA
OFF-ROAD RECREATIONAL VEHICLES	HUMAN POPULATION (EXCEPT SNOWMOBILES BASED ON SNOW)
OFF-ROAD EQUIPMENT	HUMAN POPULATION
OFF-ROAD EQUIPMENT (PERP)	HUMAN POPULATION
FARM EQUIPMENT	AGRICULTURAL AREA
FUEL STORAGE AND HANDLING	HUMAN POPULATION

F. 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 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.

IV. EMISSIONS INVENTORY COMPONENTS

A summary of the components that make up the Western Nevada County 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. 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.

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 Western portion of Nevada County's 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 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

EMFAC2017 SAFE Vehicles Rules Off-Model Adjustment Removal

On September 27, 2019, U.S. EPA and National Highway Traffic Safety Administration (NHTSA) published the "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program" (SAFE-1).[20] 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, U.S. 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[21].

[20] 84 FR 51310. https://www.govinfo.gov/content/pkg/FR-2019-09-27/pdf/2019-20672.pdf.
[21] 87 FR 14332. https://www.govinfo.gov/content/pkg/FR-2022-03-14/pdf/2022-05227.pdf.

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

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. 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:

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

EMFAC2017 Heavy-Duty Omnibus Off-Model Adjustment

On August 27, 2020, CARB adopted the Heavy-Duty (HD) Omnibus regulation, which would establish NOx 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) NOx emissions and deterioration-related emissions. More details on the inventory analysis for this regulation can be found in Appendix D 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

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, 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 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

EMFAC2017 Heavy-Duty Inspection and Maintenance Off-Model Adjustment

Dec. 9th, 2021, California Air Resources Board 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 NOx and PM2.5 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 with EMFAC2021 in order to reflect the regulation. More information on this analysis is provided in Appendix D 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.

B. 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 are developed to support recent regulations. The sections below summarize the updates made to specific off-road categories.

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

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

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

Small Off-Road Engines (SORE)
Small off-road engines (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. Most 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 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

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 U.S. 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

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

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

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

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 U.S. EPA as of 2018. The inventory reflects the TRU ATCM and 2021 amendments. 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

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 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

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 U.S. 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

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

C. 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 District by the facility operators through calendar year 2017.

Stationary point sources also include smaller point sources, such as gasoline dispensing facilities, 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 District.

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

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

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

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 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

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 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

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

Gasoline Dispensing Facilities
This category uses a 2015 CARB methodology to estimate emissions from fuel transfer and storage operations at gasoline dispensing facilities (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

Gasoline Cargo Tank

This category uses a 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

D. 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 District.

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

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 are 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 are 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

Architectural Coatings

Architectural coatings are coatings applied to stationary structures and their accessories. They include house paints, stains, industrial maintenance coatings, traffic coatings, and various 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

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 years 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 household 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

Residential Wood Combustion

Residential Wood Combustion estimates are based off a 2011 CARB methodology. It reflects survey data on types of wood burning devices and wood consumption rates, updates to the 2002 U.S. EPA National Emission Inventory (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/miscellaneous-process-methodologies

Residential Natural Gas Combustion

CARB staff updated the methodology to reflect 2017 fuel use from the California Energy Consumption Database. The emissions estimates reflect the most recent emissions factors from

U.S. EPA’s AP-42 for residential natural gas combustion. Growth is based on California Energy Commission (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

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 U.S. 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, 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

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. 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

Fires

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

Managed Burning & Disposal –Forest Management
The 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

E. Point and Areawide Source Emissions Forecasting
Emission forecasts (2018 and subsequent years) are based on growth profiles that in many cases incorporate historical trends up to the base year or beyond. The growth surrogates used to forecast the emissions from these categories are presented below in **Table 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 3**.

Table 2: Growth Surrogates for Point and Areawide Sources

Source Category	Subcategory	Growth Surrogate
Food and Agricultural Processing	Ag Irrigation I. C. Engines	FMMP irrigated farmland acreage, 2008
Service and Commercial	Natural Gas	CEC forecast, 2019
	Other Fuels	EIA forecast, 2018
Other (Fuel Combustion)	Diesel	Modeled estimate, 2003
Waste Disposal	All	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

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
Food & Agriculture	All	REMI economic forecast, version 2.4.5
Mineral Processes	All	REMI version 2.4.5; EIA forecast, 2018
Consumer Products	Personal Care Products	Real Disposable Personal Income per REMI, version 2.4.5
	Other Consumer Products	DOF population forecast, 2020
	Aerosol Coatings	No growth
Architectural Coatings & Related Process Solvents	All	DOF household forecast, 2020
Pesticides & Fertilizers	Agricultural Pesticides	CARB projection of harvested acreage per FMMP, 2016
	Structural Pesticides	DOF housing units, 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	Non-Agricultural Open Burning	Rural counties: DOF population forecast, 2020

	Forest Management	10-year average, held flat
Cooking	All	DOF population forecast, 2020

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

Agency	Rule/Reg No.	Rule Title	Source Categories Impacted
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**	Agricultural IC Engine Emission Scalers	Agricultural irrigation internal combustion engines
CARB	**NONAGICENG**	Non-Agricultural IC Engine Emission Scalers	Non-agricultural internal combustion reciprocating engines

External Adjustments

External adjustments were made in CEPAM to account for military growth and other unaccounted regulatory factors. The Western Nevada external adjustments reflected in the CEPAM2019v1.04 inventory is listed below in **Table 4.**

Table 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 (ACT) / Omnibus Low NOx; Opacity; ICT_UBUS adjustments

V. TRANSPORTATION CONFORMITY ANALYSIS

The California Air Resources Board (CARB) has prepared the motor vehicle emissions budget (MVEB)[22] for the 70 parts per billion (ppb) 8-hr ozone National Ambient Air Quality Standard (NAAQS). The MVEB is the maximum allowable emissions from motor vehicles within a nonattainment area and is used for determining whether transportation plans and projects conform to the applicable State Implementation Plan (SIP).

A. Introduction

Transportation conformity is the federal regulatory procedure for linking and coordinating the transportation and air quality planning processes through MVEB established in the SIP. Under section 176(c) of the Clean Air Act (Act), federal agencies may not approve or fund transportation plans and projects unless they are consistent with the regional SIP. In addition, conformity with the SIP requires that transportation activities do not (1) cause or contribute to new air quality violations, (2) increase the frequency or severity of any existing violation, or (3) delay timely attainment of NAAQS. Therefore, quantifying on-road motor vehicle emissions and comparing those emissions with a budget established in the SIP determine transportation conformity between air quality and transportation planning.

The MVEBs are set for each criteria pollutant or its precursors for each milestone year and the attainment year of the Western Nevada 8-hr ozone SIP. Subsequent transportation plans and programs produced by transportation planning agencies must conform to the budgets by demonstrating that the emissions from the proposed plan, program, or project do not exceed the MVEBs established in the applicable SIP. The MVEBs established in this SIP apply as a "ceiling" or limit on transportation emissions for Western Nevada County and the Nevada County Transportation Commission (NCTC) for the years in which they are defined and for all subsequent years until another year for which a different budget is specified, or until a SIP revision modifies the budget. For the Western Nevada County 70 ppb 8-hr ozone SIP, the milestone years and the attainment year of the SIP (also referred to as the plan analysis years) are 2023 and 2026.

B. Methodology

The MVEB for 70 ppb ozone SIP is established based on guidance from U.S. EPA on the motor vehicle emission categories and precursors that must be considered in transportation conformity determinations as found in the transportation conformity regulation and final rules as described below.

The MVEB must be clearly identified and precisely quantified, and consistent with applicable CAA requirements for reasonable further progress and attainment toward meeting NAAQS. Further, it should be consistent with the emission inventory and control measures in the SIP.

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

The 70 ppb 8-hr ozone SIP establishes budgets for Reactive Organic Gases (ROG) and Nitrogen Oxide (NOx) emission precursors using emission rates from California's motor vehicle emission model, EMFAC2017 (V.1.0.3)[23], using activity data (vehicle miles traveled [VMT] and speed distributions) from the 2016 Nevada County Regional Transportation Plan (RTP) adopted by NCTC in January 2018.[24]

On August 15, 2019, the U.S. EPA approved EMFAC2017 for use in SIPs and to demonstrate transportation conformity.[25] The EMFAC model estimates emissions from two combustion processes (start and running) and four evaporative processes (hot soak, running loss, diurnal, and resting loss). In addition, the emissions output from the EMFAC2017 model was adjusted to account for the impacts of recently adopted regulations that are not reflected in the EMFAC2017 model using off-model adjustments.[26] The regulations incorporated in this way are the Heavy-Duty (HD) Warranty Phase 1, Innovative Clean Transit (ICT), Amendments to the Heavy-Duty Vehicle Inspection Program (HDVIP), Periodic Smoke Inspection Program (PSIP), Advanced Clean Trucks (ACT), and Heavy-Duty (HD) Omnibus.

The MVEB for this SIP was developed to be consistent with the on-road emissions inventory[27] and attainment demonstration, using the following method:

1) Used the EMFAC2017 model to produce an initial/preliminary calculation of the on-road motor vehicle emissions totals (average summer day) for the appropriate pollutants (ROG and NOx) using 2016 RTP activity data.
2) Applied the off-model adjustments to account for recently adopted regulations.
3) Rounded the totals for both ROG and NOx to the nearest tenth ton.

C. Motor Vehicle Emissions Budget

The MVEB in **Table 5** was established according to the methodology outlined above and in consultation[28] with the MPO, the air district, U.S. EPA, Federal Highway Administration (FHWA), and Federal Transit Administration (FTA). The MVEB is consistent with the emission inventories and control measures in the 70 ppb 8-hr ozone SIP. These budgets will be effective once U.S. EPA determines it is adequate.

Table 5 contains the detailed MVEB for the Western Nevada County region. It includes ozone precursor pollutants of ROG and NOx emissions for milestone and attainment years using the EMFAC2017 model and 2016 RTP activity data. In addition, it provides vehicular emissions

[23] 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
[24] Nevada County Transportation Commission - Regional Transportation Plan (ca.gov)
[25] U.S. EPA approval of EMFAC2017 can be found at 84 FR 41717 https://www.federalregister.gov/d/2019-17476
[26] Off-Model Adjustment Factors to Account for Recently Adopted Regulations in EMFAC2017 Model https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory
[27] More information about the on-road motor vehicle emission budgets can be found in Section C of the plan.
[28] To satisfy the requirements established in 40 CFR Part 93, Section 118(e)(4)(ii).

from the EMFAC 2017 model and recently adopted regulations using off-model adjustments for both ROG and NOx emissions.

Table 5. MVEB for the 70 ppb Ozone Standard (Summer Season) for the Western Nevada County Region

MVEB (Tons/Day)	2023		2026	
	ROG	**NOx**	**ROG**	**NOx**
Vehicular Exhaust	0.6	1.2	0.5	1.0
Reductions from recently adopted regulations using off-model adjustment[a]	0.0000	0.0142	0.0003	0.2498
Total[b]	0.59	1.14	0.52	0.74
Motor Vehicle Emission Budget[c]	0.6	1.2	0.6	0.8

[a] This reflects the adjustment factor for HD Warranty Phase 1, ICT, HDVIP/PSIP, ACT, and HD Omnibus regulations.
[b] Values from EMFAC2017 v1.03 may not add up due to rounding.
[c] Motor Vehicle Emission Budgets calculated are rounded up to the nearest tenth of a tpd.

Source: EMFAC2017 v1.03

VI. EMISSIONS STATEMENT RULE

Pursuant to CAA §182(a)(3)(B) 29 subsection (i), states must have an Emissions Statement program (i.e., rule) in place that requires stationary sources to annually report and certify accuracy of their NOx and VOC emissions. Subsection (ii) has waiver provisions for stationary sources emitting less than 25 tpy of NOx or VOC. District Rule 513 (Emission Statements and Recordkeeping), was revised in coordination with EPA to meet all applicable requirements and approved by the NSAQMD Board on June 27, 2016. EPA approved the revised rule into the SIP June 21, 2017, at 82 FR 28240.

[29] CAA §182(a)(3)(B) details Emissions Statement requirements for O_3 nonattainment areas classified as marginal and above.

VII. NEW SOURCE REVIEW

The Clean Air Act §182(a)(2)(C) requires the District to address emissions from new sources and major modifications to existing sources. Pursuant to CAA §182(c)(10), the District is required to have an New Source Review (NSR) rule designed to address emissions from new and modified major stationary sources of NOx or VOC. District Rule 428 (New Source Review Requirements for New and Modified Major Sources Nonattainment Areas) was last amended November 25, 2019, following extensive communication with CARB and EPA. It was submitted to EPA February 19, 2020, and approved by EPA on November 20, 2020.

The Rule was designed to accommodate changes in Classification, so the substance of the Rule is equally applicable to a Serious Nonattainment Area or a Moderate Nonattainment Area. Section 1.1(a) of District Rule 428 is applicable to nonattainment pollutants for which the source is major. The definition of Nonattainment points to 40 CFR 81.305, which contains the areas designation. The rule incorporates the 40 CFR 51.165(a)(1) definition of major source and contains each of the major source thresholds for each designation. Likewise, Section 4.4 of the rule includes the offset ratios for designations up to Severe.

VIII. SERIOUS NONATTAINMENT PLAN REQUIREMENTS

The EPA's Implementation Rule for the 2015, 8-hour O_3 NAAQS requires additional planning and emission control demonstration necessary for serious nonattainment areas to comply with the CAA.

Reasonable Available Control Technology (RACT): CAA §182(b)(2) requires implementation of RACT for all major sources of VOC and for each VOC source category for which the EPA has issued a control techniques guideline. The RACT SIP was adopted by the District on January 25, 2021 and submitted to U.S. EPA for inclusion in the California SIP on March 23, 2021. On August 3, 2022, the U.S. EPA approved the RACT SIP that concluded all the existing SIP-approved District rules meet RACT requirements or are not subject to RACT requirements for the 70 ppb 8-hour ozone standard and included negative declarations certifying that no sources are present in the nonattainment area for the applicable CTGs.

General Conformity: CAA §176(c) requirement is not applicable to Western Nevada County as there are no such federal projects in the nonattainment area.

Vehicle Inspection & Maintenance: CAA §182(c)(3) is not applicable to the Western Nevada County Nonattainment area, as the population in the nonattainment area is below the threshold.

Clean Fuels Fleet Program: CAA §182(c)(4)(A) and CAA §246 is not applicable to the Western Nevada County Nonattainment area, as the population in the nonattainment area is below the threshold.

Reasonably Available Control Measures (RACM): CAA §172(c), verifying that all potential RACM the District or CARB could potentially adopt, including those for stationary sources, mobile sources, transportation-related, and consumer products, would not provide the additional emissions reductions necessary to advance the predicted attainment year for the 2015 ozone NAAQS from 2026 to 2025.

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

Attainment Demonstration: CAA §182(c)(2)(A), comprised of photochemical air quality simulation modeling and other approved analytical techniques collectively called the "Weight of Evidence". Together, these analyses demonstrate the ability of the Emissions Inventory Components (Section IV) to provide for attainment of the 2015 ozone NAAQS as expeditiously as practicable. Ozone nonattainment areas are required to model attainment in the ozone season prior to their specific attainment date. For Western Nevada Nonattainment Area, the demonstrated attainment year is 2026. This date encompasses the first full ozone season prior to the August 3, 2027, attainment deadline as a Serious Nonattainment Area.

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

IX. REASONABLE AVAILABLE CONTROL MEASURES (RACM) DEMONSTRATION

A. RACM Requirements

The federal Clean Air Act (CAA) requires a demonstration that all Reasonably Available Control Measures are being implemented as expeditiously as practicable.[30] Specifically, the air district must consider a wide range of potential additional measures beyond those already being implemented to further control emissions from stationary sources, transportation, and other mobile sources. A potential additional measure is considered "reasonably available" and must be implemented if it would, either alone or in combination with other feasible measures, advance the predicted attainment year by one year (i.e., from 2026 to 2025). In other words, the reasonably available measures would need to reduce emissions to 2026 levels by 2025.

Air quality modeling (**see Appendix E**) and the Weight of Evidence analysis (**see Appendix G**) demonstrate that ozone concentrations in Western Nevada County are overwhelmingly impacted by the transport of ozone and precursor emissions from upwind areas, primarily the Sacramento metropolitan area. As a result, the reduction of NOx and VOC emissions in Western Nevada County will not significantly impact ozone concentrations in the nonattainment area. Regardless, a RACM analysis was conducted in compliance with Clean Air Act requirements to determine whether the application of more restrictive SIP-approved control measures would reduce nonattainment area emissions inventories by the difference between 2025 and 2026 totals. Based on this analysis, the District finds that there are no potential additional measures that can alone or collectively reduce emissions to 2026 levels by 2025.

For a more thorough analysis for the 2015 70 ppb 8-hour ozone national ambient air quality standard (NAAQS), this RACM analysis accounts for projected emissions from the Western Nevada County ozone nonattainment area (**see Attachment A – Emission Inventory**). **Table 6** identifies the increment of emissions reductions needed in 2025 to reach attainment. Western Nevada County would need an additional 0.1 tons per day of volatile organic compound (VOC) reductions and an additional 0.07 tons per day of oxides of nitrogen (NOx) reductions in 2025 to advance the attainment year from 2026 to 2025.

[30] CAA §172(c)(1)

Table 6: Emissions Reductions Required to Advance Attainment by One Year, 2015 70 ppb Ozone NAAQS (tons per average summer day)[31]

Emissions Totals	Emissions (tpd)
2026 VOC Emissions Inventory (Appendix A-Table 1)	4.5441
2025 VOC Emissions Inventory (Appendix A-Table 1)	4.6408
VOC Emissions Reductions Needed in 2025 to Demonstrate Attainment	**0.0968**
2026 NOx Emissions Inventory (Appendix A-Table 2)	1.9754
2025 NOx Emissions Inventory (Appendix A-Table 2)	2.0437
NOx Emissions Reductions Needed in 2025 to Demonstrate Attainment	**0.0683**

Air quality modeling demonstrates that ozone formation in Western Nevada County is NOx-limited (**see Appendix E**). This means that because of an abundance of VOC emissions from natural vegetation sources, reduction of ozone formation will not occur as a result of a reduction of VOC emissions, but only through a reduction of NOx emissions. As a result, the remainder of this analysis will focus exclusively on potential NOx reductions.

B. Stationary and Areawide Sources

Relatively few stationary and areawide source categories in the NOx emission inventory for Western Nevada County report non-zero emissions. A tabulation of these source categories reporting summer day average NOx emissions greater than 0.00005 tons/summer day are presented in **Table 7**. This threshold was chosen as it includes non-zero stationary and area source NOx sources in the Western Nevada County emission inventory.

Table 7: Stationary and Areawide Emission Inventory Categories Reporting Greater Than 0.00005 Tons of NOx Emissions Per Average Summer Day in 2025

EICSUM	EICSOU	2025
610-RESIDENTIAL FUEL COMBUSTION	608-FUEL COMBUSTION - WATER HEATING	0.05721
099-OTHER (FUEL COMBUSTION)	040-I.C. RECIPROCATING ENGINES	0.02660
610-RESIDENTIAL FUEL COMBUSTION	995-OTHER	0.02454
430-MINERAL PROCESSES	424-ASPHALTIC CONCRETE PRODUCTION	0.02452
610-RESIDENTIAL FUEL COMBUSTION	606-FUEL COMBUSTION - SPACE HEATING	0.02176
060-SERVICE AND COMMERCIAL	020-SPACE HEATING	0.01654
670-MANAGED BURNING AND DISPOSAL	666-FOREST MANAGEMENT	0.01318
060-SERVICE AND COMMERCIAL	030-WATER HEATING	0.01109

[31] Source: CARB CEPAM2019 emissions inventory, Version 1.04.

060-SERVICE AND COMMERCIAL	995-OTHER	0.00981
610-RESIDENTIAL FUEL COMBUSTION	600-WOOD COMBUSTION - WOOD STOVES	0.00843
060-SERVICE AND COMMERCIAL	995-OTHER	0.00705
610-RESIDENTIAL FUEL COMBUSTION	610-FUEL COMBUSTION - COOKING	0.00621
610-RESIDENTIAL FUEL COMBUSTION	995-OTHER	0.00561
610-RESIDENTIAL FUEL COMBUSTION	606-FUEL COMBUSTION - SPACE HEATING	0.00486
060-SERVICE AND COMMERCIAL	995-OTHER	0.00359
610-RESIDENTIAL FUEL COMBUSTION	602-WOOD COMBUSTION - FIREPLACES	0.00334
052-FOOD AND AGRICULTURAL PROCESSING	042-AG. IRRIGATION I.C. ENGINES	0.00243
052-FOOD AND AGRICULTURAL PROCESSING	042-AG. IRRIGATION I.C. ENGINES	0.00229
130-INCINERATORS	995-OTHER	0.00151
120-LANDFILLS	132-FLARES	0.00074
670-MANAGED BURNING AND DISPOSAL	670-NON-AGRICULTURAL OPEN BURNING	0.00050
660-FIRES	656-STRUCTURAL FIRES	0.00026
050-MANUFACTURING AND INDUSTRIAL	040-I.C. RECIPROCATING ENGINES	0.00025
670-MANAGED BURNING AND DISPOSAL	664-RANGE IMPROVEMENT	0.00016
130-INCINERATORS	130-INCINERATION	0.00011
440-METAL PROCESSES	995-OTHER	0.00007

The individual source categories in **Table 8** can be grouped into EICSUM categories for collective analysis as the emission reduction strategies will generally be common within EICSUM categories. The resulting EICSUM emission subtotals are presented in **Table 8**.

Table 8: Stationary and Areawide Emission Inventory EICSUM Subtotals of Categories Reporting Greater Than 0.00005 Tons of NOx Emissions Per Average Summer Day in 2025

Category	NOx Emissions Ton/Summer Day
RESIDENTIAL FUEL COMBUSTION	0.13197
SERVICE AND COMMERCIAL	0.04809
OTHER (FUEL COMBUSTION)	0.02660
MINERAL PROCESSES	0.02452
MANAGED BURNING AND DISPOSAL	0.01384
FOOD AND AG PROCESSING	0.00472

INCINERATORS	0.00163
LANDFILLS	0.00074
STRUCTURE FIRES	0.00026
MANUFACTURING AND INDUSTRIAL	0.00025
METAL PROCESSES	0.00007

Residential Fuel Combustion

Residential fuel combustion sources include water heaters, cooking stoves, and space heating systems. The most restrictive emission limits for water heaters and space heating systems in California are found in South Coast Air Quality Management District's (SCAQMD) Rules 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters) and 1111 (Reduction of NOx Emissions from Natural Gas-Fired, Fan-Type Central Furnaces). SCAQMD has not adopted any rules that limit NOx emissions from residential natural gas cooking stoves.

SCAQMD Rule 1121 limits new water heaters sold after 2006 to 10 nanograms per joule (ng/J). The average useful life of residential water heaters is 10 years.[32] Most urban air districts have adopted similar rules. As a result, almost all residential water heaters now in use in the state were manufactured to this standard. Since residential water heaters in current use meet this standard, no emission benefit would be achieved through adoption of a similar rule by NSAQMD.

SCAQMD Rule 1111 limits NOx emissions from natural gas-fired, fan-type central furnaces to 40 ng/J for new furnaces sold after 1984 and 14 ng/J for new furnaces after 2015. The average useful life of residential central furnaces is 17.5 years.[33] If SCAQMD Rule 1111 were implemented in the Western Nevada County ozone nonattainment area, NOx emissions would be reduced as new 14 ng/J furnaces replaced existing 40 ng/J furnaces over a two-year period from 2023 through 2025. The emission reduction achieved by such implementation in 2025 would be 0.009 tons of NOx per summer day.

Service and Commercial Combustion

Service and commercial combustion sources include water heaters, restaurant cooking stoves, and space heating systems. The most restrictive emission limits for water heaters and space heating systems in California are found in South Coast Air Quality Management District's (SCAQMD) Rules 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters) and 1111 (Reduction of NOx Emissions from Natural Gas-Fired, Fan-Type Central Furnaces). SCAQMD has not adopted any rules that limit NOx emissions from restaurant cooking stoves.

SCAQMD Rule 1121 limits new water heaters sold after 2006 to 10 nanograms per joule (ng/J). The average useful life of commercial water heaters is 10 years.[34] Most urban air districts have adopted similar rules. As a result, almost all commercial water heaters now in use in the state

[32] https://watertechadvice.com/how-long-water-heaters-last/
[33] https://www.atdhomeinspection.com/advice/average-product-life/
[34] https://aaaplumbers.com/blog/long-commercial-water-heaters-last/

were manufactured to this standard. Since commercial water heaters in current use meet this standard, no emission benefit would be achieved through adoption of a similar rule by NSAQMD.

SCAQMD Rule 1111 limits NOx emissions from natural gas-fired, fan-type central furnaces to 40 ng/J for new furnaces sold after 1984 and 14 ng/J for new furnaces after 2015. The average useful life of commercial central furnaces is 17.5 years.[35] If SCAQMD Rule 1111 were implemented in the Western Nevada County ozone nonattainment area, NOx emissions would be reduced as new 14 ng/J furnaces replaced existing 40 ng/J furnaces over a four-year period from 2023 through 2025. The emission reduction achieved by such implementation in 2025 would be 0.003 tons per summer day of NOx.

Other Combustion – IC Diesel Engines
NOx emissions from stationary diesel engines are regulated by the CARB Air Toxic Control Measure (ATCM), which was adopted in 2011. No district has a adopted a more restrictive regulation. The CARB ATCM is enforced in Western Nevada County, and no NOx emissions reductions are available from adoption of an alternative SIP-approved regulation.

Mineral Processes - Asphalt Concrete Plants
SCAQMD has implemented Rule 1147 (NOx Reductions from Miscellaneous Sources) that limits NOx emissions from industrial heaters operating at less than 1200 °F to 30 parts per million volume (ppmv) corrected to 3% O_2. Vulcan Material Company operates the only asphalt concrete batch plant heater in Western Nevada County. A source test of this batch plant conducted on November 18, 2021 reported NOx emissions from the heater exhaust to be 24.7 ppm at 14.8% O_2. This NOx concentration is equivalent to 71.7 ppm corrected to 3% O_2. Adoption and implementation of Rule 1147 in Western Nevada County would reduce NOx emissions from this heater by 58%, or 0.014 tons per summer day in 2025 when applied to this source category.

Managed Burning and Disposal - Range Improvement Burning
Range improvement burning is not regulated with respect to NOx emissions by any district. As a result, no NOx emissions reductions are available through adoption of a SIP-approved regulation.

Food & Agriculture Processing – IC Diesel Engines
NOx emissions from stationary diesel engines are regulated by the CARB Air Toxic Control Measure (ATCM), which was adopted in 2011. No district has adopted a more restrictive regulation. The CARB ATCM is enforced in Western Nevada County, and no NOx emissions reductions are available from adoption of an alternative SIP-approved regulation.

Incinerators – Pathological
SCAQMD Rule 1147 (NOx Reductions from Miscellaneous Sources) limits NOx emissions from in-use incinerators to 60 ppmv corrected to 3% O_2. One 1999 source test report of a

[35] https://www.atdhomeinspection.com/advice/average-product-life/

pathological incinerator handling 400 pounds per hour (lb/hr) of animal carcasses showed NOx emissions to be 89.4 ppmv at 12.8% O_2. This emission concentration is equivalent to 195.2 ppmv @ 3% O_2. If SCAQMD Rule 1147 were implemented in Western Nevada County, pathological incinerator emissions would be reduced by 69% or 0.001 tons per summer day in 2025.

Landfills - Flares
SCAQMD Rule 1118.1 (Control of Emissions from Non-Refinery Flares) limits NOx emissions from landfill flares to 0.025 pounds per million British Thermal Units (lb/MMBtu). A source test conducted of the McCourtney Road landfill flare in 2006 reports NOx emissions to be 0.022 lb/MMBtu. Implementation of SCAQMD Rule 1118.1 in Western Nevada County would not reduce NOx emissions from this landfill flare as it currently complies with SCAQMD Rule 1118.1.

Structure Fires
Structure fires are an uncontrollable emission source. No NOx emission reduction are available through adoption of a SIP-approved regulation.

Manufacturing and Industrial
San Joaquin Valley Air Pollution Control District (SJVAPCD) Rule 4702 (Internal Combustion Engines) limits NOx emissions from lean-burn spark ignition engines to 0.6 g/bhp-hr or 43 ppmv of NOx. The staff report for this rule estimates the NOx emission reduction to be 43% between 2021 and 2024.[36] This reduction applied to the Manufacturing and Industrial emission category – which includes natural gas IC engines – would be equivalent to 0.0001 tons of NOx per average summer day.

Metal Processes - Steel Reworking
It is unclear from the CEPAM emission inventory or NSAQMD permitting record what sources are included in this portion of the inventory. As a conservative estimate, the shutdown of this source would produce an emission reduction of 0.000065 tons of NOx per summer day.

[36] http://www.valleyair.org/workshops/postings/2021/08-19-21-r4702/DraftStaffReport.pdf

Total Reductions Achievable

Table 9: Total Stationary and Areawide NOx Emissions Reduction Achievable Tons per Summer day in 2025

Emission Categories	NOx Reduction Potential, tpd summer
Residential Fuel Combustion	0.009
Service and Commercial Combustion	0.003
Other Combustion – IC Diesel Engines	0.000
Asphalt Concrete Plants	0.014
Range Improvement Burning	0.000
Food & Agriculture – IC Diesel Engines	0.000
Incinerators – Pathological	0.001
Landfill Flares	0.000
Structure Fires	0.000
Manufacturing & Industrial – Nat Gas Engines	0.000
Steel Reworking	0.000
Subtotal	**0.027**

C. Transportation Control Measures

Potential RACM also includes Transportation Control Measures (TCMs), which are strategies to reduce motor vehicle trips, vehicle miles traveled, or vehicle idling and the associated air pollutant emissions. Table 10 lists the 16 TCMs identified in CAA §108(f) and their implementation status in Western Nevada County. These include transit and traffic flow improvements, ridesharing, high occupancy vehicle (HOV) lanes, pedestrian-only streets, and limits on extended vehicle idling. The agencies responsible for developing and implementing these TCMs include the Nevada County Transportation Commission (NCTC) and other State and local transportation agencies.

Table 10: Transportation Control Measures listed in CAA §108(f)(1)(A), Implementation Status in Western Nevada County

Transportation Control Measure	Implemented?
1. Programs for improved public transit	Yes
2. Restriction of certain roads or lanes to, or construction of such roads or lanes for use by, passenger buses or high occupancy vehicles	No
3. Employer-based transportation management plans, including incentives	No
4. Trip-reduction ordinances	No*
5. Traffic flow improvement programs that achieve emission reductions	Yes
6. Fringe and transportation corridor parking facilities serving multiple occupancy vehicle programs or transit service	Yes

7. Programs to limit or restrict vehicle use in downtown areas or other areas of emission concentration particularly during periods of peak use	No
8. Programs for the provision of all forms of high-occupancy, shared-ride services	Yes
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	Not Applicable
10. Programs for secure bicycle storage facilities and other facilities, including bicycle lanes, for the convenience and protection of bicyclists, in both public and isolated areas	Yes
11. Programs to control extended idling of vehicles	Yes, CARB Programs
12. Programs to reduce motor vehicle emissions, consistent with Title II, which are caused by extreme cold start conditions	Not Applicable
13. Employer-sponsored programs to permit flexible work schedules	No
14. Programs and ordinances to facilitate non-automobile travel, provision and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts of a locality, including programs and ordinances applicable to new shopping centers, special events, and other centers of vehicle activity	Yes
15. Programs for new construction and major 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	Yes
16. 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	Yes

*Adopted in 1994, but rescinded in 1995 when federal and State laws were amended eliminating the mandate for such measures

Improved Public Transit

The Nevada County Regional Transportation Plan 2015-2035 (RTP) reports that Western Nevada County fixed route one-way passenger trips between 2010/2011 and 2014/2015 increased by 20.5%, and that vehicle service hours increased by 12.3%.[37] Additionally, several nonprofit organizations provide demand response transportation services for designated clienteles.

High Occupancy Vehicle (HOV) Lanes

There are no HOV lanes in the Western Nevada County nonattainment area as there is little demand for such facilities. Level of Service (LOS) E conditions occur periodically on State Highways 49 and 20 near the Grass Valley/Nevada City communities, but these conditions are

[37] Nevada County Regional Transportation Plan 2015-2035, Nevada County Transportation Commission, January 2018, https://www.nctc.ca.gov/Reports/Regional-Transportation-Plan/index.html

typically short-lived. No LOS F conditions are found on these routes. Caltrans has prepared a Corridor System Management Plan for Highway 49 from the Placer County line to the intersection with Highway 20. The California Environmental Quality Act (CEQA) Guidelines no longer use LOS as a standard for judging the environmental impacts of land use and other types of development projects on traffic levels but use vehicle miles-traveled (VMT) instead.

Employer-Based Transportation Management Plans

Employer-based transportation management plans are not required in the nonattainment area as traffic congestion levels are moderate due to the low population and employment levels.

Trip Reduction Ordinances

No trip reduction ordinances have been adopted in the nonattainment area due to federal and state legislation prohibiting their implementation.

Traffic Flow Improvement to Reduce Emissions

Roundabouts are being installed at major intersections in the nonattainment area to facilitate flow improvement and reduce idling emissions.

Park-and-Ride Facilities

Four park-and-ride facilities have been constructed within the nonattainment area to reduce VMT by commuters travelling to employment centers in Placer and Sacramento Counties.

Peak-Period Vehicle Restrictions in Downtown Areas

This measure is feasible only in high-density portions of compact metropolitan areas with an extensive transit system. Given the nonattainment areas's historically low-density land use pattern, and therefore longer transit travel times, this measure is not yet feasible.

Shared-Ride Services

The 511 Sacramento Regional Travel Information System provides information on ridesharing, supporting the Sacramento Region Commuter Club, which offers tools and information for carpooling, vanpooling, walking, bicycling, and transit. The system also directs drivers to other regional resources for carpools and vanpools. Connecting Point 211 also provides tools and

information for walking, biking, and transit options, as well as travel training.

Road Surface Restrictions for Motor Vehicles in Metro Areas

This measure is not applicable as there are no metropolitan areas within the nonattainment area.

Bicycle Facilities

The NCTC adopted the Nevada County Active Transportation Plan in 2019 to increase walking and bicycling, among other goals.[38] The 2019 Plan indicates that between 2013 and 2018 approximately 34 multimodal bicycle and pedestrian projects were completed within the nonattainment area with expenditures of approximately $10,034,000. NCTC in coordination with the local jurisdictions continues to aggressively pursue state and federal funding sources to

[38] Nevada County Active Transportation Plan, Nevada County Transportation Commission, July 2019, https://www.nctc.ca.gov/documents/Projects/ATP/NevadaCountyATP_Final_190703_full_red.pdf

implement the Nevada County Active Transportation Plan.

Idling Controls
CARB has adopted several diesel-fueled vehicle idling limitation programs, which include but are not limited to:

- School buses;
- On-road trucks;
- Off-road equipment;
- Locomotives;

Vehicle Cold Start Emissions in Extreme Cold Conditions
This measure is not applicable as extreme cold conditions do not occur within the nonattainment area.

Flexible Work Schedules
Flexible work schedules have not been implemented in the nonattainment area as traffic congestion levels are moderate due to the low population and employment levels.

Programs and Ordinances Facilitating Non-Automotive Travel
This measure has been implemented in the nonattainment area via the progressive iterations of the RTP, adopted by NCTC, which include investments in public transportation, bike paths, and pedestrian improvements.

Paths or Areas Encouraging Non-Motorized Travel
The NCTC, County, and Cities in the nonattainment area have implemented a growing network of bicycling facilities, many of which also serve pedestrians. The 2019 Plan indicates that between 2013 and 2018 approximately 34 multimodal bicycle and pedestrian projects were completed within the nonattainment area with expenditures of approximately $10,034,000. NCTC in coordination with the local jurisdictions continues to aggressively pursue state and federal funding sources to implement the Nevada County Active Transportation Plan.

Removal of Older, Higher-Polluting Light Duty Vehicles
A state-run vehicle retirement program is administered by the California Department of Consumer Affairs' Bureau of Automotive Repair to scrap older, higher-polluting light duty vehicles.

Total Reductions Achievable
The NCTC has concluded that no other TCMs beyond those currently being implemented are feasible given the nonattainment area's low population density.

D. Mobile Source Measures

Most California regions, including Western Nevada County face challenges in reducing emissions from mobile sources, which are the primary source of air pollution in the region. Almost 90 percent of the total daily NOx emissions in the nonattainment area are attributable to mobile sources. To address the severity of these air quality challenges, CARB has implemented the most stringent mobile source emissions control programs in the nation.

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

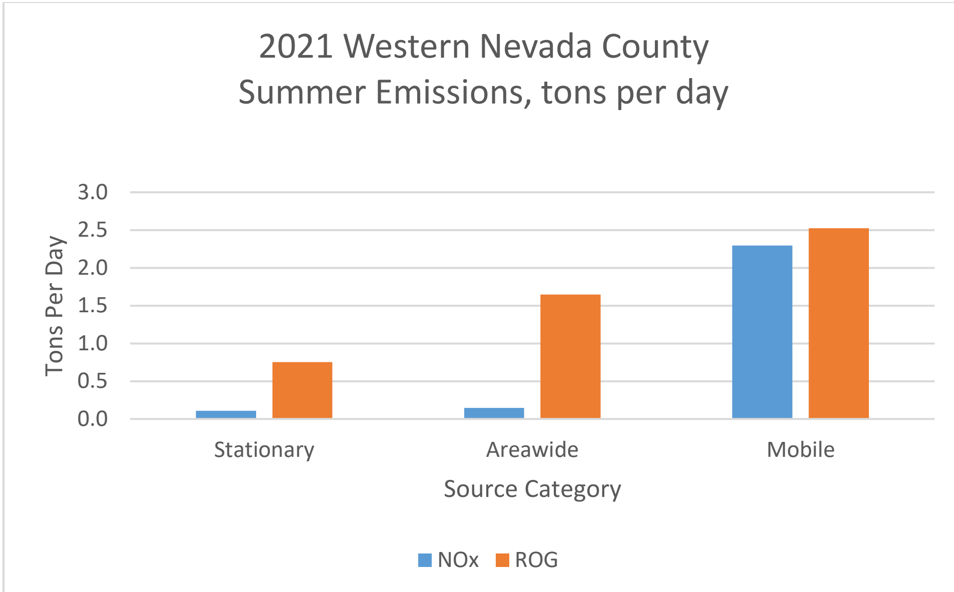
Given the severity of California's air quality challenges, CARB has implemented the most stringent mobile source emissions control program in the nation. CARB's comprehensive strategy to reduce emissions from mobile sources includes stringent emissions standards, for new vehicles, in-use programs to reduce emissions from existing vehicle and equipment fleets, cleaner fuels that minimize emissions, and incentive programs to accelerate the penetration of the cleanest vehicles beyond that achieved by regulations alone. A detailed analysis reviewing possible RACM for mobile sources and consumer products in the Western Nevada County region was completed by CARB in 2020 (see Section IX). CARB's analysis concluded that there are no reasonably California mobile source and consumer products regulatory control measures excluded from use in this Attainment Plan; therefore, there are no emissions reductions associated with unused regulatory control measures that, on their own, could advance Western Nevada County's attainment of the 2015 ozone NAAQS by one year from 2026 to 2025 (i.e. 0.068 tons of NOx per day, as determined in Table 6).

E. RACM Cumulative Analysis

It is common for air pollutants to transport between air basins. The District's air quality is impacted from transport of ozone and its precursor emissions being transported from Sacramento and the San Francisco Bay Area. Local anthropogenic emissions, varied terrain, and meteorological conditions favorable for the formation and buildup of ozone all contribute to the ozone air quality challenges in the Western Nevada County.

The combination of potential additional Reasonably Available Control Measures for stationary sources, TCMs, and mobile sources (see **Figure 10**), if adopted and implemented in 2023, could provide no more than 0.027 tons of NOx reductions per day. This falls short of the 0.068 tons per day of NOx reductions that would be needed to advance attainment from 2026 to 2025, as illustrated in **Table 6**. Therefore, there is no combination of reasonably available control measures that would advance attainment of the 70 ppb ozone standard by one year.

Figure 10: Emissions Inventory Overview.



X. REASONABLE FURTHER PROGRESS (RFP)

Sections 172(c)(2) and 182(b)(1) of the Clean Air Act (Act) require ozone attainment plans to provide for Reasonable Further Progress (RFP). RFP is defined in section 171(1) of the Act as "…such annual incremental reductions in emissions of the relevant air pollutant as are required…for the purpose of ensuring attainment of the applicable national ambient air quality standard by the applicable date." This requirement to demonstrate steady progress in emission reductions between the baseline year and attainment date ensures that areas will begin lowering air pollution in a timely manner and not delay implementation of control programs until immediately before the attainment deadline.

There are two separate RFP requirements for ozone nonattainment areas depending upon their classification. For ozone nonattainment areas classified as Moderate or above, there is a one-time requirement for a 15 percent reduction in reactive organic gases (ROG) emissions over the first six years of the planning period (section 182(b)(1)). For ozone nonattainment areas classified as Serious or higher, section 182(c)(2)(B) of the Act has an additional requirement to demonstrate 3 percent per year cumulative reduction of ozone precursors averaged over each consecutive three-year period until attainment.

On June 21, 2021, U.S. EPA approved the 15 percent ROG-only rate of progress element as meeting the requirements of 182(b)(1) of the Act[39]. As such, the requirement under section 182(b)(1) of the Act in the first 6 years of the attainment planning period has been met for the Western Nevada County ozone nonattainment area.

For the 182(c)(2)(B) RFP requirement for Serious and higher areas, U.S. EPA guidance allows for oxides of nitrogen (NOx) substitution to demonstrate the annual 3 percent reductions of ozone precursors if it can be demonstrated that substitution of NOx emission reductions (for ROG reductions) yields equivalent ozone reductions.[40] Additional U.S. EPA guidance states that certain conditions are needed to use NOx substitution in an RFP demonstration.[41] First, an equivalency demonstration must show that cumulative RFP emission reductions are consistent with the NOx and ROG emission reductions determined in the ozone attainment demonstration. Second, the reductions in NOx and ROG emissions should be consistent with the continuous RFP emission reduction requirement. The guidance states that "Any combination of VOC (ROG) and NOx emission reductions which totals 3 percent per year and meet other SIP consistency requirements described in this document are allowed."

Photochemical modeling included in the attainment demonstration shows that NOx reductions are critical for the Western Nevada County to reach attainment and yields more ozone reductions compared to the same percentage of ROG reductions. See Appendix E for more information.

Table 11 demonstrates that the cumulative ROG and NOx emission reductions in Western Nevada County meets the RFP targets in the 2023 milestone year and the attainment year, 2026. In accordance with U.S. EPA guidance for implementation of the 70 ppb 8-hour ozone standard attainment plans, *Implementation of the 2015 National Ambient Air Quality Standards for*

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[39] 86 FR 27524, https://www.govinfo.gov/content/pkg/FR-2021-05-21/pdf/2021-10510.pdf

[40] P1001E8Z.PDF (epa.gov)

[41] https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19931201_oaqps_nox_substitution_guidance.pdf

Ozone: Nonattainment Area State Implementation Plan Requirements, the emissions reductions in the RFP demonstration occur inside the nonattainment area, are achieved through existing control regulations, and start from a baseline year of 2017.[42]

The Western Nevada County 70 ppb 8-hour ozone RFP demonstration was developed using CARB's California Emissions Projection Analysis Model (CEPAM), 2019 Emission Projections, Version 1.04 (**see Appendix A**). In order to demonstrate consistency between the RFP demonstration and the motor vehicle emissions budgets (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 (**see Appendix A**).

Table 11: RFP demonstration for the Western Nevada County 70 ppb Ozone SIP

Year	**2017**	**2023**	**2026**
ROG emissions	**5.21**	**4.78**	**4.54**
MVEB Rounding Margin		0.01	0.08
ROG Emissions + MVEB Rounding Margin		4.79	4.62
Required % change since 2017		18%	27%
Target ROG Level		4.27	3.80
Shortfall (-)/ Surplus (+) in ROG		-0.53	-0.82
Shortfall (-)/ Surplus (+) in ROG, %		-10.1%	-15.8%
Year	2017	2023	2026
NOx emissions	**3.12**	**2.18**	**1.72**
MVEB Rounding Margin		0.06	0.06
NOx Emissions + MVEB Rounding Margin		2.24	1.78
Change in NOx since 2017		0.88	1.34
Change in NOx since 2017, %		28.2%	42.9%
NOx reductions since 2017 used for ROG substitution in this milestone year, %		10.1%	15.8%
NOx reductions since 2017 surplus after meeting ROG substitution needs in this milestone year, %		18.1%	27.1%
RFP shortfall (-) if any		0%	0%
RFP Met?		**YES**	**YES**

Note: numbers may not add up due to rounding

[42] 83 FR 62998, 2018-25424.pdf (govinfo.gov)

XI. MODEL ATTAINMENT DEMONSTRATION

Photochemical modeling plays a crucial role in the SIP process to demonstrate attainment of air quality standards based on estimated future emissions and for the development of emissions targets necessary for attainment. Currently, the Western Nevada Non-attainment Area (WNNA) is classified as serious nonattainment for the 2015 70 ppb O_3 standard, which means it must demonstrate attainment of the 2015 standard by 2026. Consistent with U.S. EPA guidance for model attainment demonstrations (U.S. EPA, 2018), photochemical modeling was used to estimate the 2026 O_3 design values (DVs) at the Grass Valley-Litton Building monitoring site in WNNA to show attainment of the 70 ppb O_3 standards.

The findings of WNNA's model attainment demonstration are summarized below. Additional information and a detailed description of the procedures employed in this modeling are available in the Modeling Protocol and Attainment Demonstration Appendix of this document.

U.S. EPA modeling guidance (U.S. EPA, 2018) outlines the approach for utilizing regional chemical transport models (CTMs) to predict future attainment of the 2015 (70 ppb) 8-hour ozone standard. The 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 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. The U.S. EPA recommends using an average of three DVs to better account for the year-to-year variability in ozone levels due to meteorology. This average DV is called a 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, an alternative methodology was used 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 4th highest 8-hour O_3 concentrations from 2018 and 2019.

These reference DVs serve as the anchor point for estimating future year projected design values. The year 2026 was the future year modeled in this attainment demonstration since this is the year for which attainment must be demonstrated.

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 (2026) 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.

Table summarizes the 2018 and 2026 WNNA anthropogenic emissions. Overall, anthropogenic NO_x emissions in CEPAM v1.04 were projected to decrease by ~43% between 2018 and 2026 (from 3 tpd to 1.7 tpd) in the WNNA with bulk of the reductions coming from on-road mobile sources. In contrast, anthropogenic ROG was projected to decrease ~15% by 2026 (from 5.3 tpd to 4.5 tpd) with the bulk of those reductions coming from all mobile sources including on-road and other mobile sources. Details on the emission inventory can be found in the Modeling Emissions Inventory **Appendix F**.

Table 12. WNNA Summer Planning Emissions for 2018 and 2026 (tons/day)

Source Category	2018 NOx [tpd]	2026 NOx [tpd]	NOx diff	2018 ROG [tpd]	2026 ROG [tpd]	ROG diff
Stationary	0.1	0.1	-5.7%	0.8	0.8	0.7%
Area	0.1	0.1	0.7%	1.7	1.7	1.6%
On-Road Mobile	1.8	0.7	-60.0%	0.8	0.5	-35.3%
Other Mobile	0.9	0.7	-18.8%	2.1	1.6	-24.3%
Total	**3.0**	**1.7**	**-42.7%**	**5.3**	**4.5**	**-14.2%**

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

As part of the model attainment demonstration, the fractional change in ozone mixing ratios between the model reference year and model future year was calculated at the Grass Valley-Litton Building site following U.S. EPA modeling guidance and procedures outlined in the Modeling Protocol and Attainment Demonstration Appendix. The fractional change is called a “relative response factor” or RRF. The site-specific RRF was then multiplied by the baseline DV from the Grass Valley-Litton Building site to predict the future year DV.

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

The RRF and future year design values for the Grass Valley-Litton Building site in the WNNA were calculated and are summarized in **Table 13.** The projected ozone design value in 2026 is 69 ppb at the site when the fire impacted days were excluded in the baseline design value calculation. Therefore, the attainment demonstration modeling predicts that the WNNA will attain the 2015 70 ppb 8-hour ozone standard by 2026.

Table 13. Summary of key parameters related to the calculation of future year 2026 8-hour ozone design values (DV), using the method defined in the U.S. EPA guidance, at the Grass Valley-Litton Building monitoring site in the WNNA.

Days in Base DV Calculation	RRF	2018 Average DV (ppb)	2026 DV (ppb)	2026 DV Truncated (ppb)
All	0.9035	86.0	77.7	77
Fire Days Excluded	0.9035	77.3	69.8	69

Reference

U.S. EPA. 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.

XII. Contingency Measure

A. Introduction

Contingency measures provide additional emissions reductions in the event that a nonattainment area fails to achieve reasonable further progress targets or to attain the applicable ozone standard by its attainment date. U.S. EPA has interpreted this requirement to represent one year's worth of RFP, which amounts to three percent reductions. As these are reductions not accounted for in the attainment demonstration, these emissions reductions are additional to the reductions needed for attainment. Contingency measures must also provide for the implementation of specific measures without any further rulemaking action. These reductions are triggered if and only if U.S. EPA formally determines that the District failed to achieve RFP (as outlined in Section X), or if the District did not attain the standard by the August 3, 2027 attainment date.

As discussed in greater detail throughout this section, there is a scarcity of options for contingency measures both statewide and within the Western Nevada County Nonattainment area. CARB has and will continue to implement stringent control programs and is including a zero-emission component in most of its regulations. There are few sources remaining without a control measure implemented by CARB or the District, and those that do remain are primarily-federally or internationally regulated sources.

Western Nevada County is also a unique rural area with few area sources and ozone concentrations heavily influenced by regional transport from the upwind dense population areas of Sacramento and the San Francisco Bay. Precursor emissions generated in the upwind Sacramento and Bay Area nonattainment areas overshadow those from Western Nevada County. Western Nevada County's NOx and ROG emissions amounted to about 5 percent of Sacramento nonattainment area emissions in 2020. Similarly, Western Nevada's 2020 NOx and ROG emissions are only 2 percent of those from the Bay Area. The difference in emissions between these upwind, contributing areas and Western Nevada County helps explain the important role of transport in Western Nevada County's ozone air quality, and the scarcity of local control options capable of meeting one year's worth of RFP.

Given the limited number of emissions sources under the regulatory authority of NSAQMD, options for additional reductions measures for the WNNA are scarce. NSAQMD already follows statewide and federal requirements for source controls, and with few emitting facilities, NSAQMD relies on emission reductions from upwind areas and mobile source control measures at the State level to achieve many of its emission reductions, programs which notably continue to achieve emissions reductions in futures years in excess of what is needed for RFP and attainment. Finding an additional control measure that would achieve the full required emissions reductions needed for a contingency measure would be nearly impossible.

The most prudent contingency measure to implement for WNNA is the CARB Suggested Control Measure (SCM) for Architectural Coatings, described in further detail in Section XII, E. NSAQMD investigated reasonable potential contingency measures and could not identify any that would result in larger emission reductions than adopting the SCM for Architectural Coatings. NSAQMD adopted Rule 230, Architectural Coatings, as its contingency measure to meet SIP requirements for the 2015 8-hour 70ppb ozone standard.

B. The Clean Air Act

The Clean Air Act 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 Clean Air Act 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, U.S. 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 Federal Register 13510, 13512 (April 16, 1992)). Further, U.S. 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". U.S. EPA, though, has accepted contingency measures that equal less than a year's worth of progress when the circumstances fit under "U.S. 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.'"[43]

Contingency measures are required by the Clean Air Act to be implemented should an area fail to make reasonable further progress or attain the NAAQS by the required date. Over the last few years, multiple court decisions in the 9th circuit and nation-wide have effectively disallowed the SIP-approved approach which CARB and the districts have historically used to meet contingency measure requirements. CARB continues to strive to meet the requirements, but U.S. EPA has not yet released comprehensive and updated guidance encompassing the full scope of contingency measure requirements, in light of the results of the varying court decisions. Guidance is needed for CARB, and other air agencies across California and the U.S., to ensure that any resources devoted to creating, adopting, and implementing a measure will result in one that meets the requirements and be approved into the SIP.

Historically, U.S. EPA allowed contingency measure requirements to be met via excess emission reductions from ongoing implementation of adopted emission reduction programs, a method that CARB has used for a contingency measure and U.S. EPA has approved in the past. In 2016, in *Bahr v. U.S. Environmental Protection Agency*[44] *(Bahr),* the 9th Circuit Court of Appeals determined U.S. EPA erred in approving a contingency measure that relied on an already-implemented measure for a nonattainment area in Arizona, thereby rejecting U.S. EPA's longstanding interpretation of section 172(c)(9). U.S. 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 reasonable further progress. This decision was applicable to the states covered by the 9th Circuit Court. In the rest of the country, U.S. EPA was still approving contingency measures using their pre-Bahr stance. In January 2021, in *Sierra Club v. Environmental Protection*

[43] See, e.g., 78 Fed.Reg. 37741, 37750 (Jun. 24, 2013), approval finalized with 78 Fed.Reg. 64402 (Oct. 29, 2013).
[44] *Bahr v. U.S. Environmental Protection Agency,* (9th Cir. 2016) 836 F.3d 1218.

Agency[45], 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 U.S. 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, U.S. 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. U.S. 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.

Additionally, 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, U.S. EPA guidance required contingency measures to achieve approximately one year's worth of emission reductions. CARB's control programs are advanced, and primarily-federally regulated sources contribute over half of the emissions. Thus, opportunities for a triggered contingency measure that can be implemented by the State and result in one year's worth of emission reductions in the required time frame are not readily available. Further, if any measure that could achieve this level of emission reductions existed, it would be adopted to improve air quality and support attainment of NAAQS, and would not be withheld for contingency purposes. Even with recent court decisions, U.S. EPA has the opportunity to justify a revised approach for contingency measures recognizing the maturity of control programs or allow states to provide a reasoned justification for achieving less than the required amount. California continues to work towards meeting contingency measure requirements, but U.S. EPA must issue guidance to provide clarity and direction for states to move forward and pursue contingency measures that will meet the requirements.

Subsequently, the Association of Irritated Residents filed a lawsuit against the U.S. 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 9th Circuit Court of Appeals issued its decision in *Association of Irritated Residents v. EPA*[46] (*AIR*) that U.S. 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 emission reductions. Most importantly, the 9th Circuit Court said that, in line with U.S. EPA's longstanding interpretation of what is required of a contingency measure and the purpose it serves, together with *Bahr*, all reductions

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

needed to satisfy the Clean Air Act'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 U.S. EPA formally changing its historic stance on the amount of reductions required. U.S. 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, surplus emission reductions from ongoing programs cannot reduce the amount of reductions needed for contingency.

In response to *Bahr* and *Sierra Club*, in 2021, U.S. EPA convened a nation-wide internal task force to develop guidance to support states in their development of contingency measures. That task force is now also considering the impact of *AIR*. U.S. EPA has indicated that the contingency measure guidance may be released fall 2022. The SIPs for the 70 ppb 8-hour ozone standard are due to U.S. EPA August 3, 2022. In their updated guidance, U.S. EPA needs to recognize that many state control programs are mature and opportunities to withhold measures for contingency are scarce.

Since *Bahr*, CARB has worked closely with our U.S. EPA regional office in developing contingency measures with little success. CARB is committed to meeting the Clean Air Act requirements for contingency measures, but without finalized national guidance on this complex issue, it is not a good use of resources to pursue contingency measures that may not ultimately coincide with the upcoming new guidance.

C. California's Issues with Contingency Measures

Although, much has changed since U.S. EPA's 1992 guidance on contingency measures. Control programs across the country have matured as have the health-based standards. Ozone standards have strengthened in 2008 and 2015 with attainment dates out to 2037. California has the only two extreme areas in the country. Control measures identified for these areas must be implemented for meeting the standard and not held in reserve.

To address contingency measure requirements given the courts' decisions and current U.S. EPA guidance, CARB and local air districts would need to develop a measure or measures that, when triggered by a failure to attain or failure to meet RFP, will achieve one year's worth of emissions reductions for the given nonattainment area, or approximately 3 percent of total baseline emissions.

Given CARB's wide array of mobile source control programs, the relatively limited portion of emissions primarily regulated by the local air district, and the fact that primarily-federally regulated sources are expected to account for approximately 49 percent of statewide NOx emissions by 2026[47], finding a single triggered measure that will achieve the required reductions would be nearly impossible. That said, even discounting the amount to reflect the proportion that is primarily-federally regulated, approximately 1.3 percent of total baseline emissions would still be needed. Even targeting a lower percentage, additional control measures that can be identified

[47] Source: CARB 2019 CEPAM v1.03; based on 2037 emissions totals.

by CARB are scarce or nonexistent that would achieve the require emissions reductions needed for a contingency measure.

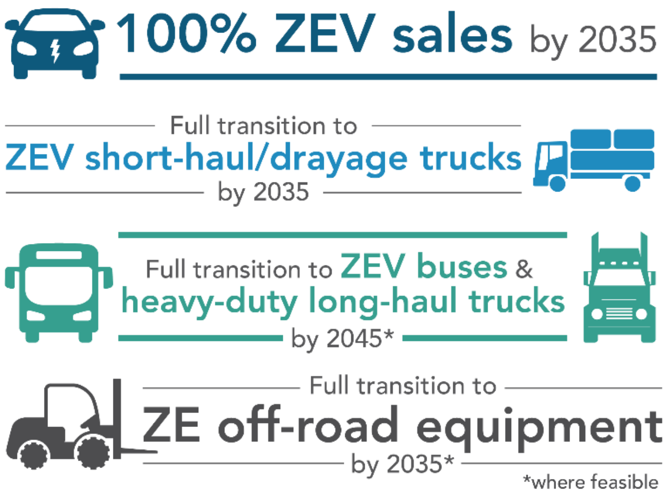
Adding to the difficulty of identifying available control measures, not only does the suite of contingency measures need to achieve a large amount of reductions, but they will also need to achieve these reductions in the year following the year in which the failure to attain or meet RFP has been identified. Control measures achieving the level of reductions required may take years to implement and will likely not result in immediate reductions. In the 2022 State SIP Strategy, CARB's three largest NOx reduction measures, In-Use Locomotive Regulation, Zero -Emission Standards for Space and Water Heaters and Advanced Clean Fleets, rely on accelerated turnover of older engines/trucks. Buildup of infrastructure and equipment options limits the availability to have significant emission reductions in a short amount of time. Unless U.S. EPA changes its historic stance or finds a reasoned justification for requiring less than the stated amount, adopting a single triggered measure that can be implemented and achieve the necessary reductions in the time frame required is scarce in California and may not be possible.

CARB has over 50 years of experience reducing emissions from mobile and 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 in anticipation of U.S. EPA's written guidance. CARB anticipates that U.S. EPA's guidance will allow an assessment of viability of such a state-wide measure.

D. CARB Moving Forward

A central issue in considering a statewide contingency measure under CARB's authority, is that CARB is already fully committed to the "drive to zero" effort. In 2020, Governor Newsom signed Executive Order N-79-20 (**Figure 11**) 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 11. Governor Newson Executive Order N-79-20



CARB is committed to achieving these goals. Thus, CARB's programs not only go beyond emissions standards and programs set at the federal level, but many include zero-emissions requirements or otherwise, through incentives and voluntary programs, drive mobile sources to zero-emissions, as listed in **Table 14** below. 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 the 2022 State Strategy for the State Implementation Plan. With most source categories being driven to zero-emissions, opportunities for which a triggered measure that could reduce emissions by the amount required for contingency measures are scarce.

Table 14: Emissions Sources and Respective CARB Programs with a Zero-Emissions Requirement/Component

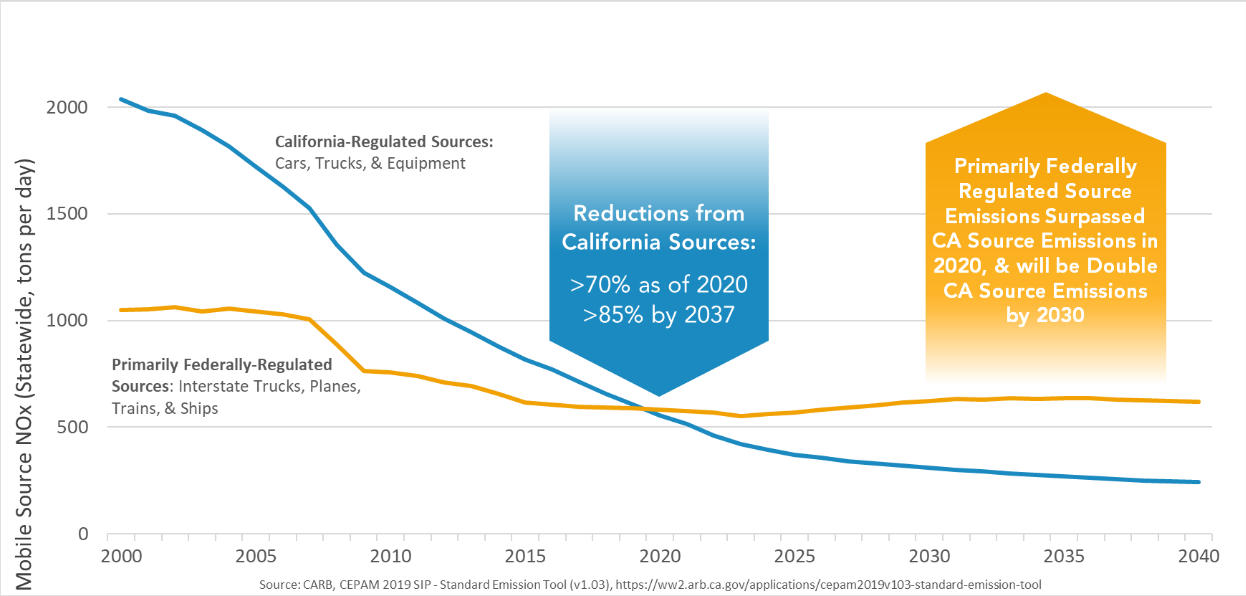
Emission Source	Regulatory Programs
Light-Duty Passenger Vehicles and Light-Duty Trucks	• Advanced Clean Cars Program (I and II*), including the Zero Emission Vehicle Regulation • Clean Miles Standard *
Motorcycles	• On-Road Motorcycle Regulation*
Medium Duty-Trucks	• Advanced Clean Cars Program (I and 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 is in development

There are few sources remaining without a control measure implemented by CARB, and those that do remain 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 emission reductions are limited.

Figure 12: Mobile Source NOx 2000-2040



At this time, CARB is including a zero-emission component in most of our regulations, both those already adopted and those that are in development, and the vast majority of these regulations are statewide. Beyond the wide array of sources CARB has been regulating over the last few decades, and especially considering those we are driving to zero-emission, there are few sources of emissions left for CARB to implement additional controls upon under its authorities. 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 local air districts will need to implement contingency measures that, when triggered, would achieve one year's worth of emissions reductions, or at least the relevant portion equivalent to the contribution of sources primarily regulated at the State and local level, unless a reasoned rationale for achieving less emission reductions can be provided. Considering the air quality challenges California and local air districts face, CARB would implement the measure to support expeditious attainment of the NAAQS as the Clean Air Act requires rather than withhold it for contingency measure purposes. Should there be a measure achieving the required emission reductions, the measure would likely take more than one year to reduce the necessary emissions.

CARB fully intends to meet the contingency requirement as required by the Clean Air Act, but written U.S. EPA guidance that addresses the dilemma California faces is needed to provide direction and clarity for CARB and local air districts to develop and adopt approvable contingency measures. CARB continues to explore potential contingency measures while awaiting U.S. EPA's written guidance. Further, since it's been about 30 years, since U.S. EPA developed the guidance, this may be the time for U.S. EPA to update the guidance by formally changing its historic stance on the amount of reductions required to meet the contingency measure requirement and allowing states with mature control programs to demonstrate that contingency measure opportunities are scarce.

E. Western Nevada County Rule 230

NSAQMD has largely relied on mobile source control programs at the State level, implemented regardless of contingency measure requirements, to help reduce on-going emissions. However, recent litigation concluded that regions cannot rely solely on already implemented measures and an additional contingency measure is needed.[48] For that reason, the district has proposed to implement the statewide Suggested Control Measure (SCM) for Architectural Coatings as a contingency measure. The NSAQMD investigated reasonable potential contingency measures and could not identify any that would result in larger emission reductions than adopting the SCM for Architectural Coatings. Specifically, the District adopted the rule with the required trigger mechanism, to implement the rule without further Board action if the EPA issues a final rulemaking that the Nonattainment Area failed to meet an RFP milestone or make attainment by the attainment deadline.

CARB estimates the VOC emissions from Architectural Coatings for Northern Sierra AQMD is 0.1 tpd. The VOC reductions from the 2019 SCM for Architectural Coatings for Northern Sierra AQMD is 0.014 tpd (2022 implementation year). These values are calculated by a simple ratio of population statewide to locale of interest. The district-wide reduction figure modified by the fraction of district population in the nonattainment area (around 85,000 in Western Nevada County per the US Census Bureau) yields anticipated reductions in the nonattainment area of 0.010 tpd[49]. Again, this measure will be enacted (without Board action) if and only if the EPA makes a formal finding that WNNA failed to meet an RFP milestone or attainment deadline, thus necessitating implementation of the contingency measures.

Table 15: District Contingency Measure, 2015 Ozone NAAQS

Contingency Measure and Trigger Mechanism	Adoption Date	Dates where applicable
Implement adopted NSAQMD Rule 230. **Summary:** NSAQMD will implement adopted rule 230, Architectural Coatings if the contingency measure is triggered. **Process:** The adopted rule will be submitted to the EPA (through CARB) for inclusion into the SIP. **Applicability:** The measure will satisfy the contingency measure requirement for the District's Western Nevada County Serious Attainment Plan for the 2015 ozone NAAQS.	February 27, 2023.	If and only when the EPA makes a finding that Western Nevada County has failed to satisfy a regulatory requirement necessitating implementation of the measure (e.g. failure to make RFP or attain ozone standard by August 3, 2027.) The applicable section will be triggered without additional Board action needed.

[48] Bahr v. EPA, 836 F.3d 1218, at 1235-1237 (9th Cir. 2016).
[49] https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2017/

The District’s predicted attainment year for the 2015 ozone NAAQS is 2026. Should the District fail to attain the 2015 ozone NAAQS or meet reasonable further progress, this contingency measure would reduce VOC emissions from Architectural Coatings in the District by 0.01 tpd.

XIII. CONCLUSION

Pursuant to CAA requirements and EPA guidance, CARB and the District conducted many analyses to determine timely attainment of 2015, 8-hour Ozone NAAQS for Western Nevada County as a Serious nonattainment area. The results of the modeling provide a strong conclusion that the emission control measures defined by CARB and the District in this Attainment Plan are sufficient to continue reducing O_3 concentrations throughout the District's Nonattainment Area to meet the 2015, 8-hour Ozone NAAQS by the conclusion of the 2026 O_3 season.

Appendix A

Emission Inventories for 2017, 2018, 2020, 2023, 2026, & 2027

Table 1: Emission Inventory of Ozone Precursors in West Nevada County Nonattainment Area (tons per day)

SOURCE SUBCATEGORY	ROG					
	2017	**2018**	**2020**	**2023**	**2026**	**2027**
ELECTRIC UTILITIES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MANUFACTURING AND INDUSTRIAL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FOOD AND AGRICULTURAL PROCESSING	0.0005	0.0005	0.0004	0.0003	0.0002	0.0002
SERVICE AND COMMERCIAL	0.0023	0.0024	0.0025	0.0025	0.0024	0.0024
OTHER (FUEL COMBUSTION)	0.0031	0.0031	0.0021	0.0021	0.0021	0.0021
SEWAGE TREATMENT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LANDFILLS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
INCINERATORS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAUNDERING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DEGREASING	0.2494	0.2544	0.2796	0.2864	0.2827	0.2704
COATINGS AND RELATED PROCESS SOLVENTS	0.0918	0.0927	0.0932	0.0987	0.1029	0.1035
PRINTING	0.0955	0.0961	0.0849	0.0900	0.0917	0.0915
ADHESIVES AND SEALANTS	0.0568	0.0575	0.0554	0.0570	0.0570	0.0565
OTHER (CLEANING AND SURFACE COATINGS)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PETROLEUM MARKETING	0.1432	0.1396	0.1348	0.1268	0.1190	0.1167
CHEMICAL	0.0932	0.0937	0.0847	0.0860	0.0867	0.0862
FOOD AND AGRICULTURE	0.0031	0.0032	0.0030	0.0031	0.0033	0.0034
MINERAL PROCESSES	0.0189	0.0190	0.0175	0.0187	0.0188	0.0187
METAL PROCESSES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WOOD AND PAPER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STATIONARY SUBTOTAL	**0.7582**	**0.7625**	**0.7585**	**0.7719**	**0.7672**	**0.7520**
CONSUMER PRODUCTS	0.5206	0.5288	0.5398	0.5440	0.5628	0.5669
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	0.1398	0.1403	0.1413	0.1435	0.1452	0.1454
PESTICIDES/FERTILIZERS	0.0200	0.0171	0.0187	0.0188	0.0188	0.0188
ASPHALT PAVING / ROOFING	0.3212	0.3381	0.3498	0.3734	0.3885	0.3926
RESIDENTIAL FUEL COMBUSTION	0.1507	0.1506	0.1506	0.1505	0.1504	0.1504
FARMING OPERATIONS	0.1162	0.1135	0.1087	0.1024	0.0971	0.0956
CONSTRUCTION AND DEMOLITION	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PAVED ROAD DUST	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
UNPAVED ROAD DUST	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FUGITIVE WINDBLOWN DUST	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FIRES	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011
MANAGED BURNING AND DISPOSAL	0.1919	0.3779	0.3294	0.3294	0.3295	0.3295
COOKING	0.0100	0.0100	0.0100	0.0101	0.0102	0.0102
OTHER (MISCELLANEOUS PROCESSES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AREAWIDE SUBTOTAL	**1.4717**	**1.6775**	**1.6496**	**1.6734**	**1.7039**	**1.7107**
LIGHT DUTY PASSENGER (LDA)	0.1699	0.1529	0.1269	0.1019	0.0869	0.0833
LIGHT DUTY TRUCKS - 1 (LDT1)	0.0634	0.0562	0.0463	0.0382	0.0315	0.0295
LIGHT DUTY TRUCKS - 2 (LDT2)	0.2180	0.2070	0.1880	0.1655	0.1447	0.1381
MEDIUM DUTY TRUCKS (MDV)	0.1396	0.1317	0.1187	0.0978	0.0866	0.0838
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDGT1)	0.0708	0.0666	0.0582	0.0541	0.0524	0.0525
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDGT2)	0.0036	0.0034	0.0030	0.0024	0.0019	0.0018
MEDIUM HEAVY DUTY GAS TRUCKS (MHDGT)	0.0026	0.0023	0.0018	0.0015	0.0013	0.0013
HEAVY HEAVY DUTY GAS TRUCKS (HHDGT)	0.0002	0.0002	0.0001	0.0000	0.0000	0.0000
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDDT1)	0.0225	0.0210	0.0182	0.0142	0.0108	0.0099
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDDT2)	0.0047	0.0045	0.0040	0.0033	0.0028	0.0026
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDDT)	0.0149	0.0125	0.0089	0.0007	0.0006	0.0006
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDDT)	0.0401	0.0348	0.0261	0.0120	0.0123	0.0124
MOTORCYCLES (MCY)	0.1081	0.1057	0.1012	0.0941	0.0863	0.0834
HEAVY DUTY DIESEL URBAN BUSES (UBD)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DUTY GAS URBAN BUSES (UBG)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SCHOOL BUSES - GAS (SBG)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
SCHOOL BUSES - DIESEL (SBD)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
OTHER BUSES - GAS (OBG)	0.0008	0.0007	0.0006	0.0004	0.0004	0.0004
OTHER BUSES - MOTOR COACH - DIESEL (OBC)	0.0002	0.0002	0.0001	0.0000	0.0000	0.0000
ALL OTHER BUSES - DIESEL (OBD)	0.0011	0.0009	0.0007	0.0000	0.0000	0.0000
MOTOR HOMES (MH)	0.0015	0.0013	0.0010	0.0007	0.0005	0.0005
AIRCRAFT	0.0486	0.0486	0.0486	0.0486	0.0486	0.0486
TRAINS	0.0075	0.0080	0.0080	0.0081	0.0080	0.0080
RECREATIONAL BOATS	1.4227	1.3627	1.2492	1.1042	0.9806	0.9443
OFF-ROAD RECREATIONAL VEHICLES	0.1391	0.1357	0.1305	0.1171	0.1110	0.1047
OFF-ROAD EQUIPMENT	0.4164	0.4096	0.4045	0.3999	0.3406	0.3149
OFF-ROAD EQUIPMENT (PERP)	0.0042	0.0040	0.0034	0.0028	0.0026	0.0025
FARM EQUIPMENT	0.0271	0.0370	0.0329	0.0288	0.0247	0.0234
FUEL STORAGE AND HANDLING	0.0489	0.0472	0.0442	0.0406	0.0380	0.0374
MOBILE SUBTOTAL	**2.9767**	**2.8549**	**2.6252**	**2.3372**	**2.0735**	**1.9841**
GRAND TOTAL WNNA	**5.2066**	**5.2950**	**5.0334**	**4.7826**	**4.5445**	**4.4468**

Source: 2022 CARB CEPAM emissions inventory, Northern Sierra Air Quality Management District, Version 1.04v, Summer, Grown and Controlled.

Table 2: Emission Inventory of Ozone Precursors in West Nevada County Nonattainment Area (tons per day)

SOURCE SUBCATEGORY	NOx					
	2017	**2018**	**2020**	**2023**	**2026**	**2027**
ELECTRIC UTILITIES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MANUFACTURING AND INDUSTRIAL	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003
FOOD AND AGRICULTURAL PROCESSING	0.0070	0.0066	0.0061	0.0053	0.0045	0.0042
SERVICE AND COMMERCIAL	0.0453	0.0468	0.0482	0.0484	0.0479	0.0477
OTHER (FUEL COMBUSTION)	0.0317	0.0317	0.0266	0.0266	0.0266	0.0266
SEWAGE TREATMENT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LANDFILLS	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
INCINERATORS	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016
LAUNDERING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DEGREASING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
COATINGS AND RELATED PROCESS SOLVENTS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PRINTING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ADHESIVES AND SEALANTS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
OTHER (CLEANING AND SURFACE COATINGS)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PETROLEUM MARKETING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CHEMICAL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FOOD AND AGRICULTURE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MINERAL PROCESSES	0.0246	0.0248	0.0228	0.0243	0.0245	0.0244
METAL PROCESSES	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
WOOD AND PAPER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STATIONARY SUBTOTAL	**0.1112**	**0.1126**	**0.1064**	**0.1073**	**0.1061**	**0.1056**
CONSUMER PRODUCTS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PESTICIDES/FERTILIZERS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ASPHALT PAVING / ROOFING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
RESIDENTIAL FUEL COMBUSTION	0.1372	0.1347	0.1356	0.1334	0.1310	0.1302
FARMING OPERATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CONSTRUCTION AND DEMOLITION	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PAVED ROAD DUST	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
UNPAVED ROAD DUST	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FUGITIVE WINDBLOWN DUST	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FIRES	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003
MANAGED BURNING AND DISPOSAL	0.0097	0.0089	0.0138	0.0138	0.0138	0.0138
COOKING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
OTHER (MISCELLANEOUS PROCESSES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AREAWIDE SUBTOTAL	**0.1472**	**0.1439**	**0.1497**	**0.1474**	**0.1451**	**0.1443**
LIGHT DUTY PASSENGER (LDA)	0.1145	0.0995	0.0763	0.0551	0.0436	0.0412
LIGHT DUTY TRUCKS - 1 (LDT1)	0.0375	0.0321	0.0243	0.0174	0.0127	0.0115
LIGHT DUTY TRUCKS - 2 (LDT2)	0.1959	0.1762	0.1422	0.1037	0.0759	0.0686
MEDIUM DUTY TRUCKS (MDV)	0.1261	0.1135	0.0916	0.0611	0.0442	0.0401
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDGT1)	0.0454	0.0421	0.0357	0.0292	0.0237	0.0223
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDGT2)	0.0031	0.0029	0.0025	0.0019	0.0015	0.0013
MEDIUM HEAVY DUTY GAS TRUCKS (MHDGT)	0.0038	0.0034	0.0028	0.0021	0.0016	0.0015
HEAVY HEAVY DUTY GAS TRUCKS (HHDGT)	0.0011	0.0010	0.0007	0.0003	0.0001	0.0001
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDDT1)	0.4367	0.4001	0.3306	0.2406	0.1680	0.1480
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDDT2)	0.0759	0.0700	0.0587	0.0441	0.0323	0.0290
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDDT)	0.1606	0.1531	0.1381	0.0709	0.0657	0.0640
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDDT)	0.7132	0.6918	0.6432	0.4826	0.4785	0.4758
MOTORCYCLES (MCY)	0.0202	0.0194	0.0180	0.0161	0.0146	0.0142
HEAVY DUTY DIESEL URBAN BUSES (UBD)	0.0011	0.0011	0.0008	0.0004	0.0002	0.0002
HEAVY DUTY GAS URBAN BUSES (UBG)	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
SCHOOL BUSES - GAS (SBG)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SCHOOL BUSES - DIESEL (SBD)	0.0114	0.0113	0.0110	0.0103	0.0095	0.0091
OTHER BUSES - GAS (OBG)	0.0014	0.0013	0.0010	0.0007	0.0005	0.0005
OTHER BUSES - MOTOR COACH - DIESEL (OBC)	0.0034	0.0032	0.0026	0.0012	0.0013	0.0013
ALL OTHER BUSES - DIESEL (OBD)	0.0113	0.0102	0.0086	0.0037	0.0039	0.0040
MOTOR HOMES (MH)	0.0149	0.0138	0.0118	0.0094	0.0076	0.0071
AIRCRAFT	0.0054	0.0054	0.0054	0.0054	0.0054	0.0054
TRAINS	0.1603	0.1733	0.1780	0.1863	0.1917	0.1948
RECREATIONAL BOATS	0.2252	0.2223	0.2168	0.2096	0.2036	0.2020
OFF-ROAD RECREATIONAL VEHICLES	0.0061	0.0062	0.0064	0.0067	0.0073	0.0074
OFF-ROAD EQUIPMENT	0.3312	0.3236	0.2990	0.2564	0.2180	0.2073
OFF-ROAD EQUIPMENT (PERP)	0.0506	0.0467	0.0369	0.0273	0.0220	0.0193
FARM EQUIPMENT	0.1165	0.1324	0.1192	0.1042	0.0906	0.0864
FUEL STORAGE AND HANDLING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MOBILE SUBTOTAL	**2.8730**	**2.7560**	**2.4624**	**1.9467**	**1.7242**	**1.6628**
GRAND TOTAL FOR WNNA	**3.1314**	**3.0125**	**2.7185**	**2.2015**	**1.9754**	**1.9127**

Source: 2022 CARB CEPAM emissions inventory, Northern Sierra Air Quality Management District, Version 1.04v, Summer, Grown and Controlled.

Appendix B

CARB Control Measures, 1985 to 2019

Board Action	Hearing Date
Public Meeting to Consider San Joaquin Valley Agricultural Equipment Incentive Measure: The Board adopted the San Joaquin Valley Agricultural Equipment Incentive Measure for submission to the United States Environmental Protection Agency as a revision to the California State Implementation Plan (SIP). The measure achieves SIP creditable emission reductions from agricultural equipment incentive projects	12/13/19
Public Hearing to Consider Proposed Amendments to the Regulation for Limiting Ozone Emissions from Indoor Air Cleaning Devices: The Board adopted amendments to the air cleaner regulation, which limits ozone emissions from air cleaning devices.	12/12/19
Public Hearing to Consider Proposed Control Measure for OceanGoing Vessels At Berth: The Board adopted the Control Measure for Ocean-Going Vessels At Berth. The Proposed Regulation would take effect in 2021 and is designed to achieve further emissions from vessels at berth to reduce adverse health impacts to communities surrounding ports and terminals throughout California. These benefits would be achieved by including new vessel categories (such as vehicle carriers and tanker vessels), new ports, and independent marine terminals.	12/5/19
Public Hearing to Consider Proposed Amendments to the Low Carbon Fuel Standard: The Board adopted amendments to the Low Carbon Fuel Standard (LCFS) Regulation, focusing on strengthening the program's cost containment provisions and ensuring that LCFS residential charging credit revenue value benefits disadvantaged and low-income communities	11/21/19
Public Hearing to Consider the Proposed Zero-Emission Airport Shuttle Regulation: The Board adopted the Zero-Emission Airport Shuttle Regulation. The regulation will transition combustion powered airport shuttles to zero-emission vehicles and will apply to private and public fixed destination shuttles that serve California's commercial airports. The Board certified the Final Environmental Analysis, approving the written response to any environmental comments received, approving findings and statement of overriding considerations, and adopting the regulation at this meeting	6/27/19
Public Meeting to Consider Proposed Updates to the Architectural Coatings Suggested Control Measure: The Board adopted updates to the Suggested Control Measure (SCM) for Architectural Coatings. The updates to the SCM would reduce volatile organic compound (VOC) limits for several coating categories, create two new coatings categories, and set limits for colorants (tints) added to architectural coatings at the point of sale. The updated SCM would serve as a model rule and assist air districts in their efforts to further reduce VOC emissions to meet ambient air quality standards for ozone.	5/23/19
Public Hearing to Consider Proposed Amendments to the Regulation for the Certification of Vapor Recovery Systems for Cargo Tanks: The Board adopted amendments to the Certification of Vapor Recovery Systems on Cargo Tanks Regulation that establish a regulatory mechanism to periodically evaluate program costs and subsequently adjust the certification fee to recover these costs, per the authority under the Health and Safety Code Section 41962. In addition, the amendments will establish: (1) a requirement for a public meeting prior to adjusting fees, (2) an effective date of January 1 following a fee revision, (3) the cost of replacement decals, and (4) procedures to request a certification fee refund.	4/25/19
Public Hearing to Consider Proposed Amendments to the Red Sticker Program for Off-Highway Recreational Vehicles: The Board adopted amendments to the Red Sticker Program for Off-Highway Recreation Vehicles (OHRV). OHRV are primarily used in public State parks and federally designated lands, as well as on private tracks. The goal of the amendments is to end the current red sticker program which allows for CARB certification of OHRV that do not meet emissions standards. The amendments include provisions that end the certification of new red sticker vehicles, end riding restrictions on public lands for existing red sticker vehicles, establish new OHRV emissions standards, and increase incentives for fleet emissions averaging and zero emission OHRV. The amendments are intended to cause emissions reductions from OHRV in California while ensuring availability for California dealers and riders.	4/25/19
Public Hearing to Consider the Proposed Amendments to the On-Road Heavy-Duty Diesel-Fueled Residential and Commercial Solid Waste Collection Vehicles Regulation to Include Heavy Cranes: The Board adopted amendments to the On-Road Heavy-Duty Diesel-Fueled Residential and Commercial Solid Waste Collection Vehicles (SWCV) regulation. The amendments include two distinct changes to the regulation, (1) to ensure that compliant SWCVs do not experience registration delays at the California Department of Motor Vehicles due to recent changes in California law; (2) to provide a more cost-effective compliance option for specialized heavy cranes.	1/24/19

Public Hearing to Consider the Proposed Innovative Clean Transit Regulation, a Replacement of the Fleet Rule for Transit Agencies: The Board adopted the Innovative Clean Transit (ICT) Regulation that requires California transit agencies to gradually transition their buses to zero-emission technologies. The ICT regulation is structured to allow transit agencies to take advantage of incentive programs by acting early and in a manner to implement plans that are best suited for their own situations. This is the second of two Board hearings on this item; the Board certified the Final Environmental Analysis, approving the written response to comments received on the Draft Environmental Analysis, and adopting the amendments at this meeting.	12/14/18
Public Hearing to Consider California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation: The Cap-and-Trade Regulation amendments are intended to conform with the requirements in AB 398, respond to Board direction in Resolution 17-21, and enhance program implementation and oversight. The amendments include changes to provisions relating to free allocation for minimizing leakage and transition assistance, offsets usage limits and criteria related to direct environmental benefits in the State, and cost containment.	12/13/18
Public Hearing to Consider Proposed Amendments to the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions: The Mandatory Reporting of Greenhouse Gas Emissions amendments are targeted revisions to clarify the existing regulation related to how entities report their greenhouse gas emissions to support the Cap-and-Trade Program, and to ensure the data that are collected for CARB's climate change programs are complete and accurate.	12/13/18
Public Hearing to Consider Proposed Revisions to On Board Diagnostic System Requirements, Including the Introduction of Real Emissions Assessment Logging, for Heavy Duty Engines, Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engine: The Board adopted amendments to the heavy-duty (HD) On Board Diagnostic (OBD) and medium-duty OBD II requirements to update the monitoring requirements for gasoline and diesel vehicles, to require more data parameters to be tracked and reported by the engine/vehicle, and to clarify and improve the regulation where necessary. Staff also updated the associated HD OBD enforcement regulation to align with the proposed changes to the HD OBD regulation and to modify the manufacturer self-testing requirements.	11/15/18
Public Hearing to Consider Proposed California Certification Procedures for Light-Duty Engine Packages for Use in New Light-Duty Specially-Produced Motor Vehicles for 2019 and Subsequent Model Years: The Board adopted the California Regulation and Certification Procedures for Light-Duty Engine Packages for Use In New Light-Duty Specially-Produced Motor Vehicles for 2019 And Subsequent Model Years. Staff presented regulations and certification procedures for manufacturers of light-duty engine packages for use in new light-duty specially constructed vehicles which resemble heritage vehicles originally produced at least 25 years ago.	10/25/18
Public Meeting to Consider Proposed Amendments to California Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks: The Board adopted amendments to Vehicle Fill Pipe Specifications to help ensure new motor vehicle fill pipes are compatible and form a good seal with Phase II recovery nozzles that are certified for use at California gasoline stations as a means to reduce overpressure.	10/25/18
Public Hearing to Consider Proposed Amendments to Enhanced Vapor Recovery Regulations to Standardize Gas Station Nozzle Spout Dimensions to Help Address Storage Tank Overpressure: The Board adopted amendments to Enhanced Vapor Recovery Regulations to standardize gas station nozzle spout dimensions to improve compatibility with newer motor vehicle fill pipes. This compatibility is necessary to reduce air ingestion at the nozzle, which will help reduce storage tank overpressure conditions.	10/25/18
Public Meeting to Consider the Proposed Submission of California's Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities into the California State Implementation Plan: The Board adopted a resolution directing staff to submit California's Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities into the California State Implementation Plan (Oil and Gas SIP Submittal). California Air Resources Board submitted the Oil and Gas SIP Submittal to the United States Environmental Protection Agency as a revision to the California State Implementation Plan.	10/25/18
Public Hearing to Consider Proposed Amendments to the LowEmission Vehicle III Greenhouse Gas Emission Regulation: The Board adopted amendments to the Low-Emission Vehicle III greenhouse gas emission regulation to clarify that the "deemed to comply" option for model years 2021 through 2025 is applicable only if the currently adopted federal regulations remain in effect.	9/27/18

Public Hearing to Consider Proposed Amendments to the Low Carbon Fuel Standard Regulation and to the Regulation on Commercialization of Alternative Diesel Fuels: The Board adopted amendments designed to strengthen the Low Carbon Fuel Standard (LCFS) regulation through 2030 in line with the Senate Bill 32 greenhouse gas reduction goals. The amendments would enhance LCFS credit for zero-emission vehicle fueling infrastructure per Governor Brown's Executive Order B-48-18, adopt a protocol to enable credit generation for carbon capture and sequestration projects, expand fuel types and vehicle applications to which the LCFS regulation applies (including adding alternative jet fuel), improve crediting for innovative actions at petroleum refineries, and establish an independent third-party verification and verifier accreditation system to ensure accuracy of LCFS reported data. The amendments also include several technical changes to improve, simplify, streamline, and clarify the regulation. As part of this rulemaking, the Board will comply with a California court order by considering supplemental environmental analysis related to oxides of nitrogen (NOx) emissions from biodiesel, and a proposed amendment to the Alternative Diesel Fuels regulation based on that analysis. This is the first of two Board hearings on this item; the Board will not vote on the amendments at this meeting.	8/27/18
Public Hearing to Consider Proposed Amendments to California Emission Control System Warranty Regulations and Maintenance Provisions for 2022 and Subsequent Model Year On-Road Heavy-Duty Diesel Vehicles with Gross Vehicle Weight Rating Greater Than 14,000 Pounds and Heavy-Duty Diesel Engines in Such Vehicles: The Board adopted amendments to the California warranty and maintenance provisions for on-road heavy-duty (HD) diesel vehicles, and the engines used in such vehicles. Currently, because the warranty mileage period is disproportionate to the actual service lives of many modern HD vehicles and engines, vehicle owners have no incentive to pay for repairs of emissions-related problems that do not adversely affect fuel economy or performance, which results in additional emissions. Accordingly, staff presented to lengthen both the existing warranty periods and minimum maintenance intervals so as to reduce emissions by incentivizing vehicle owners to perform required maintenance and to seek more timely repairs, and to encourage manufacturers to design and produce more durable parts. Staff also clarified that the warranty coverage extends to any part that causes the illumination of the HD on-board diagnostic system malfunction indicator light.	6/28/18
Public Meeting to Consider Submission of the 2013 Amendments to the Cargo Tank Vapor Recovery Regulation into the California State Implementation Plan: The Board adopted a resolution directing staff to submit the 2013 Amendments to the Cargo Tank Vapor Recovery Regulations into the California State Implementation Plan (Cargo Tank SIP Submittal). CARB submitted the Cargo Tank SIP Submittal to the United States Environmental Protection Agency as a revision to the California State Implementation Plan.	6/28/18
Public Hearing to Consider Proposed Amendments to the HeavyDuty Vehicle Inspection Program and Periodic Smoke Inspection Program: The amendments lower the allowable opacity limit for HD vehicles operating in California for both the HDVIP and PSIP, establish reporting requirements for the PSIP and smoke tester training requirements, and allow 2013 model year and newer engines to report on-board diagnostic data in lieu of performing the annual PSIP smoke test.	5/25/18
Public Hearing to Consider Proposed Amendments to the Consumer Products Regulation and Method 310: The adopted amendments to the consumer products regulation established an alternate compliance option for multi-purpose lubricant (MPL) products.	5/25/18
Public Hearing to Consider the Proposed Regulation for Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration and Foam End-Uses: The adopted regulation will provide prohibitions on the use of certain high-global warming potential hydrofluorocarbons (HFC) in stationary refrigeration and foam end-uses. The objective is to preserve HFC emissions reductions expected from the federal Significant New Alternatives Policy (SNAP) Rules for certain end-uses for which compliance dates have either already passed or are imminent.	3/23/18
Public Meeting to Consider Funding Agricultural Replacement Measures for Emission Reductions Program Guidelines: The Guidelines outline the California Air Resources Board's plans for expending these funds in a manner consistent with the legislative direction from two bills, existing statutes, and regulations. The Guidelines describe district funding allocations, eligible project categories and criteria, program implementation details, and the justification for these investments	3/23/18
Public Hearing to Consider Proposed California Greenhouse Gas Emissions Standards for Medium- and Heavy-Duty Engines and Vehicles, and Proposed Amendments to the Tractor-Trailer Greenhouse Gas Regulation: The adoption creates new, more stringent California Phase 2 GHG emission standards that largely harmonize with the federal Phase 2 standards, and proposed amendments to the Tractor-Trailer GHG regulation to harmonize California's Tractor-Trailer GHG regulation with the proposed Phase 2 trailer standards. The proposed California Phase 2 GHG standards are needed to meet the mandates of both AB 32 and of SB 32, and the California HSC.	2/8/18

Public Hearing to Consider Proposed Amendments to the Airborne Toxic Control Measure For Diesel Particulate Matter from Portable Engines Rated at 50 Horsepower and Greater – and to the Statewide Portable Equipment Registration Program Regulation: The amendments will provide more time for cleaner engine replacement while preserving the expected emission reductions, and make other improvements to the ATCM. PERP will have corresponding amendments and make other improvements to the program.	11/16/17
Public Hearing to Consider the Proposed Amendments to California's Evaluation Procedures for New Aftermarket Catalytic Converters: The amendments are for procedures used to evaluate and approve aftermarket catalytic converters designed for use on California passenger cars and trucks to allow them to be used for Low Emission Vehicle III emission standards.	9/28/17
Public Hearing to Consider Proposed Amendments to the MarketBased Compliance Mechanism Regulation (Cap-and-Trade Regulation): The amendments to the Cap-and-Trade Program extend major provisions of the Program beyond 2020, to broaden the Program through linkage with Ontario, Canada, to prevent emissions leakage in the most cost-effective manner through appropriate allocation to entities, to clarify compliance obligations for certain sectors, and to enhance ARB's ability to implement and oversee the Cap-and-Trade Program.	7/27/17
Public Hearing to Consider Proposed Amendments to the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions: The amendments to the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions are to ensure the reported GHG data are accurate and fully support the California Cap-and-Trade Regulation.	6/29/17
Public Meeting to Consider Proposed Revisions to the Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines: The updated Carl Moyer Memorial Air Quality Standards Attainment Program 2017 Guidelines implement changes directed by Senate Bill 513 and redesign the Program to meet California's need to transition to the very low and zero-emission technologies of the future.	4/27/17
Public Meeting to Consider the Proposed Amendments to the Evaporative Emission Requirements for Small Off-Road Engines: The proposed amendments will address to non-compliance of small off-road engines (SORE) with existing evaporative emission standards, as well as amendments to streamline the certification process by harmonizing where feasible with federal requirements.	11/17/16
Notice of Public Hearing to Consider Proposed Regulation to Provide Certification Flexibility for Innovative Heavy-Duty Engine and California Certification and Installation Procedures for Medium and Heavy-Duty Vehicle Hybrid Conversion Systems: This proposed regulation's certification flexibility is tailored to encourage development and market launch of heavy-duty engines meeting California's optional low oxides of oxides of nitrogen emission standards, robust heavy-duty hybrid engines, and high-efficiency heavy-duty engines.	10/20/16
Notice of Public Hearing to Consider Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulations: The proposed amendments would extend major provisions of the Regulation beyond 2020; link the Regulation with Ontario, Canada; continue cost-effective prevention of emission leakage through allowance allocations to entities; and enhance Program implementation and oversight.	9/22/16
Notice of Public Hearing to Consider Proposed Amendments to the Mandatory Reporting of Greenhouse Gas Emissions: The proposed amendments are to ensure reported GHG data are accurate and fully support the California Cap on Greenhouse Gas Emissions and Market Based Compliance Mechanisms and comply with the U.S. EPA Clean Power Plan.	9/22/16
Public Hearing to Consider Proposed Amendments to the Large Spark-Ignition Engine Fleet Requirements Regulation: The proposed amendment will establish new reporting and labeling requirements and extend existing recordkeeping requirements. The proposed regulatory amendments are expected to improve the reliability of the emission reductions projected for the existing LSI Fleet Regulation by increasing enforcement effectiveness and compliance rates.	7/21/16
Public Hearing to Consider Proposed Evaluation Procedure for New Aftermarket Diesel Particulate Filters Intended as Modified Parts for 2007 through 2009 Model Year On-Road Heavy-Duty Diesel Engines: The proposed amendment would establish a path for exempting aftermarket modified part DPFs intended for 2007 through 2009 on-road heavy-duty diesel engines from the prohibitions of the current vehicle code. Staff is also proposing to incorporate a new procedure for the evaluation of such DPFs.	4/22/16
Public Hearing to Consider Proposed Amendments to the Regulation for Small Containers of Automotive Refrigerant: The proposed amendments to the Regulation for Small Containers of Automotive Refrigerant to clarify any existing requirement that retailers must transfer the unclaimed consumer deposits to the manufacturers, clarify how the manufacturers spend the money, set the refundable consumer deposit at $10, and require additional language on the container label.	4/22/16

Amendments to the Portable Fuel Container Regulation Amendments to the Portable Fuel Container (PFC) regulation, which include requiring certification fuel to contain 10 percent ethanol, harmonizing aspects of the Board's PFC certification and test procedures with those of the U.S. EPA, revising the ARB's certification process, and streamlining, clarifying, and increasing the robustness of ARB's certification and test procedures.	2/18/16
Technical Status and Proposed Revisions to On-Board Diagnostic System Requirements and Associated Enforcement Provisions for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II) Amendments to the OBD II regulations that update requirements to account for LEV III applications and monitoring requirements for gasoline and diesel vehicles, and clarify and improve the regulation; also, updates to the associated OBD II enforcement regulation to align it with the proposed amendments to the OBD II regulations and a minor amendment to the definition of "emissions-related part" in title 13, CCR section 1900.	9/25/15
2015 Low Carbon Fuel Standard (LCFS) Amendments (2 of 2) Re-adoption of the Low Carbon Fuel Standard, which includes updates and revisions to the regulation now in effect. The proposed regulation was first presented to the Board at its February 2015 public hearing, at which the Board directed staff to make modifications to the proposal.	9/24/15
Proposed Regulation on the Commercialization of Alternative Diesel Fuels (2 of 2) Regulation governing the introduction of alternative diesel fuels into the California commercial market, including special provisions for biodiesel.	9/24/15
CA Cap on GHG Emissions and Market-Based Compliance Mechanisms (2 of 2) Amendments to the Cap and Trade Regulation to include a new Rice Cultivation Compliance Offset Protocol and an update to the United States Forest Compliance Offset Protocol that would include project eligibility in parts of Alaska.	6/25/15
Intermediate Volume Manufacturer Amendments to the Zero Emission Vehicle Regulation (2 of 2) Amendments regarding intermediate volume manufacturer compliance obligations under the Zero Emission Vehicle regulation.	5/21/15
2015 Amendments to Certification Procedures for Vapor Recovery Systems at Gasoline Dispensing Facilities—Aboveground Storage Tanks and Enhanced Conventional Nozzles Amendments would establish new performance standards and specifications for nozzles used at fleet facilities that exclusively refuel vehicles equipped with onboard vapor recovery systems, would provide regulatory relief for owners of certain existing aboveground storage tanks, and would ensure that mass-produced vapor recovery equipment matches the specifications of equipment evaluated during the ARB certification process.	4/23/15
Proposed Regulation for the Commercialization of Alternative Diesel Fuels (1 of 2) Regulation governing the introduction of alternative diesel fuels into the California commercial market, including special provisions for biodiesel. This is the first of two hearings on the item, and the Board will not take action to approve the proposed regulation.	2/19/15
Evaporative Emission Control Requirements for Spark-Ignition Marine Watercraft Regulation for controlling evaporative emissions from spark-ignition marine watercraft. The proposed regulation will harmonize, to the extent feasible, with similar federal requirements, while adding specific provisions needed to support California's air quality needs.	2/19/15
2015 Low Carbon Fuel Standard (LCFS) Amendments (1 of 2) Regulation for a Low Carbon Fuel Standard that includes re- adoption of the existing Low Carbon Fuel Standard with updates and revisions. This is the first of two hearings on the item, and the Board will not take action to approve the proposed regulation.	2/19/15
CA Cap on GHG Emissions and Market-Based Compliance Mechanisms to Add the Rice Cultivation Projects and Updated U.S. Forest Projects Protocols (1 of 2) Updates to the Cap and Trade Regulation to include a new Rice Cultivation Compliance Offset Protocol and an update to the United States Forest Compliance Offset Protocol that would include project eligibility in parts of Alaska.	12/18/14
2014 Amendments to ZEV Regulation Additional compliance flexibility to ZEV manufacturers working to bring advanced technologies to market.	10/23/14
LEV III Criteria Pollutant Requirements for Light- and Medium-Duty Vehicles the Hybrid Electric Vehicle Test Procedures, and the HD Otto-Cycle and HD Diesel Test Procedures Applies to the 2017 and subsequent model years.	10/23/14

Amendments to Mandatory Reporting Regulation for Greenhouse Gases Further align reporting methods with USEPA methods and factors, and modify reporting requirements to fully support implementation of California's Cap and Trade program.	9/19/14
Amendments to the California Cap on Greenhouse Gas Emissions and Market Based Compliance Mechanisms Technical revisions to Mandatory Reporting of Greenhouse Gas Emissions Regulation to further align reporting methods with U.S.EPA update methods and factors, and modify reporting requirements to fully support implementation of California's Cap and Trade program.	9/18/14
Amendments to the AB 32 Cost of Implementation Fee Regulation Amendments to the regulation to make it consistent with the revised mandatory reporting regulation, to add potential reporting requirements, and to incorporate requirements within the mandatory reporting regulation to streamline reporting.	9/18/14
Low Carbon Fuel Standard 2014 Update As a result of a California Court of Appeal decision, ARB will revisit the LCFS rulemaking process to meet certain procedural requirements of the APA and CEQA. Following incorporation of any modifications to the regulation, the Board will consider the proposed regulation for adoption at a second hearing held in the spring of 2015.	7/24/14
Revisions to the Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines for On-Road Heavy-Duty Trucks Revisions to 1) reduce surplus emission reduction period, 2) reduce minimum CA usage requirement, 3) prioritize on-road funding to small fleets, 4) include light HD vehicles 14000-19500 libs, and 5) clarify program specifications.	7/24/14
Amendments to Enhanced Fleet Modernization (Car Scrap) Program Amendments consistent with SB 459 which requires ARB to increase benefits for low-income California residents, promote cleaner replacement vehicles, and enhance emissions reductions.	6/26/14
Proposed Approval of Amendments to CA Cap on GHG Emissions and Market-Based Compliance Mechanisms Second hearing of two, continued from October 2013.	4/24/14
Truck and Bus Rule Update Amendments to the Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen, and Other Criteria Pollutants From In-Use On-Road Diesel-Fueled Vehicles: increasing low-use vehicle thresholds, allowing owners to newly opt-in to existing flexibility provisions, adjusting "NOx exempt" vehicle provisions, and granting additional time for fleets in certain areas to meet PM filter requirements.	4/24/14
Heavy-Duty GHG Phase I: On-Road Heavy-Duty GHG Emissions Rule, Tractor-Trailer Rule, Commercial Motor Vehicle Idling Rule, Optional Reduced Emission Standards, Heavy-Duty Hybrid-Electric Vehicles Certification Procedure New GHG standards for MD and HD engines and vehicles identical to those adopted by the USEPA in 2011 for MYs 2014-18.	12/12/13
Agricultural equipment SIP credit rule Incentive-funded projects must be implemented using Carl Moyer Program Guidelines; must be surplus, quantifiable, enforceable, and permanent, and result in emission reductions that are eligible for SIP credit.	10/25/13
Mandatory Report of Greenhouse Gas Emissions Approved a regulation that establishes detailed specifications for emissions calculations, reporting, and verification of GHG emission estimates from significant sources.	10/25/13
CA Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Technical revisions to the Mandatory Reporting of Greenhouse Gas Emissions Regulation to further align reporting methods with U.S.EPA, update factors, and modify definitions to maintain consistency with the Cap and Trade program.	10/25/13
Zero emission vehicle test procedures Existing certification test procedures for plug-in hybrid vehicles need to be updated to reflect technology developments. The ZEV regulation will require minor modifications to address clarity and implementation issues.	10/24/13
Consumer Products: Antiperspirants, Deodorants, Test Method 310, Aerosol Coatings, Proposed Repeal of Hairspray Credit) Amendments to require various consumer products to reformulate to reduce VOC or reactivity content to meet specified limits, and to clarify various regulatory provisions, improve enforcement, and add analytical procedures.	9/26/13

Alternative fuel certification procedures Amendments to current alternative fuel conversion certification procedures for motor vehicles and engines that will allow small volume conversion manufacturers to reduce the upfront demonstration requirements and allow systems to be sold sooner with lower certification costs than with the current process, beginning with MY 2018.	9/26/13
Vapor Recovery for Gasoline Dispensing Facilities Amendments to certification and test procedures for vapor recovery equipment used on cargo tanks and at gasoline dispensing facilities.	7/25/13
Off-highway recreational vehicle evaporative emission control Staff proposes to set evaporative emission standards to control hydrocarbon emissions from Off-Highway Recreational Vehicles. The running loss, hot soak, and diurnal performance standards can be met by using proven automobile type control technology.	7/25/13
Gasoline and diesel fuel test standards Adopted amendments to add test standards for the measurement of prohibited oxygenates at trace levels specified in existing regulations.	1/25/13
LEV III and ZEV Programs for Federal Compliance Option Adopted amendments to deem compliance with national GHG new vehicle standards in 2017-2025 as compliance with California GHG standards for the same model years.	11/15/12 12/6/12 EO
Consumer products (automotive windshield washing fluid) Adopted amendments to add portions of 14 California counties to the list of areas with freezing temperatures where 25% VOC content windshield washing fluid could be sold.	10/18/2012 EO 03/15/13
GHG mandatory reporting, Fee Regulation, and Cap and Trade 2012 Adopted amendments to eliminate emission verification for facilities emitting less than 25,000 MTCO2e and make minor changes in definitions and requirements.	9/20/12 11/2/12 EO
Amendments to Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines Approved amendments to the verification procedure used to evaluate diesel retrofits through emissions, durability, and field testing. Amendments will lower costs associated with required in-use compliance testing, streamline the in-use compliance process, and will extend time allowed to complete verifications.	8/23/2012 EO 07/02/13
Amendments to On-Board Diagnostics (OBD I and II) Regulations Approved amendments to the light- and medium-duty vehicle and heavy-duty engine OBD regulations.	8/23/2012 EO 06/26/13
Cap and Trade: Amendments to CA Cap on GHG Emissions and Market-Based Compliance Mechanisms, and Amendments Allowing Use of Compliance Instruments Issued by Linked Jurisdictions Amends Cap-and-Trade and compliance mechanisms to add security to the market system and to aid staff in implementation. Amendments include first auction rules, offset registry, market monitoring provisions, and information gathering necessary for the financial services operator.	6/28/12 7/31/12 EO
Vapor recovery defect list Adopted amendments to add defects and verification procedures for equipment approved since 2004, and make minor changes to provide clarity	6/11/12 EO
Tractor-Trailer GHG Regulation: Emergency Amendment Adopted emergency amendment to correct a drafting error and delay the registration date for participation in the phased compliance option	2/29/2012 2/29/12 EO
Advanced Clean Cars (ACC) Regulation: Low-Emission Vehicles and GHG Adopted more stringent criteria emission standards for MY 2015-2025 light and medium duty vehicles (LEV III), amended GHG emission standards for model year 2017-2025 light and medium duty vehicles (LEV GHG), amended ZEV Regulation to ensure the successful market penetration of ZEVs in commercial volumes, amended hydrogen fueling infrastructure mandate of the Clean Fuels Outlet regulation, and amended cert fuel for light duty vehicles from an MTBE-containing fuel to an E10 certification fuel.	1/26/12
Zero Emission Vehicle (ZEV) Adopted amendments to increase compliance flexibility, add two new vehicle categories for use in creating credits, increase credits for 300 mile FCVs, increase requirements for ZEVs and TZEVs, eliminate credit for PZEVs and AT PZEVs, expand applicability to smaller manufacturers, base ZEV credits on range, and make other minor changes in credit requirements	1/26/12

Amendments to Low Carbon Fuel Standard Regulation The amendments address several aspects of the regulation, including: reporting requirements, credit trading, regulated parties, opt-in and opt-out provisions, definitions, and other clarifying language.	12/16/11 10/10/12 EO
Amendments to Small Off-Road Engine and Tier 4 Off-Road Compression-Ignition Engine Regulations And Test Procedures; also "Recreational Marine" Spark-Ignition Marine Engine Amendments (Recreational Boats) adopted. Aligns California test procedures with U.S. EPA test procedures and requires off-road CI engine manufacturers to conduct in-use testing of their entire product lines to confirm compliance with previously established Not-To-Exceed emission thresholds.	12/16/2011 10/25/12 EO
Regulations and Certification Procedures for Engine Packages used in Light-Duty Specially Constructed Vehicles (Kit Cars) Ensures that certified engine packages, when placed into any Kit Car, would meet new vehicle emission standards, and be able to meet Smog Check requirements.	11/17/11 9/21/12 EO
Amendments to the California Reformulated Gasoline Regulations Corrects drafting errors in the predictive model, deletes outdated regulatory provisions, updates the notification requirements, and changes the restrictions on blending CARBOB with other liquids.	10/21/11 8/24/12 EO
Amendments to the In-Use Diesel Transport Refrigeration Units (TRU) ATCM Mechanisms to improve compliance rates and enforceability.	10/21/11 8/31/12 EO
Amendments to the AB 32 Cost of Implementation Fee Regulation Clarifies requirements and regulatory language, revises definitions.	10/20/11 8/21/12 EO
Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation, Including Compliance Offset Protocols Greenhouse Gas Emissions Cap-and-Trade Program, including compliance offset protocols and multiple pathways for compliance.	10/21/11 8/21/12 EO
Amendments to the Regulation for Cargo Handling Equipment (CHE) at Ports and Intermodal Rail Yards (Port Yard Trucks Regulation) Provides additional compliance flexibility, and maintains anticipated emissions reductions. As applicable to yard trucks and two-engine sweepers.	9/22/11 8/2/12 EO
Amendments to the Enhanced Vapor Recovery Regulation for Gasoline Dispensing Facilities New requirement for low permeation hoses at gasoline dispensing facilities.	9/22/11 7/26/12 EO
Amendments to Cleaner Main Ship Engines and Fuel for Ocean-Going Vessels Adjusts the offshore regulatory boundary. Aligns very low sulfur fuel implementation deadlines with new federal requirements.	6/23/11 9/13/12 EO
Particulate Matter Emissions Measurement Allowance For Heavy-Duty Diesel In-Use Compliance Regulation Emission measurement allowances provide for variability associated with the field testing required in the regulation.	6/23/11
Low Carbon Fuel Standard Carbon Intensity Lookup Table Amendments Adds new pathways for vegetation-based fuels	2/24/11
Amendments to Cleaner In-Use Heavy-Duty On-Road Diesel Trucks and LSI Fleets Regulations Amends five regulations to provide relief to fleets adversely affected by the economy, and take into account the fact that emissions are lower than previously predicted.	12/16/10 9/19/11 EO
Tractor-Trailer GHG Regulation Amendment Enacts administrative changes to increase compliance flexibility and reduce costs	12/16/10
Amendments to Cleaner In-Use Off-Road Diesel-Fueled Fleets Regulation Amendments provide relief to fleets adversely affected by the economy, and take into account the fact that emissions are lower than previously predicted.	12/16/10 10/28/11 EO
In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Rail Yard Facilities Amendments add flexibility to fleets' compliance schedules, mitigate the use of noncompliant trucks outside port and rail properties, and provide transition to the Truck and Bus regulation.	12/16/10 9/19/11 EO
Amendments to the Regulation for Mandatory Reporting of Greenhouse Gas Emissions Changes requirements to align with federal greenhouse gas reporting requirements adopted by US EPA.	12/16/10 10/28/11 EO
Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation Establishes framework and requirements for Greenhouse Gas Emissions Cap-and-Trade Program, including compliance offset protocols.	12/16/10 10/26/11 EO

Amendments to the Consumer Products Regulation Amendments set new or lower VOC limits for some categories, prohibit certain toxic air contaminants, high GWP compounds, and surfactants toxic to aquatic species. Also changes Method 310, used to determine aromatic content of certain products.	11/18/10 9/29/11 EO
Amendment of the ATCM for Diesel Transportation Refrigeration Units (TRU) Amendments expand the compliance options and clarify the operational life of various types of TRUs.	11/18/10 2/2/11 EO
Amendments to the ATCM for Stationary Compression Ignition Engines Approved amendments to closely align the emission limits for new emergency standby engines in the ATCM with the emission standards required by the federal Standards of Performance.	10/21/10 3/25/11 EO
Diesel Vehicle Periodic Smoke Inspection Program Adopted amendments to exempt medium duty diesel vehicles from smoke inspection requirements if complying with Smog Check requirements.	10/21/10 8/23/11 EO
Renewable Electricity Standard Regulation Approved a regulation that will require electricity providers to obtain at least 33% of their retail electricity sales from renewable energy resources by 2020.	9/23/10
Energy Efficiency at Industrial Facilities Adopted standards for the reporting of GHG emissions and the feasibility of emissions controls by the largest GHG-emitting stationary sources.	7/22/10 5/9/11 EO
Amendments to Commercial Harbor Craft Regulation Approved amendments to require the use of cleaner engines in diesel-fueled crew and supply, barge, and dredge vessels.	6/24/10 4/11/11 EO
Accelerated Introduction of Cleaner Line-Haul Locomotives Agreement with railroads sets prescribed reductions in diesel risk and target years through 2020 at four major railyards.	6/24/10
Amendments to New Passenger Motor Vehicle Greenhouse Gas Emission Standards Approved amendments deeming compliance with EPA's GHG standards as compliance with California's standards in 2012 through 2016 model years.	2/25/2010 03/29/10
Sulfur Hexafluoride (SF6) Regulation Regulation to reduce emissions of sulfur hexafluoride (SF6), a high-GWP GHG, from high-voltage gas-insulated electrical switchgear.	2/25/10 12/15/10 EO
Amendments to the Statewide Portable Equipment Registration Regulation and Portable Engine ATCM Approved amendments that extend the deadline for removal of certain uncertified portable engines for one year.	1/28/10 8/27/10 EO 12/8/10 EO
Diesel Engine Retrofit Control Verification, Warranty, and Compliance Regulation Amendments Approved amendments to require per-installation compatibility assessment, performance data collection, and reporting of additional information, and enhance enforceability.	1/28/10 12/6/10 EO
Stationary Equipment High-GWP Refrigerant Regulation Approved a regulation to reduce emissions of high-GWP refrigerants from stationary non-residential equipment.	12/1/09 9/14/10 EO
Amendments to Limit Ozone Emissions from Indoor Air Cleaning Devices Adopted amendments to delay the labeling compliance deadlines by one to two years and to make minor changes in testing protocols.	12/9/09
Emission Warranty Information Reporting Regulation Amendments Repealed the 2007 regulation and readopted the 1988 regulation with amendments to implement adverse court decision.	11/19/09 9/27/10 EO
Amendments to Maximum Incremental Reactivity Tables Added many new compounds and modified reactivity values for many existing compounds in the tables to reflect new research data.	11/3/09 7/23/10 EO
AB 32 Cost of Implementation Fee Regulation AB 32 authorizes ARB to adopt by regulation a schedule of fees to be paid by sources of greenhouse gas emissions regulated pursuant to AB 32. ARB staff will propose a fee regulation to support the administrative costs of AB 32 implementation.	9/24/2009 05/06/10 EO
Passenger Motor Vehicle Greenhouse Gas Limits Amendments Approved amendments granting credits to manufacturers for compliant vehicles sold in other states that have adopted California regulations.	9/24/09 2/22/10 EO
Consumer Products Amendments Approved amendments that set new VOC limits for multi-purpose solvent and paint thinner products and lower the existing VOC limit for double phase aerosol air fresheners.	9/24/09 8/6/10 EO

Amendments to In-Use Off-Road Diesel-Fueled Fleets Regulation Approved amendments to implement legislatively directed changes and provide additional incentives for early action.	7/23/09 12/2/09 EO 6/3/10 EO
Methane Emissions from Municipal Solid Waste Landfills Approved a regulation to require smaller and other uncontrolled landfills to install gas collection and control systems, and also requires existing and newly installed systems to operate optimally.	6/25/09 5/5/10 EO
Cool Car Standards Approved a regulation requiring the use of solar management window glass in vehicles up to 10,000 lb GVWR.	6/25/09
Enhanced Fleet Modernization (Car Scrap) Approved guidelines for a program to scrap up to 15,000 light duty vehicles statewide.	6/25/09 7/30/10 EO
Amendments to Heavy-Duty On-Board Diagnostics Regulations Approved amendments to the light and medium-duty vehicle and heavy duty engine OBD regulations.	5/28/2009 4/6/10 EO
Smog Check Improvements BAR adopted amendments to implement changes in state law and SIP commitments adopted by ARB between 1996 and 2007.	5/7/09 By BAR 6/9/09 EO
AB 118 Air Quality Improvement Program Guidelines The Air Quality Improvement Program provides for up to $50 million per year for seven years beginning in 2009-10 for vehicle and equipment projects that reduce criteria pollutants, air quality research, and advanced technology workforce training. The AQIP Guidelines describe minimum administrative, reporting, and oversight requirements for the program, and provide general criteria for how the program shall be implemented.	04/23/09 08/28/09 EO
Pesticide Element Reduce volatile organic compound (VOC) emissions from the application of agricultural field fumigants in the South Coast, Southeast Desert, Ventura County, San Joaquin Valley, and Sacramento Metro federal ozone nonattainment areas.	4/20/09 10/12/09 EO (2) 8/2/11 EO
Low Carbon Fuel Standard Approved new standards to lower the carbon content of fuels.	4/20/09 11/25/09 EO
Pesticide Element for San Joaquin Valley DPR Director approved pesticide ROG emission limit of 18.1 tpd and committed to implement restrictions on non-fumigant pesticide use by 2014 in the San Joaquin Valley.	4/7/09 DPR
Tire Pressure Inflation Regulation Approved a regulation requiring automotive service providers to perform tire pressure checks as part of every service.	3/26/09 2/4/10 EO
Sulfur Hexafluoride from Non-Utility and Non-Semiconductor Applications Approved a regulation to phase out use of Sulfur Hexafluoride over the next several years.	2/26/09 11/12/09 EO
Semiconductor Operations Approved a regulation to set standards to reduce fluorinated gas emissions from the semiconductor and related devices industry.	2/26/09 10/23/09 EO
Plug-In Hybrid Electric Vehicles Test Procedure Amendments Amends test procedures to address plug-in-hybrid electric vehicles.	1/23/09 12/2/09 EO
In-Use Off-Road Diesel-Fueled Fleets Amendments Makes administrative changes to recognize delays in the supply of retrofit control devices.	1/22/09
Small Containers of Automotive Refrigerant Approved a regulation to reduce leakage from small containers, adopt a container deposit and return program, and require additional container labeling and consumer education requirements.	1/22/09 1/5/10 EO
Aftermarket Critical Emission Parts on Highway Motorcycles Allows for the sale of certified critical emission parts by aftermarket manufacturers.	1/22/09 6/19/09 EO
Heavy-Duty Tractor-Trailer Greenhouse Gas (GHG) Reduction Approved a regulation to reduce greenhouse gas emissions by improving long haul tractor and trailer efficiency through use of aerodynamic fairings and low rolling resistance tires.	12/11/08 10/23/09 EO
Cleaner In-Use Heavy-Duty Diesel Trucks (Truck and Bus Regulation) Approved a regulation to reduce diesel particulate matter and oxides of nitrogen through fleet modernization and exhaust retrofits. Makes enforceability changes to public fleet, off-road equipment, and portable equipment regulations.	12/11/08 10/19/09 EO 10/23/09 EO
Large Spark-Ignition Engine Amendments Approved amendments to reduce evaporative, permeation, and exhaust emissions from large spark-ignition (LSI) engines equal to or below 1 liter in displacement.	11/1/08 3/12/09 EO

Small Off-Road Engine (SORE) Amendments Approved amendments to address the excessive accumulation of emission credits.	11/21/08 2/24/10 EO
Proposed AB 118 Air Quality Guidelines for the Air Quality Improvement Program and the Alternative and Renewable Fuel and Vehicle and Technology Program. The California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007 (AB 118) requires ARB to develop guidelines for both the Alternative and Renewable Fuel and Vehicle Technology Program and the Air Quality Improvement Program to ensure that both programs do not adversely impact air quality.	09/25/08 EO 05/20/09
Portable Outboard Marine Tanks and Components (part of Additional Evaporative Emission Standards) Approved a regulation that establishes permeation and emission standards for new portable outboard marine tanks and components.	9/25/08 7/20/09 EO
Cleaner Fuel in Ocean Going Vessels Approved a regulation that requires use of low sulfur fuel in ocean-going ship main engines, and auxiliary engines and boilers.	7/24/08 4/16/09 EO
Spark-Ignition Marine Engine and Boat Amendments Provides optional compliance path for > 500 hp sterndrive/inboard marine engines.	7/24/08 6/5/09 EO
Consumer Products Amendments Approved amendments that add volatile organic compound (VOC) limits for seven additional categories and lower limits for twelve previously regulated categories.	6/26/08 5/5/09 EO
Zero emission vehicles Updated California's ZEV requirements to provide greater flexibility with respect to fuels, technologies, and simplifying compliance pathways. Amendments give manufacturers increased flexibility to comply with ZEV requirements by giving credit to plug-in hybrid electric vehicles and establishing additional ZEV categories in recognition of new developments in fuel cell vehicles and battery electric vehicles.	3/27/08 12/17/08 EO
Amendments to the Verification Procedure, Warranty, and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines Adds verification requirements for control technologies that only reduce NOx emissions, new reduction classifications for NOx reducing technologies, new testing requirements, and conditional extensions for verified technologies.	1/24/08 12/4/08 EO
Mandatory Report of Greenhouse Gas Emissions Approved a regulation that establishes detailed specifications for emissions calculations, reporting, and verification of GHG emission estimates from significant sources.	12/6/07 10/12/08 EO
Gaseous Pollutant Measurement Allowances for In-Use Heavy-Duty Diesel Compliance Measurement accuracy margins are to be determined through an ongoing comprehensive testing program performed by an independent contractor. Amendments include these measurement accuracy margins into the regulation.	12/6/07 10/14/08 EO
Ocean-Going Vessels While at Berth (aka Ship Hoteling) - Auxiliary Engine Cold Ironing and Clean Technology Approved a regulation that reduces emissions from auxiliary engines on ocean-going ships while at-berth.	12/6/07 10/16/08 EO
In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Rail Yard Facilities Approved a regulation that establishes emission standards for in-use, heavy-duty diesel-fueled vehicles that transport cargo to and from California's ports and intermodal rail facilities.	12/6/07 10/12/08 EO
Commercial Harbor Craft Approved a regulation that establishes in-use and new engine emission limits for both auxiliary and propulsion diesel engines on ferries, excursion vessels, tugboats, and towboats.	11/15/07 9/2/08 EO
Suggested Control Measure for Architectural Coatings Amendments Approved amendments to reduce the recommended VOC content of 19 categories of architectural coatings.	10/26/07
Aftermarket Catalytic Converter Requirements Approved amendments that establish more stringent emission performance and durability requirements for used and new aftermarket catalytic converters offered for sale in California.	10/25/07 2/21/08 NOD
Limiting Ozone Emissions from Indoor Air Cleaning Devices Approved ozone emission limit of 0.050 ppm for portable indoor air cleaning devices in response to requirements of AB 2276 (2006).	9/27/07 8/7/08 EO

Pesticide Commitment for Ventura County in 1994 SIP Approved substitution of excess ROG emission reductions from state motor vehicle program for 1994 SIP reduction commitment from pesticide application in Ventura County.	9/27/07 11/30/07 EO
In-Use Off-Road Diesel Equipment Approved a regulation that requires off-road diesel fleet owners to modernize their fleets and install exhaust retrofits.	7/26/07 4/4/08 EO
Emission Control and Environmental Performance Label Regulations Approved amendments to add a Global Index Label and modify the formal of the Smog Index Label on new cars.	6/21/07 5/2/08 EO
Vapor Recovery from Aboveground Storage Tanks Approved a regulation to establish new performance standards and specifications for the vapor recovery systems and components used with aboveground storage tanks.	6/21/07 5/2/08 EO
CaRFG Phase 3 amendments Approved amendments to mitigate the increases in evaporative emissions from on-road motor vehicles resulting from the addition of ethanol to gasoline.	6/14/07 4/25/08 EO 8/7/08 EO
Formaldehyde from Composite Wood Products Approved an ATCM to limit formaldehyde emissions from hardwood plywood, particleboard, and medium density fiberboard to the maximum amount feasible.	4/26/07 3/5/08 EO
Portable equipment registration program (PERP) and airborne toxic control measure for diesel-fueled portable engines Approved amendments to allow permitting of Tier 0 portable equipment engines used in emergency or low use duty and to extend permitting of certain Tier 1 and 2 "resident" engines to 1/1/10.	3/22/07 7/31/07 EO
Perchloroethylene Control Measure Amendments Approved amendments to the Perchloroethylene ATCM to prohibit new Perc dry cleaning machines beginning 2008 and phase out all Perc machines by 2023.	1/25/07 11/7/07 EO
Amendments to Emission Warranty Information Reporting & Recall Regulations Approved amendments that tighten the provisions for recalling vehicles for emissions-related failures, helping ensure that corrective action is taken to vehicles with defective emission control devices or systems.	12/7/06 3/22/07 10/17/07 EO
Voluntary accelerated vehicle retirement regulations Approved amendments that authorize the use of remote sensing to identify light-duty high emitters and that establish protocols for quantifying emissions reductions from high emitters proposed for retirement.	12/7/06
Emergency regulation for portable equipment registration program (PERP), airborne toxic control measures for portable and stationary diesel-fueled engines	12/7/06
Amendments to the Hexavalent Chromium ATCM Approved amendments that require use of best available control technology on all chrome plating and anodizing facilities.	12/7/06
Consumer Products Regulation Amendments Approved amendments that set lower emission limits in 15 product categories.	11/17/06 9/25/07 EO
Requirements for Stationary Diesel In-Use Agricultural Engines Approved amendments to the stationary diesel engine ATCM which set emissions standards for in-use diesel agricultural engines.	11/16/06 7/3/07 NOD
Ships - Onboard Incineration Approved amendments to cruise ship incineration ATCM to include all oceangoing ships of 300 gross registered tons or more.	11/16/06 9/11/07 EO
Zero Emission Bus Approved amendments postponing the 15 percent purchase requirement three years for transit agencies in the diesel path and one to two years for transit agencies in the alternative fuel path, in order to keep pace with developments in zero emission bus technology, and adding an Advanced Demonstration requirement to offset emission losses.	10/19/06 8/27/07 EO
Distributed generation certification Approved amendments improving the emissions durability and testing requirements, adding waste gas emission standards, and eliminating a redundant PM standard in the current 2007 emission standards.	10/19/06 5/17/07 NOD
Heavy-Duty Diesel In-Use Compliance Regulation Approved amendments to the heavy-duty diesel engine regulations and test procedures to create a new in-use compliance program conducted by engine manufacturers. The amendments would help ensure compliance with applicable certification standards throughout an engine's useful life.	9/28/06 7/19/07 NOD

Revisions to OBD II and the Emission Warranty Regulations Approved amendments to the OBD II regulation to provide for improved emission control monitoring including air-fuel cylinder imbalance monitoring, oxygen sensor monitoring, catalyst monitoring, permanent fault codes for gasoline vehicles and new thresholds for diesel vehicles.	9/28/06 8/9/07 EO
Off-Highway Recreational Vehicle Amendments Approved amendments to the Off-Highway Recreational Vehicle Regulations including harmonizing evaporative emission standards with federal regulations, expanding the definition of ATVs, modifying labeling requirements, and adjusting riding seasons.	7/20/06 6/1/07 EO
Portable Equipment Registration Program (PERP) Amendments Approved amendments to the Statewide Portable Equipment Registration program that include installation of hour meters on equipment, and revisions to recordkeeping, reporting, and fees.	6/22/06 11/13/06 NOD
Heavy Duty Vehicle Service Information Approved amendments to the Service Information Rule to require manufacturers to make available diagnostic equipment and information for sale to the aftermarket.	6/22/06 5/3/07 EO
LEV II technical amendments Approved amendments to evaporative emission test procedures, four-wheel drive dynamometer provisions, and vehicle label requirements.	6/22/06 9/27/06 NOD
Dry Cleaning ATCM Amendments Approved amendments to the Dry Cleaning ATCM to limit siting of new dry cleaners, phase out use of Perc at co-residential facilities, phase out higher emitting Perc sources at other facilities, and require enhanced ventilation at existing and new Perc facilities.	5/25/06
Forklifts and other Large Spark Ignition (LSI) Equipment Adopted a regulation to reduce emissions from forklifts and other off-road spark-ignition equipment by establishing more stringent standards for new equipment, and requiring retrofits or engine replacement on existing equipment. Adopts EPA's standards for 2007; adopts more stringent standards for 2010.	5/25/06 3/2/07 EO
Enhanced Vapor Recovery Amendments Approved amendments to the vapor recovery system regulation and adopted revised test procedures.	5/25/06
Diesel Retrofit Technology Verification Procedure Approved amendments to the Diesel Emission In-use Control Strategy Verification Procedure to substitute a 30% increase limit in NOx concentration for an 80% reduction requirement from PM retrofit devices.	3/23/06 12/21/06 NOD
Heavy duty vehicle smoke inspection program amendments Approved amendments to impose a fine on trucks not displaying a current compliance certification sticker.	1/26/06 12/4/06 EO
Ocean-going Ship Auxiliary Engine Fuel Approved a regulation to require ships to use cleaner marine gas oil or diesel to power auxiliary engines within 24 nautical miles of the California coast.	12/8/05 10/20/06 EO
Diesel Cargo Handling Equipment Approved a regulation to require new and in-use cargo handling equipment at ports and intermodal rail yards to reduce emissions by utilizing best available control technology.	12/8/05 6/2/06 EO
Public and Utility Diesel Truck Fleets Approved a regulation to reduce diesel particulate matter emissions from heavy duty diesel trucks in government and private utility fleets.	12/8/05 10/4/06 EO
Cruise ships – Onboard Incineration Adopted an Air Toxic Control Measure to prohibit cruise ships from conducting onboard incineration within three nautical miles of the California coast.	11/17/05 2/1/06 NOD
Inboard Marine Engine Rule Amendments Approved amendments to the 2001 regulation to include additional compliance options for manufacturers.	11/17/05 9/26/06 EO
Heavy-Duty Diesel Truck Idling Technology Approved a regulation to limit sleeper truck idling to 5 minutes. Allows alternate technologies to provide cab heating/cooling and power.	10/20/05 9/1/06 EO
Automotive Coating Suggested Control Measure Approved an SCM for automotive coatings for adoption by air districts. The measure will reduce the VOC content of 11 categories of surface protective coatings.	10/20/05
2007-09 Model-year heavy duty urban bus engines and the fleet rule for transit agencies Adopted amendments to align urban bus emission limits with on-road heavy duty truck emission limits and allow for the purchase of non- complying buses under the condition that bus turnover increase to offset NOx increases.	10/20/05 10/27/05 7/28/06 EO
Portable fuel containers (part 2 of 2) Approved amendments to revise spout and automatic shutoff design.	9/15/05 7/28/06 EO

Portable Fuel Containers (part 1 of 2) Approved amendments to include kerosene containers in the definition of portable fuel containers.	9/15/05 11/9/05 NOD
2007-09 Model-year heavy duty urban bus engines and the fleet rule for transit agencies Adopted amendments to require all transit agencies in SCAQMD to purchase only alternate fuel versions of new buses.	9/19/05 Superceded by 10/20/05
Reid vapor pressure limit emergency rule Approved amendments to relax Reid vapor pressure limit to accelerate fuel production for Hurricane Katrina victims.	9/8/05 Operative for September and October 2005 only
Heavy-Duty Truck OBD Approved a regulation to require on-board diagnostic (OBD) systems for new gas and diesel trucks, similar to the systems on passenger cars.	7/21/05 12/28/05 EO
Definition of Large Confined Animal Facility Adopted a regulation to define the size of a large CAF for the purposes of air quality permitting and reduction of ROG emissions to the extent feasible.	6/23/05 4/13/06 EO
ATCM for stationary compression ignition engines Approved emergency amendments (3/17/05) and permanent amendments (5/26/05) to relax the diesel PM emission limits on new stationary diesel engines to current off-road engine standards to respond to the lack of availability of engines meeting the original ATCM standard.	3/17/05 5/26/05 7/29/05 EO
Transit Fleet Rule Approved amendments to add emission limits for non-urban bus transit agency vehicles, require lower bus and truck fleet-average NOx and PM emission limits, and clarify emission limits for CO, NMHC, and formaldehyde.	2/24/05 10/19/05 NOD
Thermal Spraying ATCM Approved a regulation to reduce emissions of hexavalent chromium and nickel from thermal spraying operations.	12/9/04 7/20/05 EO
Tier 4 Standards for Small Off-Road Diesel Engines (SORE) Approved new emission standards for off-road diesel engines to be phased in between 2008 and 2015.	12/9/04 10/21/05 EO
Emergency Regulatory Amendment Delaying the January 1, 2005 Implementation Date for the Diesel Fuel Lubricity Standard Adopted an emergency regulation delaying the lubricity standard compliance deadline by five months to respond to fuel pipeline contamination problems.	11/24/04 12/10/04 EO
Enhanced vapor recovery compliance extension Approved amendments to the EVR regulation to extend the compliance date for onboard refueling vapor recovery compatibility to the date of EVR compliance.	11/18/04 2/11/05 EO
CaRFG Phase 3 amendments Approved amendments correcting errors and streamlining requirements for compliance and enforcement of CaRFG Phase 3 regulations adopted in 1999.	11/18/04
Clean diesel fuel for harborcraft and intrastate locomotives Approved a regulation that required harborcraft and locomotives operating solely within California to use clean diesel fuel.	11/18/04 3/16/05 EO
Nonvehicular Source, Consumer Product, and Architectural Coating Fee Regulation Amendment Approved amendments to fee regulations to collect supplemental fees when authorized by the Legislature.	11/18/04
Greenhouse gas limits for motor vehicles Approved a regulation that sets the first ever greenhouse gas emission standards on light and medium duty vehicles starting with the 2009 model year.	9/24/04 8/4/05 EO
Gasoline vapor recovery system equipment defects list Approved the addition of defects to the VRED list for use by compliance inspectors.	8/24/04 6/22/05 EO
Unihose gasoline vapor recovery systems Approved an emergency regulation and an amendment to delay the compliance date for unihose installation to the date of dispenser replacement.	7/22/04 11/24/04 EO
General Idling Limits for Diesel Trucks Approved a regulation that limits idling of heavy-duty diesel trucks operating in California to five minutes, with exceptions for sleeper cabs.	7/22/04
Consumer Products Approved a regulation to reduce ROG emissions from 15 consumer products categories, prohibit the use of 3 toxic compounds in consumer products, ban the use of PDCB in certain products, allow for the use of Alternative Control Plans, and revise Test Method 310.	6/24/04 5/6/05 EO
Urban bus engines/fleet rule for transit agencies Approved amendments to allow for the purchase of hybrid diesel buses and revise the zero emission bus demonstration and purchase timelines.	6/24/04

Engine Manufacturer Diagnostics Approved a regulation that would require model year 2007 and later heavy duty truck engines to be equipped with engine diagnostic systems to detect malfunctions of the emission control system.	5/20/04
Chip Reflash Approved a voluntary program and a backstop regulation to reduce heavy duty truck NOx emissions through the installation of new software in the engine's electronic control module.	3/25/04 3/21/05 EO
Portable equipment registration program (PERP) Approved amendments to allow uncertified engines to be registered until December 31, 2005, to increase fees, and to modify administrative requirements.	2/26/04 1/7/05 EO 6/21/05 EO
Portable Diesel Engine ATCM Adopted a regulation to reduce diesel PM emissions from portable engines through a series of emission standards that increase in stringency through 2020.	2/26/04 1/4/05 EO
California motor vehicle service information rule Adopted amendments to allow for the purchase of heavy duty engine emission-related service information and diagnostic tools by independent service facilities and aftermarket parts manufacturers.	1/22/04 5/20/04
Transportation Refrigeration Unit ATCM Adopted a regulation to reduce diesel PM emissions from transport refrigeration units by establishing emission standards and facility reporting requirements to streamline inspections.	12/11/03 2/26/04 11/10/04 EO
Diesel engine verification procedures Approved amendments that reduced warranty coverage to the engine only, delayed the NOx reduction compliance date to 2007, added requirements for proof-of-concept testing for new technology, and harmonized durability requirements with those of U.S. EPA.	12/11/03 2/26/04 10/17/04
Chip Reflash Approved a voluntary program and a backstop regulation to reduce heavy duty truck NOx emissions through the installation of new software in the engine’s electronic control module.	12/11/03 3/27/04 3/21/05 EO
Revised tables of maximum incremental reactivity values Approved the addition of 102 more chemicals with associated maximum incremental reactivity values to existing regulation allowing these chemicals to be used in aerosol coating formulations.	12/3/03
Stationary Diesel Engines ATCM Adopted a regulation to reduce diesel PM emissions from stationary diesel engines through the use of clean fuel, lower emission standards, operational practices.	11/20/03 12/11/03 2/26/2004 9/27/04 EO
Solid waste collection vehicles Adopted a regulation to reduce toxic diesel particulate emissions from solid waste collection vehicles by over 80 percent by 2010. This measure is part of ARB's plan to reduce the risk from a wide range of diesel engines throughout California.	9/25/03 5/17/04 EO
Small off-road engines (SORE) Adopted more stringent emission standards for the engines used in lawn and garden and industrial equipment, such as string trimmers, leaf blowers, walk-behind lawn mowers, generators, and lawn tractors.	9/25/03 7/26/04 EO
Off-highway recreational vehicles Changes to riding season restrictions.	7/24/03
Clean diesel fuel Adopted a regulation to reduce sulfur levels and set a minimum lubricity standard in diesel fuel used in vehicles and off-road equipment in California, beginning in 2006.	7/24/03 5/28/04 EO
Ozone Transport Mitigation Amendments Adopted amendments to require upwind districts to (1) have the same no-net-increase permitting thresholds as downwind districts, and (2) Adopt "all feasible measures."	5/22/03 10/2/03 NOD
Zero emission vehicles Updated California’s ZEV requirements to support the fuel cell car development and expand sales of advanced technology partial ZEVs (like gasoline-electric hybrids) in the near-term, while retaining a role for battery electric vehicles.	3/27/03 12/19/03 EO
Heavy duty gasoline truck standards Aligned its existing rules with new, lower federal emission standards for gasoline-powered heavy-duty vehicles starting in 2008.	12/12/02 9/23/03 EO
Low emission vehicles II Minor administrative changes.	12/12/02 9/24/03 EO

Gasoline vapor recovery systems test procedures Approved amendments to add advanced vapor recovery technology certification and testing standards.	12/12/02 7/1/03 EO 10/21/03 EO
CaRFG Phase 3 amendments Approved amendments to allow for small residual levels of MTBE in gasoline while MTBE is being phased out and replaced by ethanol.	12/12/02 3/20/03 EO
School bus Idling Adopted a measure requiring school bus drivers to turn off the bus or vehicle engine upon arriving at a school and restart it no more than 30 seconds before departure in order to limit children's exposure to toxic diesel particulate exhaust.	12/12/02 5/15/03 EO
California Interim Certification Procedures for 2004 and Subsequent Model Year Hybrid-Electric Vehicles in the Urban Transit Bus and Heavy-Duty Vehicle Classes Regulation Amendment Adopted amendments to allow diesel-path transit agencies to purchase alternate fuel buses with higher NOx limits, establish certification procedures for hybrid buses, and require lower fleet-average PM emission limits.	10/24/02 9/2/03 EO
CaRFG Phase 3 amendments Approved amendments delaying removal of MTBE from gasoline by one year to 12/31/03.	7/25/02 11/8/02 EO
Diesel retrofit verification procedures, warranty, and in-use compliance requirements Adopted regulations to specify test procedures, warranty, and in-use compliance of diesel engine PM retrofit control devices.	5/16/02 3/28/03 EO
On-board diagnostics for cars Adopted changes to the On-Board Diagnostic Systems (OBD II) regulation to improve the effectiveness of OBD II systems in detecting motor vehicle emission-related problems.	4/25/02 3/7/03 EO
Voluntary accelerated light duty vehicle retirement regulations Establishes standards for a voluntary accelerated retirement program.	2/21/02 11/18/02 EO
Residential burning Adopted a measure to reduce emissions of toxic air contaminants from outdoor residential waste burning by eliminating the use of burn barrels and the outdoor burning of residential waste materials other than natural vegetation.	2/21/02 12/18/02 EO
California motor vehicle service information rule Adopted regulations to require light- and medium-duty vehicle manufacturers to offer for sale emission-related service information and diagnostic tools to independent service facilities and aftermarket parts manufacturers.	12/13/01 7/31/02 EO
Vapor recovery regulation amendments Adopted amendments to expand the list of specified defects requiring equipment to be removed from service.	11/15/01 9/27/02 EO
Distributed generation guidelines and regulations Adopted regulations requiring the permitting by ARB of distributed generation sources that are exempt from air district permitting and approved guidelines for use by air districts in permitting non-exempt units.	11/15/01 7/23/02 EO
Low emission vehicle regulations (LEV II) Approved amendments to apply PM emission limits to all new gasoline vehicles, extend gasoline PZEV emission limits to all fuel types, and streamline the manufacturer certification process.	11/15/01 8/6/02 EO
Gasoline vapor recovery systems test methods and compliance procedures Adopted amendments to add test methods for new technology components, streamline test methods for liquid removal equipment, and***.	10/25/01 7/9/02 EO
Heavy-duty diesel trucks Adopted amendments to emissions standards to harmonize with EPA regulations for 2007 and subsequent model year new heavy-duty diesel engines.	10/25/01
Automotive coatings Adopted Air Toxic Control Measure which prohibits the sale and use in California of automotive coatings that contain hexavalent chromium or cadmium.	9/20/01 9/2/02 EO
Inboard and sterndrive marine engines Lower emission standards for 2003 and subsequent model year inboard and sterndrive gasoline-powered engines in recreational marine vessels.	7/26/01 6/6/02 EO
Asbestos from construction, grading, quarrying, and surface mining Adopted an Airborne Toxic Control Measure for construction, grading, quarrying, and surface mining operations requiring dust mitigation for construction and grading operations, road construction and maintenance activities, and quarries and surface mines to minimize emissions of asbestos-laden dust.	7/26/01 6/7/02 EO

Zero emission vehicle infrastructure and standardization of electric vehicle charging equipment Adopted amendments to the ZEV regulation to alter the method of quantifying production volumes at joint-owned facilities and to add specifications for standardized charging equipment.	6/28/01 5/10/02 EO
Pollutant transport designation Adopted amendments to add two transport couples to the list of air basins in which upwind areas are required to adopt permitting thresholds no less stringent than those adopted in downwind areas.	4/26/01
Zero emission vehicle regulation amendments Adopted amendments to reduce the numbers of ZEVs required in future years, add a PZEV category and grant partial ZEV credit, modify the ZEV range credit, allow hybrid-electric vehicles partial ZEV credit, grant ZEV credit to advanced technology vehicles, and grant partial ZEV credit for several other minor new programs.	1/25/01 12/7/01 EO 4/12/02 EO
Heavy duty diesel engines supplemental test procedures Approved amendments to extend "Not-To-Exceed" and EURO III supplemental test procedure requirements through 2007 when federal requirements will include these tests.	12/7/00
Light and medium duty low emission vehicle alignment with federal standards Approved amendments that require light and medium duty vehicles sold in California to meet the more restrictive of state or federal emission standards.	12/7/00 12/27/00 EO
Exhaust emission standards for heavy duty gas engines Adopted amendments that establish 2005 emission limits for heavy duty gas engines that are equivalent to federal limits.	12/7/00 12/27/00 EO
CaRFG Phase 3 amendments Approved amendments to regulate the replacement of MTBE in gasoline with ethanol.	11/16/00 4/25/01 EO
CaRFG Phase 3 test methods Approved amendments to gasoline test procedures to quantify the olefin content and gasoline distillation temperatures.	11/16/00 7/11/01 EO 8/28/01 EO
Antiperspirant and deodorant regulations Adopted amendments to relax a 0% VOC limit to 40% VOC limit for aerosol antiperspirants.	10/26/00
Diesel risk reduction plan Adopted plan to reduce toxic particulate from diesel engines through retrofits on existing engines, tighter standards for new engines, and cleaner diesel fuel.	9/28/00
Conditional rice straw burning regulations Adopted regulations to limit rice straw burning to fields with demonstrated disease rates reducing production by more than 5 percent.	9/28/00
Asbestos from unpaved roads Tightened an existing Air Toxic Control Measure to prohibit the use of rock containing more than 0.25% asbestos on unsurfaced roads.	7/20/00
Aerosol Coatings Approved amendments to replace mass-based VOC limits with reactivity-based limits, add a table of Maximum Incremental Reactivity values, add limits for polyolefin adhesion promoters, prohibit use of certain toxic solvents, and make other minor changes.	6/22/00 5/1/01 EO
Consumer products aerosol adhesives Adopted amendments to delete a 25% VOC limit by 2002, add new VOC limits for six categories of adhesives, prohibit the use of toxic solvents, and add new labeling and reporting requirements.	5/25/00 3/14/01 EO
Automotive care products Approved an Air Toxic Control Measure to eliminate use of perchloroethylene, methylene chloride, and trichloroethylene in automotive products such as brake cleaners and degreasers.	4/27/00 2/28/01 EO
Enhanced vapor recovery emergency regulation Adopted a four-year term for equipment certifications.	5/22/01 EO
Enhanced vapor recovery Adopted amendments to require the addition of components to reduce spills and leakage, adapt to onboard vapor recovery systems, and continuously monitor system operation and report equipment leaks immediately.	3/23/00 7/25/01 EO
Agricultural burning smoke management Adopted amendments to add marginal burn day designations, require day-specific burn authorizations by districts, and smoke management plans for larger prescribed burn projects.	3/23/00 1/22/01 EO

Urban transit buses Adopted a public transit bus fleet rule and emissions standards for new urban buses that mandates a lower fleet-average NOx emission limit, PM retrofits, lower sulfur fuel use, and purchase of specified percentages of zero emission buses in future years.	1/27/00 2/24/00 11/22/00 EO 5/29/01 EO
Small Off-Road (diesel) Equipment (SORE) Adopted amendments to conform with new federal requirements for lower and engine power-specific emission limits, and for the averaging, banking, and trading of emissions among SORE manufacturers.	1/28/00
CaRFG Phase 3 MTBE phase out Adopted regulations to enable refiners to produce gasoline without MTBE while preserving the emissions benefits of Phase 2 cleaner burning gasoline.	12/9/99 6/16/00 EO
Consumer products – mid-term measures II Adopted a regulation which adds emission limits for 2 new categories and tightens emission limits for 15 categories of consumer products.	10/28/99
Portable fuel cans Adopted a regulation requiring that new portable fuel containers, used to refuel lawn and garden equipment, motorcycles, and watercraft, be spill-proof beginning in 2001.	9/23/99 7/6/00 EO
Clean fuels at service stations Adopted amendments rescinding requirements applicable to SCAB in 1994-1995, modifying the formula for triggering requirements, and allowing the Executive Officer to make adjustments to the numbers of service stations required to provide clean fuels.	7/22/99
Gasoline vapor recovery Adopted amendments to certification and test methods.	6/24/99
Reformulated gasoline oxygenate Adopted amendments rescinding the requirement for wintertime oxygenate in gasoline sold in the Lake Tahoe Air Basin and requiring the statewide labeling of pumps dispensing gasoline containing MTBE.	6/24/99
Marine pleasurecraft Adopted regulations to control emissions from spark-ignition marine engines, specifically, outboard marine engines and personal watercraft.	12/11/98 2/17/00 EO 6/14/00 EO
Voluntary accelerated light duty vehicle retirement Adopted regulation setting standards for voluntary accelerated retirement program.	12/10/98 10/22/99 EO
Off-highway recreational vehicles and engines Approved amendments to allow non-complying vehicles to operate in certain seasons and in certain ORV-designated areas.	12/10/98 10/22/99 EO
On-road motorcycles Amended on-road motorcycle regulations, to lower the tailpipe emission standards for ROG and NOx.	12/10/98
Portable equipment registration program (PERP) Approved amendments to exclude non-dredging equipment operating in OCS areas and equipment emitting hazardous pollutants, include NSPS Part OOO rock crushers, require SCR emission limits and onshore emission offsets from dredging equipment operating in OCS areas, set catalyst emission limits for gasoline engines, and relieve certain retrofitted engines from periodic source testing.	12/10/98
Liquid petroleum gas motor fuel specifications Approved amendment rescinding 5% propene limit and extending 10% limit indefinitely.	12/11/98
Reformulated gasoline Approved amendments to rescind the RVP exemption for fuel with 10% ethanol and allow for oxygen contents up to 3.7% if the Predictive Model weighted emissions to not exceed original standards.	12/11/98
Consumer products Adopted amendments to add new VOC test methods, to modify Method 310 to quantify low vapor pressure VOC (LVP-VOC) constituents, and to exempt LVP-VOC from VOC content limits	11/19/98
Consumer products Approved amendments to extend the 1999 VOC compliance deadline for several aerosol coatings, antiperspirants and deodorants, and other consumer products categories to 2002, to exempt methyl acetate from the VOC definition, and make other minor changes.	11/19/98

Low-emission vehicle program (LEV II) Adopted regulations adding exhaust emission standards for most sport utility vehicles, pick-up trucks and mini-vans, lowering tailpipe standards for cars, further reducing evaporative emission standards, and providing additional means for generating zero-emission vehicle credits.	11/5/98 9/17/99 EO
Off-road engine aftermarket parts Approved implementation of a new program to test and certify aftermarket parts in gasoline and diesel, light-duty through heavy duty, engines used in off-road vehicles and equipment.	11/19/98 10/1/99 EO 7/18/00 EO
Off-road spark ignition engines Adopted new emission standards for small and large spark ignition engines for off-road equipment, a new engine certification program, an in-use compliance testing program, and a three-year phase-in for large LSI.	10/22/98
Gasoline deposit control additives Adopted amendments to decertify pre-RFG additives, tighten the inlet valve deposit limits, add a combustion chamber deposit limit, and modify the test procedures to align with the characteristics of reformulated gasoline formulations.	9/24/98 4/5/99 EO
Stationary source test methods Adopted amendments to stationary source test methods to align better with federal methods.	8/27/98 7/2/99 EO
Locomotive MOA for South Coast Memorandum of agreement (MOA) signed by ARB, U.S. EPA and major railroads to concentrate cleaner locomotives in the South Coast by 2010 and fulfill 1994 ozone SIP commitment.	7/2/98
Gasoline vapor recovery Adopted amendments to certification and test methods to add methods for onboard refueling vapor recovery, airport refuelers, and underground tank interconnections, and make minor changes to existing methods.	5/21/98 8/27/98
Reformulated gasoline Approved amendments to rescind the wintertime oxygenate requirement, allow for sulfur content averaging, and make other minor technical amendments.	8/27/98
Ethylene oxide sterilizers Adopted amendments to the ATCM to streamline source testing requirements, add EtO limits in water effluent from control devices, and make other minor changes.	5/21/98
Chrome platers Adopted amendments to ATCM to harmonize with requirements of federal NESHAP standards for chrome plating and chromic acid anodizing facilities.	5/21/98
On-road heavy-duty vehicles Approved amendments to align on-road heavy duty vehicle engine emission standards with EPA's 2004 standards and align certification, testing, maintenance, and durability requirements with those of U.S. EPA.	4/23/98 2/26/99 EO
Small off-road engines (SORE) Approved amendments to grant a one-year delay in implementation, relaxation of emissions standards for non-handheld engines, emissions durability requirements, averaging/banking/trading, harmonization with the federal diesel engine regulation, and modifications to the production line testing requirements.	3/26/98
Heavy duty vehicle smoke inspection program Adopted amendments to require annual smoke testing, set opacity limits, and exempt new vehicles from testing for the first four years.	12/11/97 3/2/98 EO
Consumer products (hairspray credit program) Adopted standards for the granting of tradable emission reduction credits achieved by sales of hairspray products having VOC contents less than required limits.	11/13/97
Light-duty vehicle off-cycle emissions Adopted standards to control excess emissions from aggressive driving and air conditioner use in light duty vehicles and added two light duty vehicle test methods for certification of new vehicles under these standards.	7/24/97 3/19/98 EO
Consumer products Adopted amendments to add VOC limits to 18 categories of consumer products used in residential and industrial cleaning, automobile maintenance, and commercial poisons.	7/24/97
Enhanced evaporative emissions standards Adopted amendments extending the compliance date for ultra-small volume vehicle manufacturers by one year.	5/22/97
Emission reduction credit program Adopted standards for District establishment of ERC programs including certification, banking, use limitation, and reporting requirements.	5/22/97

Lead as a toxic air contaminant Adopted an amendment to designate inorganic lead as a toxic air contaminant.	4/24/97
Consumer products (hair spray) Adopted amendments to (1) delay a January 1, 1998, compliance deadline to June 1, 1999, (2) require progress plans from manufacturers, and (3) authorize the Executive Officer to require VOC mitigation when granting variances from the June 1, 1999 deadline.	3/27/97
Portable engine registration program (PERP) Adopted standards for (1) the permitting of portable engines by ARB and (2) District recognition and enforcement of permits.	3/27/97
Liquefied petroleum gas Adopted amendments to extend the compliance deadline from January 1, 1997, to January 1, 1999, for the 5% propene limit in liquefied petroleum gas used in motor vehicles.	3/27/97
Onboard diagnostics, phase II Adopted amendments to extend the phase-in of enhanced catalyst monitoring, modify misfire detection requirements, add PVC system and thermostat monitoring requirements, and require manufacturers to sell diagnostic tools and service information to repair shops.	12/12/96
Consumer products Adopted amendments to delay 25% VOC compliance date for aerosol adhesives, clarify portions of the regulation, exempt perchloroethylene from VOC definition, extend the sell-through time to three years, and add perchloroethylene reporting requirements.	11/21/96
Consumer products (test method) Adopted an amendment to add Method 310 for the testing of VOC content in consumer products.	11/21/96
Pollutant transport designation Adopted amendments to modify transport couples from the Broader Sacramento area and add couples to the newly formed Mojave Desert and Salton Sea Air Basins.	11/21/96
Diesel fuel certification test methods Approved amendments specifying the test methods used for quantifying the constituents of diesel fuel.	10/24/96 6/4/97 EO
Wintertime requirements for utility engines & off-highway vehicles Optional hydrocarbon and NOx standards for snow throwers and ice augers, raising CO standard for specialty vehicles under 25hp.	9/26/96
Large off-road diesel Statement of Principles National agreement between ARB, U.S. EPA, and engine manufacturers to reduce emissions from heavy-duty off-road diesel equipment four years earlier than expected in the 1994 SIP for ozone.	9/13/96
Regulatory improvement initiative Rescinded two regulations relating to fuel testing in response to Executive Order W-127-95.	5/30/96
Zero emission vehicles Adopted amendments to eliminate zero emission vehicle quotas between 1998 and 2002, and approved MOUs with seven automobile manufacturers to accelerate release of lower emission "49 state" vehicles.	3/28/96 7/24/96 EO
CaRFG variance requirements Approved amendments to add a per gallon fee on non-compliant gasoline covered by a variance and to made administrative changes in variance processing and extension.	1/25/96 2/5/96 EO 4/2/96 EO
Utility and lawn and garden equipment engines Adopted an amendment to relax the CO standard from 300 to 350 ppm for Class I and II utility engines.	1/25/96
National security exemption of military tactical vehicles Such vehicles would not be required to adhere to exhaust emission standards.	12/14/95
CaRFG regulation amendments Approved amendments to allow for downstream addition of oxygenates and expansion of compliance options for gasoline formulation.	12/14/95
Required additives in gasoline (deposit control additives) Terms, definitions, reporting requirements, and test procedures for compliance are to be clarified.	11/16/95
CaRFG test method amendments Approved amendments to designate new test methods for benzene, aromatic hydrocarbon, olefin, and sulfur content of gasoline.	10/26/95

Motor vehicle inspection and maintenance program Handled by BAR.	10/19/95 by BAR
Antiperspirants and deodorants, consumer products, and aerosol coating products Ethanol exemption for all products, modifications to aerosol special requirements, modifications for regulatory language consistency, modifications to VOC definition.	9/28/95
Low emission vehicle (LEV III) standards Reactivity adjustment factors, introduction of medium-duty ULEVs, window labels, and certification requirements and test procedures for LEVs.	9/28/95
Medium- and heavy-duty gasoline trucks Expedited introduction of ultra-low emission medium-duty vehicles and lower NOx emission standards for heavy-duty gasoline trucks to fulfill a 1994 ozone SIP commitment.	9/1/95
Retrofit emission standards: all vehicle classes to be included in the alternate durability test plan, kit manufacturers to be allowed two years to validate deterioration factors under the test plan, update retrofit procedures allowing manufacturers to disable specific OBDs if justified by law.	7/27/95
Gasoline vapor recovery systems Adopts revised certification and test procedures.	6/29/95
Onboard refueling vapor recovery standards 1998 and subsequent MY engine cars, LD trucks, and MD trucks less than 8500 GVWR.	6/29/1995 4/24/96 EO
Heavy duty vehicle exhaust emission standards for NOx Amendments to standards and test procedures for 1985 and subsequent MY HD engines, amendments to emission control labels, amendments to Useful Life definition and HD engines and in-use vehicle recalls.	6/29/95
Aerosol coatings regulation Adopted regulation to meet California Clean Air Act requirements and a 1994 ozone SIP commitment.	3/23/95
Periodic smoke inspection program Delays start of PSIP from 1995 to 1996.	12/8/94
Onboard diagnostics phase II Amendments to clarify regulation language, ensure maximum effectiveness, and address manufacturer concerns regarding implementation.	12/8/94
Alternative control plan (ACP) for consumer products A voluntary, market-based VOC emissions cap upon a grouping of consumer products, flexible by manufacturer that will minimize overall costs of emission reduction methods and programs.	9/22/94
Diesel fuel certification: new specifications for diesel engine certification fuel, amended oxygen specification for CNG certification fuel, and amended commercial motor vehicle liquefied petroleum gas regulations.	9/22/94
Utility and lawn and garden equipment (UGLE) engines Modification to emission test procedures, ECLs, defects warranty, quality-audit testing, and new engine compliance testing.	7/28/94
Evaporative emissions standards and test procedures **Adopted evaporative emissions standards for medium-duty vehicles.**	2/10/94
Off-road recreational vehicles Adopted emission control regulations for off-road motorcycles, all-terrain vehicles, go-karts, golf carts, and specialty vehicles.	1/1/94
Perchloroethylene from dry cleaners Adopted measure to control perchloroethylene emissions from dry cleaning operations.	10/1/93
Wintertime oxygenate program Amendments to the control time period for San Luis Obispo County, exemption for small retailers bordering Nevada, flexibility in gasoline delivery time, calibration of ethanol blending equipment, gasoline oxygen content test method.	9/9/93
Onboard diagnostic phase II	7/9/93
Urban transit buses Amended regulation to tighten state NOx and particulate matter (PM) standards for urban transit buses beyond federal standards beginning in 1996**.**	6/10/93
1-year implementation delay in emission standards for utility engines	4/8/93
Non-ferrous metal melting Adopted Air Toxic Control Measure for emissions of cadmium, arsenic, and nickel from non-ferrous metal melting operations.	1/1/93
Certifications requirements for low emission passenger cars, light-duty trucks & medium duty vehicles	1/14/93

Airborne toxic control measure for emissions of toxic metals from non-ferrous metal melting	12/10/92
Periodic self-inspection program Implemented state law establishing a periodic smoke self-inspection program for fleets operating heavy-duty diesel-powered vehicles.	12/10/92
Notice of general public interest for consumer products	11/30/92
Substitute fuel or clean fuel incorporated test procedures	11/12/92
New vehicle testing using CaRFG Phase 2 gasoline Approved amendments to require the use of CaRFG Phase 2 gasoline in the certification of exhaust emissions in new vehicle testing.	8/13/92
Standards and test procedures for alternative fuel retrofit systems	5/14/92
Alternative motor vehicle fuel certification fuel specification	3/12/92
Heavy-duty off-road diesel engines Adopted the first exhaust emission standards and test procedures for heavy-duty off-road diesel engines beginning in 1996.	1/9/92
Consumer Products - Tier II Adopted Tier II of regulations to reduce emissions from consumer products.	1/9/92
Wintertime oxygen content of gasoline Adopted regulation requiring the addition of oxygenates to gasoline during winter to satisfy federal Clean Air Act mandates for CO nonattainment areas.	12/1/91
CaRFG Phase 2 Adopted CaRFG phase 2 specifications including lowering vapor pressure, reducing the sulfur, olefin, aromatic, and benzene content, and requiring the year-round addition of oxygenates to achieve reductions in ROG, NOx, CO, oxides of sulfur (SOx) and toxics.	11/1/91
Low emissions vehicles amendments revising reactivity adjust factor (RAF) provisions and adopting a RAF for M85 transitional low emission vehicles	11/14/91
Onboard diagnostic, phase II	11/12/91
Onboard diagnostics for light-duty trucks and light & medium-duty motor vehicles	9/12/91
Utility and lawn & garden equipment Adopted first off-road mobile source controls under the California Clean Air Act regulating utility, lawn and garden equipment.	12/1/90
Control for abrasive blasting	11/8/90
Roadside smoke inspections of heavy-duty vehicles Adopted regulations implementing state law requiring a roadside smoke inspection program for heavy-duty vehicles.	11/8/90
Consumer Products Tier I Adopted Tier I of standards to reduce emissions from consumer products.	10/11/90
CaRFG Phase I Adopted CaRFG Phase I reformulated gasoline regulations to phase-out leaded gasoline, reduce vapor pressure, and require deposit control additives.	9/1/90
Low-emission vehicle (LEV) and clean fuels Adopted the landmark LEV/clean fuel regulations which called for the gradual introduction of cleaner cars in California. The regulations also provided a mechanism to ensure the availability of alternative fuels when a certain number of alternative fuel vehicles are sold.	9/1/90
Evaporative emissions from vehicles Modified test procedure to include high temperatures (up to 105 F) and ensure that evaporative emission control systems function properly on hot days.	8/9/90
Dioxins from medical waste incinerators Adopted Airborne Toxic Control Measure to reduce dioxin emissions from medical waste incinerators.	7/1/90
CA Clean Air Act guidance for permitting Approved California Clean Air Act permitting program guidance for new and modified stationary sources in nonattainment areas.	7/1/90
Consumer products BAAQMD	6/14/90
Medium duty vehicle emission standards Adopted three new categories of low emission MDVs, required minimum percentages of production, and established production credit and trading.	6/14/90

Medium-duty vehicles Amended test procedures for medium-duty vehicles to require whole-vehicle testing instead of engine testing. This modification allowed enforcement of medium-duty vehicle standards through testing and recall.	6/14/90
Ethylene oxide sterilizers Adopted Airborne Toxic Control Measure to reduce ethylene oxide emissions from sterilizers and aerators.	5/10/90
Asbestos in serpentine rock Adopted Airborne Toxic Control Measure for asbestos-containing serpentine rock in surfacing applications.	4/1/90
Certification procedure for aftermarket parts	2/8/90
Antiperspirants and deodorants Adopted first consumer products regulation, setting standards for antiperspirants and deodorants.	11/1/89
Residential woodstoves Approved suggested control measure for the control of emissions from residential wood combustion.	11/1/89
On-Board Diagnostic Systems II Adopted regulations to implement the second phase of on-board diagnostic requirements which alert drivers of cars, light-trucks and medium-duty vehicles when the emission control system is not functioning properly.	9/1/89
Cars and light-duty trucks Adopted regulations to reduce ROG and CO emissions from cars and light trucks by 35 percent.	6/1/89
Architectural coatings Approved a suggested control measure to reduce ROG emissions from architectural coatings.	5/1/89
Chrome from cooling towers Adopted Airborne Toxic Control Measure to reduce hexavalent chromium emissions from cooling towers.	3/1/89
Reformulated Diesel Fuel Adopted regulations requiring the use of clean diesel fuel with lower sulfur and aromatic hydrocarbons beginning in 1993.	11/1/88
Vehicle Recall Adopted regulations implementing a recall program which requires auto manufacturers to recall and fix vehicles with inadequate emission control systems (Vehicles are identified through in-use testing conducted by the ARB).	9/1/88
Suggested control measure for oil sumps Approved a suggested control measure to reduce emissions from sumps used in oil production operations.	8/1/88
Chrome platers Adopted Airborne Toxic Control Measure to reduce emissions of hexavalent chromium emissions from chrome plating and chromic acid anodizing facilities.	2/1/88
Suggested control measure for boilers Approved suggested control measure to reduce NOx emissions from industrial, institutional, and commercial boilers, steam generators and process heaters.	9/1/87
Benzene from service stations Adopted Airborne Toxic Control Measure to reduce benzene emissions from retail gasoline service stations (Also known as Phase II vapor recovery).	7/1/87
Agricultural burning guidelines Amended existing guidelines to add provisions addressing wildland vegetation management.	11/1/86
Heavy-duty vehicle certification Amended certification of heavy-duty diesel and gasoline-powered engines and vehicles to align with federal standards.	4/1/86
Cars and light-duty trucks Adopted regulations reducing NOx emissions from passenger cars and light-duty trucks by 40 percent.	4/1/86
Sulfur in diesel fuel Removed exemption for small volume diesel fuel refiners.	6/1/85
On-Board Diagnostics I Adopted regulations requiring the use of on-board diagnostic systems on gasoline-powered vehicles to alert the driver when the emission control system is not functioning properly.	4/1/85
Suggested control measure for wood coatings Approved a suggested control measure to reduce emissions from wood furniture and cabinet coating operations.	3/1/85
Suggested control measure for resin manufacturing Approved a suggested control measure to reduce ROG emissions from resin manufacturing.	1/1/85

Appendix C

CARB Analyses of Key Mobile Source Regulations & 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 (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.

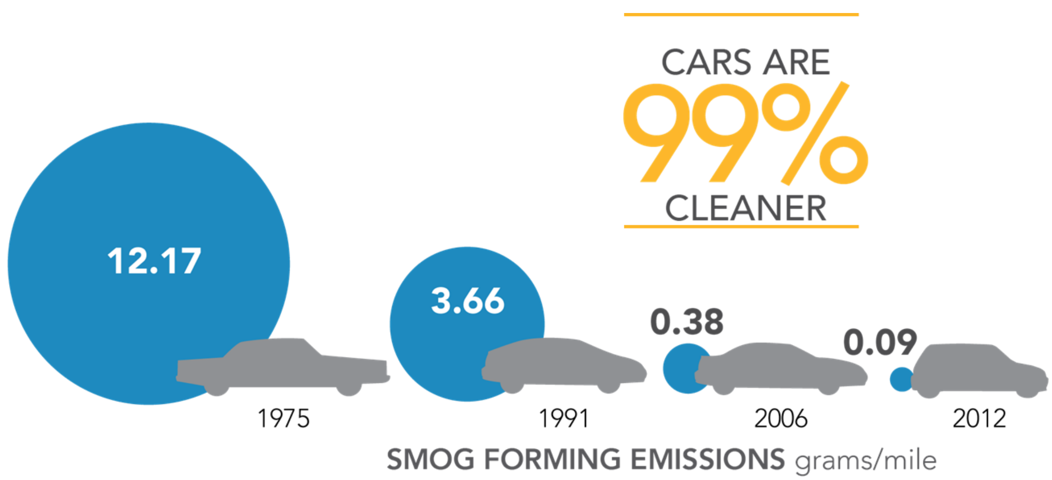
In 1998, CARB identified diesel particulate matter as a toxic air contaminant. Since then, CARB adopted numerous regulations aimed at reducing exposure to diesel particulate matter while concurrently providing reductions in oxides of nitrogen (NOx) from freight transport sources like heavy-duty diesel 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 2037 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.

I. Light-Duty Vehicles

Figure 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 NOx emissions along with hydrocarbon emissions. The simultaneous control of emissions from motor vehicles and fuels led to the use of cleaner-burning reformulated gasoline (RFG) that has removed the emissions equivalent of 3.5 million vehicles from California's roads. Since CARB first adopted it in 1990, the Low Emission Vehicle Program (LEV and LEV II) and Zero-Emission Vehicle (ZEV) Program have resulted in the production and sales of hundreds of thousands of zero-emission vehicles (ZEVs) in California.

Figure 1: Light-Duty Emission Standards



As a result of these efforts, light-duty vehicle emissions in Western Nevada County have been reduced significantly since 1990 and will continue to go down through 2026. From today, light-duty vehicle NOx emissions are projected to decrease by over 55 percent in 2026. Key light-duty programs include Advanced Clean Cars (ACC), On-Board Diagnostics, Reformulated Gasoline, Incentive Programs, and the Enhanced Smog Check Program.

II. 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.

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.

III. 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

[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

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.

IV. 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 cutpoints;
- 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 talking 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.

V. 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.

VI. 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.

VII. 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 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).

a. *Clean Vehicle Rebate Program*

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 by offering 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.

b. *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 Clean Cars 4 All.

c. *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 Clean Cars 4 All 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.

VIII. Consumer Assistance Program

California's voluntary vehicle retirement program, the Consumer Assistance Program, 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.

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 Western Nevada County have been reduced significantly since 1990 and will continue to decrease through 2026. From today, medium- and heavy-duty NOx emissions are projected to decrease by over 61 percent in 2026. 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.

IX. Heavy-Duty Engine Standards

Since 1990, heavy-duty engine NOx emission standards have become dramatically more stringent, dropping from 6 grams per brake horsepower-hour (g/bhp-hr) in 1990 down to the current 0.2 g/bhp-hr standard, which took effect in 2010. In addition to mandatory NOx standards, there have been several generations of optional lower NOx standards put in place over the past 15 years. Most recently in 2015, engine manufacturers were allowed to certify to three optional NOx emission standards of 0.1 g/bhp-hr, 0.05 g/bhp-hr, and 0.02 g/bhp-hr (i.e., 50 percent, 75 percent, and 90 percent lower than the current mandatory standard of 0.2 g/bhp-hr). The optional standards allow local air districts and CARB to preferentially provide incentive funding to buyers of cleaner trucks, and to encourage the development of cleaner engines.

X. Optional Low-NOx Standards for Heavy-Duty Diesel Engines

In 2013, California established optional low-NOx 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-NOx standards were developed to pave the way for more stringent mandatory standards by encouraging manufacturers to develop and certify low-NOx engines, and incentivizing potential customers to purchase these low-NOx 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-NOx standards.

XI. Heavy-Duty Engine and Vehicle Omnibus Regulation

In 2021, CARB comprehensively overhauled how NOx emissions from new heavy-duty engines are regulated in California through the adoption of the Heavy-Duty Engine and Vehicle Omnibus Regulation (Omnibus Regulation) which reduces NOx emissions from the engines in medium- and heavy-duty vehicle classes. The Omnibus Regulation includes NOx certification emission standards and in-use standards that significantly reduce tailpipe NOx 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.

XII. 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 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.

XIII. 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.

XIV. 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 Board 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, the Board 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.

XV. 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.

XVI. 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.

XVII. 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.

XVIII. 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.

XIX. 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 rapidly transition to zero-emission.

a. *Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project*

CARB's HVIP incentive program 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.

b. *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. *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 (San Joaquin Valley, South Coast, Bay Area, 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 demonstration 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.

d. *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.

XX. Moyer Program

The 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 has 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 NOx trucks certified to meet the 0.02 g/bhp-hr NOx standard or lower. Currently, only the San Joaquin Valley Air Pollution Control District and the South Coast Air Quality Management 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, 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 NOx 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.

XXI. 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.

XXII. Volkswagen (VW) Mitigation Trust

In 2015, after a CARB-led investigation, in concert with the United States Environmental Protection Agency (U.S. 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 NOx 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.

XXIII. 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 Community Emission Reductions Plans.

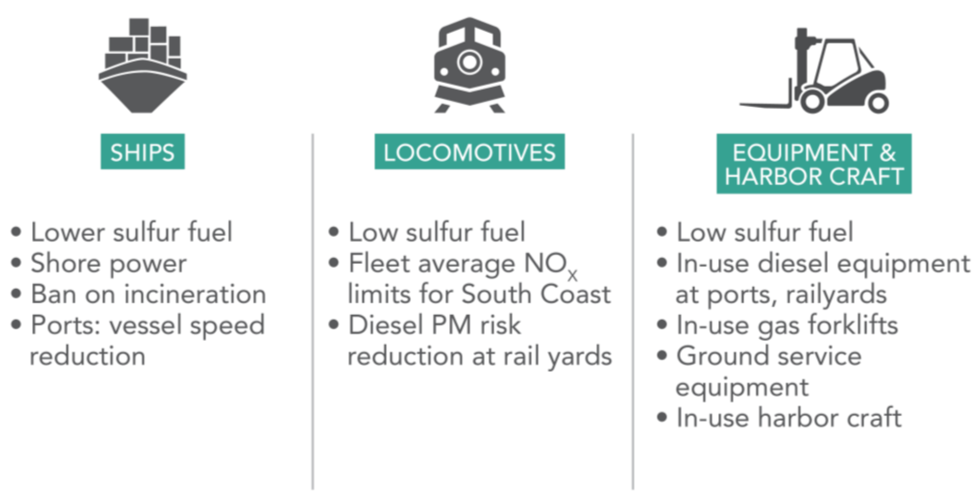
CARB and air districts partner to run the programs, with CARB developing guidelines and the districts administering funds for their regions. In most cases throughout the State, selected communities have identified mobile source emissions as a target for reductions. It is likely that a significant portion of the AB 617-allocated funding will incentivize the accelerated turnover to cleaner vehicles and equipment in and around low-income and disadvantaged communities.

XXIV. 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 2 illustrates the comprehensive suite of emission control measures applicable to the broad variety of engines and vehicle that fall under the Off-Road category. As a result of these emission control efforts, off-road emissions in Western Nevada County have been reduced significantly since 1990 and will continue to decrease through 2026. From today, off-road NOx emissions are projected to decrease by over 19 percent by 2026. Key programs in this sector include the Off-Road Engine Standards, Locomotive Engine Standards, Clean Diesel Fuel, Cleaner In-Use Off-Road Regulation and In-Use Large Spark Ignition (LSI) Fleet Regulation.

Figure 2: Off-Road Vehicle and Equipment Control Programs



XXV. Off-Road Engine Standards

The Clean Air Act preempts states, including California, from adopting requirements for new off-road engines less than 175 HP used in farm or construction equipment. California may adopt emission standards for in-use off-road engines pursuant to Section 209(e)(2), but must receive authorization from U.S. EPA before it may enforce the adopted standards.

CARB first approved regulations to control exhaust emissions from small off-road engines (SORE) such as lawn and garden equipment in December 1990 with amendments in 1998, 2003, 2010, 2011, 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.

XXVI. 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 are used in construction, manufacturing, the rental industry, road maintenance, airport ground support and landscaping. In December 2011, the Off-Road Regulation was modified to include on-road trucks with two diesel engines.

The Off-Road Regulation will significantly reduce emissions of diesel PM and NOx from the over 150,000 in-use off-road diesel vehicles that operate in California. The Regulation affects dozens of vehicle types used in thousands of fleets by requiring owners to modernize their fleets by replacing older engines or vehicles with newer, cleaner models, retiring older vehicles or using them less often, or by applying retrofit exhaust controls.

The Off-Road Regulation imposes idling limits on off-road diesel vehicles, requires a written idling policy, and requires a disclosure when selling vehicles. The Regulation also requires that all vehicles be reported to CARB and labeled, restricts the addition of older vehicles into fleets, and requires fleets to reduce their emissions by retiring, replacing, or repowering older engines, or installing verified exhaust retrofits. The requirements and compliance dates of the Off-Road Regulation vary by fleet size.

Fleets are subject to increasingly stringent restrictions on adding older vehicles. The regulation also sets performance requirements. While the regulation has many specific provisions, in general by each compliance deadline, a fleet must demonstrate that it has either met the fleet average target for that year, or has completed the Best Available Control Technology requirements. The performance requirements of the Off-Road Regulation were phased in from January 1, 2014 through January 1, 2019.

Compliance assistance and outreach activities in support of the Off-Road Regulation include:

- The Diesel Off-road On-line Reporting System, an online reporting tool developed and maintained by CARB staff;
- The Diesel Hotline (866-6DIESEL), which provides the regulated public with questions about the regulations and access to CARB staff. Staff is able to respond to questions in English, Spanish and Punjabi; and
- The Off-road Listserv, providing equipment owners and dealerships with timely announcement of regulatory changes, regulatory assistance documents, and reminders for deadlines.

XXVII. Clean Diesel Fuel

Since 1993, CARB has required that diesel fuel have a limit on the aromatic hydrocarbon content and sulfur content of the fuel. Diesel powered vehicles account for a disproportionate amount of the diesel particulate matter which is considered a toxic air contaminant 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.

XXVIII. Locomotive Engine Standards

The Clean Air Act and the U.S. EPA national locomotive regulations expressly preempt states and local governments from adopting or enforcing “any standard or other requirement relating to the control of emissions from new locomotives and new engines used in locomotives” (U.S. EPA interpreted new engines in locomotives to mean remanufactured engines, as well). U.S. EPA has approved two sets of national locomotive emission regulations (1998 and 2008). In 1998, U.S. EPA approved the initial set of national locomotive emission regulations. These regulations primarily emphasized NOx reductions through Tier 0, 1, and 2 emission standards. Tier 2 NOx emission standards reduced older uncontrolled locomotive NOx emissions by up to 60 percent, from 13.2 to 5.5 g/bhphr.

In 2008, U.S. EPA approved a second set of national locomotive regulations. Older locomotives upon remanufacture are required to meet more stringent particulate matter (PM) emission standards which are about 50 percent cleaner than Tier 0-2 PM emission standards. U.S. EPA refers to the PM locomotive remanufacture emission standards as Tier 0+, Tier 1+, and Tier 2+. The new Tier 3 PM emission standard (0.1 g/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 NOx and PM emission standards. The U.S. EPA Tier 4 NOx and PM emission standards further reduced emissions by approximately 95 percent from uncontrolled levels.

In April 2017, CARB petitioned U.S. EPA for rulemaking, seeking the amendment of emission standards for newly built locomotives and locomotive engines and lower emission standards for remanufactured locomotives and locomotive engines. The petition asks U.S. EPA to update its standards to take effect for remanufactured locomotives in 2023 and for newly built locomotives in 2025. The new emission standards would provide critical criteria pollutant reductions, particularly in the disadvantaged communities that surround railyards. U.S. EPA recently responded to this petition. As part of U.S. EPA's response, they are taking steps to focus resources and expertise on developing options and recommendations for new locomotives as well as those that are already operating in communities nationwide. This includes considering appropriate actions for new locomotives in addition to proposing revisions to our existing locomotive preemption regulations to ensure they don't inappropriately limit California's and other states' authorities under the Clean Air Act to address their air quality issues. Also, U.S. EPA has formed a rail study team to evaluate how best to address air pollutant emissions from the locomotive sector.

XXIX. 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, U.S. 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 U.S. 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 + NOx 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 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.

XXX. Cargo Handling Equipment (CHE)

Cargo handling equipment (CHE) include yard trucks (hostlers), rubber-tired gantry cranes, container handlers, forklifts, dozers, and other types. The 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 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 NOx at ports and intermodal rail yards throughout California.

XXXI. 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.

XXXII. 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, SORE such as lawn and garden equipment, heavier CHE, and ZE applications at railyards, marine ports, freight facilities, and along freight corridors.

a. *Clean Off-Road Equipment Voucher Incentive Project*

The CORE incentive program 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.

b. *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.

XXXIII. 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 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 NOx over the lifetime of the projects, Statewide.

XXXIV. 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.

XXXV. 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.

XXXVI. Conclusion

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.

Appendix D

CARB Ozone Reasonable Available Control Measures

Assessment – State 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 meet the RACM requirement in Western Nevada County.

I. RACM Requirements

U.S. 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.

II. RACM For Mobile Sources

a. Waivers 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 U.S. 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.

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

[1] Locomotives and engines less than 175 horsepower (hp) used in farm and construction equipment are exempt from California's waiver authority.

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 U.S. 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.

III. CARB's Mobile Source Controls

CARB's current mobile source control program, along with efforts at the local and federal level, have 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 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 exploring and proposing 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

[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

these technologies into the fleet, and to accelerate the deployment of cleaner technologies through incentives.

a. 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 NOx 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 and will be finalized this year. ACC II, which was recently adopted by the 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 ZEVs 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.

b. 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 an on-road heavy-duty diesel fleet with 2010 engines emitting 98 percent less NOx and PM2.5 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-NOx 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 NOx emissions from new heavy-duty engines are regulated in California. The Omnibus Regulation also includes in-use standards that significantly reduce tailpipe NOx 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

Advanced Clean Fleets measure. 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.

c. *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 is also including in the 2022 State SIP Strategy a measure for amendments to the existing Off-Road Regulation. These amendments would 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, potentially 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 + NOx 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 NOx 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 U.S. EPA and European Stage V nonroad regulations and would require the use of best available control technologies for both PM and NOx.

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. The Clean Off-Road Equipment Voucher Incentive Project (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. 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.

e. 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. U.S. 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 Western Nevada County's 75 ppb 8-hour ozone standard, which included the State's current control program and new measure commitments from the 2016 State SIP Strategy, U.S. EPA found that,

> "CARB and the Nevada County Transportation Commission (NCTC) provide for the implementation of RACM for mobile sources of NOx and VOC; there are no additional RACM that would advance attainment of the 2008 ozone NAAQS in Western Nevada County by at least one year; and therefore, the 2018 Western Nevada County Ozone Plan provides for the implementation of all RACM as required by [the] CAA."[3]

In addition to declarations that the mobile source control program meets RACM requirements, U.S. EPA has also provided past determinations that CARB's mobile source control programs meet the more rigorous Best Available Control Measure (BACM) requirements. As BACM requirements are considered a more stringent threshold to meet than RACM, U.S. EPA has stated that a determination that the control program has meet BACM requirements also constitutes a conclusion that it meets RACM requirements.[4] U.S. EPA has acknowledged CARB's mobile source control program as meeting BACM in their 2020 approval of the San

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[3] 86 FR 27524 https://www.govinfo.gov/content/pkg/FR-2021-05-21/pdf/2021-10510.pdf

[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

Joaquin Valley's PM2.5 Serious Area 2018 Plan, [5] and in their 2019 approval of the South Coast's PM2.5 Serious Area Plan.[6] In their 2018 proposal for that approval, U.S. 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 PM2.5 and PM2.5 precursors in the South Coast nonattainment area."[7]

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 U.S. 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 Western Nevada County 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.

IV. 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.

U.S. EPA also regulates consumer products. U.S. EPA's consumer products regulation was promulgated in 1998, however, federal consumer products VOC limits have not been revised since their adoption. U.S. EPA also promulgated reactivity limits for aerosol coatings. As with the general consumer products, California's requirements for aerosol coatings are more stringent

[5] 85 FR 44192 https://www.federalregister.gov/documents/2020/07/22/2020-14471/clean-air-plans-2006-fine-particulate-matter-nonattainment-area-requirements-san-joaquin-valley

[6] 84 FR 3305 https://www.federalregister.gov/documents/2019/02/12/2019-01922/approval-and-promulgation-of-implementation-plans-california-south-coast-serious-area-plan-for-the

[7] 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

than the U.S. 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 measures that, when considered in aggregate, would advance the attainment date by at least one year.

Appendix E

Modeling Protocol and Attainment Demonstration

Modeling Protocol and Attainment Demonstration for the 2022 Western Nevada Ozone State Implementation Plan

Prepared by
California Air Resources Board
Northern Sierra Air Quality Management District

Prepared for
United States Environmental Protection Agency Region IX
October 2022

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Acronyms

ACM2 – Asymmetric Convective Model version 2

ADAM – Aerometric Data Analysis and Management

AQMIS – Air Quality and Meteorological Information System

BCs – Boundary Conditions

CalNex – 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 – the Community Earth System Model version 2

CMAQ Model – Community Multi-Scale Air Quality Model

CTM – Chemical Transport Model

DV – Design Value

EBI – Euler Backward Iterative solver

HYSPLIT – Hybrid Single Particle Lagrangian Integrated Trajectory

ICs – Initial Conditions

IOA – Index of Agreement

LAI – Leaf Area Index

MB – Mean Bias

MCAB – Mountain Counties Air Basin

MCIP – Meteorology-Chemistry Interface Processor

MDA8 – Maximum Daily Average 8-hour Ozone

ME – Mean Error

MEGAN – Model of Emissions of Gases and Aerosols from Nature

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

NOx – Nitrogen Oxides

NSAQMD – Northern Sierra Air Quality Management District

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

VOC – Volatile Organic Compounds

WNNA – Western Nevada county Non-attainment Area

WRF – Weather Research and Forecasting Model

I. Introduction

Nevada County stretches from the foothills to the mountains of the Sierra Nevada mountain range within the Mountain Counties Air Basin (MCAB), covering an area of ~978 square miles with an estimated population of 102,241 in 2020. The western portion of Nevada County is designated nonattainment for the 2015 8-hour ozone National Ambient Air Quality Standards (NAAQS) (U.S. EPA, 2017). The Western Nevada County Non-attainment Area (WNNA) is a region of highly complex terrain, with elevations ranging from a few hundred feet above sea level to over 9,000 feet. It extends from the foothills of the Sierra Nevada mountain range in the west into the Tahoe National Forest to the east. The WNNA is located to the east of California's Central Valley, which is a 500-mile-long northwest-southeast oriented valley encompassing two of the most polluted air basins in the nation – San Joaquin Valley Air Basin (SJVAB) and Sacramento Valley Air Basin (SVAB) (**Figure 1**). The Northern Sierra Air Quality Management District (NSAQMD) has jurisdiction over the WNNA.

The air flow into the WNNA is typically from the south-southwest (U.S. EPA, 2008). It is regularly impacted by emissions and polluted air masses from within the Sacramento Federal Ozone Nonattainment Area (SFNA) and San Francisco Bay Area. The air quality in the WNNA is affected by various factors, including its complex terrain and topographic features, precursor emissions in the upwind source regions, local emissions from anthropogenic and naturally occurring biogenic sources, ozone chemistry along the transport pathways, as well as the meteorological conditions that facilitate transport of ozone and its precursors.

From year 2000 to 2020, the emissions of ozone precursors in the WNNA continued to decline with a significant decrease in local anthropogenic nitrogen oxides (NO_x) (from ~7.6 tpd to ~2.7 tpd) and reactive organic compounds (ROG) (from ~8.4 tpd to ~5 tpd) emissions (**Figure 2**). The anthropogenic NO_x and ROG emissions trends for the upwind SFNA are also displayed in Figure 2 and show large decreases in both anthropogenic NO_x (from ~174.5 tpd to ~58 tpd) and ROG (from ~164.5 tpd to ~91 tpd) emissions over the same time period. The SFNA emissions are much greater than the WNNA local sources. When aided by conducive meteorological conditions that facilitate pollutant transport, these can be the dominant contributor to ozone levels in the WNNA. Summer biogenic ROG emissions in the WNNA and the SFNA averaged over May to October 2018 are also included in **Figure 2** (green circle and triangle markers). Biogenic ROG is estimated to be ~32 tpd and ~6 times the anthropogenic ROG inventory (~ 5.3 tpd) in the WNNA, while the biogenic ROG is estimated to be ~163.2 tpd and ~1.7 times the corresponding anthropogenic emissions (~94.1 tpd) in the SFNA.

Figure 1. Map of California (top) along with the location of Western Nevada county 8-hour ozone Non-attainment Area (WNNA) in blue and Sacramento Federal 8-hour ozone Non-attainment Area (SFNA) in magenta. SV, MC and SJV denote Sacramento Valley, Mountain Counties (MC) and San Joaquin Valley (SJV) air basins. The color scale 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 and approximate regional boundary of SFNA (Magenta line), WNNA (blue) and location of the Grass Valley site (circle marker).

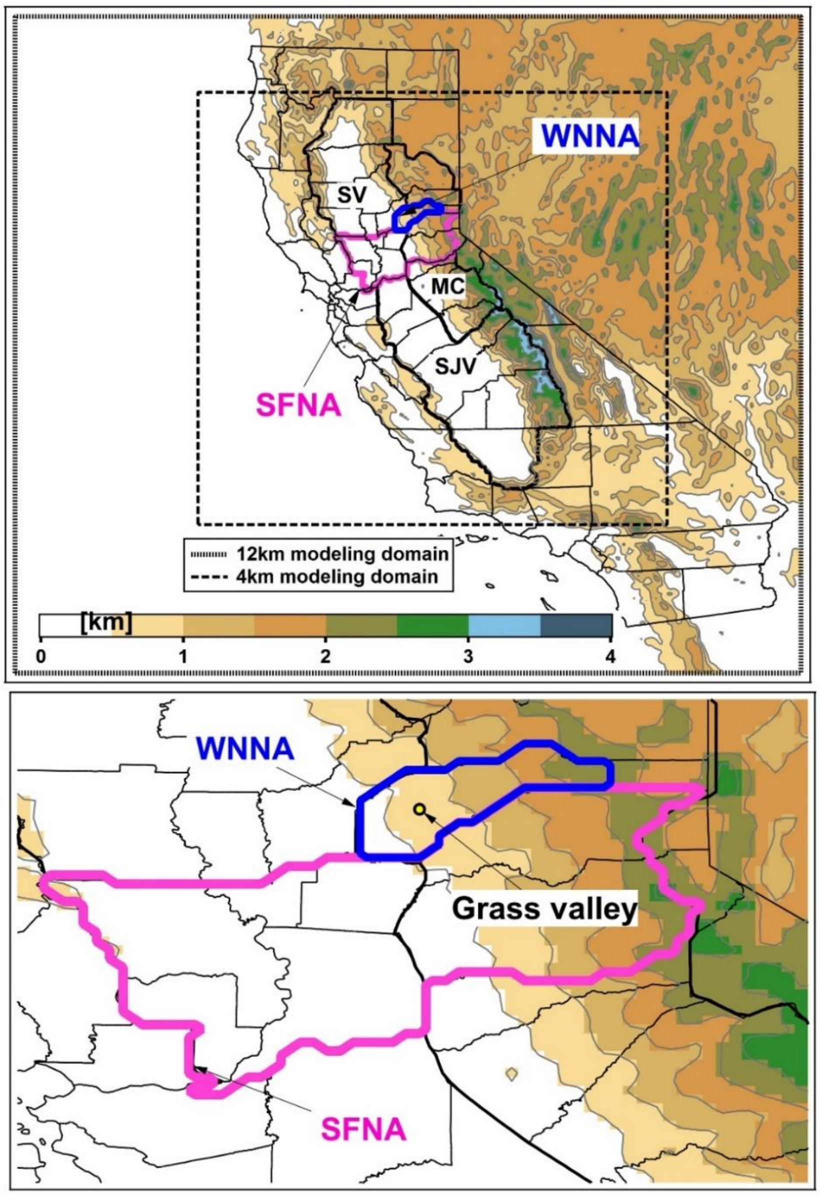
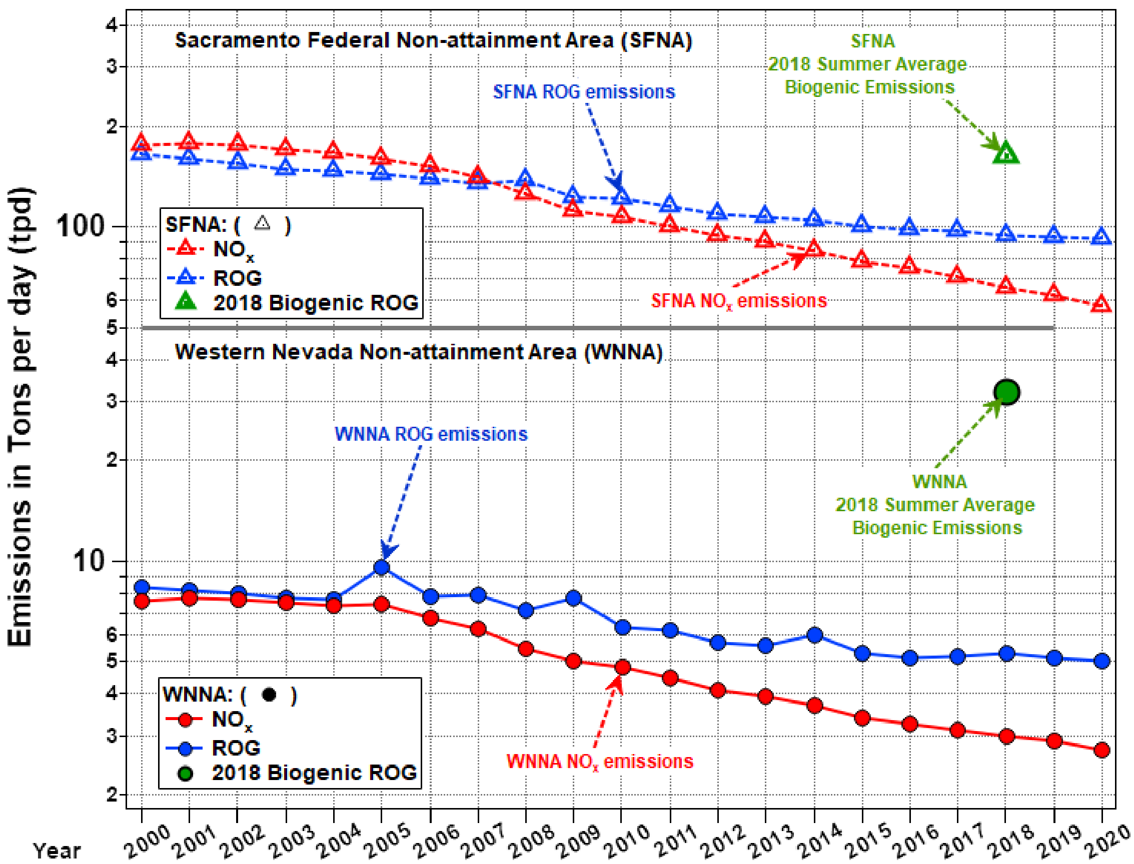
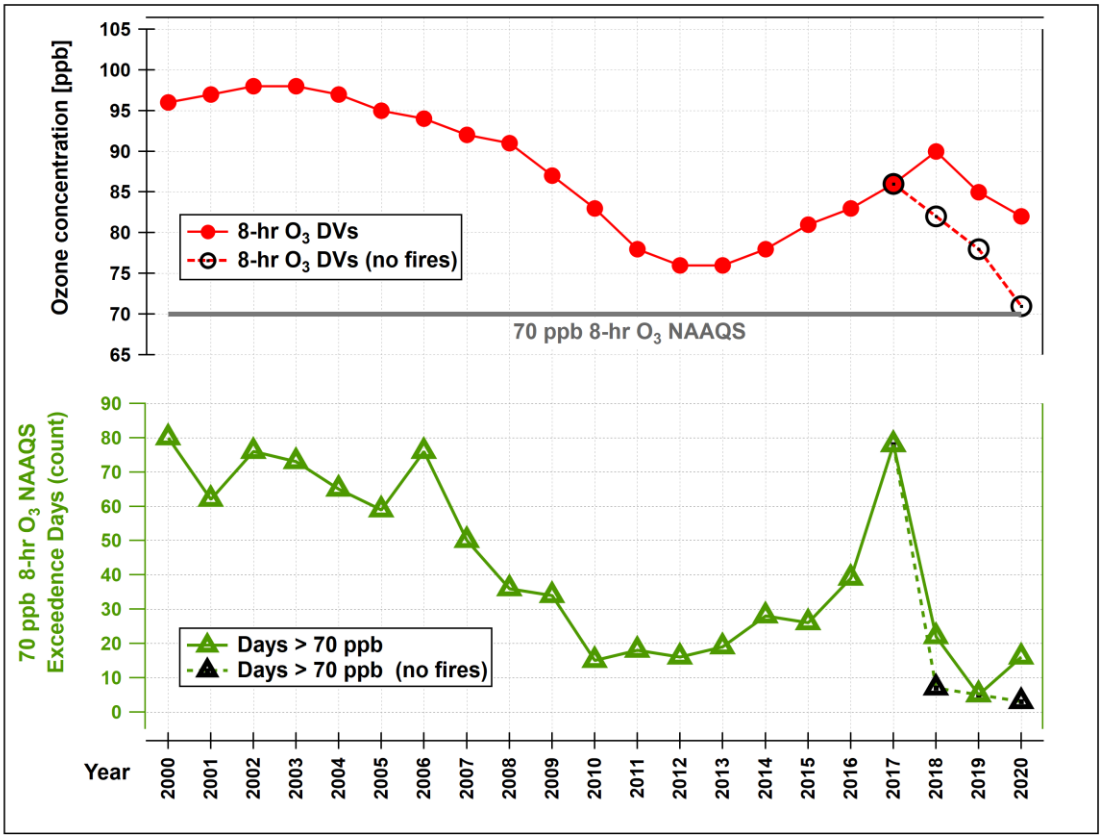


Figure 2. Trends in summer emissions of NOx and ROG (tons per day) between 2000 and 2020 in the SFNA and the WNNA. Anthropogenic Emissions estimates are from the California Emission Projection Model (CEPAM) 2019 Ozone SIP Baseline Projection Version 1.04 with 2017 base year. 2018 biogenic ROG emissions are from MEGAN 3.0 biogenic model calculations. Note that emissions are represented on a log scale, which can mask small changes in the emissions.



The trend in the WNNA's ozone design values (DV) for the past two decades (2000 – 2020) is shown in the top panel of **Figure 3**. The DVs exhibited a steady decline from 96 ppb in 2000 to 76 ppb in 2013. However, in recent years, DVs have shown an upward trend with DVs increasing from 76 ppb in 2013 to 86 ppb in 2017. The DVs starting from 2018 onwards suggest that the increasing trend is leveling off. Overall, the 8-hour ozone DVs in the WNNA have declined by 14 ppb (~17% reduction) from 96 ppb in 2000 to 82 ppb in 2020 (**Figure 3**). The trend in the number of exceedance days (i.e., exceeding the 70 ppb 8-hour ozone standard), which is a measure of overall air quality and the frequency of ozone exposure, is shown in the bottom panel of **Figure 3**. The number of exceedance days has reduced from 80 in 2000 to 16 in 2012, then increased from 19 in 2013 to 78 in 2017 before declining beginning in 2018.

Figure 3. WNNA trends in Maximum Daily Average 8-hour Ozone Design Value (ppb) and 70 ppb 8-hour Ozone NAAQS exceedance days between 2000 and 2020.



A few factors may have caused the higher ozone DVs in recent years. A CARB staff report (CARB, 2018) found that the high ozone concentrations and the high number of ozone exceedance days at Grass Valley site in 2017 are not shared by surrounding monitors and cannot be explained by emissions (e.g., local, biogenic or fire), upwind transport or meteorological conditions. This analysis suggests a potential positive bias in monitoring at the Grass Valley site in 2017. In 2018 and 2020, the prevalence of forest fires during the summer ozone season heavily impacted air quality in the WNNA and high ozone concentrations were observed at the Grass Valley site during fire impacted days (see Weight of Evidence section of the SIP document). To remove the impact of forest fires, ozone DVs were calculated by excluding days in 2018 and 2020 that were impacted by forest fires. Details about fire impact days can be found in the Weight of Evidence analysis. In the absence of fire impacted days, ozone DVs would be 82 ppb in 2018 and 71 ppb in 2020 (black circle markers in **Figure 3**). The number of exceedance days dropped to 7 (from 22) for 2018 and 3 (from 16) for 2020 when the fire impacted days were excluded (denoted by black triangle markers in bottom panel of **Figure 3**).

The WNNA is classified as serious for the 2015 70 ppb O_3 standard with an attainment year of 2026. This document serves as the modeling protocol and attainment demonstration for the 2015 standard for the WNNA. The modeling analysis uses 2018 as the base year for the attainment demonstration.

Methodology

U.S. EPA modeling guidance (U.S. EPA, 2018) outlines the approach for utilizing regional chemical transport models (CTMs) to predict future attainment of the 2015 (70 ppb) 8-hour ozone standards. The model attainment demonstration requires that CTMs be used in a relative sense, where the relative change in ozone to a given set of emission reductions (i.e., predicted change in future anthropogenic emissions) is modeled, and this relative change is used to predict how current/present-day ozone levels would change under future emissions scenarios.

The starting point for the attainment demonstration is the observational based design value (DV), which is used to determine the 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 1**). The U.S. EPA recommends using an average of three DVs to better account for the year-to-year variability in ozone levels due to meteorology. This average DV is called a 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 base 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 were averaged. 2020 is an atypical year with large societal changes in response to the COVID19 pandemic. 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 year 2020 was replaced by the two-year average of the 4th highest 8-hour O_3 concentrations from 2018 and 2019. **Table 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 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 DV_R).

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

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

Error! Reference source not found. (SHOUD BE TABLE 3)lists the DVs for 2018, 2019, and 2 020 as well as the weighted baseline DV for the Grass Valley monitoring site in the WNNA with and without fire impact.

Table 2. Year-specific 8-hour ozone design values for 2018, 2019 and 2020, and the average baseline design value (represented as the average of three design values) for 2018 at the Grass Valley site located in the WNNA. The 2020 DV is the two-year average of the 4th highest 8-hour O3 concentrations from 2018 and 2019.

Days in DV Calculation	2018 DV (ppb)	2019 DV (ppb)	2020 DV (ppb)	2018-2020 Average DV (ppb)
All	90	85	83	86.0
Fire Days Excluded	82	78	72	77.3

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

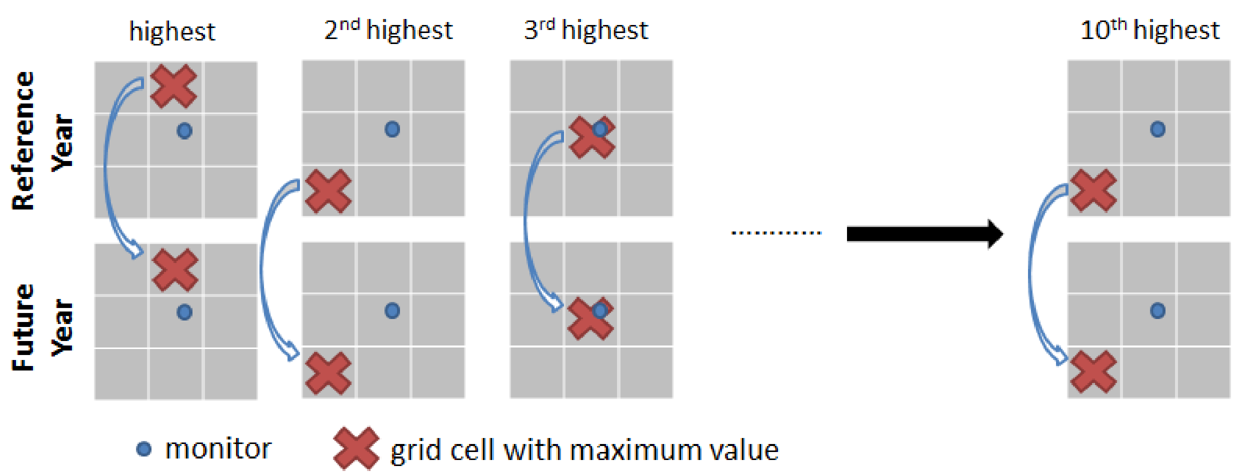
1. ***Base Year Simulation***
   The base year simulation for 2018 is used to assess model performance (i.e., to ensure that the model is reasonably able to reproduce the observed ozone mixing ratios). Since this simulation will be used to assess model performance, it is essential to include as much 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 observed local meteorological conditions, known wildfire and agricultural burning events.
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 (2026) was identical to the reference year simulation, except that the projected future year anthropogenic emission levels were used rather than the reference year emission levels. All other model inputs (e.g., meteorology, chemical boundary conditions, biogenic emissions, and calendar for day-of-week specifications in the inventory) are the same as those used in the reference year simulation.

Projecting the reference DVs to the future is done by first calculating the fractional change in ozone between the modeled future and reference years for each monitor location. These ratios, called “relative response factors” or RRFs, are calculated based on the ratio of modeled future year ozone to the corresponding modeled reference year ozone
(Equation 2).

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

Where, 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 4). 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 U.S. EPA modeling guidance (U.S. EPA, 2018) recommends using the 10 days with the highest modeled MDA8 ozone at each monitor location, where the 10 days are chosen from the reference year simulation and then the same corresponding days are selected from the future year simulation. Since the relative sensitivity to emissions changes (in both the model and real world) can vary from day-to-day due to meteorology and emissions (e.g., temperature dependent emissions or day-of-week variability) using the top 10 days ensures that the calculated RRF is not overly sensitive to any single day. Note that the MDA8 ozone from the reference and future year simulations are paired in both time (the same days are selected from each simulation) and space (the location of the peak MDA8 ozone within the 3x3 array of grid cells surrounding the monitor is selected from the reference year simulation and the same location is used when selecting the corresponding data from the future year simulation).

Figure 4. Example showing how the location of the MDA8 ozone for the top ten days in the reference and future years are chosen.



When choosing the top 10 days, the U.S. EPA recommends beginning with all days in which the simulated reference year MDA8 ozone is >= 60 ppb and then calculating RRFs based on the 10 days with the highest ozone in the reference simulation. If there are fewer than 10 days with MDA8 ozone >= 60 ppb then all days >= 60 ppb are used in the RRF calculation, as long as there are at least 5 days used in the calculation. If there are fewer than 5 days >= 60 ppb, an RRF cannot be calculated for that monitor. To ensure that only modeled days that 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.

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

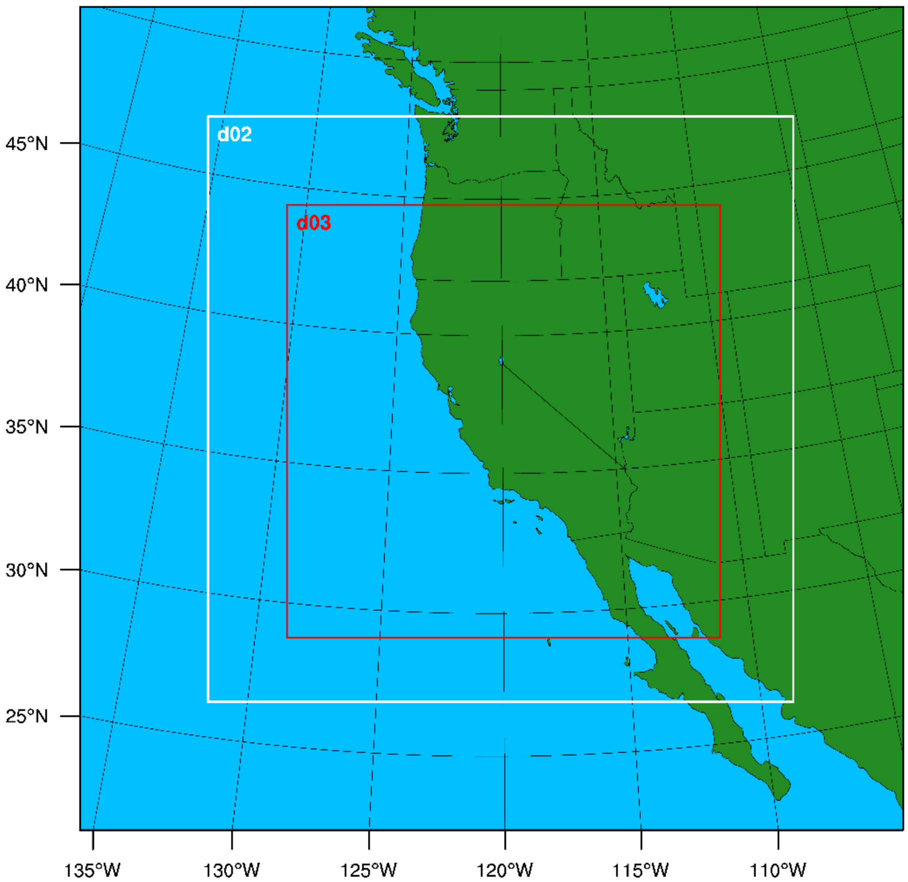
where, DV_F is the future year design value, DV_R is the reference year design value, and RRF is the site-specific RRF from Equation 2. The resulting future year DVs are then compared to the 8-hour ozone NAAQS to demonstrate whether attainment will be reached under the emissions scenario utilized in 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.

Meteorological Modeling

California's proximity to the ocean, complex terrain, and diverse climate represents a unique challenge for developing 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 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 and Schroeder 1966).

The state-of-the-science Weather Research and Forecasting (WRF) prognostic model (Skamarock et al., 2008) 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 5.**

Figure 5. WRF modeling domains (D01 36 km; D02 12 km; and D03 4 km).



The 4 km innermost domain has 427x427 grid points and spans 1748 km in the east-west and the north-south directions. There are 30 vertical layers with the lowest layer extending to 30 m above the surface (

Table **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 planetary boundary layer (PBL) scheme, cumulus parameterization for the outer two domains were the Yon-Sei University (YSU) PBL and Kain-Fritsch scheme, respectively. 5-layer thermal diffusion scheme was chosen as the land-surface option.

Table 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
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 major physics options for each domain are listed in **Table 4**. The Meteorology-Chemistry Interface Processor (MCIP) version 5.1 was used to process the 4 km (D03) WRF output for use in the CTM simulations.

Table 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

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.

The transport of pollutants from the Sacramento Federal Non-attainment Area (SFNA) can significantly contribute to the exceedances of the federal ozone NAAQS in the WNNA.

Therefore, it is useful to not only summarize the change in emissions from 2018 to 2026 in the WNNA, but also in the Sacramento Valley since emissions from this area are readily transported into the WNNA (**Table 5**).

Table 5. WNNA and SFNA Summer Planning Emissions for 2018 and 2026 (tons/day).

Source Category	2018 NOx [tpd]	2026 NOx [tpd]	NOx diff	2018 ROG [tpd]	2026 ROG [tpd]	ROG diff
Western Nevada Non-attainment Area (WNNA)						
Stationary	0.11	0.10	-5.7%	0.76	0.77	0.7%
Area	0.14	0.15	0.7%	1.68	1.70	1.6%
On-Road Mobile	1.85	0.74	-60.0%	0.80	0.52	-35.3%
Other Mobile	0.91	0.74	-18.8%	2.05	1.55	-24.3%
Total	3.01	1.72	-42.7%	5.29	4.54	-14.2%
Sacramento Federal Non-attainment Area (SFNA)						
Stationary	6.61	6.18	-6.5%	22.69	23.00	1.4%
Area	2.26	2.14	-5.2%	27.28	29.94	9.7%
On-Road Mobile	32.89	13.89	-57.8%	17.89	11.48	-35.8%
Other Mobile	23.86	18.19	-23.8%	26.28	19.81	-24.6%
Total	65.62	40.40	-38.4%	94.14	84.24	-10.5%

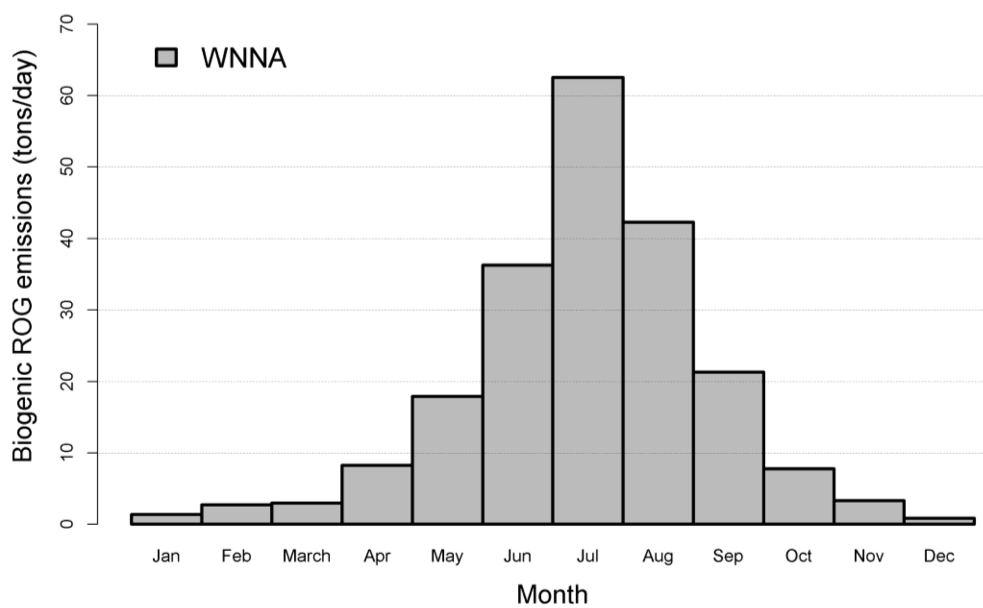
*Note that rounding errors may result in emissions totals that do not exactly match the sum of the individual categories.

Overall, anthropogenic NO_x emissions in CEPAM v1.04 were projected to decrease by ~43% between 2018 and 2026 (from 3 tpd to 1.7 tpd) in the WNNA with bulk of the reductions coming from on-road mobile sources. In contrast, anthropogenic ROG was projected to decrease ~15% by 2026 (from 5.3 tpd to 4.5 tpd) with the bulk of those reductions coming from all mobile sources including on-road and other mobile sources. In the upwind SFNA, the magnitude of the anthropogenic NO_x and ROG emissions is roughly 20 times that of the emissions in WNNA, while the relative change from 2018 to 2026 is comparable to the relative change in the WNNA.

Biogenic emissions were generated using the Model of Emissions of Gases and Aerosols from Nature model version 3.0 (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, and all stress factor adjustments were turned off.

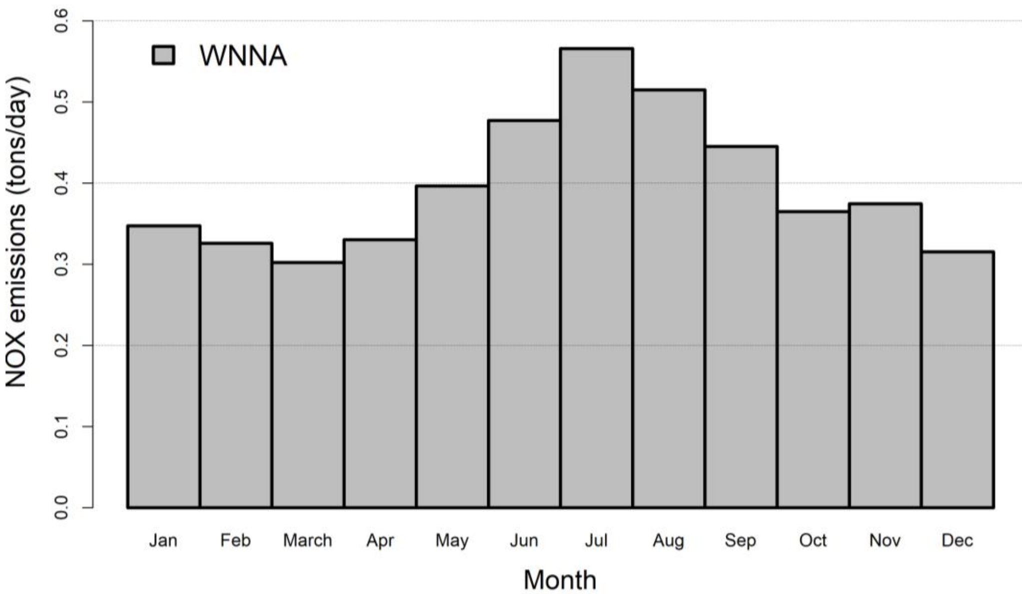
Monthly biogenic ROG totals for 2018 within the WNNA are shown in Figure 6. Throughout the summer, biogenic ROG emissions ranged from ~19 tpd in May to 62 and 42 tpd in July and August, with the difference in emissions primarily due to differences in temperature, solar radiation, and leaf area from month-to-month.

Figure 6. Monthly average biogenic ROG emissions for 2018 in the WNNA.



In addition to biogenic ROG emissions, the MEGAN model also estimates NOx 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 7** shows the monthly average soil NOx emissions for 2018 from MEGAN. Soil NOx emissions are highest during summer months where the emissions peak at 0.57 tpd in July.

Figure 7. Monthly average soil NOx emissions for 2018 in the WNNA.



Air Quality Modeling

Figure 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 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 Central valley region including the San Joaquin Valley (SJV), Sacramento Valley (SV), Mountain Counties (MC) air basins, SFNA and the WNNA, 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 **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 (U.S. EPA, 2018). CMAQ is the U.S. 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 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 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 et al., 2020; Lamarque et al., 2012) was developed by 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 vertical and horizontal setups of CMAQ meteorological inputs, and processed into CMAQ model ready format as well as mapped to CMAQ chemical species. The CAM-chem data for 2018 was obtained from the NCAR (https://www.acom.ucar.edu/cam-chem/cam-chem.shtml, Buchholz et al. 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 corresponding12 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 for the beginning day 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 starting 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.

C. Results

Meteorological Model Evaluation

Simulated surface wind speed, temperature, and relative humidity from the 4 km domain were validated against hourly observations from 15 surface stations in the region surrounding and upwind of the WNNA (**Figure 8**). Observational data for the surface stations were obtained from the CARB's Air Quality and Meteorological Information System (AQMIS) database available at http://www.arb.ca.gov/aqmis2/aqmis2.php. Table 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). Figure 8 shows the location of each of these sites, where the solid red circle markers denote the monitoring sites while the black lines denote the regional boundary of the WNNA. 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) and defined therein. The model performance statistical metrics were calculated using the available data at all the sites. A summary of these statistics for the area is shown in **Table 8**.

Table 7. Meteorological site location and parameter measured.

Site Number (Figure 3)	Site ID	Site Name	Parameter(s) Measured
1	3452	Pike County Lookout	Wind, T, RH
2	5744	Browns Valley	Wind, T, RH
3	2958	Yuba City-Almond Street	Wind, T, RH
4	3196	Cool-Highway 193	Wind, T, RH
5	5832	Auburn #3	Wind, T, RH
6	3290	Lincoln (RAWS)	Wind, T, RH
7	3291	Pilot Hill Station	Wind, T, RH
8	2956	Roseville-N Sunrise Blvd	Wind, T, RH
9	3187	Folsom-Natoma Street	Wind, T, RH
10	5776	Fair Oaks #2	Wind, T, RH
11	2731	Sacramento-Del Paso Manor	Wind, T, RH
12	5799	Bryte	Wind, T, RH
13	3011	Sacramento-T Street	Wind, T, RH
14	2143	Davis-UCD Campus	Wind, T, RH
15	3209	Sloughhouse	Wind

Figure 8. Meteorological monitoring sites utilized in the model evaluation: The solid red circle markers represent the monitoring sites while the thick black line denotes the spatial extent and regional boundary of the Western Nevada county 8-hour ozone Non-attainment Area (WNNA). Numbers reflect the sites listed in **Table 7**.

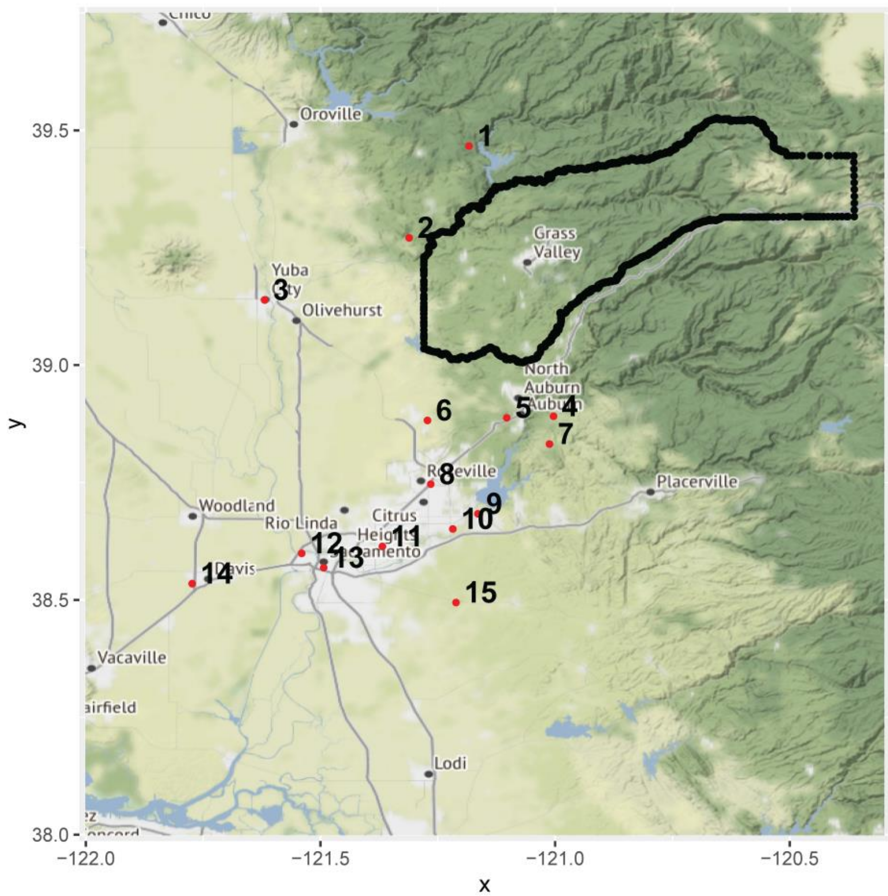


Table 8. Hourly surface wind speed, temperature and relative humidity statistics by region for Apr through October 2018. IOA denotes index of agreement.

Variable	Observed Mean	Modeled Mean	Mean Bias	Mean Error	IOA
Wind Speed (m/s)	1.73	2.38	0.68	0.72	0.73
Temperature (K)	293.99	292.82	-1.17	1.69	0.97
Relative Humidity (%)	52.02	64.37	12.35	13.75	0.83

The average hourly wind speed bias for April-October 2018 is relatively small at 0.68 m/s, while the average mean error is 0.72 m/s. The index of agreement for the wind speed in this period is 0.73. Temperature is biased low with an average bias of -1.17 K, while the IOA for temperature is 0.97. Consistent with the negative temperature bias, relative humidity has a positive bias of 12.35%. The distribution of daily mean bias and mean error are shown in Figure 9 while observed vs. modeled scatter plots of hourly wind speed, temperature, and relative humidity are shown in **Figure 10**.

These results are comparable to other recent WRF modeling efforts in California investigating ozone formation in Central California (Hu et al., 2012) and modeling analyses for the CalNex and CARES field studies (Fast et al., 2012; Baker et al., 2013; Kelly et al., 2013; Angevine et al., 2012). Detailed hourly time-series of surface temperature, wind speed, and wind direction for the area along with spatial distribution of the mean bias and mean error can be found in the supplemental materials.

Figure 9. Distribution of daily mean bias (left) and mean error (right) from April – October 2018. Results are shown for wind speed (top), temperature (middle), and RH (bottom).

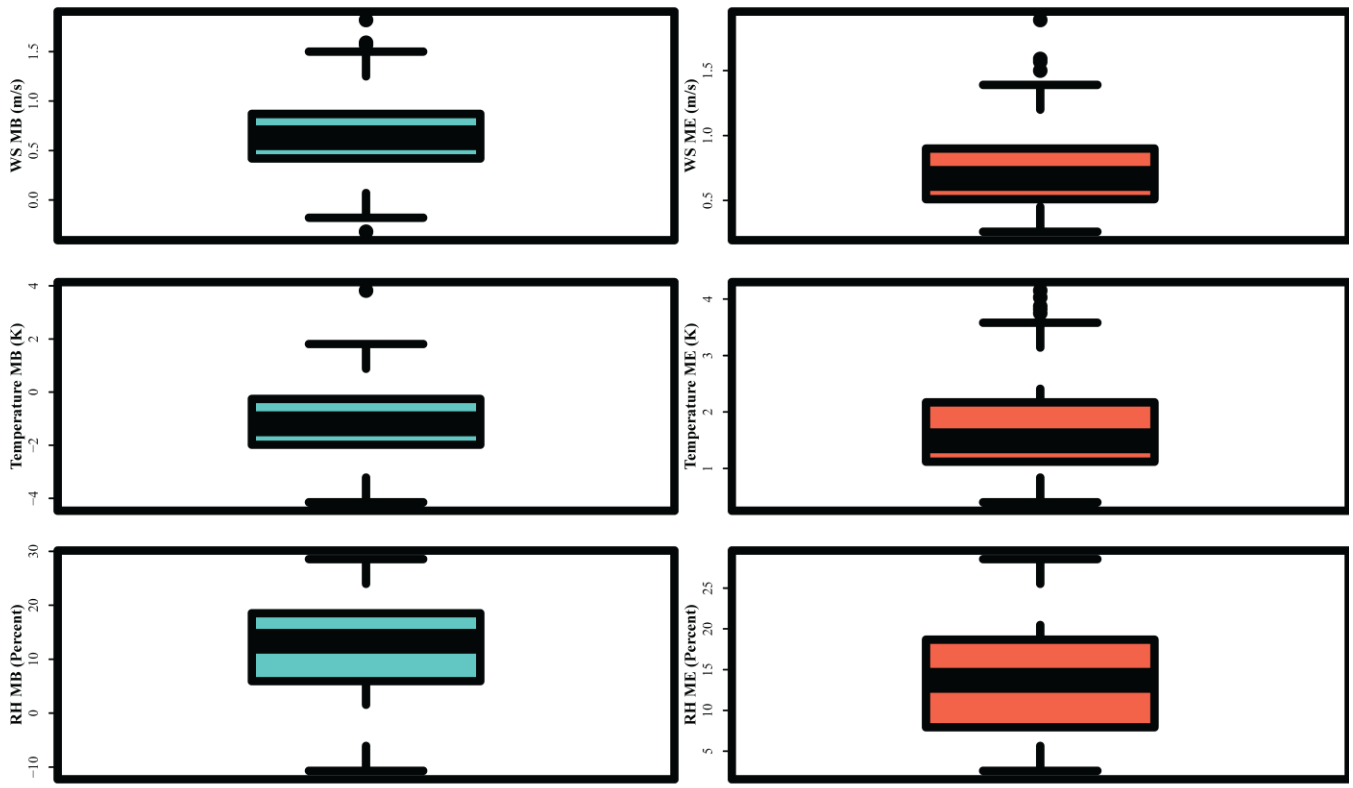
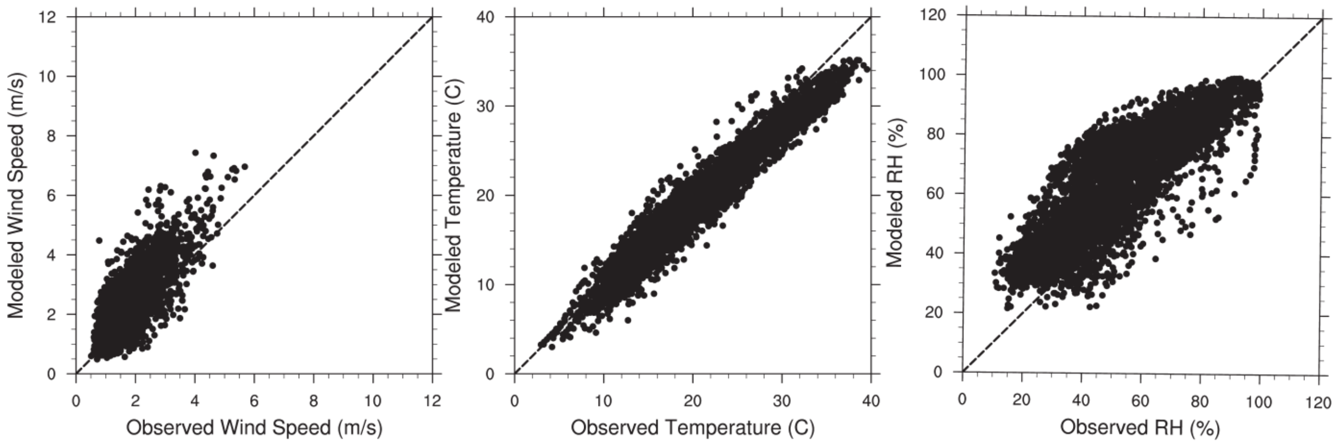


Figure 10. Comparison of modeled and observed hourly wind speed (left), 2-meter temperature (center), and relative humidity (right), April – October 2018.



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 WNNA in more detail.

Past observations and analyses have shown that the WNNA is subject to pollution transport from the south to south west including from the Sacramento metropolitan area (Van Ooy and Carroll 1995; CARB, 2018). Its meteorology is also expected to be influenced by upslope and downslope winds associated with the surrounding terrain. Figure 11 shows the 24-hour back trajectories from every hour on July 19, 2018 at the Grass Valley-Litton Building ozone monitoring site. The highest 8-hour ozone concentration without fire impact at the site in 2018 occurred on this day with a maximum daily average 8-hour ozone mixing ratio of 77 ppb observed at the Grass Valley ozone monitoring site. The trajectories were calculated with the National Oceanic and Atmospheric Administration (NOAA) Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model (Stein et al., 2015) driven by WRF meteorology. These back trajectories are typical of a high ozone day at the Grass Valley monitor and demonstrate that the transport pathways are generally from the southwest. Some of the trajectories have a circular pattern around the Grass Valley site indicating downslope and upslope flow impacts which illustrates that the model is able to reproduce these complex transport pathways to and within the WNNA. The upper-level weather charts show that a 500 mb high pressure system was observed over California and most of the Southwest US on that day. **Figure 12**

Figure 11. Grass Valley 24-hour back trajectories from every hour on July 19, 2018 at 3 m above ground level. The Grass Valley-Litton Building ozone monitoring site is marked with a red star.

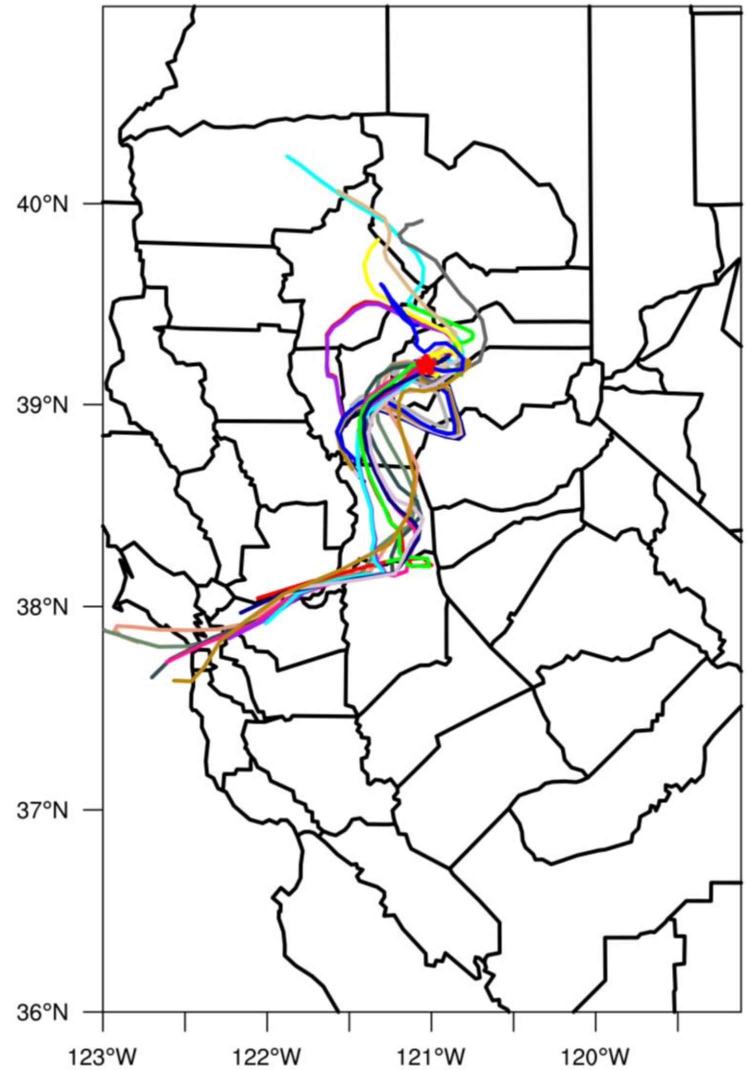
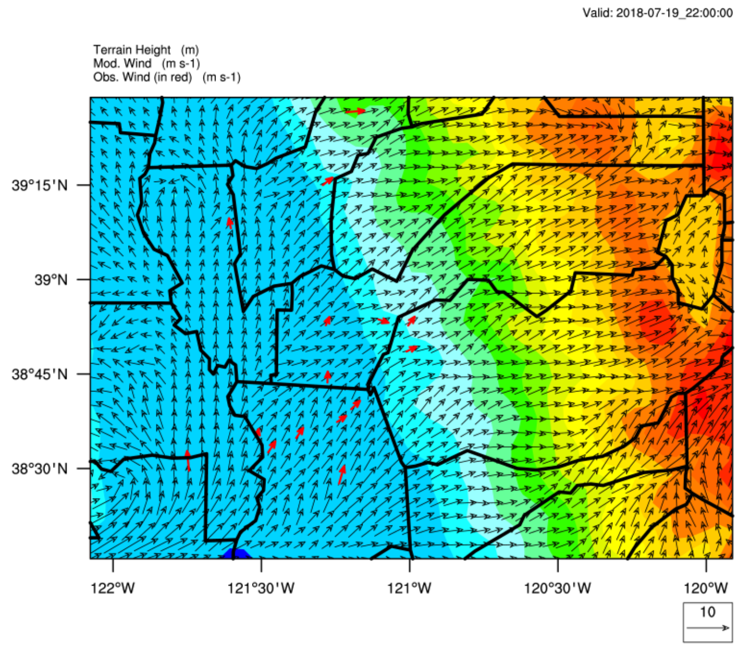
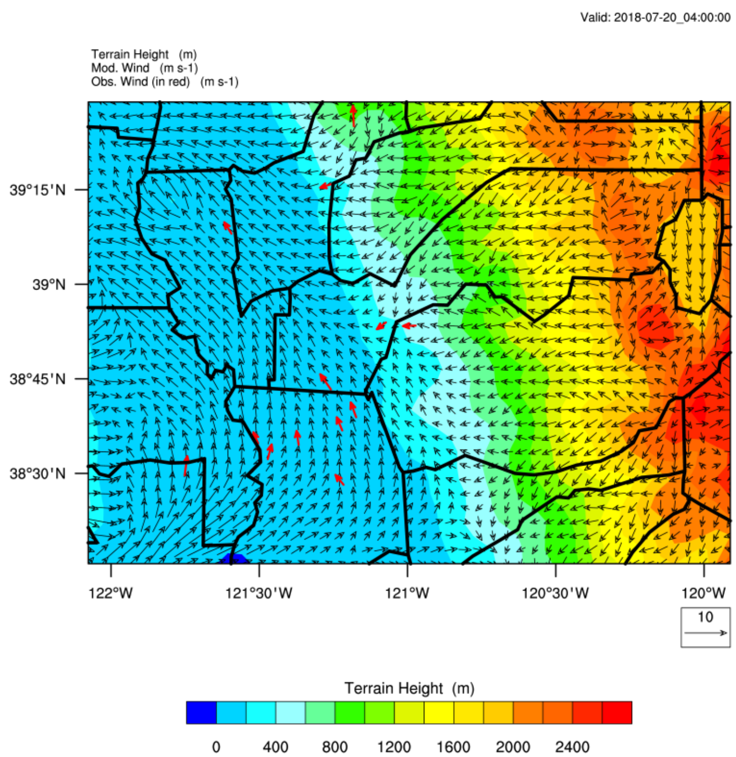


Figure 12 shows the surface wind fields in the early afternoon (14:00 PST) and the evening (20:00 PST) on July 19, 2018 with the observed and modeled values denoted by red and black arrows, respectively. Overall, modeled winds compare relatively well with the observed values, with winds during the early afternoon hours being influenced by upslope flows, while evening winds were impacted by downslope flows over the mountain counties. Winds in the Sacramento Valley show an influence from both the Coastal Ranges to the west and the Sierra Nevada Range to the east. At 20:00 PST, the wind field had an eddy like pattern over the Yolo and Solano areas, indicating the occurrence of the Schultz eddy along the west side of the valley.

Figure 12. Surface wind field at 14:00 PST (top) and 20:00 PST (bottom) on July 19, 2018. Modeled wind field is shown with black wind vectors, while observations are shown in red.



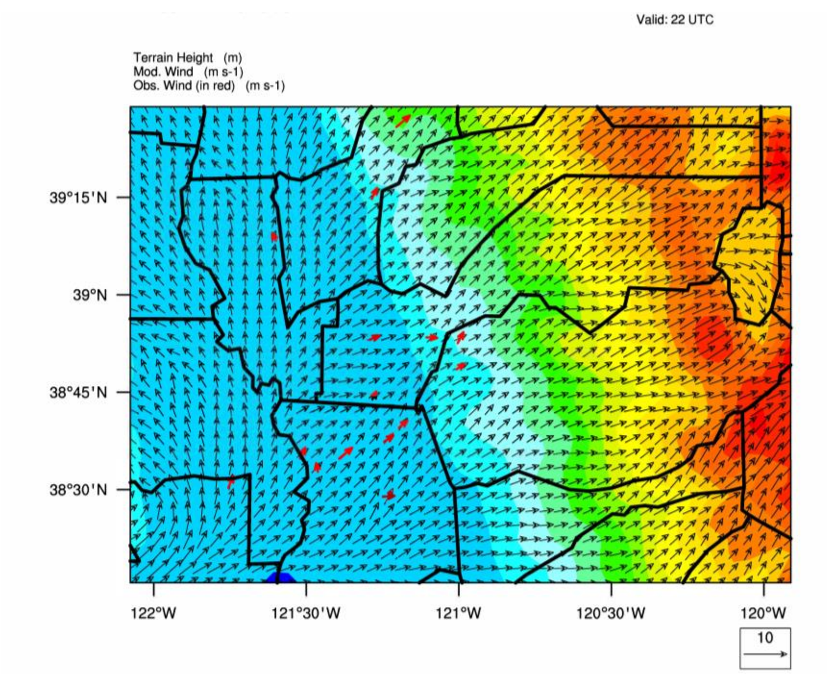


Since RRF calculations in the model attainment test described previously are based on the top 10 peak ozone days, the modeled and measured winds in the region were examined in further detail for the top 10 ozone days observed at the Grass Valley site in 2018. The ten highest maximum daily average 8-hour ozone mixing ratios observed at the Grass Valley-Litton Building site in 2018 occurred on July 19, September 21, September 20, June 26, September 28, August 19, September 4, August 6, August 15 and August 20, respectively. **Figure 13** shows the mean wind field (vector average) for the top 10 ozone days at 14:00 PST and 21:00 PST, respectively. Overall, the surface wind distribution indicates that the model is in general agreement with the observations and is able to capture many of the important features of the observed meteorological fields on those days when elevated ozone levels occurred.

Figure 14 shows the 500 hPa geopotential height at 00:00 UTC and 12:00 UTC for the top 10 ozone days in 2018 at the Grass Valley site. These times were chosen to coincide with timing of the upper-air observations in the region. 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 (including upper-air observations) 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 it is one of the major parameters related to regional synoptic patterns. It can be seen from Figure 14 that on average the 500 hPa geopotential height is ~5800 m above sea level on these peak ozone days, 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 8**), provides added confidence in the meteorological fields utilized for this attainment demonstration modeling.

Figure 13. Average wind field at 14:00 PST (top) and 21:00 PST (bottom) for the top 10 observed ozone days at Grass Valley-Litton Building monitor in 2018. Modeled wind field is shown with black wind vectors, while observations are shown in red.



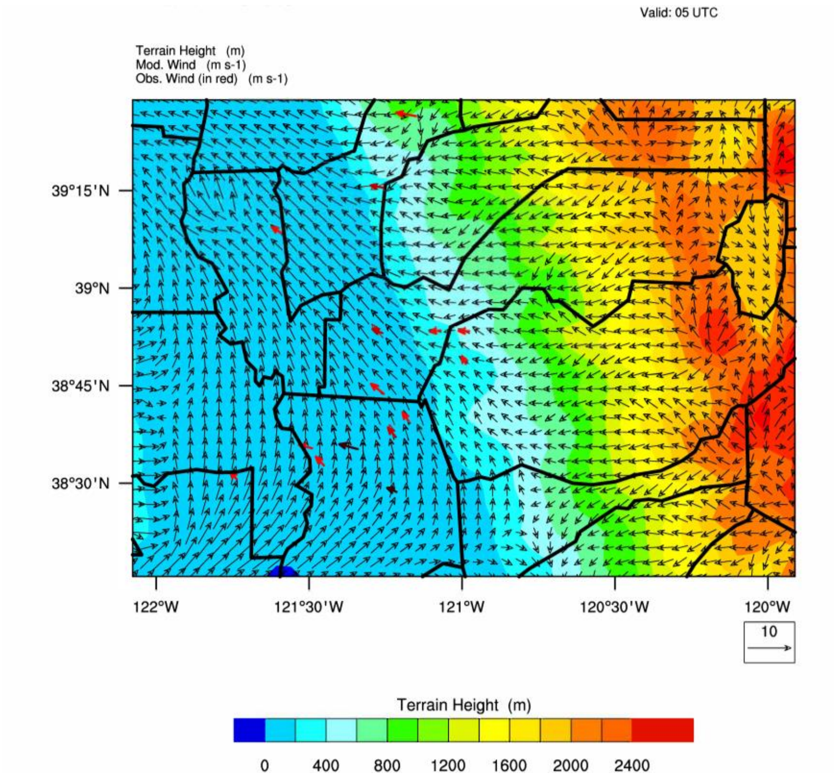
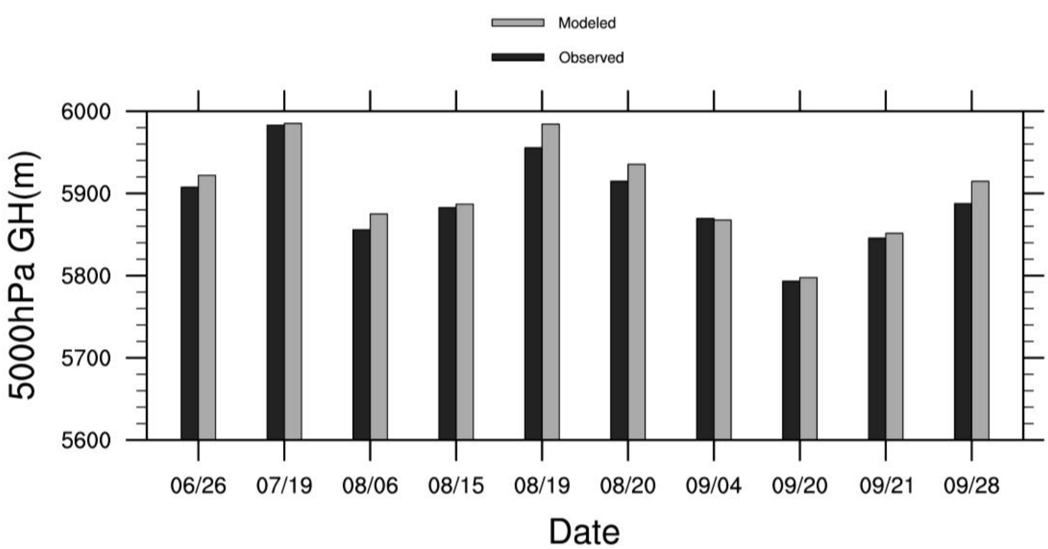
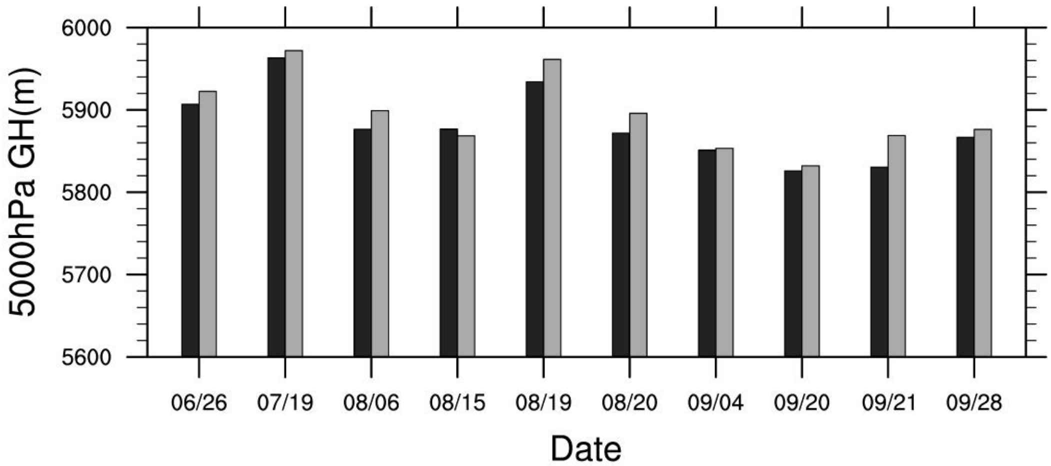


Figure 14. Modeled and observed at 00:00 UTC (top) and 12:00 UTC (bottom) 500 hPa geopotential height for the top 10 observed ozone days at the Grass Valley monitor in 2018.





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 ozone at the Grass Valley-Litton Building site. The U.S. EPA modeling guidance (U.S. 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 been used in different model evaluation studies (Emery et al., 2017), U.S. 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. Since fire days were excluded for baseline design value calculation (**Error! Reference source not found.**), (Table 2) model performance for days without wildfires w as also evaluated.

As recommended by U.S. EPA modeling guidance (U.S. EPA 2018), 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 Grass Valley-Litton Building site in the WNNA. Performance statistics for modeling scenarios with all valid data, only data above 60 ppb, and data excluded from fire days are reported separately for different ozone metrics including maximum daily average 8-hour ozone, maximum daily average 1-hour ozone, and hourly ozone (all hours of the day) for the monitored grid cell as well as the 3x3 maximum.

Model performance with data excluded from fire days is also evaluated for the Grass Valley-Litton Building site in the WNNA. Performance statistics for maximum daily average 8-hour ozone are shown in Table 9 and **Error! Reference source not found.**. Overall, when simulated data extracted at the grid cell are used for comparison with observations (as shown in **Table 9**), the model shows a bias of 2.82 ppb of maximum daily average 8-hour ozone in the WNNA. However, when only observed data greater than 60 ppb are used, the model shows a negative bias of -6.18 ppb. Similarly, when the 3x3 maximum data is used for comparison, there is a positive bias in the model with all the valid data (3.59 ppb) and a negative bias with only observed data over 60 ppb (-5.14 ppb). This result indicates the model has a slight under-prediction of maximum daily average 8-hour ozone at high values in the WNNA. Model performance shows significant improvement when data from fires days are excluded from the evaluation. The mean bias of model predictions for maximum daily average 8-hour ozone with 60 ppb cutoff are -1.31 ppb and -0.35 ppb for data extracted at the monitor grid cell and 3x3 maximum grid cells surrounding the monitor, respectively. Similar statistics for maximum daily average 1-hour ozone and hourly ozone can be found in **Table 11** to **Table 13**.

Model performance statistics within the range of values shown in **Table 9** to **Table 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 SAPRC07 chemical mechanism and found that a model bias of -10.8 ppb for maximum daily average 8-hour ozone with 60 ppb cutoff (compared to -6.18 ppb for all data and -1.31 ppb for data excluding fire days for WNNA in Table 9 of this work). Hu et al. (2012) also shows a model bias of -12.7 ppb for maximum daily average 1-hour ozone in Central California with 60 ppb cutoff (compared to -4.43 ppb for all data and -0.80 ppb for data excluding fire days in this work).

Table 9. Maximum daily average 8-hour ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated maximum daily average 8-hour ozone data were extracted at grid cell where the monitor is located.

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	210	195	62	47
Mean obs (ppb)	54.87	52.51	70.61	65.85
Mean Bias (ppb)	2.82	4.69	-6.18	-1.31
Mean Error (ppb)	8.86	7.90	9.41	5.57
RMSE (ppb)	11.51	9.84	13.38	6.78
Mean Fractional Bias (%)	6.50	9.19	-8.62	-2.28

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Mean Fractional Error (%)	15.95	14.99	13.44	8.64
Normalized Mean Bias (%)	5.14	8.92	-8.75	-1.99
Normalized Mean Error (%)	16.16	15.04	13.32	8.45
R-squared	0.29	0.33	0.02	0.19

Table 10. Maximum daily average 8-hour ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated maximum daily average 8-hour ozone data were extracted from the 3x3 grid cell array maximum centered at the monitor.

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	210	195	62	47
Mean obs (ppb)	54.87	52.51	70.61	65.85
Mean Bias (ppb)	3.59	5.42	-5.14	-0.35
Mean Error (ppb)	9.03	8.17	9.26	5.77
RMSE (ppb)	11.62	10.15	13.04	6.97
Mean Fractional Bias (%)	7.81	10.46	-7.07	-0.84
Mean Fractional Error (%)	16.19	15.39	13.14	8.84
Normalized Mean Bias (%)	6.54	10.31	-7.28	-0.52
Normalized Mean Error (%)	16.45	15.55	13.11	8.77
R-squared	0.30	0.34	0.02	0.17

Table 11. Maximum daily average1-hour ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated maximum daily average 1-hour ozone data were extracted at grid cell where the monitor is located.

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	208	193	89	74
Mean obs (ppb)	59.19	56.68	72.01	68.08
Mean Bias (ppb)	2.20	4.10	-4.43	-0.80
Mean Error (ppb)	9.27	8.25	8.69	5.93
RMSE (ppb)	12.19	10.32	12.86	7.72
Mean Fractional Bias (%)	5.11	7.65	-5.77	-1.36
Mean Fractional Error (%)	15.56	14.63	11.87	8.69
Normalized Mean Bias (%)	3.71	7.24	-6.15	-1.18
Normalized Mean Error (%)	15.66	14.56	12.07	8.71
R-squared	0.31	0.35	0.08	0.24

Table 12. Maximum daily average 1-hour ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated maximum daily average 1-hour ozone data were extracted from the 3x3 grid cell array maximum centered at the monitor.

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	208	193	89	74
Mean obs (ppb)	59.19	56.68	72.01	68.08
Mean Bias (ppb)	3.45	5.27	-2.81	0.65

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Mean Error (ppb)	9.45	8.63	8.45	6.13
RMSE (ppb)	12.22	10.76	12.23	7.88
Mean Fractional Bias (%)	7.10	9.54	-3.44	0.78
Mean Fractional Error (%)	15.80	15.15	11.43	8.84
Normalized Mean Bias (%)	5.83	9.29	-3.91	0.96
Normalized Mean Error (%)	15.96	15.23	11.74	9.00
R-squared	0.34	0.37	0.10	0.23

Table 13. Hourly ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated hourly ozone data were 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	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	5074	4719	923	608
Mean obs (ppb)	49.33	47.35	70.04	65.70
Mean Bias (ppb)	2.07	3.61	-10.60	-5.67
Mean Error (ppb)	9.54	8.81	12.58	8.41
RMSE (ppb)	12.14	10.85	16.60	10.49
Mean Fractional Bias (%)	5.82	8.29	-16.46	-9.80
Mean Fractional Error (%)	19.43	18.74	19.34	13.80
Normalized Mean Bias (%)	4.19	7.61	-15.14	-8.63

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Normalized Mean Error (%)	19.34	18.60	17.96	12.80
R-squared	0.25	0.26	0.01	0.11

Simon et al. (2012) conducted a review of photochemical model performance statistics published between 2006 and 2012 for North America (from 69 peer-reviewed articles). In Figure 15, the statistical evaluation of this model attainment demonstration is compared to the model performance summary presented in Simon et al. (2012) by overlaying various summary statistics onto the Simon et al. (2012) model performance summary. Note that the box-and-whisker plot (colored in black) shown in Figure 15 is reproduced using data from Figure 4 of Simon et al. (2012). The red dot and blue triangle in each of the panels in Figure 15 denote the model performance statistics from the current modeling work, calculated using the simulated monitor grid cell and the 3x3 maximum, respectively. Corresponding model performance statistics when fire days are excluded from calculation are shown as purple dot and brown triangle in each of the panels in Figure 15. As shown in the plot, the model performance improved significantly with fire days excluded from calculation for all statistical metrics.

Figure 15 clearly shows that the model performance statistical metrics for hourly, maximum daily average 8-hour ozone and maximum daily average 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 9** and **Error! Reference source not found.**.

Spatial distributions of modeled and observed average maximum daily average 8-hour ozone for the top 10 O_3 days at the Grass Valley-Litton Building site are displayed in **Figure 16**. The observation data are from the monitoring sites located in Sacramento, WNNA that are within the modeling domain. The model is able to capture the observed spatial gradient of ozone in the modeling domain with good agreement between model and observation at the Grass Valley site. Additional analysis, including time series, scatter plots, and frequency distribution of the hourly, maximum daily average 1-hour ozone and maximum daily average 8-hour ozone data can be found in the supplemental materials. There is no NO_x measurement available at Grass Valley-Litton Building site. The supplemental materials also include time series comparison between modeled and observed data for NO_x at nearby upwind sites in the SFNA: Roseville and Folsom.

Figure 15. Comparison of various statistical metrics from the model attainment demonstration modeling to the range of statistics from the 69 peer-reviewed studies summarized in Simon et al (2012). (MDA denotes Maximum Daily Average). 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. For data excluding fire days, purple circular markers show statistics calculated from modeled ozone at the monitor location, while brown triangular markers show statistics calculated from the maximum ozone in the 3x3 array of grid cells surrounding the monitor. Statistics were calculated with all valid modeled ozone data.

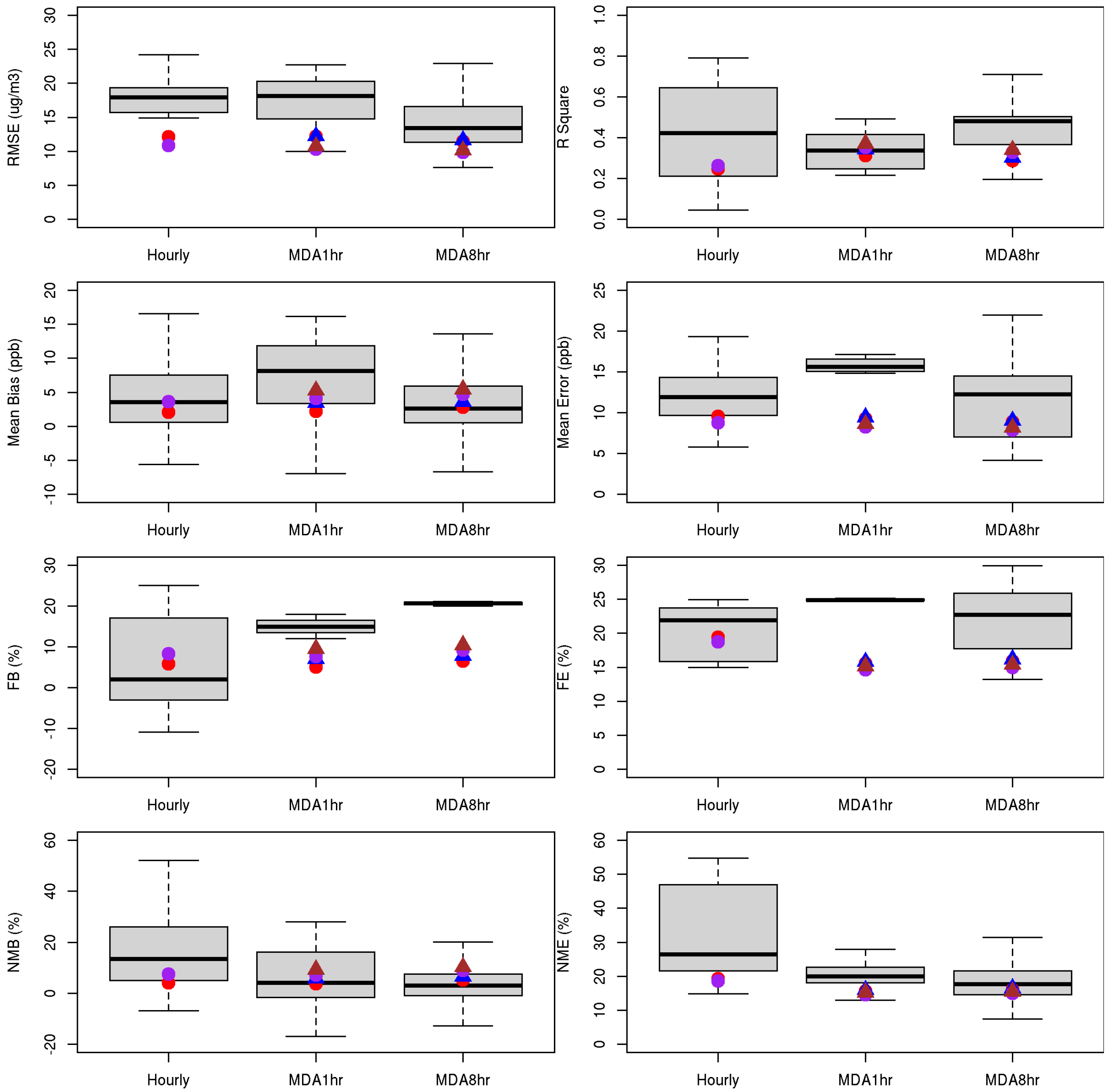
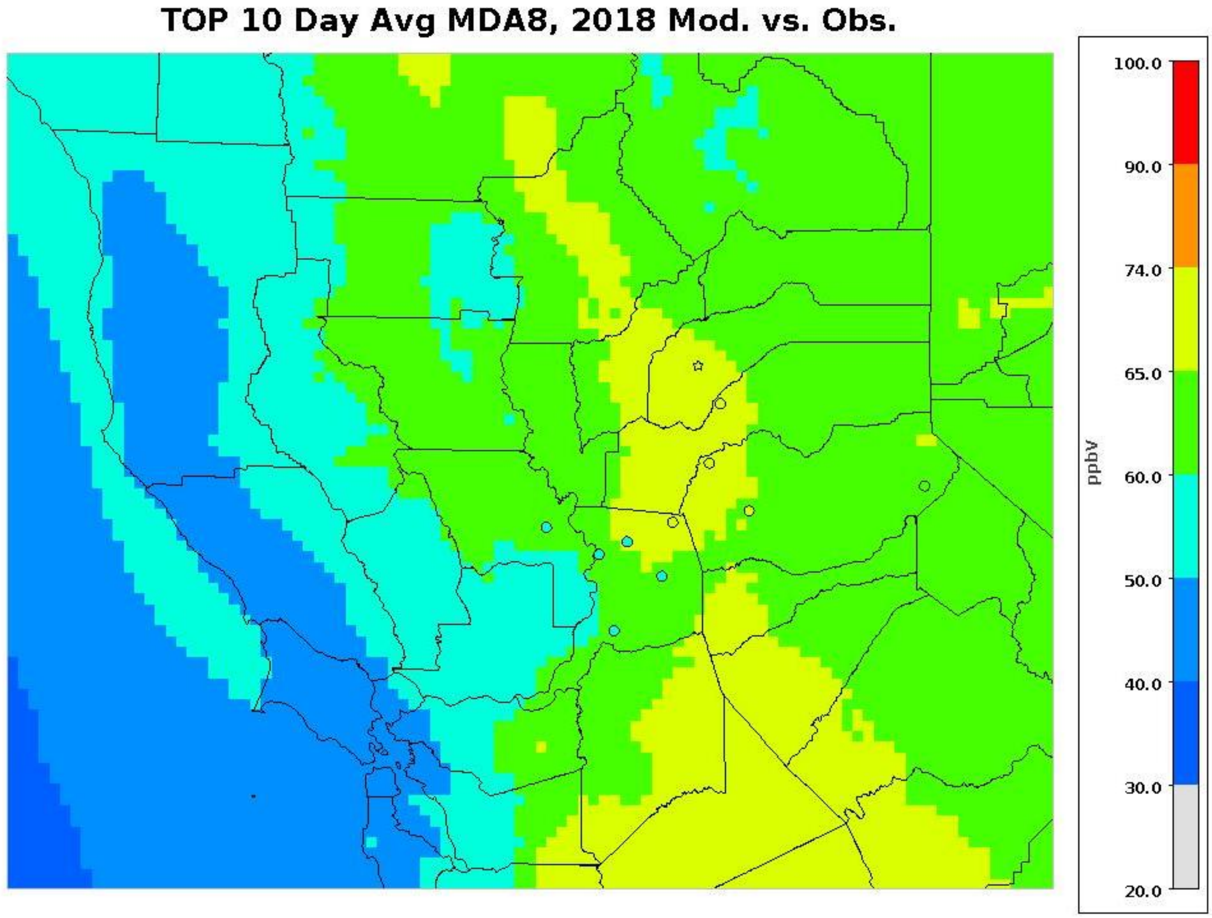


Figure 16. Average MDA8 ozone for the top 10 ozone days in 2018 from the model simulations overlaid with observation data (Sacramento sites marked as circle, Grass Valley marked as star), where the top 10 days from the observations were chosen based on the Grass Valley-Litton Building site.



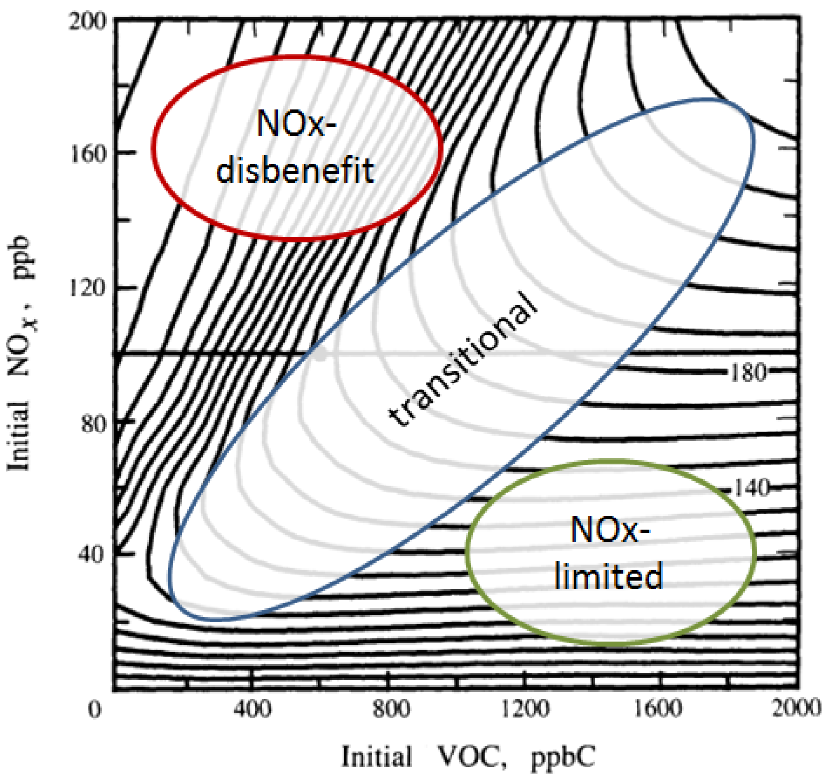
Air Quality Model Diagnostic Evaluation

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 can reproduce observed 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 many major urbanized areas where emissions of NO_x are substantially lower on weekends than on weekdays due to reduced truck activity but measured levels of ozone are higher. This is due to the complex and non-linear relationship between NO_x and ROG precursors and ozone (Sillman 1999).

In general terms, under ambient conditions of high-NO_x and low-ROG (NO_x-disbenefit region in **Figure 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 17.**), ozone formation shows a benefit to reductions in NO_x emissions, while changes in ROG emissions result in only minor decreases in ozone. These two distinct "ozone chemical regimes" are illustrated in **Figure 17.** along with a transitional regime that can exhibit characteristics of both the NO_x-disbenefit and NOx-limited regimes. Note that **Figure 17.** is shown for illustrative purposes only and does not represent the actual ozone sensitivity within the WNNA for a given combination of NO_x and ROG (VOC) emissions.

Figure 17. Illustrates 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).



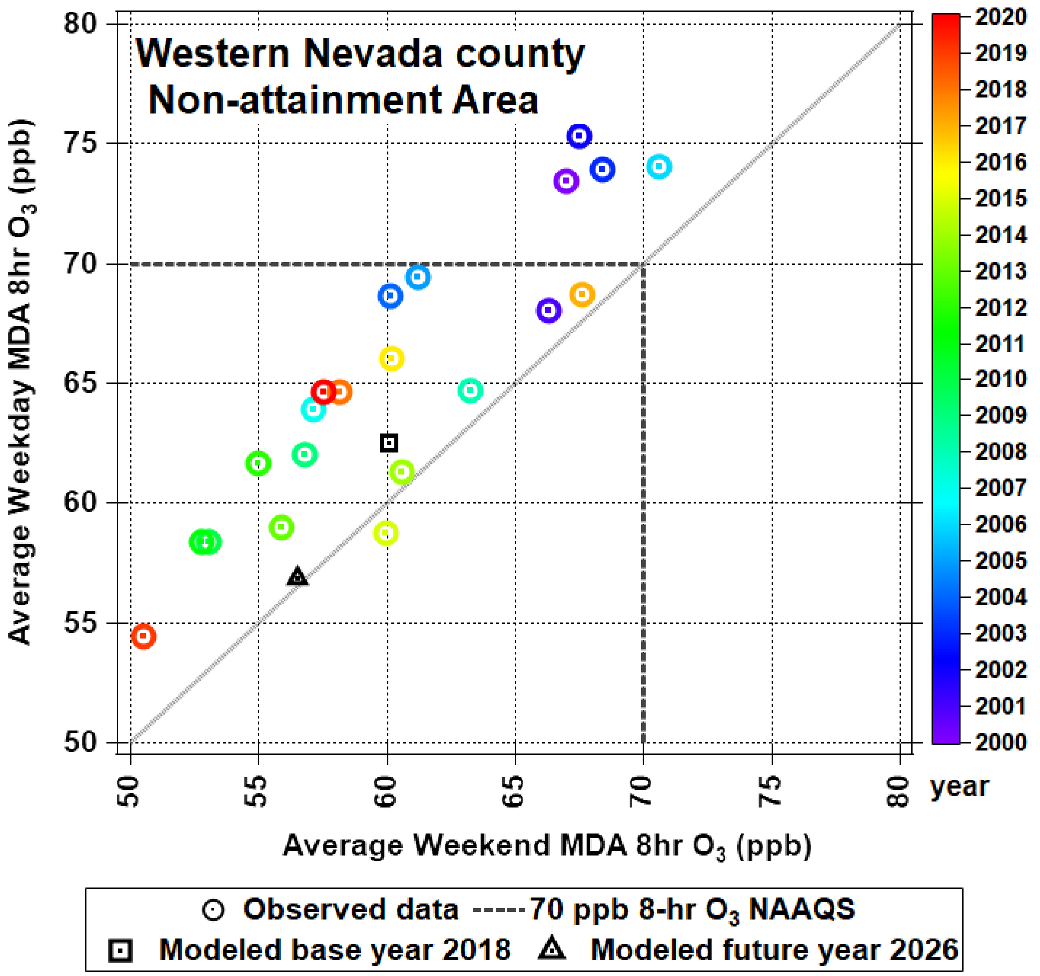
In this context, the prevalence of a weekend effect in a region suggests that the region is in a NO_x-disbenefit regime (Heuss et al., 2003). A lack of a weekend effect (i.e., no pronounced high O_3 occurrences during weekends) would suggest that the region is in a transition regime and moving between exhibiting a NO_x-disbenefit and being NO_x-limited. A reversed 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 WNNA and how well it is represented in the modeling. The trend in day-of-week dependence in the WNNA 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 18**). Different definitions of weekday and weekend days were also investigated and did not show appreciable differences from the Wednesday/Thursday and Sunday definitions.

A key observation in **Figure 18** is that the summertime average weekday and weekend MDA8 ozone levels have steadily declined between 2000 and 2020. Along with the declining ozone, it is evident that the WNNA has been in a NO_x limited regime at least since 2000, as seen from the greater weekday ozone when compared to weekend ozone. This region is in close vicinity of biogenic ROG emissions sources and farther away from the anthropogenic NO_x sources, such that low NO_x and high ROG reactivity conditions are prevalent, which is consistent with the region being in a NO_x-limited regime. The occasional shift in weekday/weekend ozone levels closer to the 1:1 dashed line (and in some years crossing over the line) is likely due to interannual variability in meteorological conditions and its impact on the regional transport patterns and local biogenic ROG emissions.

The simulated baseline 2018 weekday/weekend values (black square marker in Figure 18) from the attainment demonstration modeling shows greater weekday ozone compared to weekend ozone, which is consistent with observed findings in 2018 that show a prevalence of NO_x-limited conditions in the WNNA. The predicted future 2026 value (black triangle marker in **Figure 18**) clearly shows that weekday and weekend ozone decline significantly (all values are below 65 ppb) suggesting that NO_x controls will be more effective than corresponding ROG controls in lowering the ozone levels in the WNNA.

Figure 18. Site-specific average weekday and weekend maximum daily average 8-hour ozone for each year from 2000 to 2020 in the WNNA. The colored circle markers denote observed values while the black square and triangle markers denote the simulated baseline 2018 and future year 2026 values. Points falling below the 1:1 dashed line represent a NOx-disbenefit regime, those on the 1:1 dashed line represent a transitional regime, and those above the 1:1 dashed line represent a NOx-limited regime.



Relative Response Factors and Future Year Design Values

The RRFs and future year design values for the Grass Valley-Litton Building site in the WNNA were calculated using the procedures outlined in the corresponding sections and are summarized in **Table 14.** The projected ozone design value in 2026 is 69 ppb at the site when the fire impacted days were excluded in the baseline design value calculation.

Table 14. Summary of key parameters related to the calculation of future year 2026 8-hour ozone design values (DV), using the method defined in the U.S. EPA guidance, at the Grass Valley-Litton Building monitoring site in the WNNA.

Days in Base DV Calculation	RRF	2018 Average DV (ppb)	2026 DV (ppb)	2026 DV Truncated (ppb)
All	0.9035	86.0	77.7	77
Fire Days Excluded	0.9035	77.3	69.8	69

NOx/VOC Sensitivity Analysis for Reasonable Further Progress (RFP)

For the Clean Air Act 182(c)(2)(B) RFP requirement for areas classified as serious nonattainment and above, U.S. 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 U.S. EPA guidance states that certain conditions are needed to use NO_x substitution in an RFP demonstration (U.S. 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 27% (3% for each of the 9 years between the designation year of 2017 and attainment year of 2026) 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 15** summarizes the design values calculated for the 27% NO_x and ROG sensitivity simulations. At the Grass Valley-Litton Building site, the ratio of the change in ozone design value to the NO_x emissions change ($\Delta O_3/\Delta\ NO_x$) are greater than that of the ROG emissions change ($\Delta O_3/\Delta ROG$). 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 15. Summary of the ozone improvement from the 27% emissions reductions at the Grass Valley-Litton Building site in the WNNA.

Site	2018 Average DV (ppb)	DV After 27% NOx Reductions (ppb)	$\Delta O_3/\Delta NOx$ (ppb/tpd)	DV After 27% ROG Reductions (ppb)	$\Delta O_3/\Delta ROG$ (ppb/tpd)
Grass Valley-Litton Building	86.0	85.9	0.1230	86.0	0.0000

Unmonitored Area Analysis

The unmonitored area analysis is used to ensure that there are no regions outside of the existing monitoring network that would exceed the NAAQS if a monitor was present (U.S. EPA, 2018). U.S. EPA recommends combining spatially interpolated design value fields with modeled ozone gradients and grid-specific RRFs in order to generate gridded future year gradient adjusted design values.
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 ARB, were utilized in this analysis.

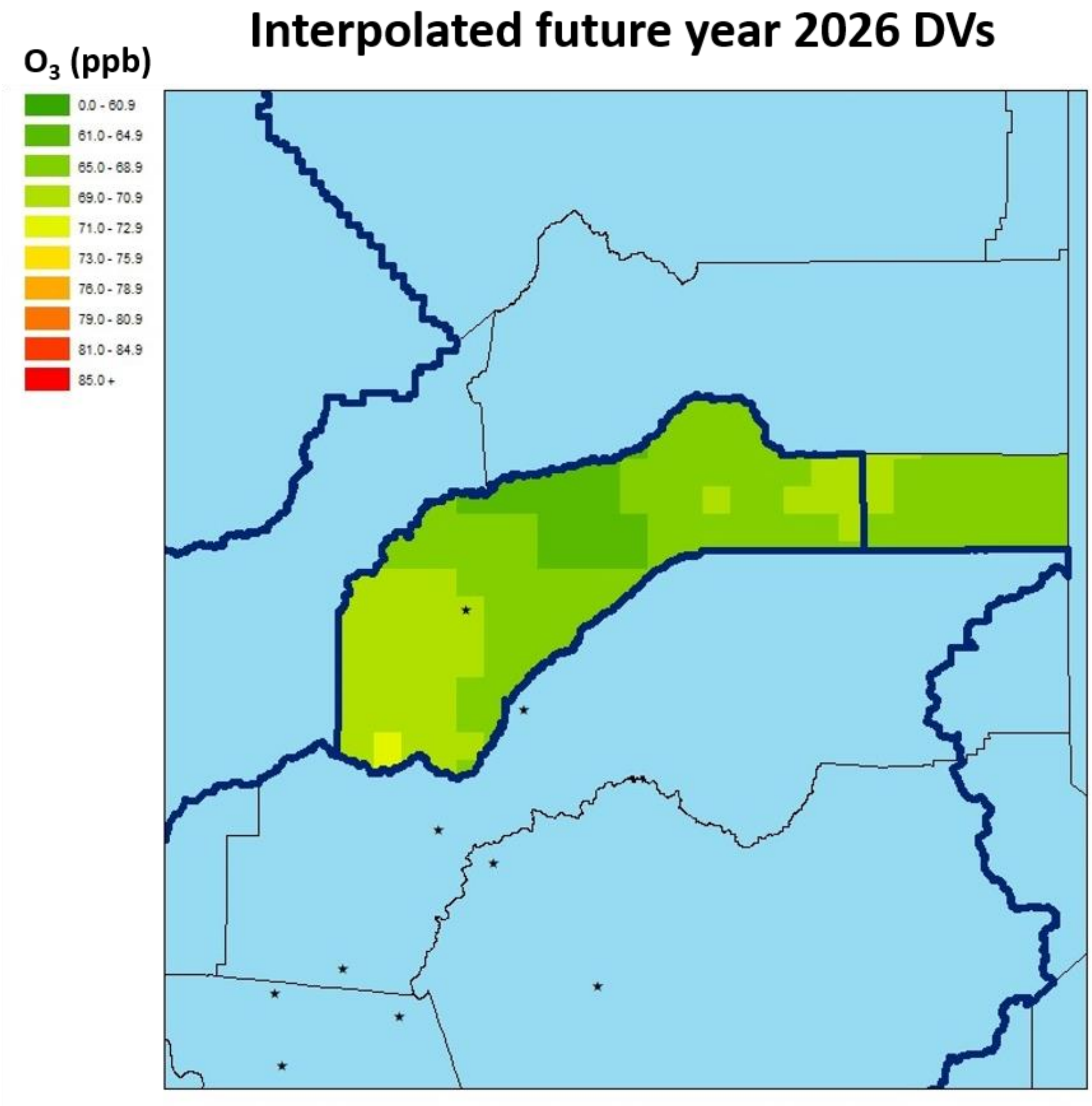
The unmonitored area analysis was conducted using the 8-hr O_3 weighted DVs from all the available sites that fall within the 4-km inner modeling domain along with the reference year 2018 and future year 2026 4 km CMAQ model outputs. The steps followed in the unmonitored area analysis are as follows:

> **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 Section II, 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 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 19 shows the spatial distribution of gridded DVs in 2026 for the WNNA based on the unmonitored area analysis described above. The black colored star markers denote the monitoring sites, which had valid reference year DVs and were used in the analysis. The unmonitored area analysis in the WNNA showed that most non-attainment area has future year 2026 DVs less than 70 ppb. The only area/grid with interpolated future DVs over 70 ppb shown in the figure is located in the lower left corner, which is next to Auburn urban area and lies directly downwind of Sacramento metro region, where the regional transport patterns significantly contribute to observed ozone levels.

Figure 19. Spatial distribution of the future 2026 DVs based on the unmonitored area analysis in the WNNA. Color scale is in ppb of ozone.



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Supplemental Materials

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Meteorological Time series and Mean Bias/Error Distribution Plots

Figure S 1. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in April 2018.

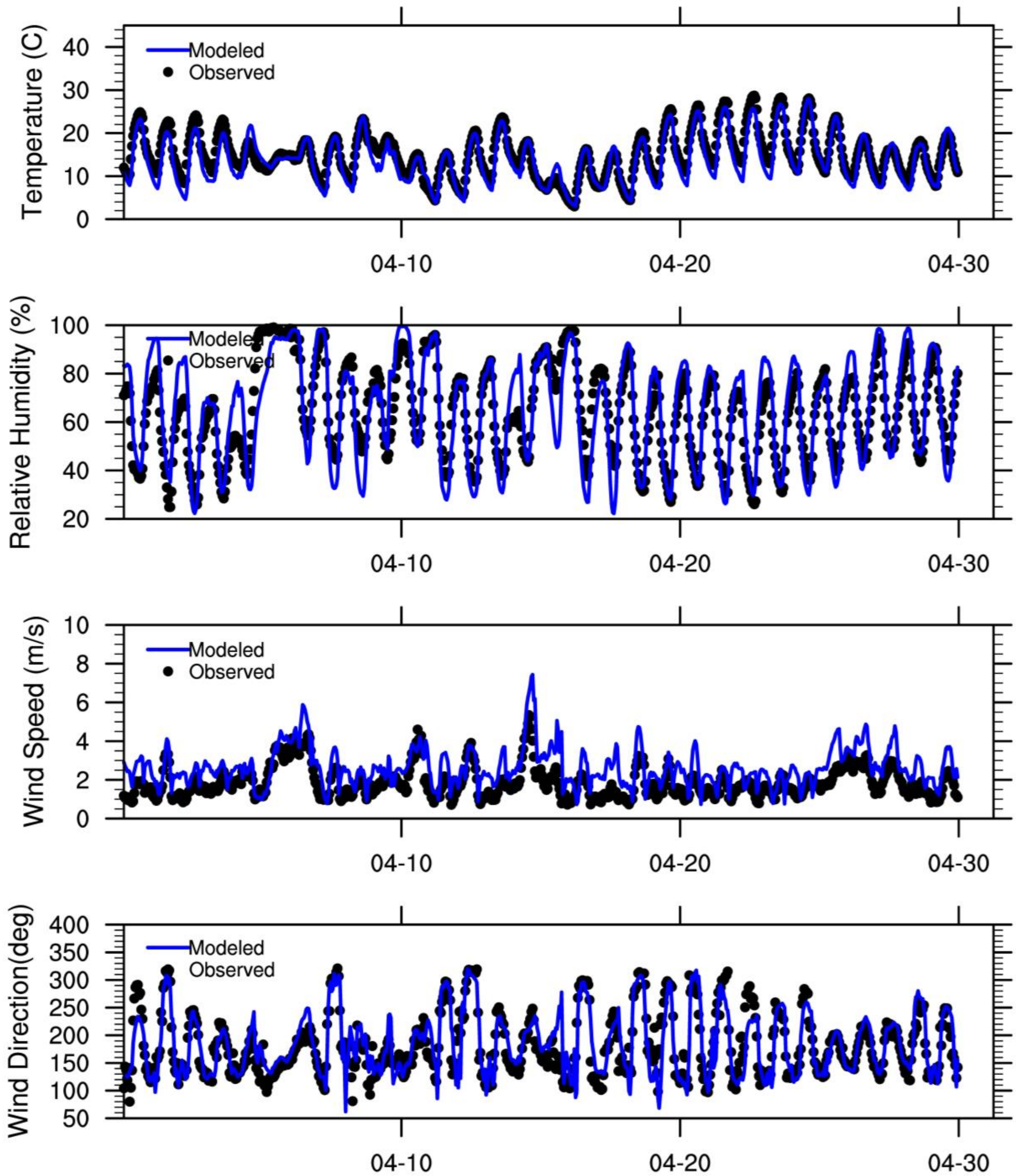
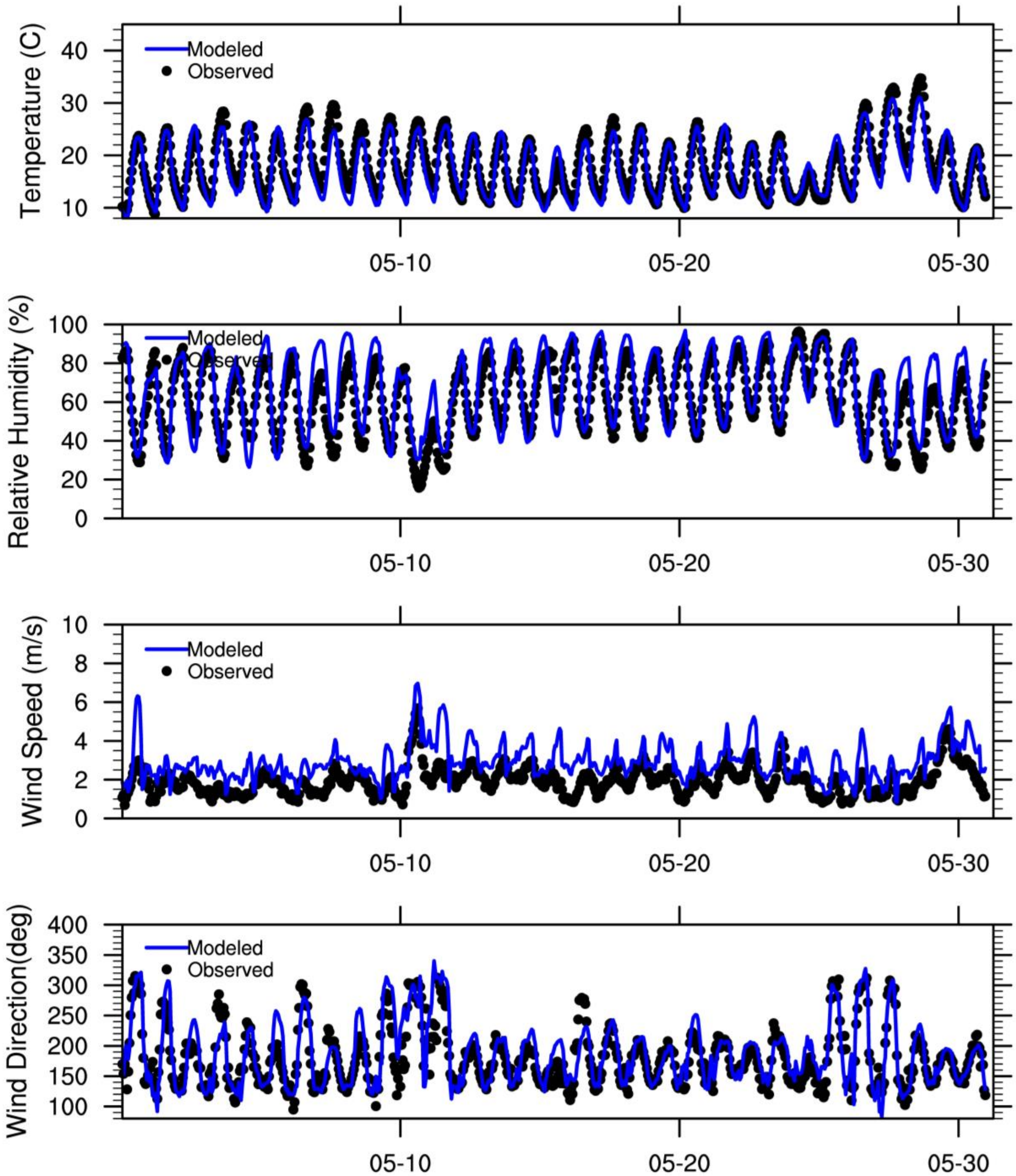


Figure S 2. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in May 2018.



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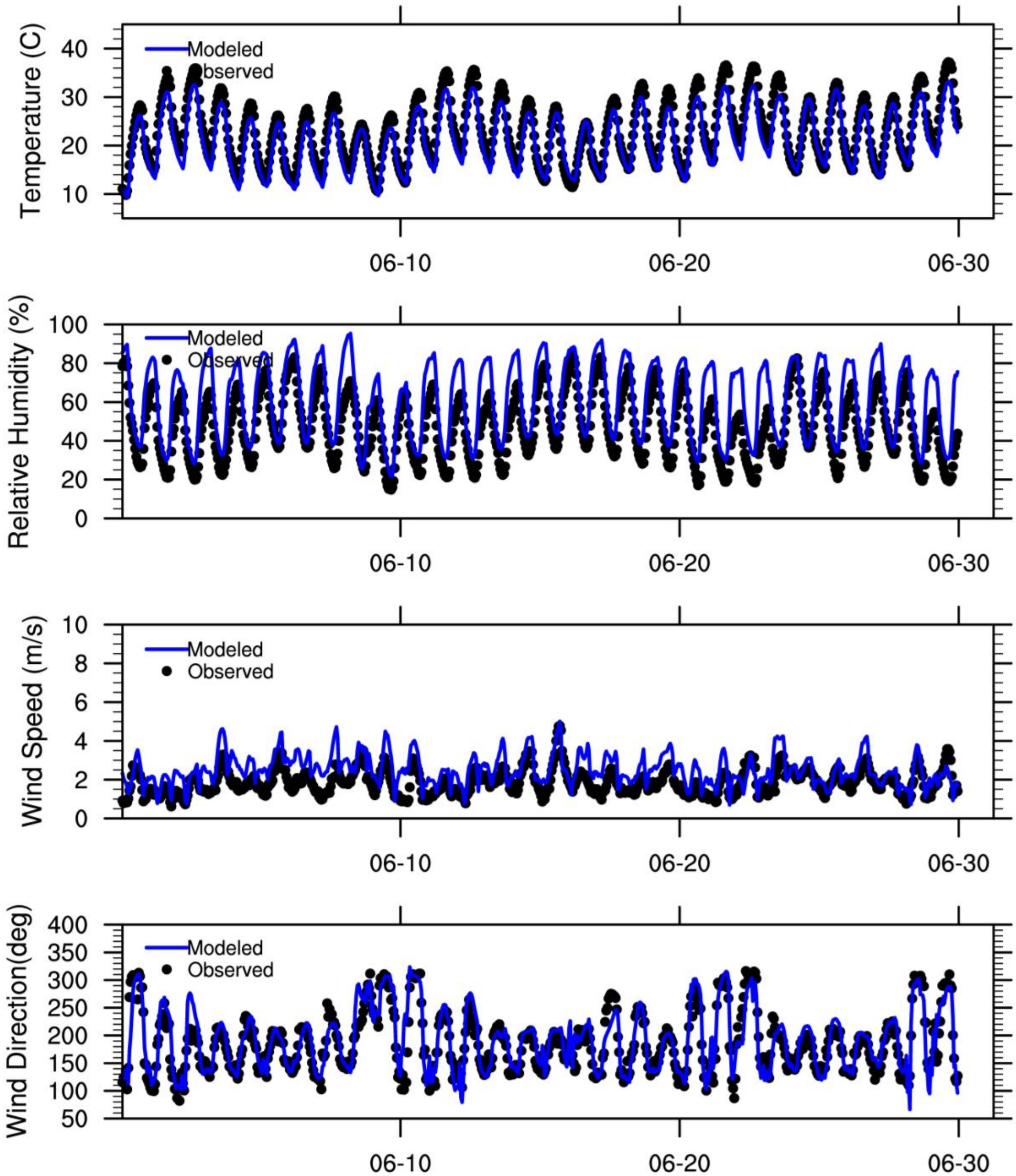
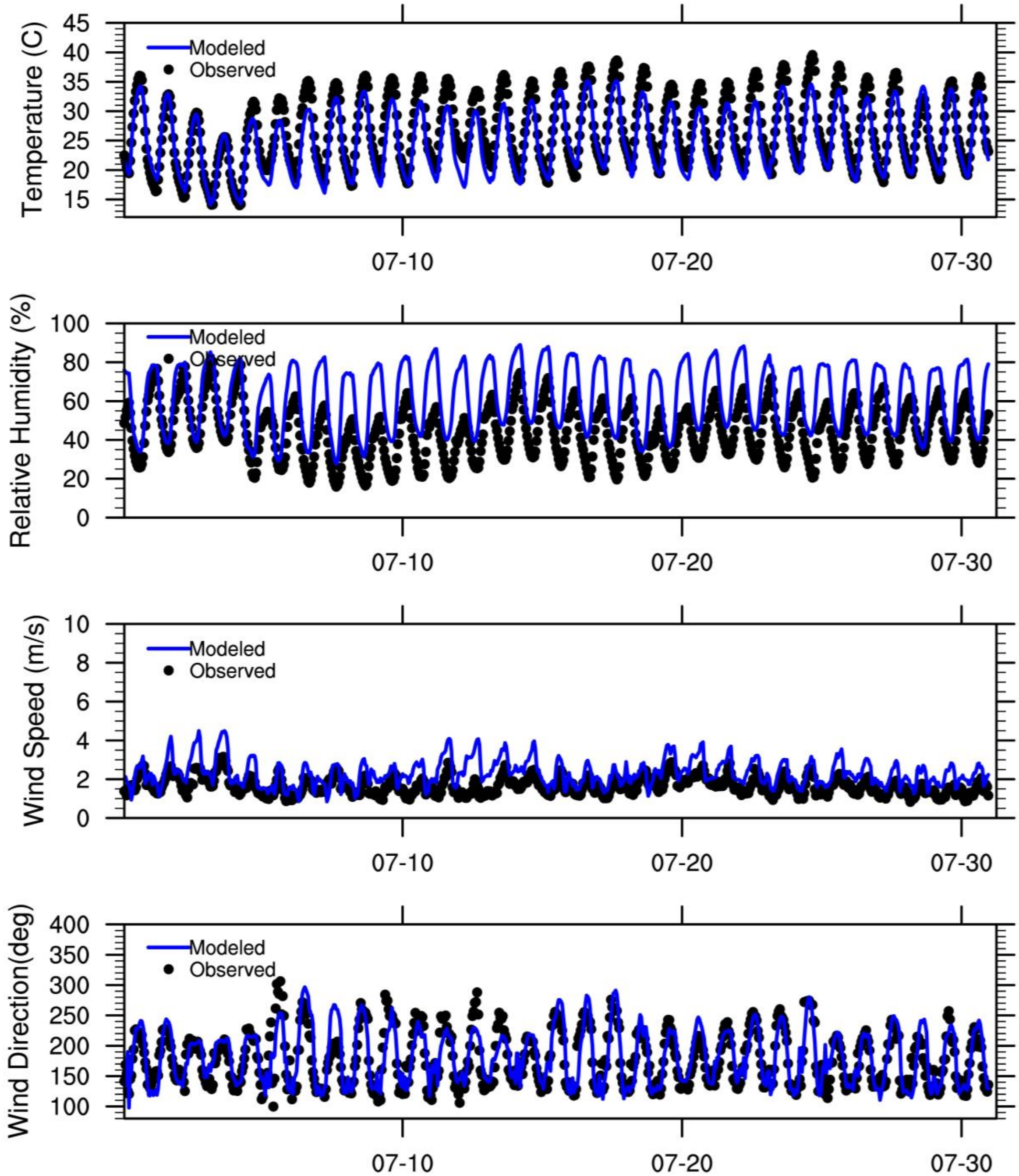


Figure S 4. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in July 2018.



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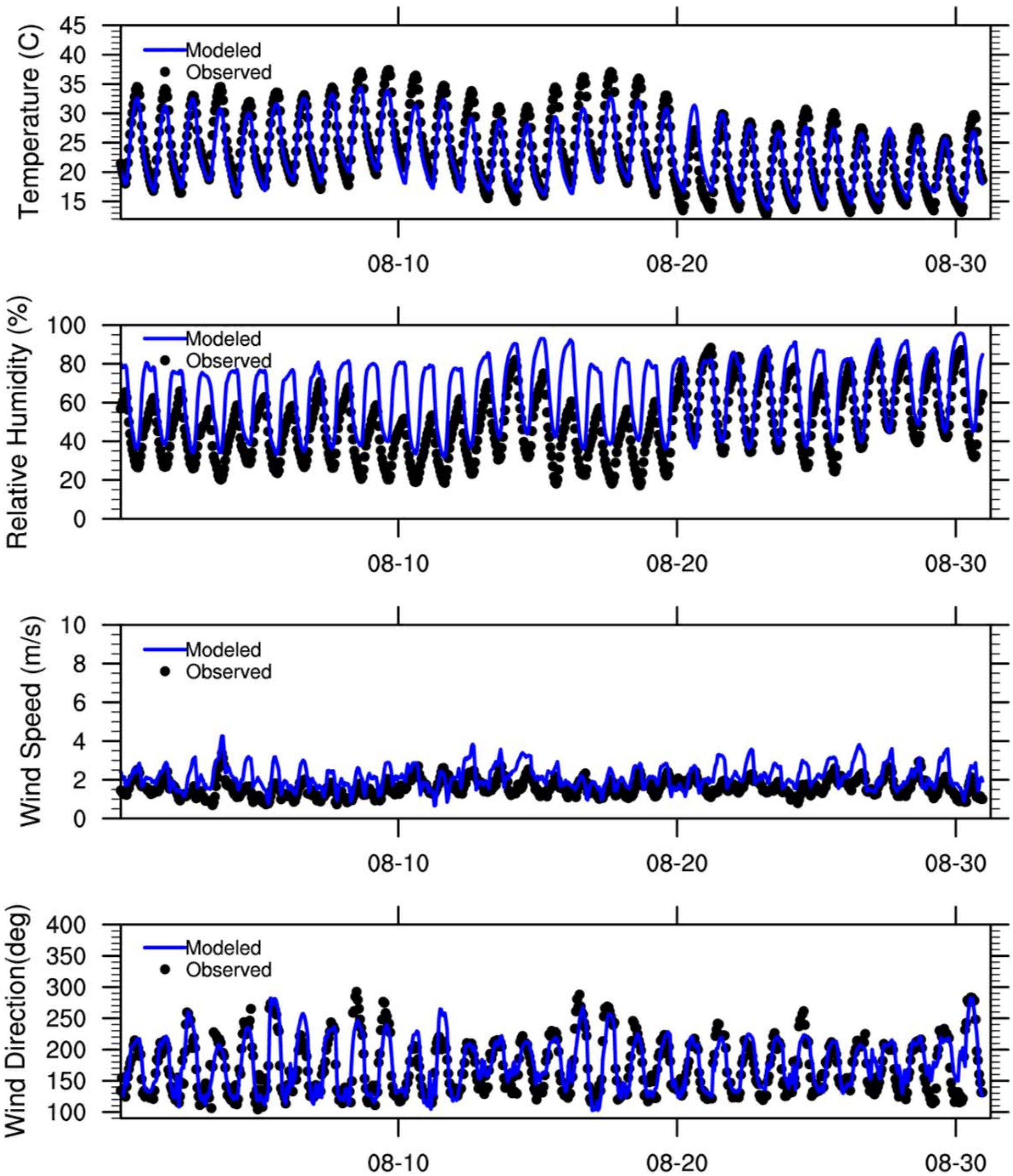

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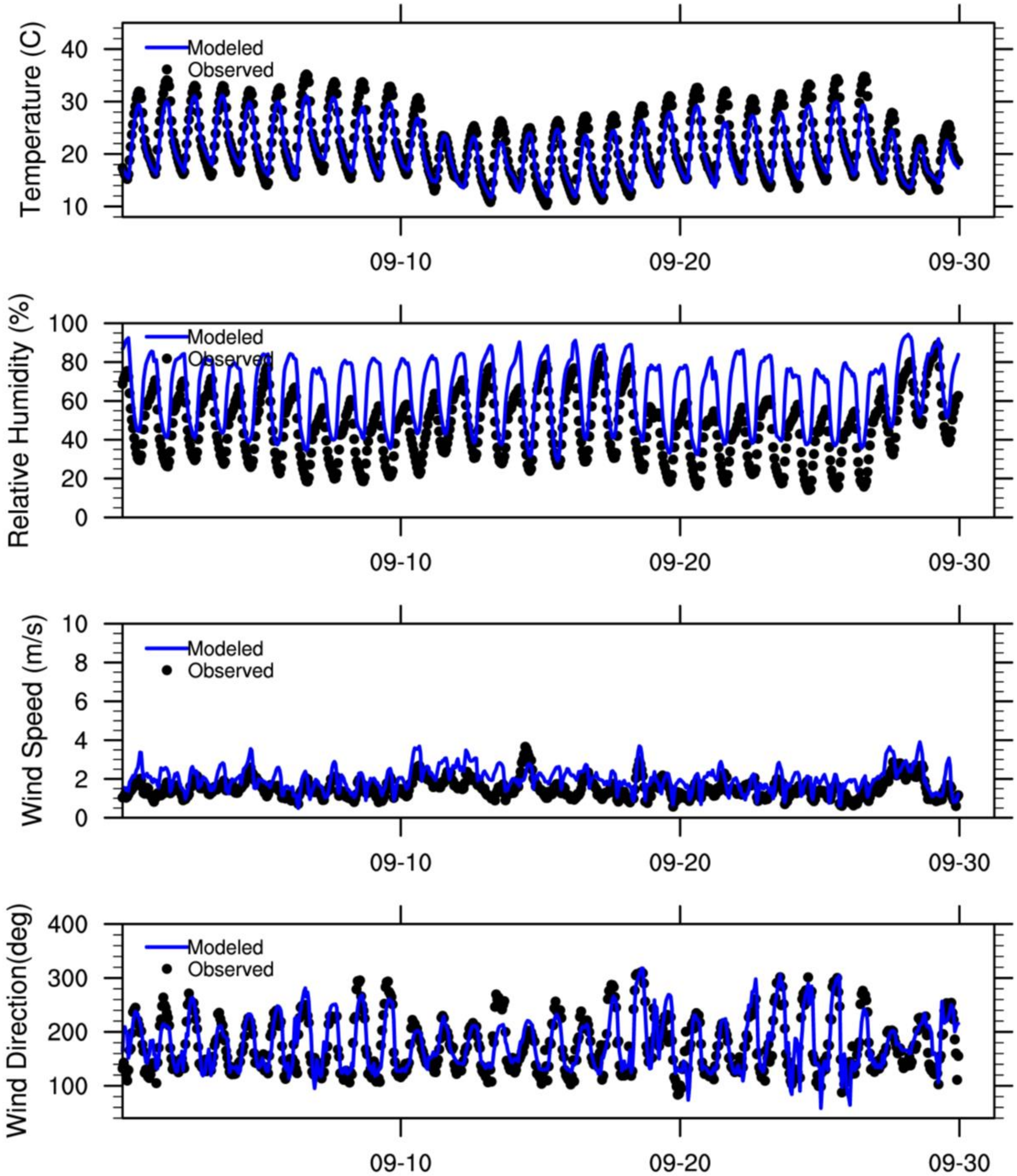

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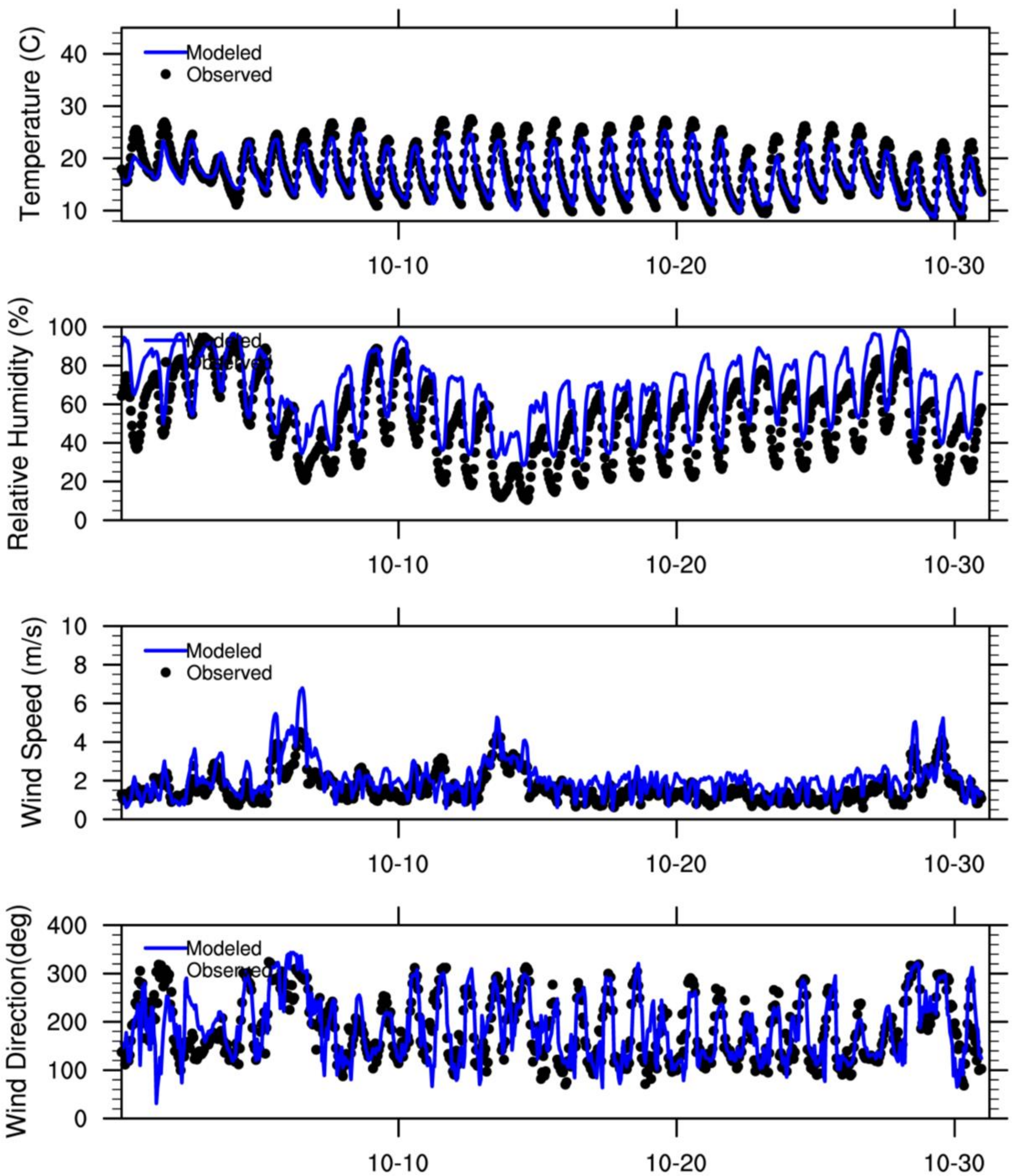

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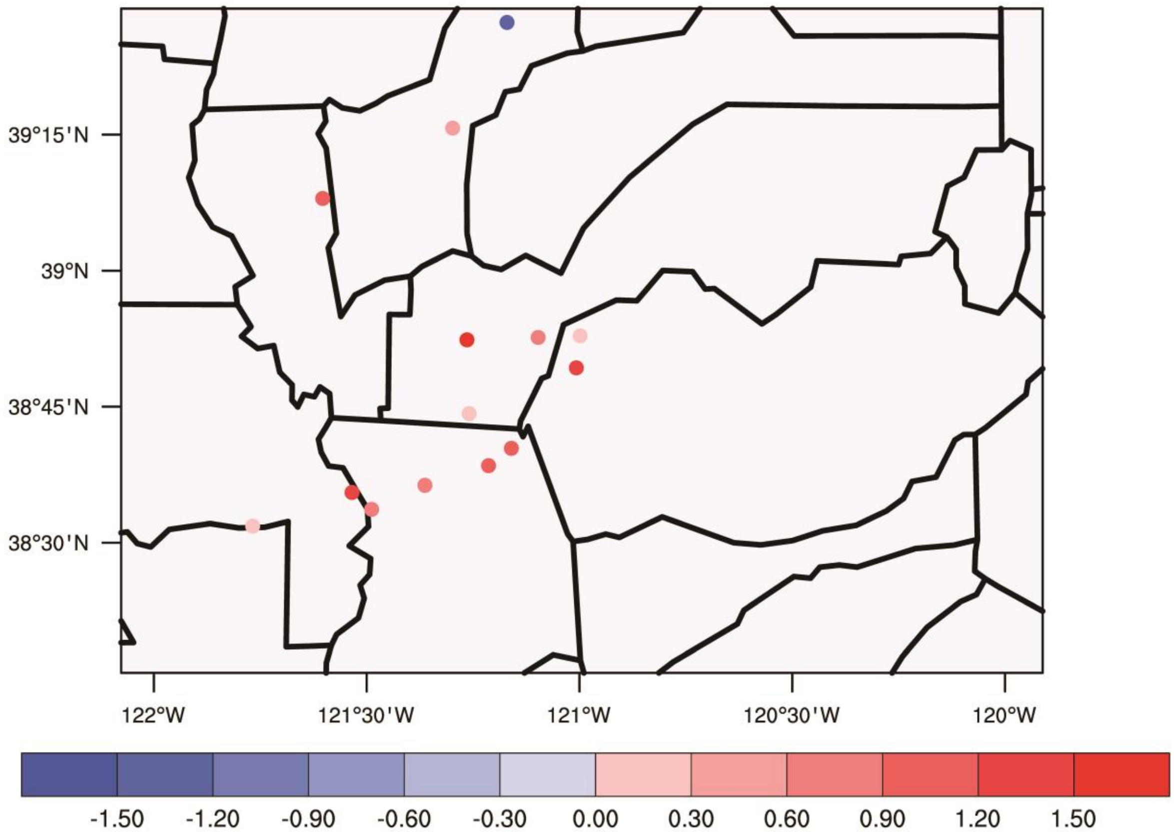

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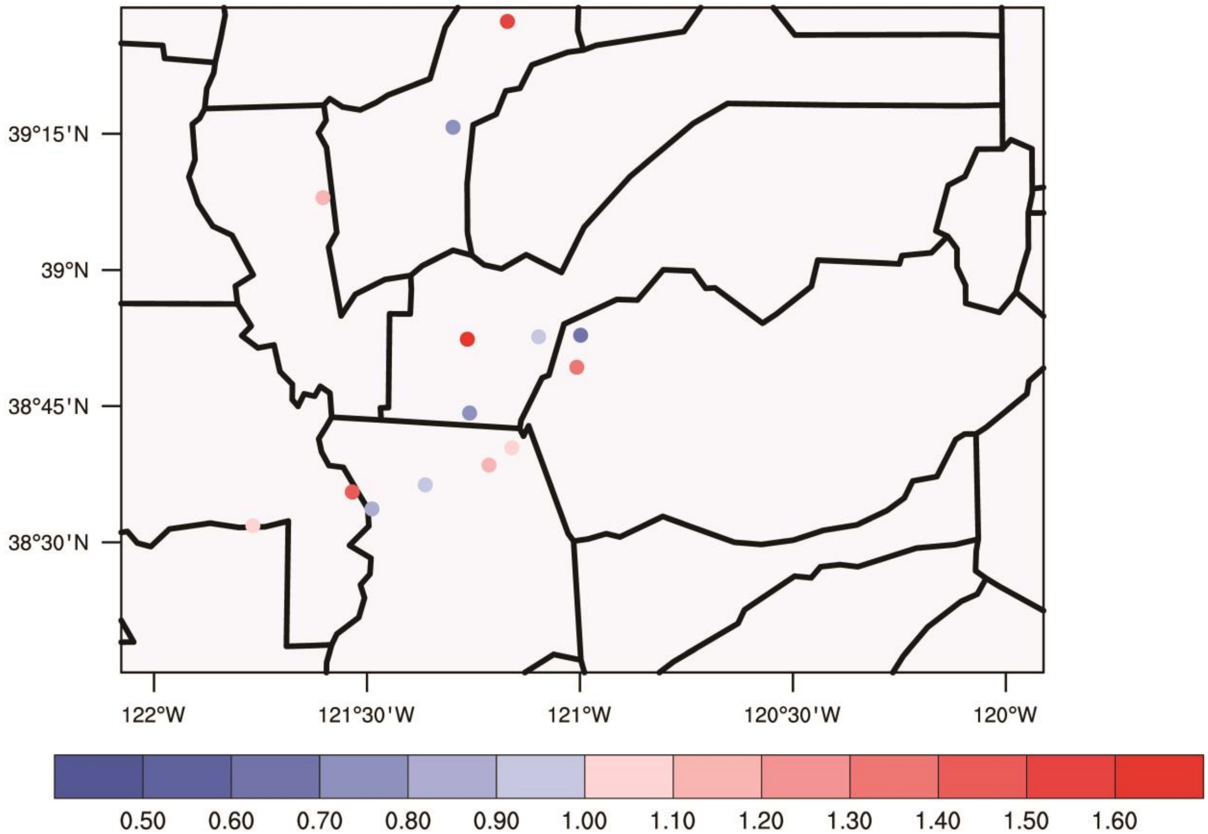

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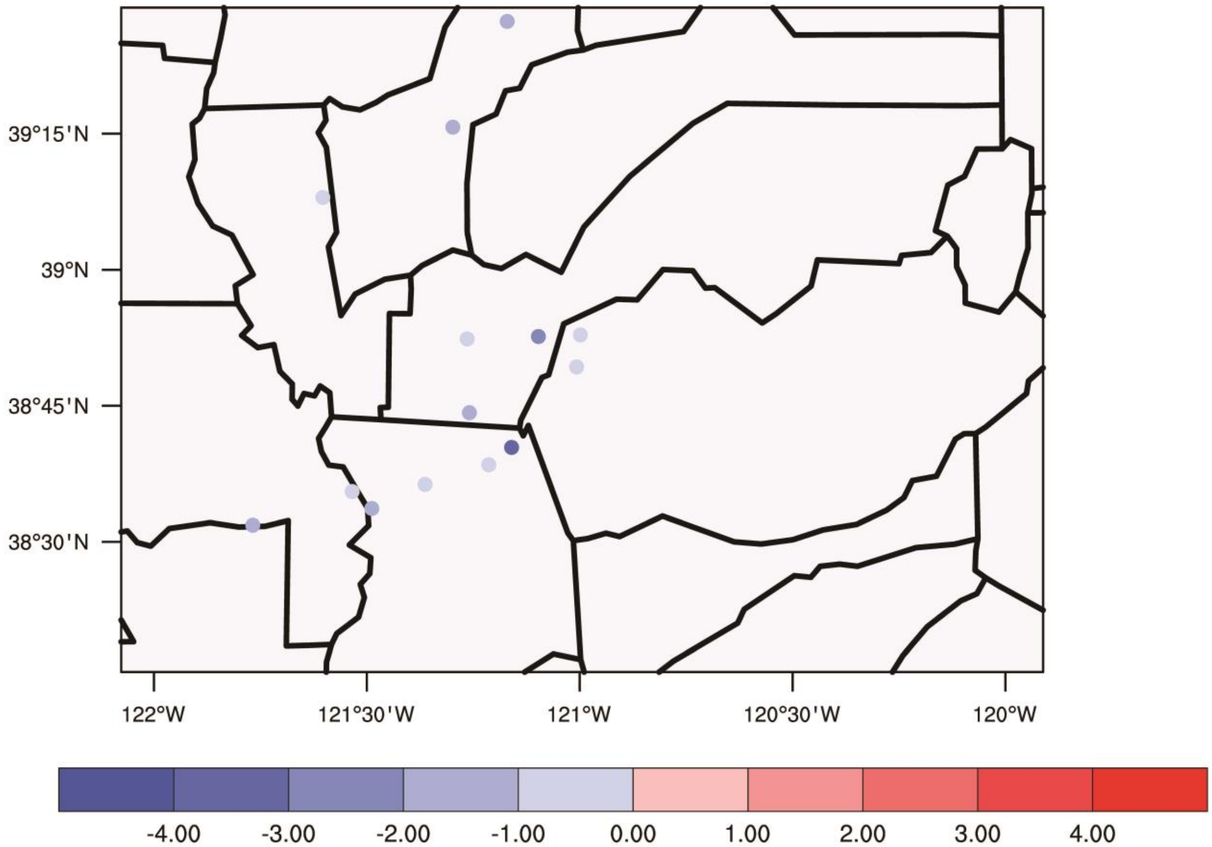

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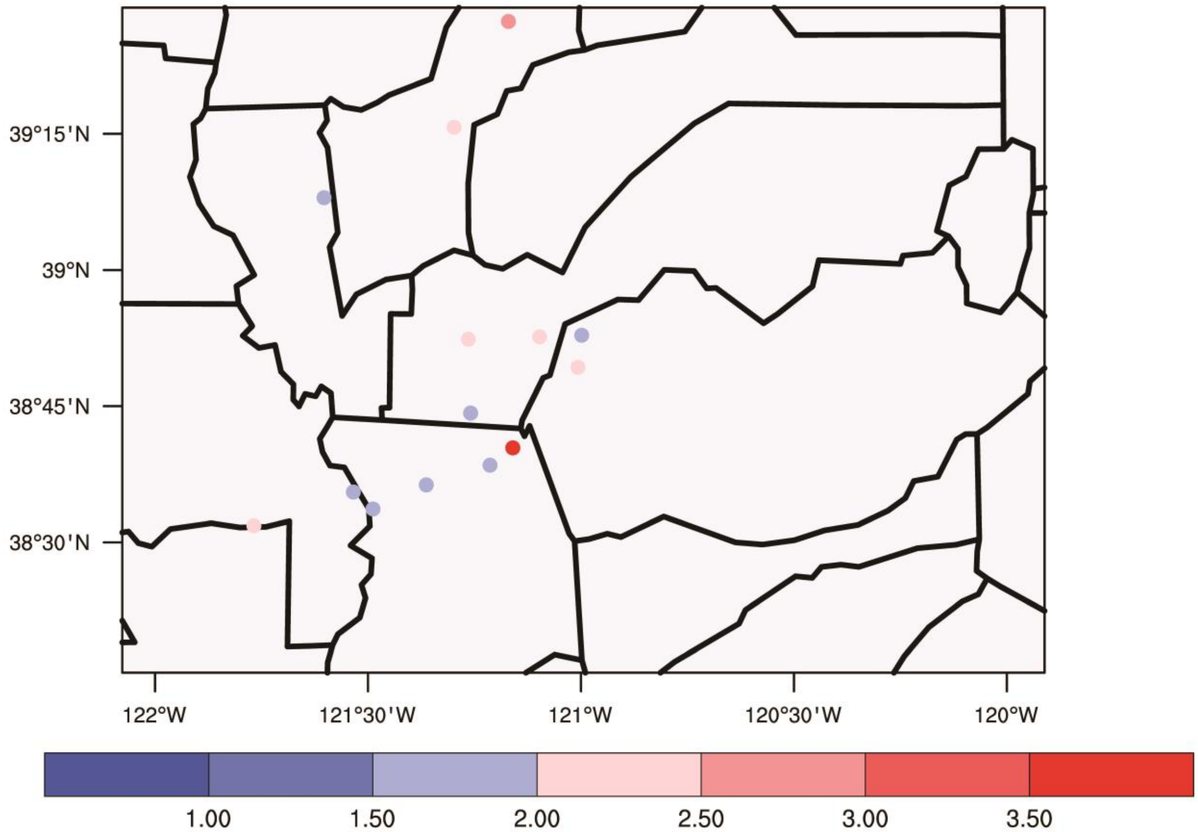
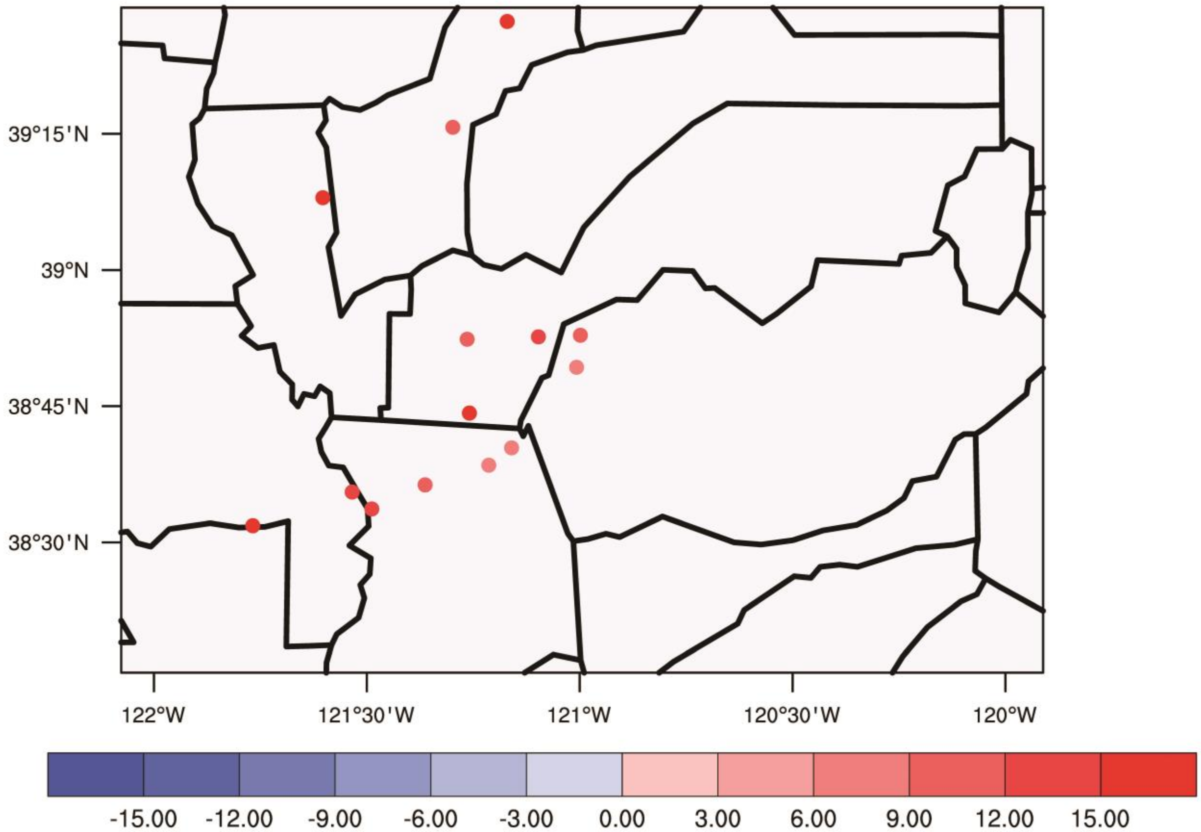


Figure S 12. Relative humidity mean bias (%) for April-October, 2018.



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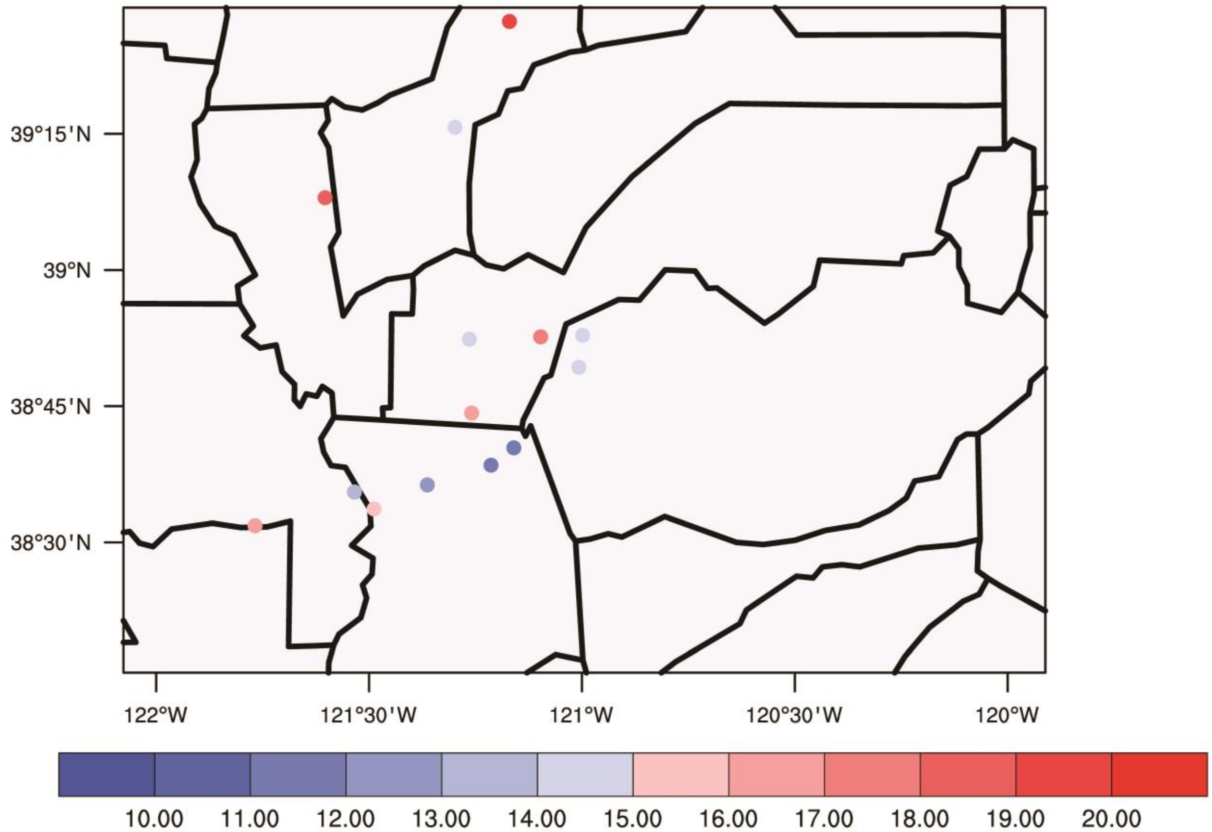
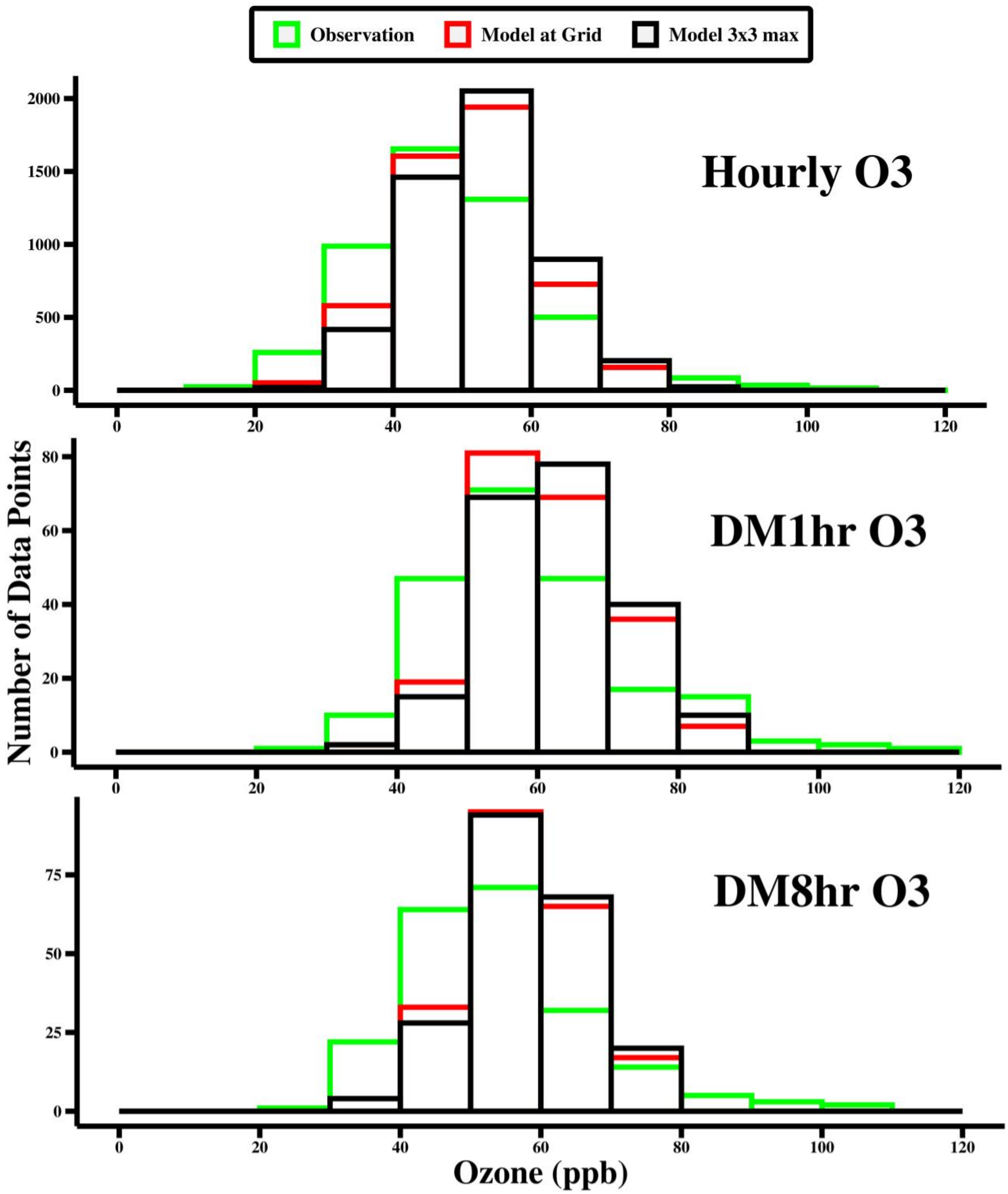


Ozone and Nitrogen Oxides Plots

Figure S 14. Observed and modeled ozone frequency distribution for the ozone season at the Grass Valley-Litton Building site (All days in April – October 2018).



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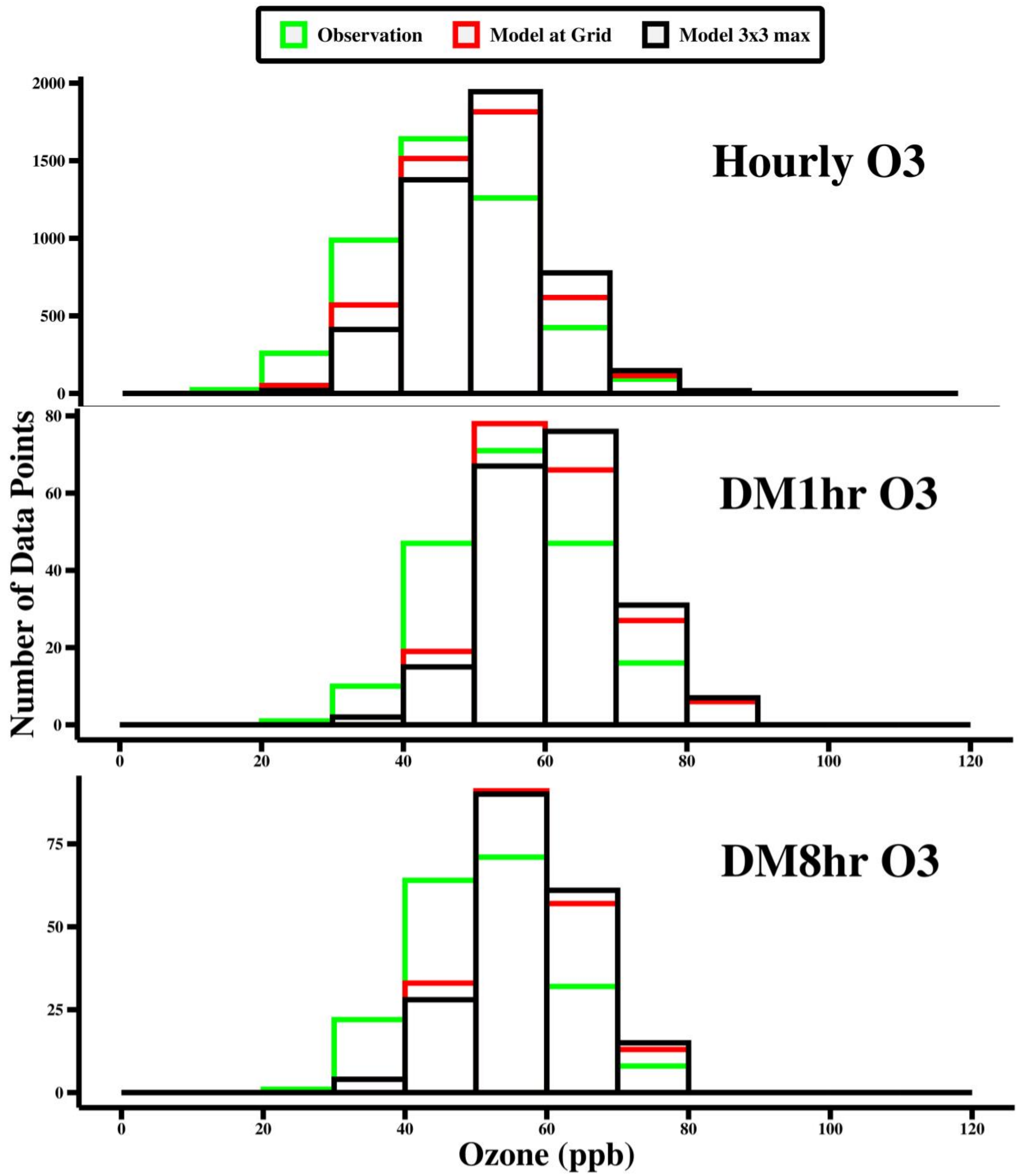

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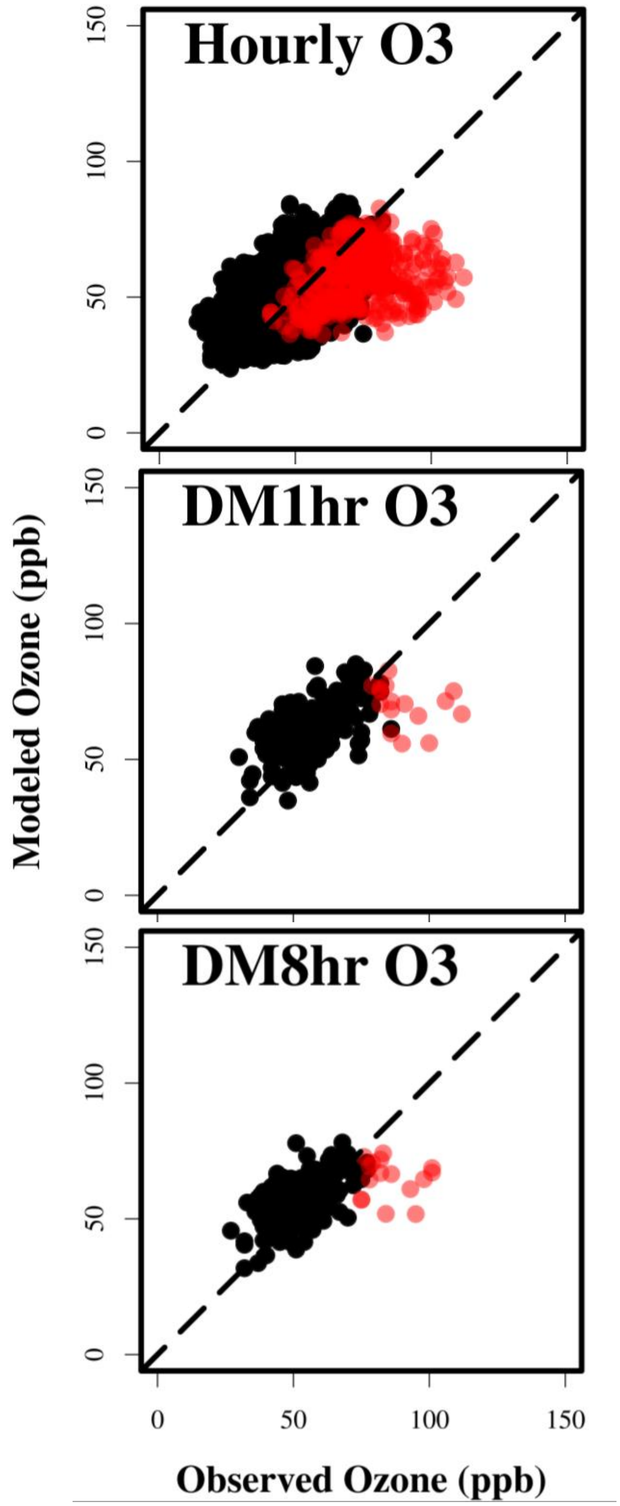
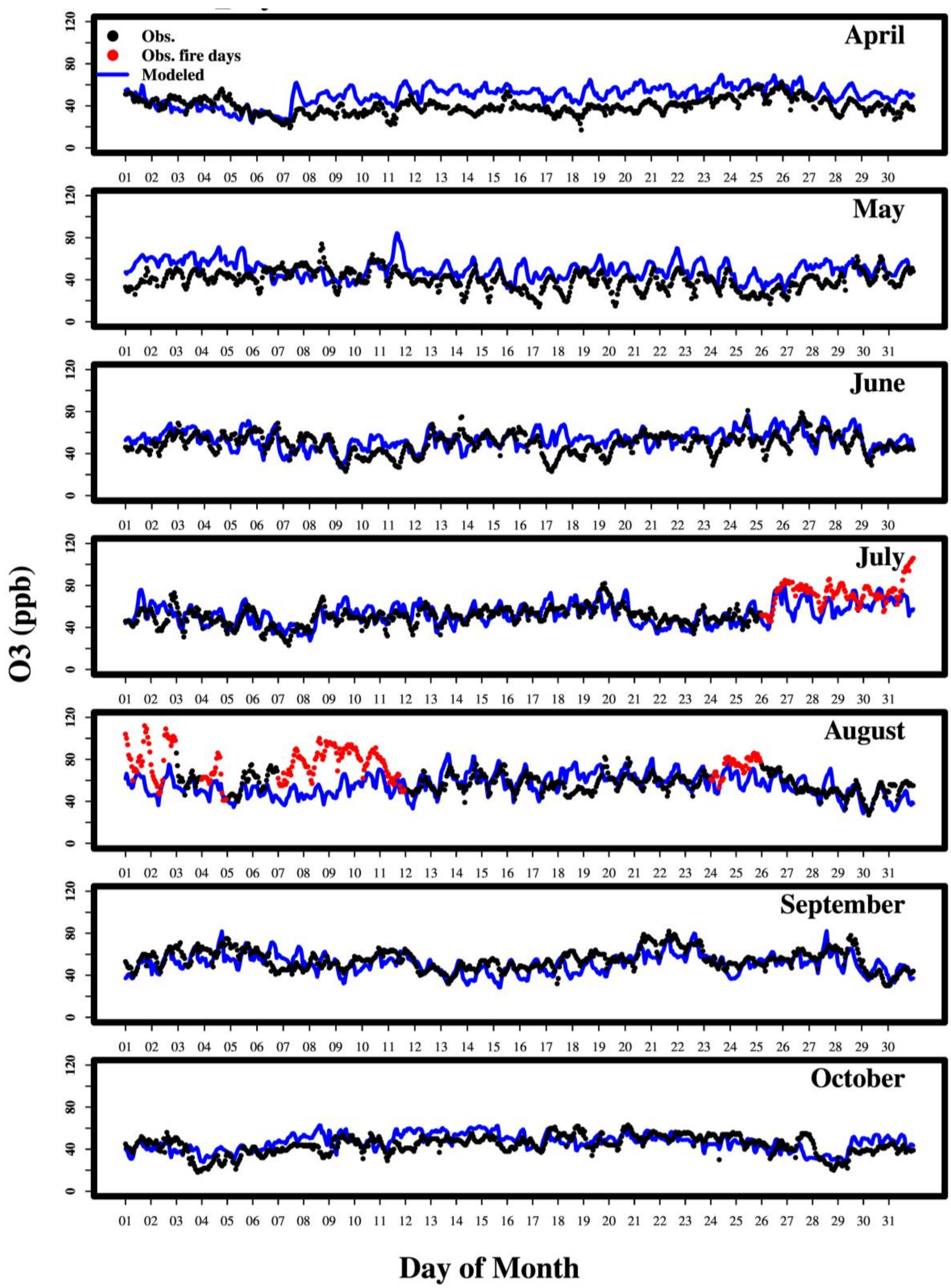


Figure S 17. Time-series of hourly ozone at the Grass Valley-Litton Building site for the ozone season (April-October 2018).



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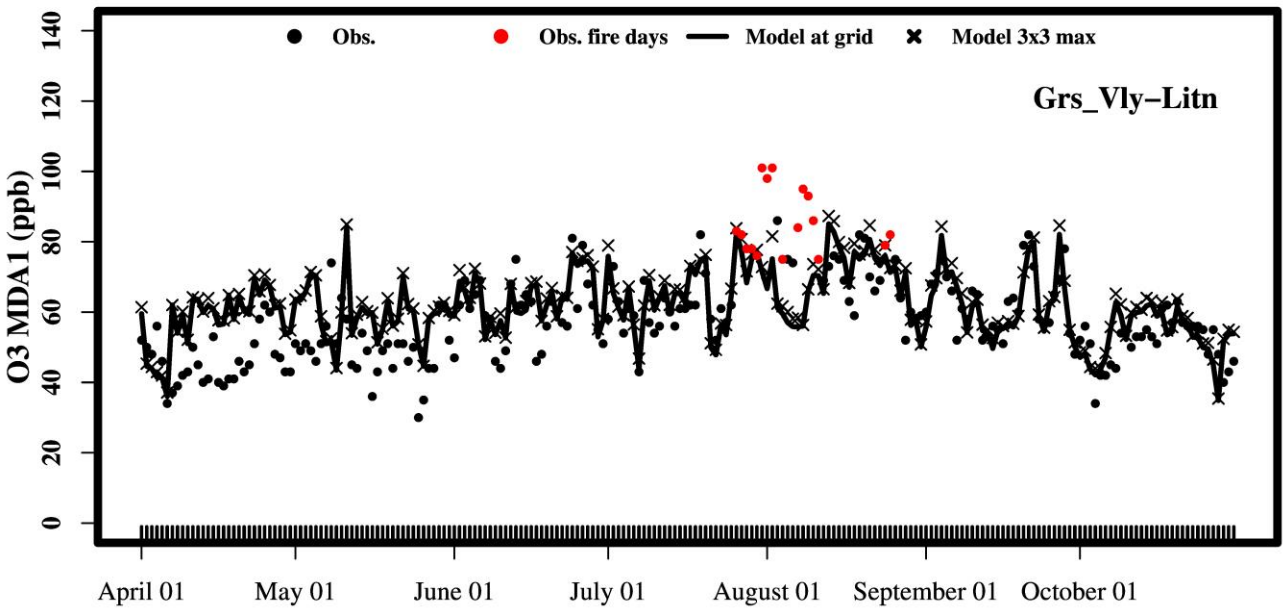

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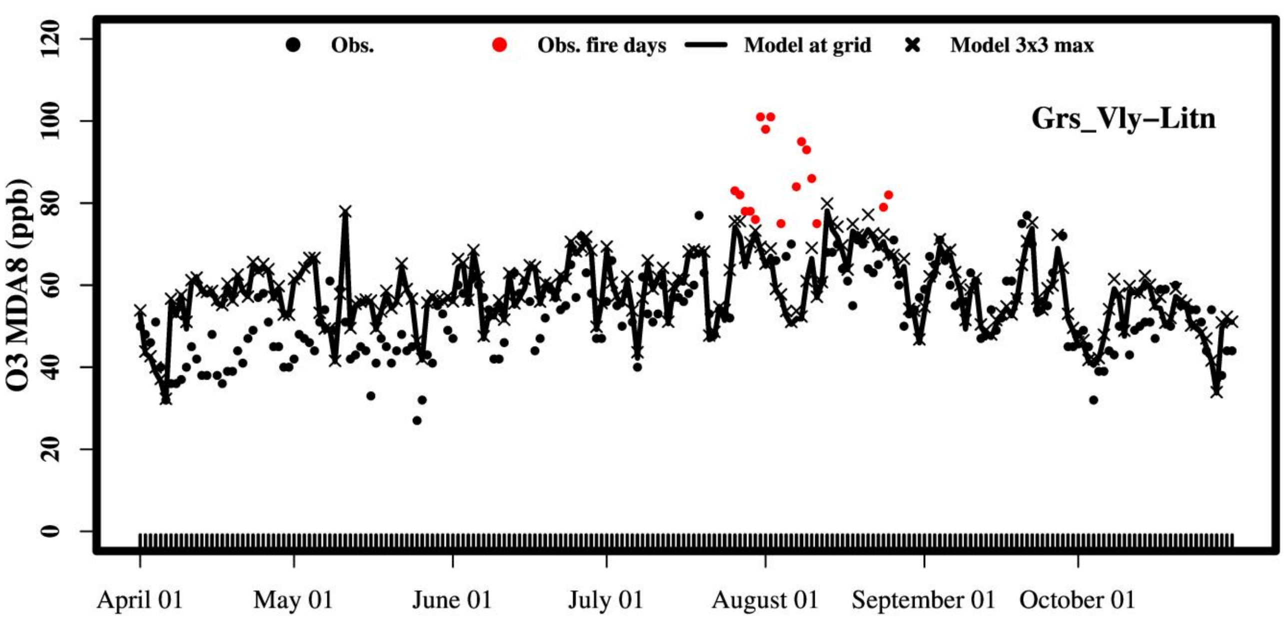

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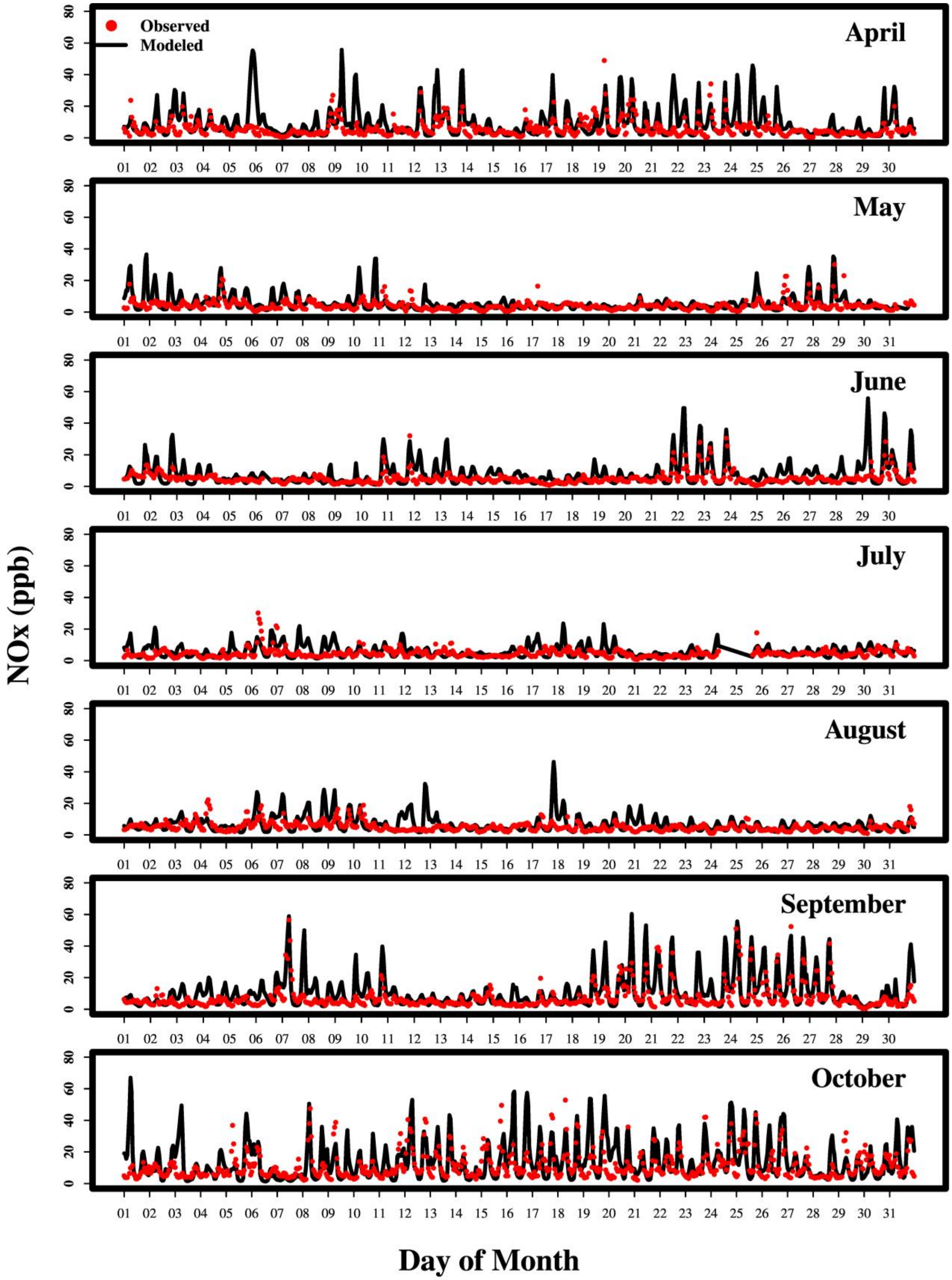

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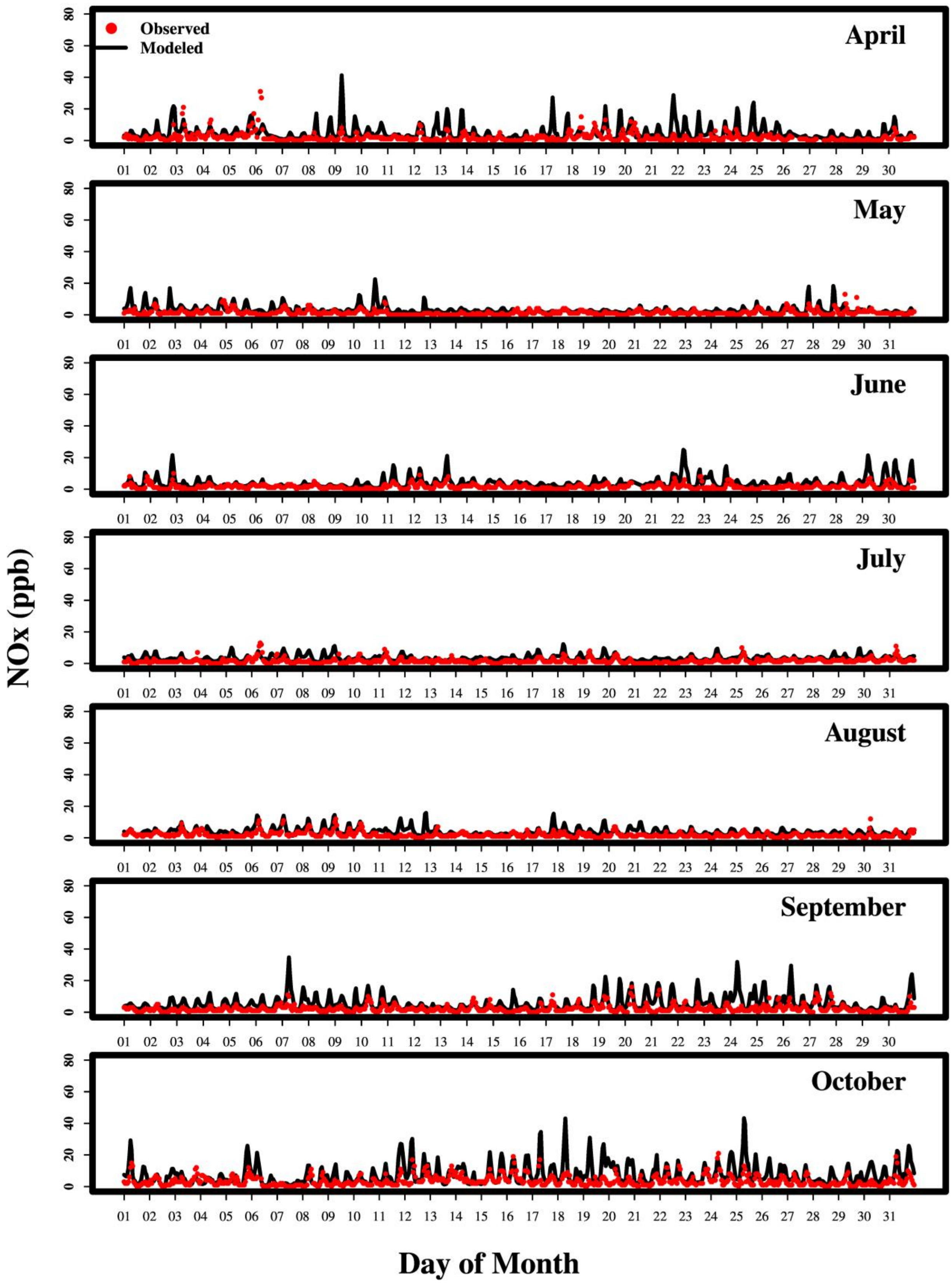

Appendix E

Modeling Protocol and Attainment Demonstration

Modeling Protocol and Attainment Demonstration for the 2022 Western Nevada Ozone State Implementation Plan

Prepared by
California Air Resources Board
Northern Sierra Air Quality Management District

Prepared for
United States Environmental Protection Agency Region IX
October 2022

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Acronyms

ACM2 – Asymmetric Convective Model version 2

ADAM – Aerometric Data Analysis and Management

AQMIS – Air Quality and Meteorological Information System

BCs – Boundary Conditions

CalNex – 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 – the Community Earth System Model version 2

CMAQ Model – Community Multi-Scale Air Quality Model

CTM – Chemical Transport Model

DV – Design Value

EBI – Euler Backward Iterative solver

HYSPLIT – Hybrid Single Particle Lagrangian Integrated Trajectory

ICs – Initial Conditions

IOA – Index of Agreement

LAI – Leaf Area Index

MB – Mean Bias

MCAB – Mountain Counties Air Basin

MCIP – Meteorology-Chemistry Interface Processor

MDA8 – Maximum Daily Average 8-hour Ozone

ME – Mean Error

MEGAN – Model of Emissions of Gases and Aerosols from Nature

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

NOx – Nitrogen Oxides

NSAQMD – Northern Sierra Air Quality Management District

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

VOC – Volatile Organic Compounds

WNNA – Western Nevada county Non-attainment Area

WRF – Weather Research and Forecasting Model

I. Introduction

Nevada County stretches from the foothills to the mountains of the Sierra Nevada mountain range within the Mountain Counties Air Basin (MCAB), covering an area of ~978 square miles with an estimated population of 102,241 in 2020. The western portion of Nevada County is designated nonattainment for the 2015 8-hour ozone National Ambient Air Quality Standards (NAAQS) (U.S. EPA, 2017). The Western Nevada County Non-attainment Area (WNNA) is a region of highly complex terrain, with elevations ranging from a few hundred feet above sea level to over 9,000 feet. It extends from the foothills of the Sierra Nevada mountain range in the west into the Tahoe National Forest to the east. The WNNA is located to the east of California's Central Valley, which is a 500-mile-long northwest-southeast oriented valley encompassing two of the most polluted air basins in the nation – San Joaquin Valley Air Basin (SJVAB) and Sacramento Valley Air Basin (SVAB) (**Figure 1**). The Northern Sierra Air Quality Management District (NSAQMD) has jurisdiction over the WNNA.

The air flow into the WNNA is typically from the south-southwest (U.S. EPA, 2008). It is regularly impacted by emissions and polluted air masses from within the Sacramento Federal Ozone Nonattainment Area (SFNA) and San Francisco Bay Area. The air quality in the WNNA is affected by various factors, including its complex terrain and topographic features, precursor emissions in the upwind source regions, local emissions from anthropogenic and naturally occurring biogenic sources, ozone chemistry along the transport pathways, as well as the meteorological conditions that facilitate transport of ozone and its precursors.

From year 2000 to 2020, the emissions of ozone precursors in the WNNA continued to decline with a significant decrease in local anthropogenic nitrogen oxides (NO_x) (from ~7.6 tpd to ~2.7 tpd) and reactive organic compounds (ROG) (from ~8.4 tpd to ~5 tpd) emissions (**Figure 2**). The anthropogenic NO_x and ROG emissions trends for the upwind SFNA are also displayed in Figure 2 and show large decreases in both anthropogenic NO_x (from ~174.5 tpd to ~58 tpd) and ROG (from ~164.5 tpd to ~91 tpd) emissions over the same time period. The SFNA emissions are much greater than the WNNA local sources. When aided by conducive meteorological conditions that facilitate pollutant transport, these can be the dominant contributor to ozone levels in the WNNA. Summer biogenic ROG emissions in the WNNA and the SFNA averaged over May to October 2018 are also included in **Figure 2** (green circle and triangle markers). Biogenic ROG is estimated to be ~32 tpd and ~6 times the anthropogenic ROG inventory (~ 5.3 tpd) in the WNNA, while the biogenic ROG is estimated to be ~163.2 tpd and ~1.7 times the corresponding anthropogenic emissions (~94.1 tpd) in the SFNA.

Figure 1. Map of California (top) along with the location of Western Nevada county 8-hour ozone Non-attainment Area (WNNA) in blue and Sacramento Federal 8-hour ozone Non-attainment Area (SFNA) in magenta. SV, MC and SJV denote Sacramento Valley, Mountain Counties (MC) and San Joaquin Valley (SJV) air basins. The color scale 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 and approximate regional boundary of SFNA (Magenta line), WNNA (blue) and location of the Grass Valley site (circle marker).

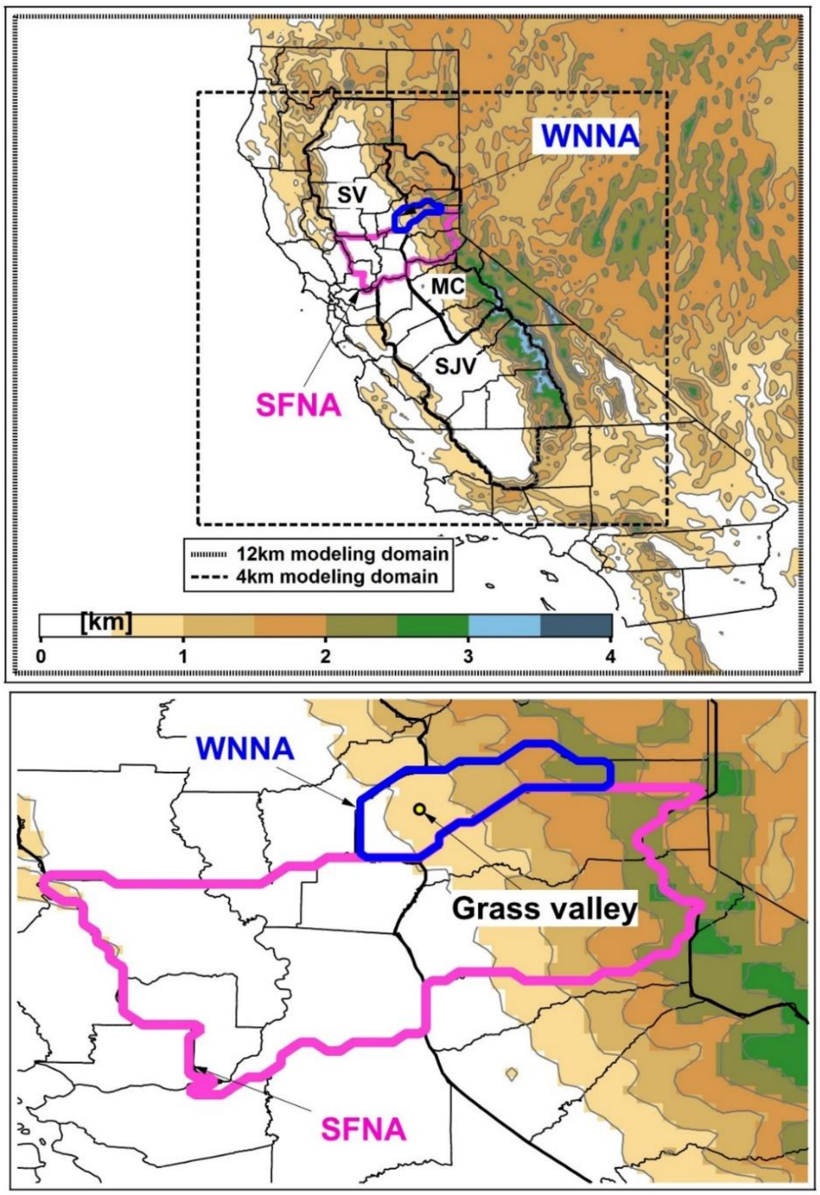
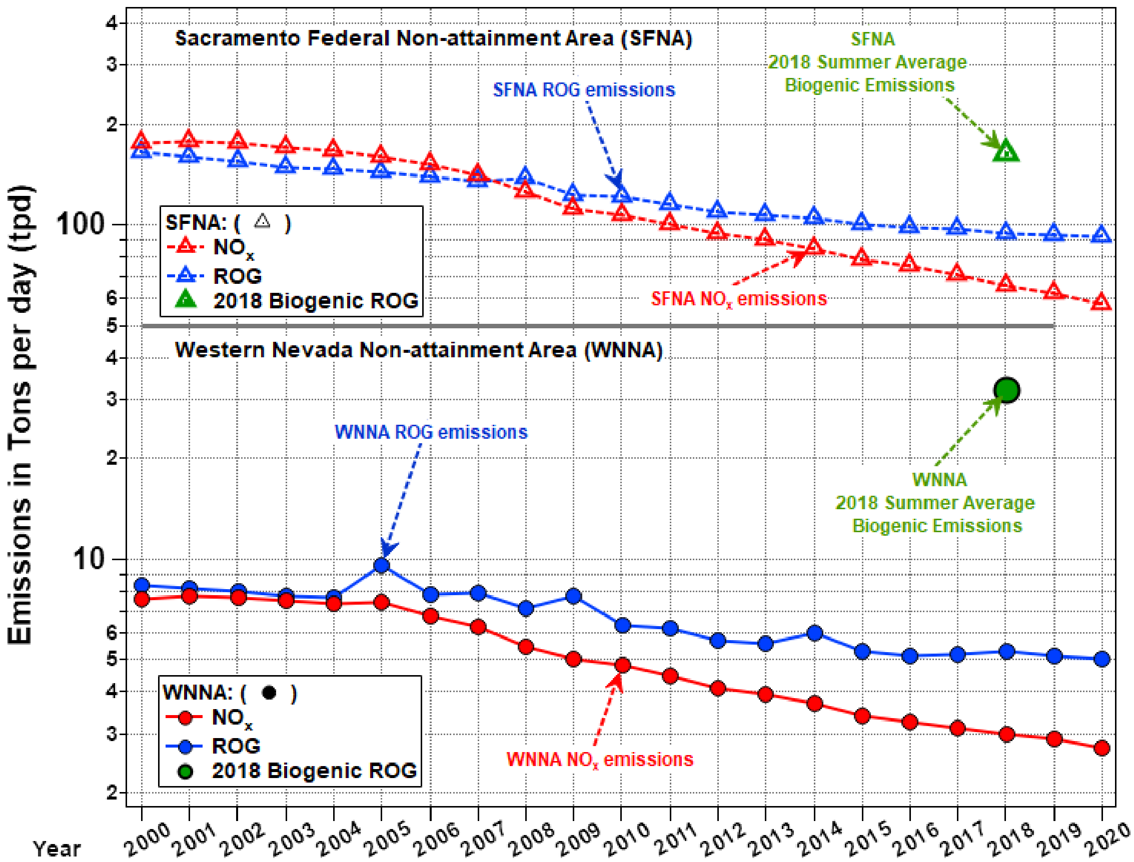
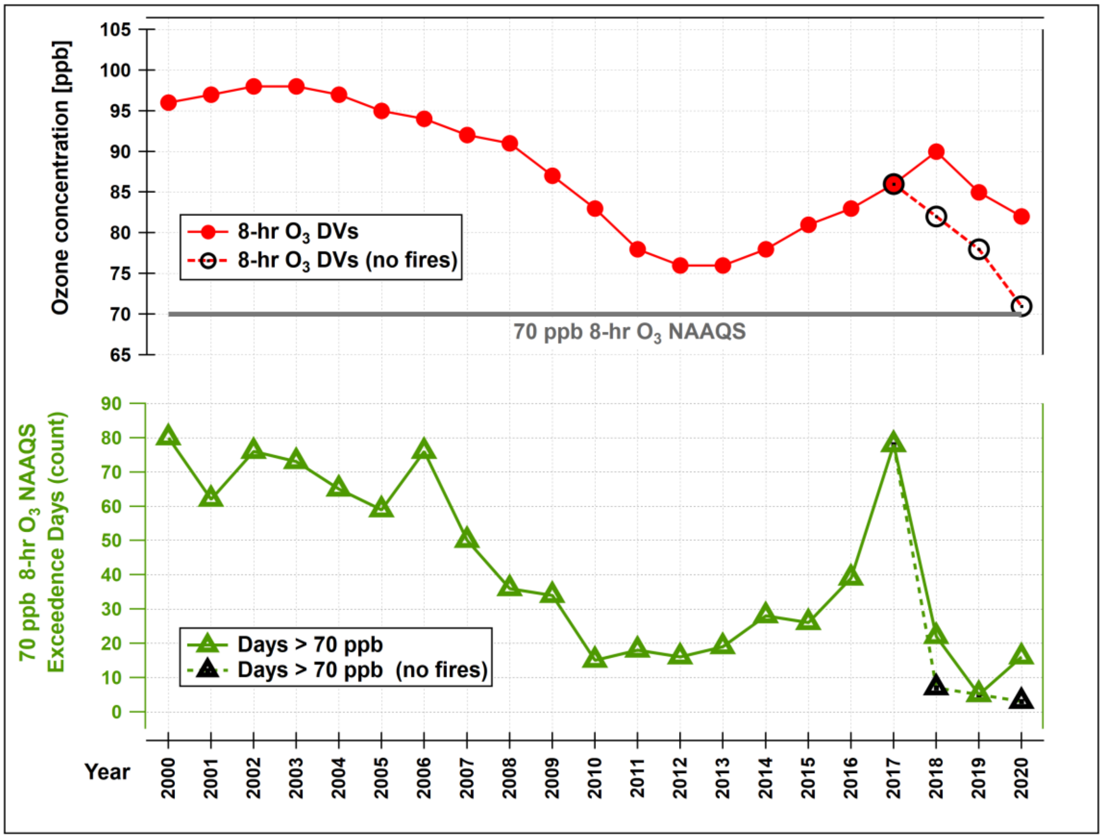


Figure 2. Trends in summer emissions of NOx and ROG (tons per day) between 2000 and 2020 in the SFNA and the WNNA. Anthropogenic Emissions estimates are from the California Emission Projection Model (CEPAM) 2019 Ozone SIP Baseline Projection Version 1.04 with 2017 base year. 2018 biogenic ROG emissions are from MEGAN 3.0 biogenic model calculations. Note that emissions are represented on a log scale, which can mask small changes in the emissions.



The trend in the WNNA's ozone design values (DV) for the past two decades (2000 – 2020) is shown in the top panel of **Figure 3**. The DVs exhibited a steady decline from 96 ppb in 2000 to 76 ppb in 2013. However, in recent years, DVs have shown an upward trend with DVs increasing from 76 ppb in 2013 to 86 ppb in 2017. The DVs starting from 2018 onwards suggest that the increasing trend is leveling off. Overall, the 8-hour ozone DVs in the WNNA have declined by 14 ppb (~17% reduction) from 96 ppb in 2000 to 82 ppb in 2020 (**Figure 3**). The trend in the number of exceedance days (i.e., exceeding the 70 ppb 8-hour ozone standard), which is a measure of overall air quality and the frequency of ozone exposure, is shown in the bottom panel of **Figure 3**. The number of exceedance days has reduced from 80 in 2000 to 16 in 2012, then increased from 19 in 2013 to 78 in 2017 before declining beginning in 2018.

Figure 3. WNNA trends in Maximum Daily Average 8-hour Ozone Design Value (ppb) and 70 ppb 8-hour Ozone NAAQS exceedance days between 2000 and 2020.



A few factors may have caused the higher ozone DVs in recent years. A CARB staff report (CARB, 2018) found that the high ozone concentrations and the high number of ozone exceedance days at Grass Valley site in 2017 are not shared by surrounding monitors and cannot be explained by emissions (e.g., local, biogenic or fire), upwind transport or meteorological conditions. This analysis suggests a potential positive bias in monitoring at the Grass Valley site in 2017. In 2018 and 2020, the prevalence of forest fires during the summer ozone season heavily impacted air quality in the WNNA and high ozone concentrations were observed at the Grass Valley site during fire impacted days (see Weight of Evidence section of the SIP document). To remove the impact of forest fires, ozone DVs were calculated by excluding days in 2018 and 2020 that were impacted by forest fires. Details about fire impact days can be found in the Weight of Evidence analysis. In the absence of fire impacted days, ozone DVs would be 82 ppb in 2018 and 71 ppb in 2020 (black circle markers in **Figure 3**). The number of exceedance days dropped to 7 (from 22) for 2018 and 3 (from 16) for 2020 when the fire impacted days were excluded (denoted by black triangle markers in bottom panel of **Figure 3**).

The WNNA is classified as serious for the 2015 70 ppb O_3 standard with an attainment year of 2026. This document serves as the modeling protocol and attainment demonstration for the 2015 standard for the WNNA. The modeling analysis uses 2018 as the base year for the attainment demonstration.

Methodology

U.S. EPA modeling guidance (U.S. EPA, 2018) outlines the approach for utilizing regional chemical transport models (CTMs) to predict future attainment of the 2015 (70 ppb) 8-hour ozone standards. The model attainment demonstration requires that CTMs be used in a relative sense, where the relative change in ozone to a given set of emission reductions (i.e., predicted change in future anthropogenic emissions) is modeled, and this relative change is used to predict how current/present-day ozone levels would change under future emissions scenarios.

The starting point for the attainment demonstration is the observational based design value (DV), which is used to determine the 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 1**). The U.S. EPA recommends using an average of three DVs to better account for the year-to-year variability in ozone levels due to meteorology. This average DV is called a 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 base 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 were averaged. 2020 is an atypical year with large societal changes in response to the COVID19 pandemic. 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 year 2020 was replaced by the two-year average of the 4th highest 8-hour O_3 concentrations from 2018 and 2019. **Table 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 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 DV_R).

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

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

Error! Reference source not found. (SHOUD BE TABLE 3)lists the DVs for 2018, 2019, and 2 020 as well as the weighted baseline DV for the Grass Valley monitoring site in the WNNA with and without fire impact.

Table 2. Year-specific 8-hour ozone design values for 2018, 2019 and 2020, and the average baseline design value (represented as the average of three design values) for 2018 at the Grass Valley site located in the WNNA. The 2020 DV is the two-year average of the 4th highest 8-hour O3 concentrations from 2018 and 2019.

Days in DV Calculation	2018 DV (ppb)	2019 DV (ppb)	2020 DV (ppb)	2018-2020 Average DV (ppb)
All	90	85	83	86.0
Fire Days Excluded	82	78	72	77.3

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

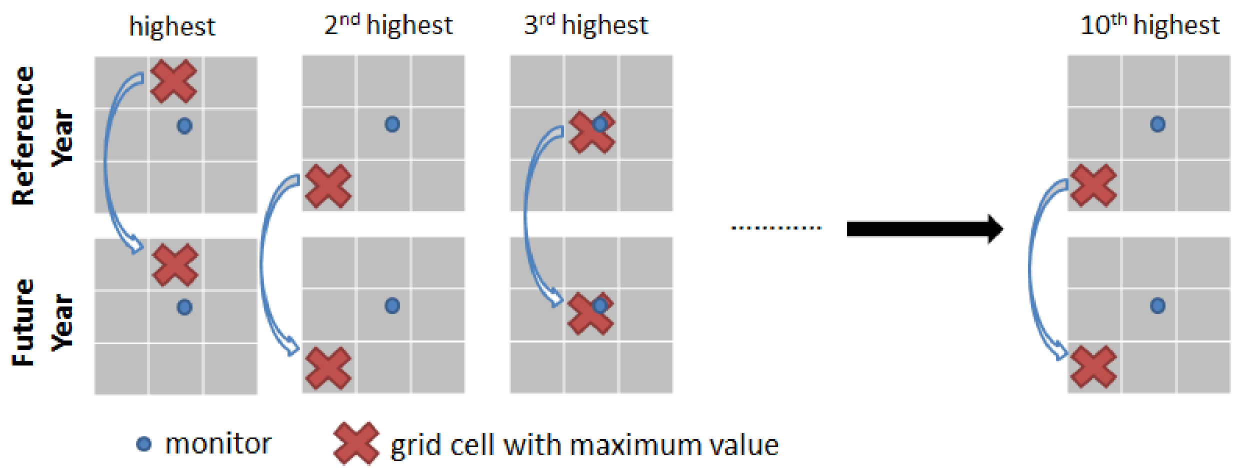
1. ***Base Year Simulation***
   The base year simulation for 2018 is used to assess model performance (i.e., to ensure that the model is reasonably able to reproduce the observed ozone mixing ratios). Since this simulation will be used to assess model performance, it is essential to include as much 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 observed local meteorological conditions, known wildfire and agricultural burning events.
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 (2026) was identical to the reference year simulation, except that the projected future year anthropogenic emission levels were used rather than the reference year emission levels. All other model inputs (e.g., meteorology, chemical boundary conditions, biogenic emissions, and calendar for day-of-week specifications in the inventory) are the same as those used in the reference year simulation.

Projecting the reference DVs to the future is done by first calculating the fractional change in ozone between the modeled future and reference years for each monitor location. These ratios, called “relative response factors” or RRFs, are calculated based on the ratio of modeled future year ozone to the corresponding modeled reference year ozone
(Equation 2).

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

Where, 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 4). 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 U.S. EPA modeling guidance (U.S. EPA, 2018) recommends using the 10 days with the highest modeled MDA8 ozone at each monitor location, where the 10 days are chosen from the reference year simulation and then the same corresponding days are selected from the future year simulation. Since the relative sensitivity to emissions changes (in both the model and real world) can vary from day-to-day due to meteorology and emissions (e.g., temperature dependent emissions or day-of-week variability) using the top 10 days ensures that the calculated RRF is not overly sensitive to any single day. Note that the MDA8 ozone from the reference and future year simulations are paired in both time (the same days are selected from each simulation) and space (the location of the peak MDA8 ozone within the 3x3 array of grid cells surrounding the monitor is selected from the reference year simulation and the same location is used when selecting the corresponding data from the future year simulation).

Figure 4. Example showing how the location of the MDA8 ozone for the top ten days in the reference and future years are chosen.



When choosing the top 10 days, the U.S. EPA recommends beginning with all days in which the simulated reference year MDA8 ozone is >= 60 ppb and then calculating RRFs based on the 10 days with the highest ozone in the reference simulation. If there are fewer than 10 days with MDA8 ozone >= 60 ppb then all days >= 60 ppb are used in the RRF calculation, as long as there are at least 5 days used in the calculation. If there are fewer than 5 days >= 60 ppb, an RRF cannot be calculated for that monitor. To ensure that only modeled days that 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.

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

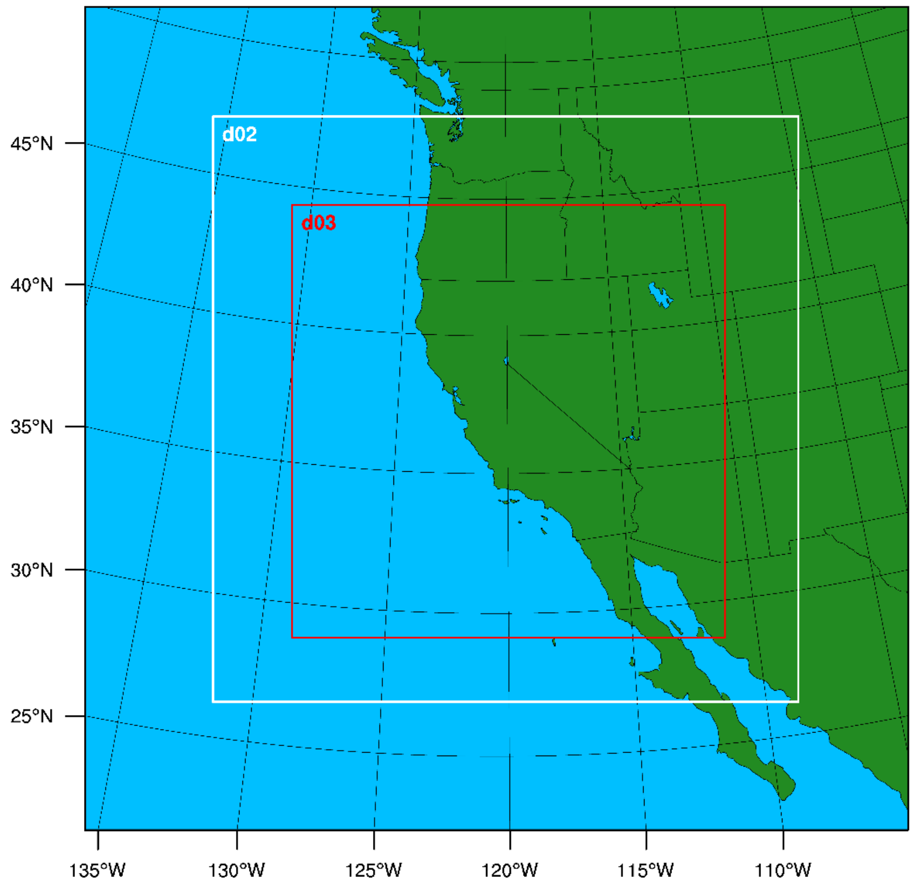
where, DV_F is the future year design value, DV_R is the reference year design value, and RRF is the site-specific RRF from Equation 2. The resulting future year DVs are then compared to the 8-hour ozone NAAQS to demonstrate whether attainment will be reached under the emissions scenario utilized in 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.

Meteorological Modeling

California's proximity to the ocean, complex terrain, and diverse climate represents a unique challenge for developing 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 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 and Schroeder 1966).

The state-of-the-science Weather Research and Forecasting (WRF) prognostic model (Skamarock et al., 2008) 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 5.**

Figure 5. WRF modeling domains (D01 36 km; D02 12 km; and D03 4 km).



The 4 km innermost domain has 427x427 grid points and spans 1748 km in the east-west and the north-south directions. There are 30 vertical layers with the lowest layer extending to 30 m above the surface (

Table **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 planetary boundary layer (PBL) scheme, cumulus parameterization for the outer two domains were the Yon-Sei University (YSU) PBL and Kain-Fritsch scheme, respectively. 5-layer thermal diffusion scheme was chosen as the land-surface option.

Table 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
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 major physics options for each domain are listed in **Table 4**. The Meteorology-Chemistry Interface Processor (MCIP) version 5.1 was used to process the 4 km (D03) WRF output for use in the CTM simulations.

Table 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

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.

The transport of pollutants from the Sacramento Federal Non-attainment Area (SFNA) can significantly contribute to the exceedances of the federal ozone NAAQS in the WNNA.

Therefore, it is useful to not only summarize the change in emissions from 2018 to 2026 in the WNNA, but also in the Sacramento Valley since emissions from this area are readily transported into the WNNA (**Table 5**).

Table 5. WNNA and SFNA Summer Planning Emissions for 2018 and 2026 (tons/day).

Source Category	2018 NOx [tpd]	2026 NOx [tpd]	NOx diff	2018 ROG [tpd]	2026 ROG [tpd]	ROG diff
Western Nevada Non-attainment Area (WNNA)						
Stationary	0.11	0.10	-5.7%	0.76	0.77	0.7%
Area	0.14	0.15	0.7%	1.68	1.70	1.6%
On-Road Mobile	1.85	0.74	-60.0%	0.80	0.52	-35.3%
Other Mobile	0.91	0.74	-18.8%	2.05	1.55	-24.3%
Total	3.01	1.72	-42.7%	5.29	4.54	-14.2%
Sacramento Federal Non-attainment Area (SFNA)						
Stationary	6.61	6.18	-6.5%	22.69	23.00	1.4%
Area	2.26	2.14	-5.2%	27.28	29.94	9.7%
On-Road Mobile	32.89	13.89	-57.8%	17.89	11.48	-35.8%
Other Mobile	23.86	18.19	-23.8%	26.28	19.81	-24.6%
Total	65.62	40.40	-38.4%	94.14	84.24	-10.5%

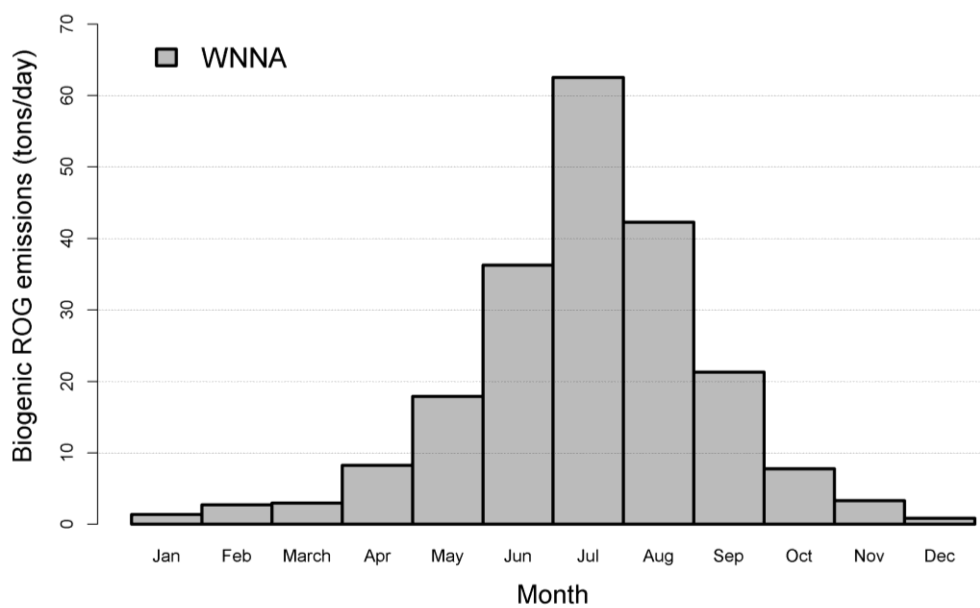
*Note that rounding errors may result in emissions totals that do not exactly match the sum of the individual categories.

Overall, anthropogenic NO_x emissions in CEPAM v1.04 were projected to decrease by ~43% between 2018 and 2026 (from 3 tpd to 1.7 tpd) in the WNNA with bulk of the reductions coming from on-road mobile sources. In contrast, anthropogenic ROG was projected to decrease ~15% by 2026 (from 5.3 tpd to 4.5 tpd) with the bulk of those reductions coming from all mobile sources including on-road and other mobile sources. In the upwind SFNA, the magnitude of the anthropogenic NO_x and ROG emissions is roughly 20 times that of the emissions in WNNA, while the relative change from 2018 to 2026 is comparable to the relative change in the WNNA.

Biogenic emissions were generated using the Model of Emissions of Gases and Aerosols from Nature model version 3.0 (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, and all stress factor adjustments were turned off.

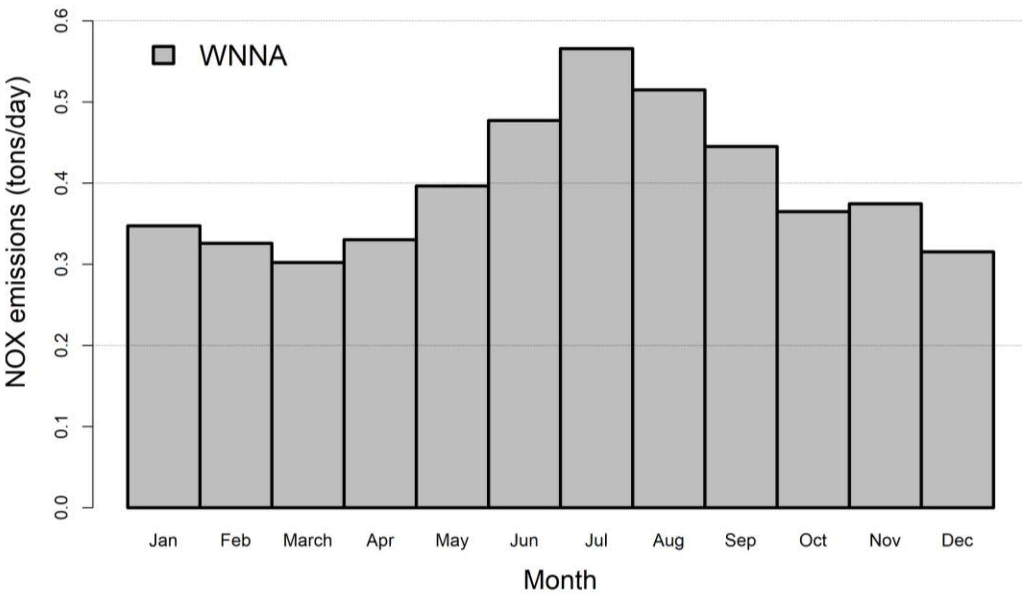
Monthly biogenic ROG totals for 2018 within the WNNA are shown in Figure 6. Throughout the summer, biogenic ROG emissions ranged from ~19 tpd in May to 62 and 42 tpd in July and August, with the difference in emissions primarily due to differences in temperature, solar radiation, and leaf area from month-to-month.

Figure 6. Monthly average biogenic ROG emissions for 2018 in the WNNA.



In addition to biogenic ROG emissions, the MEGAN model also estimates NOx 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 7** shows the monthly average soil NOx emissions for 2018 from MEGAN. Soil NOx emissions are highest during summer months where the emissions peak at 0.57 tpd in July.

Figure 7. Monthly average soil NOx emissions for 2018 in the WNNA.



Air Quality Modeling

Figure 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 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 Central valley region including the San Joaquin Valley (SJV), Sacramento Valley (SV), Mountain Counties (MC) air basins, SFNA and the WNNA, 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 **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 (U.S. EPA, 2018). CMAQ is the U.S. 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 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 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 et al., 2020; Lamarque et al., 2012) was developed by 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 vertical and horizontal setups of CMAQ meteorological inputs, and processed into CMAQ model ready format as well as mapped to CMAQ chemical species. The CAM-chem data for 2018 was obtained from the NCAR (https://www.acom.ucar.edu/cam-chem/cam-chem.shtml, Buchholz et al. 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 corresponding12 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 for the beginning day 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 starting 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.

C. Results

Meteorological Model Evaluation

Simulated surface wind speed, temperature, and relative humidity from the 4 km domain were validated against hourly observations from 15 surface stations in the region surrounding and upwind of the WNNA (**Figure 8**). Observational data for the surface stations were obtained from the CARB's Air Quality and Meteorological Information System (AQMIS) database available at http://www.arb.ca.gov/aqmis2/aqmis2.php. Table 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). Figure 8 shows the location of each of these sites, where the solid red circle markers denote the monitoring sites while the black lines denote the regional boundary of the WNNA. 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) and defined therein. The model performance statistical metrics were calculated using the available data at all the sites. A summary of these statistics for the area is shown in **Table 8**.

Table 7. Meteorological site location and parameter measured.

Site Number (Figure 3)	Site ID	Site Name	Parameter(s) Measured
1	3452	Pike County Lookout	Wind, T, RH
2	5744	Browns Valley	Wind, T, RH
3	2958	Yuba City-Almond Street	Wind, T, RH
4	3196	Cool-Highway 193	Wind, T, RH
5	5832	Auburn #3	Wind, T, RH
6	3290	Lincoln (RAWS)	Wind, T, RH
7	3291	Pilot Hill Station	Wind, T, RH
8	2956	Roseville-N Sunrise Blvd	Wind, T, RH
9	3187	Folsom-Natoma Street	Wind, T, RH
10	5776	Fair Oaks #2	Wind, T, RH
11	2731	Sacramento-Del Paso Manor	Wind, T, RH
12	5799	Bryte	Wind, T, RH
13	3011	Sacramento-T Street	Wind, T, RH
14	2143	Davis-UCD Campus	Wind, T, RH
15	3209	Sloughhouse	Wind

Figure 8. Meteorological monitoring sites utilized in the model evaluation: The solid red circle markers represent the monitoring sites while the thick black line denotes the spatial extent and regional boundary of the Western Nevada county 8-hour ozone Non-attainment Area (WNNA). Numbers reflect the sites listed in **Table 7**.

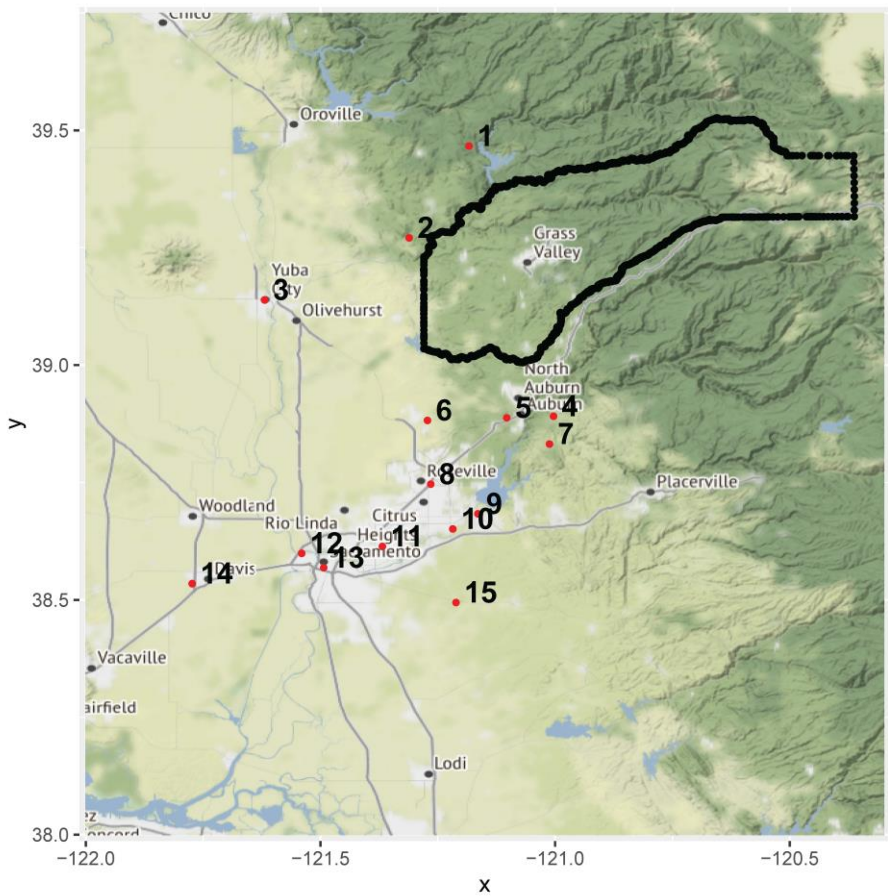


Table 8. Hourly surface wind speed, temperature and relative humidity statistics by region for Apr through October 2018. IOA denotes index of agreement.

Variable	Observed Mean	Modeled Mean	Mean Bias	Mean Error	IOA
Wind Speed (m/s)	1.73	2.38	0.68	0.72	0.73
Temperature (K)	293.99	292.82	-1.17	1.69	0.97
Relative Humidity (%)	52.02	64.37	12.35	13.75	0.83

The average hourly wind speed bias for April-October 2018 is relatively small at 0.68 m/s, while the average mean error is 0.72 m/s. The index of agreement for the wind speed in this period is 0.73. Temperature is biased low with an average bias of -1.17 K, while the IOA for temperature is 0.97. Consistent with the negative temperature bias, relative humidity has a positive bias of 12.35%. The distribution of daily mean bias and mean error are shown in Figure 9 while observed vs. modeled scatter plots of hourly wind speed, temperature, and relative humidity are shown in **Figure 10**.

These results are comparable to other recent WRF modeling efforts in California investigating ozone formation in Central California (Hu et al., 2012) and modeling analyses for the CalNex and CARES field studies (Fast et al., 2012; Baker et al., 2013; Kelly et al., 2013; Angevine et al., 2012). Detailed hourly time-series of surface temperature, wind speed, and wind direction for the area along with spatial distribution of the mean bias and mean error can be found in the supplemental materials.

Figure 9. Distribution of daily mean bias (left) and mean error (right) from April – October 2018. Results are shown for wind speed (top), temperature (middle), and RH (bottom).

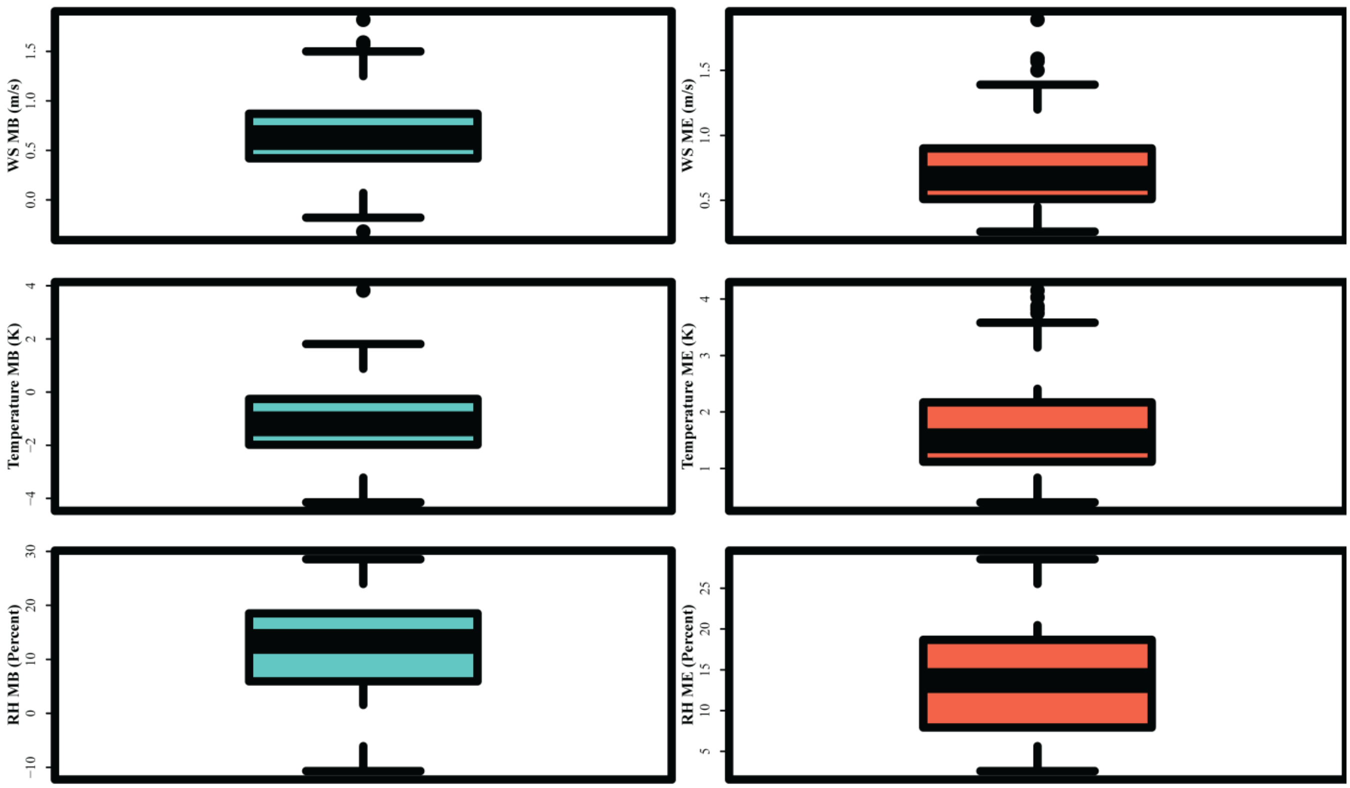
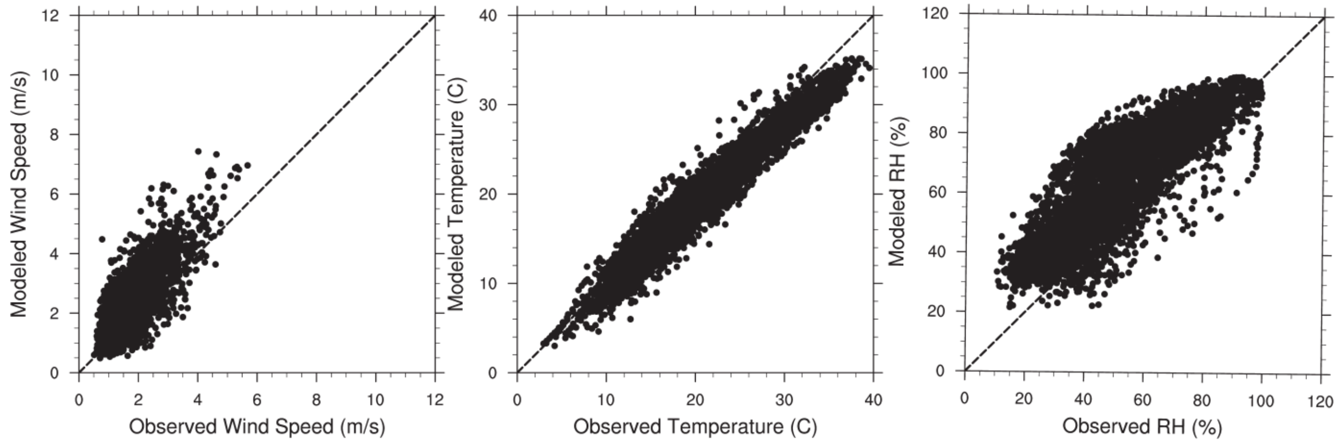


Figure 10. Comparison of modeled and observed hourly wind speed (left), 2-meter temperature (center), and relative humidity (right), April – October 2018.



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 WNNA in more detail.

Past observations and analyses have shown that the WNNA is subject to pollution transport from the south to south west including from the Sacramento metropolitan area (Van Ooy and Carroll 1995; CARB, 2018). Its meteorology is also expected to be influenced by upslope and downslope winds associated with the surrounding terrain. Figure 11 shows the 24-hour back trajectories from every hour on July 19, 2018 at the Grass Valley-Litton Building ozone monitoring site. The highest 8-hour ozone concentration without fire impact at the site in 2018 occurred on this day with a maximum daily average 8-hour ozone mixing ratio of 77 ppb observed at the Grass Valley ozone monitoring site. The trajectories were calculated with the National Oceanic and Atmospheric Administration (NOAA) Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model (Stein et al., 2015) driven by WRF meteorology. These back trajectories are typical of a high ozone day at the Grass Valley monitor and demonstrate that the transport pathways are generally from the southwest. Some of the trajectories have a circular pattern around the Grass Valley site indicating downslope and upslope flow impacts which illustrates that the model is able to reproduce these complex transport pathways to and within the WNNA. The upper-level weather charts show that a 500 mb high pressure system was observed over California and most of the Southwest US on that day. **Figure 12**

Figure 11. Grass Valley 24-hour back trajectories from every hour on July 19, 2018 at 3 m above ground level. The Grass Valley-Litton Building ozone monitoring site is marked with a red star.

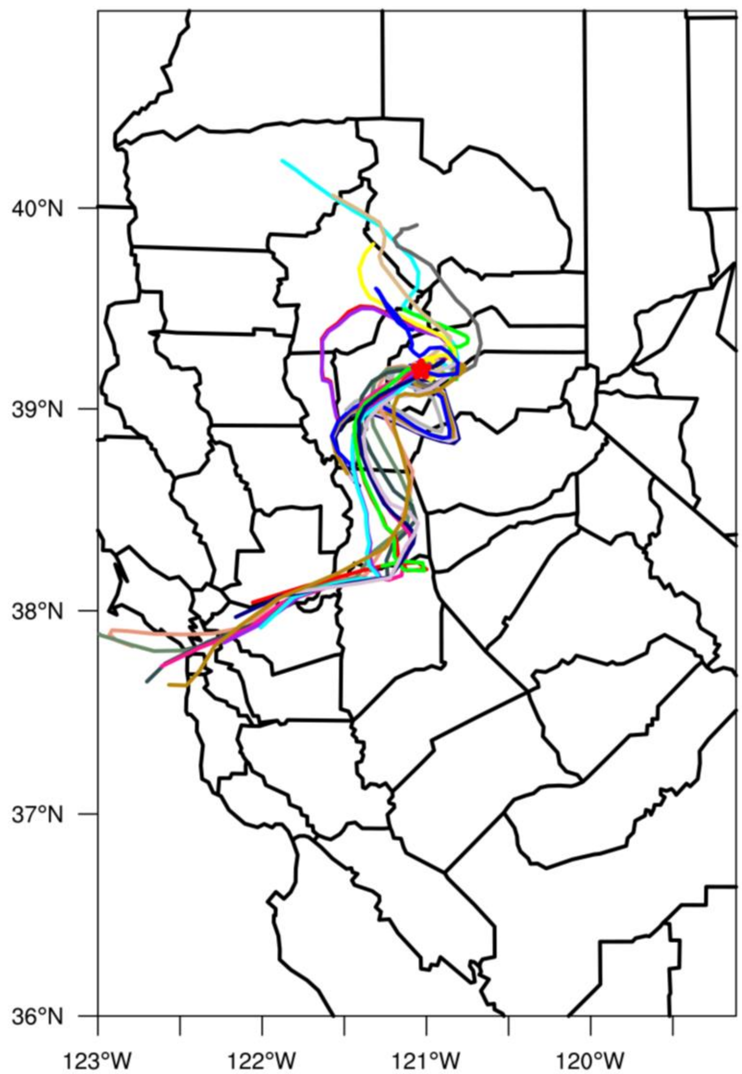
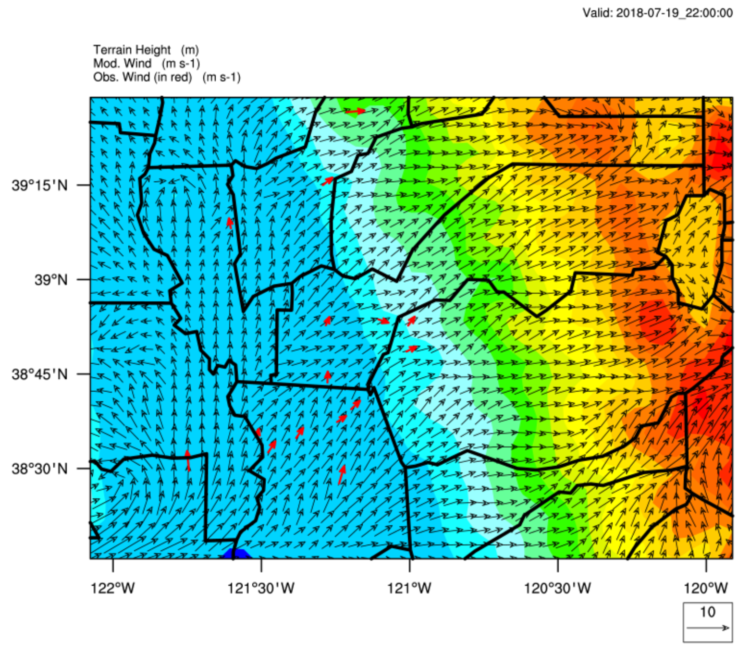
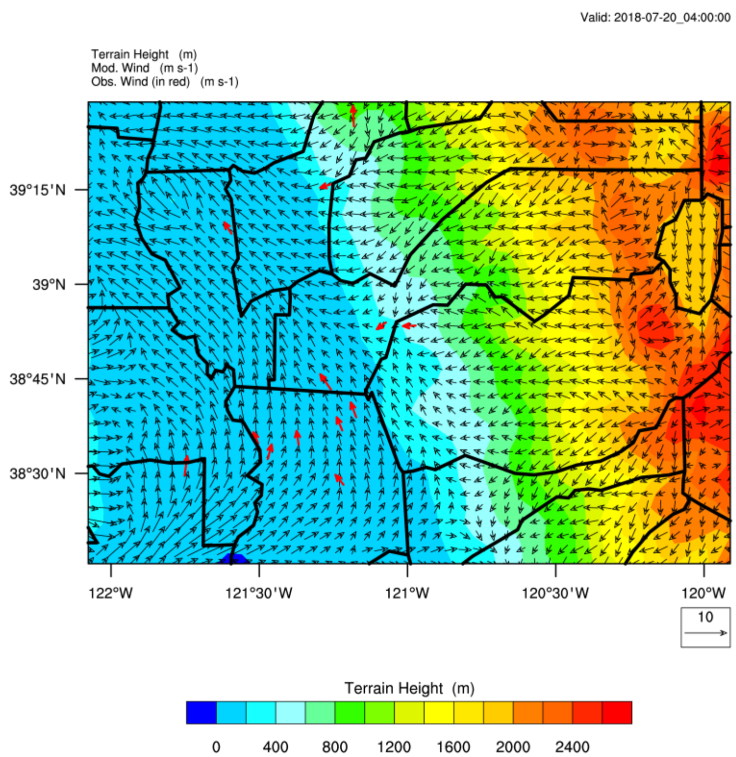


Figure 12 shows the surface wind fields in the early afternoon (14:00 PST) and the evening (20:00 PST) on July 19, 2018 with the observed and modeled values denoted by red and black arrows, respectively. Overall, modeled winds compare relatively well with the observed values, with winds during the early afternoon hours being influenced by upslope flows, while evening winds were impacted by downslope flows over the mountain counties. Winds in the Sacramento Valley show an influence from both the Coastal Ranges to the west and the Sierra Nevada Range to the east. At 20:00 PST, the wind field had an eddy like pattern over the Yolo and Solano areas, indicating the occurrence of the Schultz eddy along the west side of the valley.

Figure 12. Surface wind field at 14:00 PST (top) and 20:00 PST (bottom) on July 19, 2018. Modeled wind field is shown with black wind vectors, while observations are shown in red.



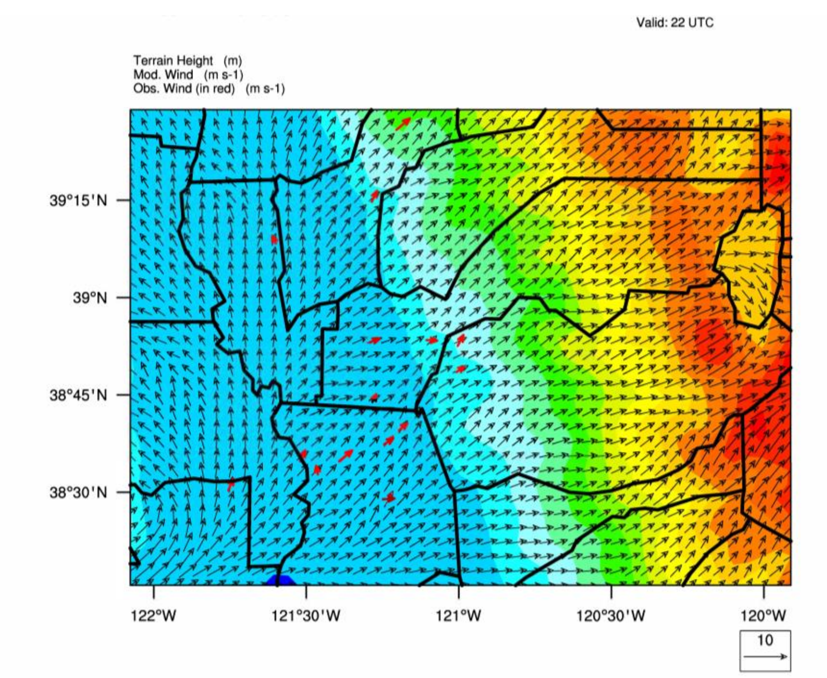


Since RRF calculations in the model attainment test described previously are based on the top 10 peak ozone days, the modeled and measured winds in the region were examined in further detail for the top 10 ozone days observed at the Grass Valley site in 2018. The ten highest maximum daily average 8-hour ozone mixing ratios observed at the Grass Valley-Litton Building site in 2018 occurred on July 19, September 21, September 20, June 26, September 28, August 19, September 4, August 6, August 15 and August 20, respectively. **Figure 13** shows the mean wind field (vector average) for the top 10 ozone days at 14:00 PST and 21:00 PST, respectively. Overall, the surface wind distribution indicates that the model is in general agreement with the observations and is able to capture many of the important features of the observed meteorological fields on those days when elevated ozone levels occurred.

Figure 14 shows the 500 hPa geopotential height at 00:00 UTC and 12:00 UTC for the top 10 ozone days in 2018 at the Grass Valley site. These times were chosen to coincide with timing of the upper-air observations in the region. 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 (including upper-air observations) 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 it is one of the major parameters related to regional synoptic patterns. It can be seen from Figure 14 that on average the 500 hPa geopotential height is ~5800 m above sea level on these peak ozone days, 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 8**), provides added confidence in the meteorological fields utilized for this attainment demonstration modeling.

Figure 13. Average wind field at 14:00 PST (top) and 21:00 PST (bottom) for the top 10 observed ozone days at Grass Valley-Litton Building monitor in 2018. Modeled wind field is shown with black wind vectors, while observations are shown in red.



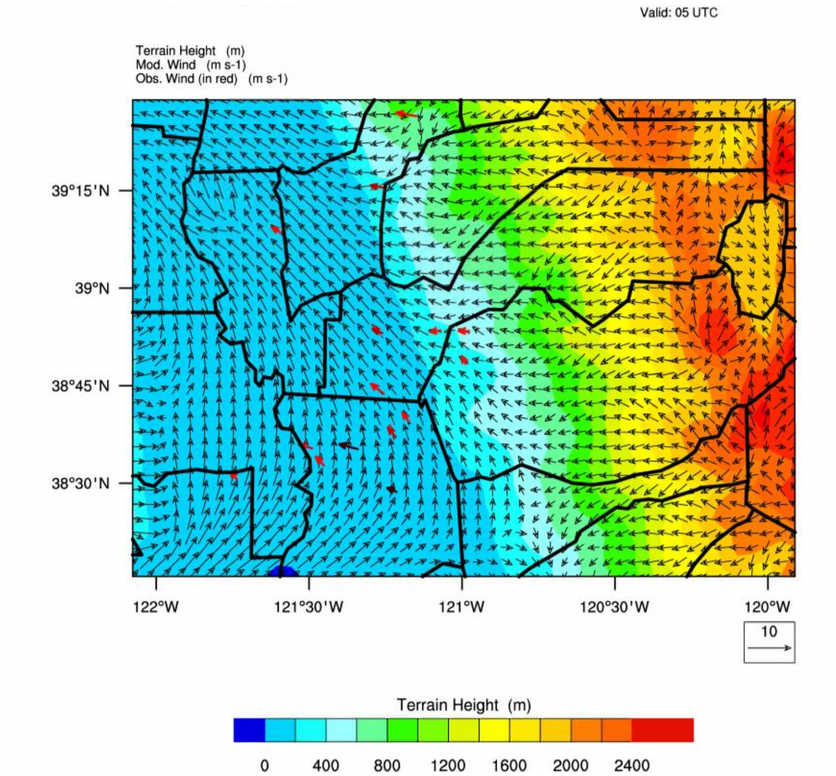
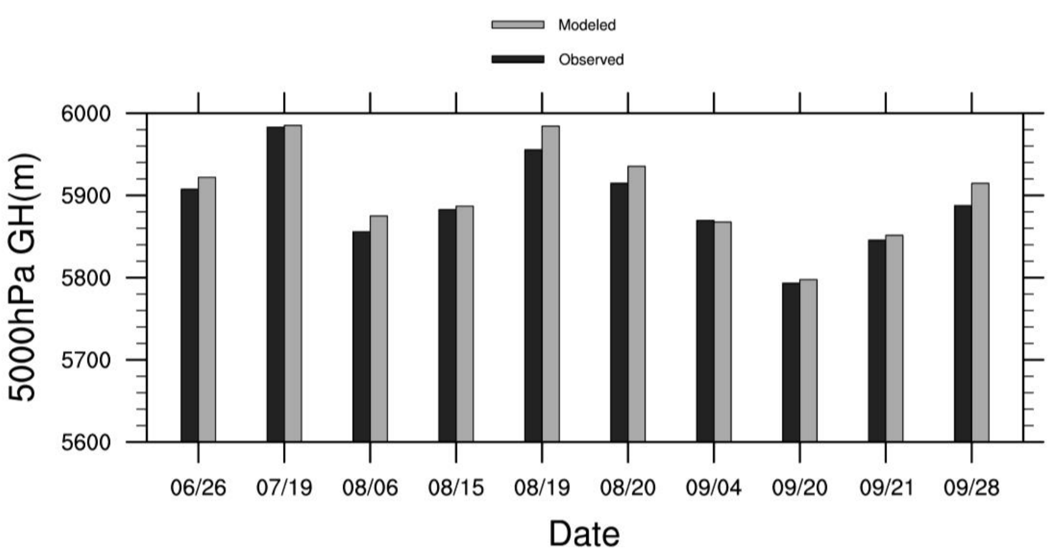
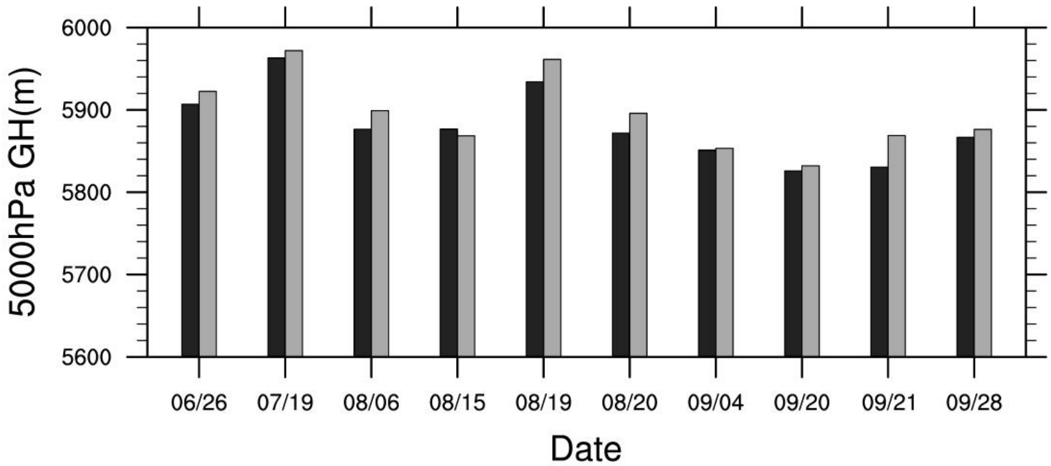


Figure 14. Modeled and observed at 00:00 UTC (top) and 12:00 UTC (bottom) 500 hPa geopotential height for the top 10 observed ozone days at the Grass Valley monitor in 2018.





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 ozone at the Grass Valley-Litton Building site. The U.S. EPA modeling guidance (U.S. 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 been used in different model evaluation studies (Emery et al., 2017), U.S. 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. Since fire days were excluded for baseline design value calculation (**Error! Reference source not found.**), (Table 2) model performance for days without wildfires w as also evaluated.

As recommended by U.S. EPA modeling guidance (U.S. EPA 2018), 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 Grass Valley-Litton Building site in the WNNA. Performance statistics for modeling scenarios with all valid data, only data above 60 ppb, and data excluded from fire days are reported separately for different ozone metrics including maximum daily average 8-hour ozone, maximum daily average 1-hour ozone, and hourly ozone (all hours of the day) for the monitored grid cell as well as the 3x3 maximum.

Model performance with data excluded from fire days is also evaluated for the Grass Valley-Litton Building site in the WNNA. Performance statistics for maximum daily average 8-hour ozone are shown in Table 9 and **Error! Reference source not found.**. Overall, when simulated data extracted at the grid cell are used for comparison with observations (as shown in **Table 9**), the model shows a bias of 2.82 ppb of maximum daily average 8-hour ozone in the WNNA. However, when only observed data greater than 60 ppb are used, the model shows a negative bias of -6.18 ppb. Similarly, when the 3x3 maximum data is used for comparison, there is a positive bias in the model with all the valid data (3.59 ppb) and a negative bias with only observed data over 60 ppb (-5.14 ppb). This result indicates the model has a slight under-prediction of maximum daily average 8-hour ozone at high values in the WNNA. Model performance shows significant improvement when data from fires days are excluded from the evaluation. The mean bias of model predictions for maximum daily average 8-hour ozone with 60 ppb cutoff are -1.31 ppb and -0.35 ppb for data extracted at the monitor grid cell and 3x3 maximum grid cells surrounding the monitor, respectively. Similar statistics for maximum daily average 1-hour ozone and hourly ozone can be found in **Table 11** to **Table 13**.

Model performance statistics within the range of values shown in **Table 9** to **Table 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 SAPRC07 chemical mechanism and found that a model bias of -10.8 ppb for maximum daily average 8-hour ozone with 60 ppb cutoff (compared to -6.18 ppb for all data and -1.31 ppb for data excluding fire days for WNNA in Table 9 of this work). Hu et al. (2012) also shows a model bias of -12.7 ppb for maximum daily average 1-hour ozone in Central California with 60 ppb cutoff (compared to -4.43 ppb for all data and -0.80 ppb for data excluding fire days in this work).

Table 9. Maximum daily average 8-hour ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated maximum daily average 8-hour ozone data were extracted at grid cell where the monitor is located.

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	210	195	62	47
Mean obs (ppb)	54.87	52.51	70.61	65.85
Mean Bias (ppb)	2.82	4.69	-6.18	-1.31
Mean Error (ppb)	8.86	7.90	9.41	5.57
RMSE (ppb)	11.51	9.84	13.38	6.78
Mean Fractional Bias (%)	6.50	9.19	-8.62	-2.28

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Mean Fractional Error (%)	15.95	14.99	13.44	8.64
Normalized Mean Bias (%)	5.14	8.92	-8.75	-1.99
Normalized Mean Error (%)	16.16	15.04	13.32	8.45
R-squared	0.29	0.33	0.02	0.19

Table 10. Maximum daily average 8-hour ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated maximum daily average 8-hour ozone data were extracted from the 3x3 grid cell array maximum centered at the monitor.

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	210	195	62	47
Mean obs (ppb)	54.87	52.51	70.61	65.85
Mean Bias (ppb)	3.59	5.42	-5.14	-0.35
Mean Error (ppb)	9.03	8.17	9.26	5.77
RMSE (ppb)	11.62	10.15	13.04	6.97
Mean Fractional Bias (%)	7.81	10.46	-7.07	-0.84
Mean Fractional Error (%)	16.19	15.39	13.14	8.84
Normalized Mean Bias (%)	6.54	10.31	-7.28	-0.52
Normalized Mean Error (%)	16.45	15.55	13.11	8.77
R-squared	0.30	0.34	0.02	0.17

Table 11. Maximum daily average1-hour ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated maximum daily average 1-hour ozone data were extracted at grid cell where the monitor is located.

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	208	193	89	74
Mean obs (ppb)	59.19	56.68	72.01	68.08
Mean Bias (ppb)	2.20	4.10	-4.43	-0.80
Mean Error (ppb)	9.27	8.25	8.69	5.93
RMSE (ppb)	12.19	10.32	12.86	7.72
Mean Fractional Bias (%)	5.11	7.65	-5.77	-1.36
Mean Fractional Error (%)	15.56	14.63	11.87	8.69
Normalized Mean Bias (%)	3.71	7.24	-6.15	-1.18
Normalized Mean Error (%)	15.66	14.56	12.07	8.71
R-squared	0.31	0.35	0.08	0.24

Table 12. Maximum daily average 1-hour ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated maximum daily average 1-hour ozone data were extracted from the 3x3 grid cell array maximum centered at the monitor.

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	208	193	89	74
Mean obs (ppb)	59.19	56.68	72.01	68.08
Mean Bias (ppb)	3.45	5.27	-2.81	0.65

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Mean Error (ppb)	9.45	8.63	8.45	6.13
RMSE (ppb)	12.22	10.76	12.23	7.88
Mean Fractional Bias (%)	7.10	9.54	-3.44	0.78
Mean Fractional Error (%)	15.80	15.15	11.43	8.84
Normalized Mean Bias (%)	5.83	9.29	-3.91	0.96
Normalized Mean Error (%)	15.96	15.23	11.74	9.00
R-squared	0.34	0.37	0.10	0.23

Table 13. Hourly ozone performance statistics in the WNNA for the 2018 ozone season (April - October). Simulated hourly ozone data were 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	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Number of data points	5074	4719	923	608
Mean obs (ppb)	49.33	47.35	70.04	65.70
Mean Bias (ppb)	2.07	3.61	-10.60	-5.67
Mean Error (ppb)	9.54	8.81	12.58	8.41
RMSE (ppb)	12.14	10.85	16.60	10.49
Mean Fractional Bias (%)	5.82	8.29	-16.46	-9.80
Mean Fractional Error (%)	19.43	18.74	19.34	13.80
Normalized Mean Bias (%)	4.19	7.61	-15.14	-8.63

Parameter	WNNA	WNNA w/o fire days	WNNA with observed data over 60 ppb	WNNA w/o fire days with observed data over 60 ppb
Normalized Mean Error (%)	19.34	18.60	17.96	12.80
R-squared	0.25	0.26	0.01	0.11

Simon et al. (2012) conducted a review of photochemical model performance statistics published between 2006 and 2012 for North America (from 69 peer-reviewed articles). In Figure 15, the statistical evaluation of this model attainment demonstration is compared to the model performance summary presented in Simon et al. (2012) by overlaying various summary statistics onto the Simon et al. (2012) model performance summary. Note that the box-and-whisker plot (colored in black) shown in Figure 15 is reproduced using data from Figure 4 of Simon et al. (2012). The red dot and blue triangle in each of the panels in Figure 15 denote the model performance statistics from the current modeling work, calculated using the simulated monitor grid cell and the 3x3 maximum, respectively. Corresponding model performance statistics when fire days are excluded from calculation are shown as purple dot and brown triangle in each of the panels in Figure 15. As shown in the plot, the model performance improved significantly with fire days excluded from calculation for all statistical metrics.

Figure 15 clearly shows that the model performance statistical metrics for hourly, maximum daily average 8-hour ozone and maximum daily average 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 9** and **Error! Reference source not found.**.

Spatial distributions of modeled and observed average maximum daily average 8-hour ozone for the top 10 O_3 days at the Grass Valley-Litton Building site are displayed in **Figure 16**. The observation data are from the monitoring sites located in Sacramento, WNNA that are within the modeling domain. The model is able to capture the observed spatial gradient of ozone in the modeling domain with good agreement between model and observation at the Grass Valley site. Additional analysis, including time series, scatter plots, and frequency distribution of the hourly, maximum daily average 1-hour ozone and maximum daily average 8-hour ozone data can be found in the supplemental materials. There is no NO_x measurement available at Grass Valley-Litton Building site. The supplemental materials also include time series comparison between modeled and observed data for NO_x at nearby upwind sites in the SFNA: Roseville and Folsom.

Figure 15. Comparison of various statistical metrics from the model attainment demonstration modeling to the range of statistics from the 69 peer-reviewed studies summarized in Simon et al (2012). (MDA denotes Maximum Daily Average). 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. For data excluding fire days, purple circular markers show statistics calculated from modeled ozone at the monitor location, while brown triangular markers show statistics calculated from the maximum ozone in the 3x3 array of grid cells surrounding the monitor. Statistics were calculated with all valid modeled ozone data.

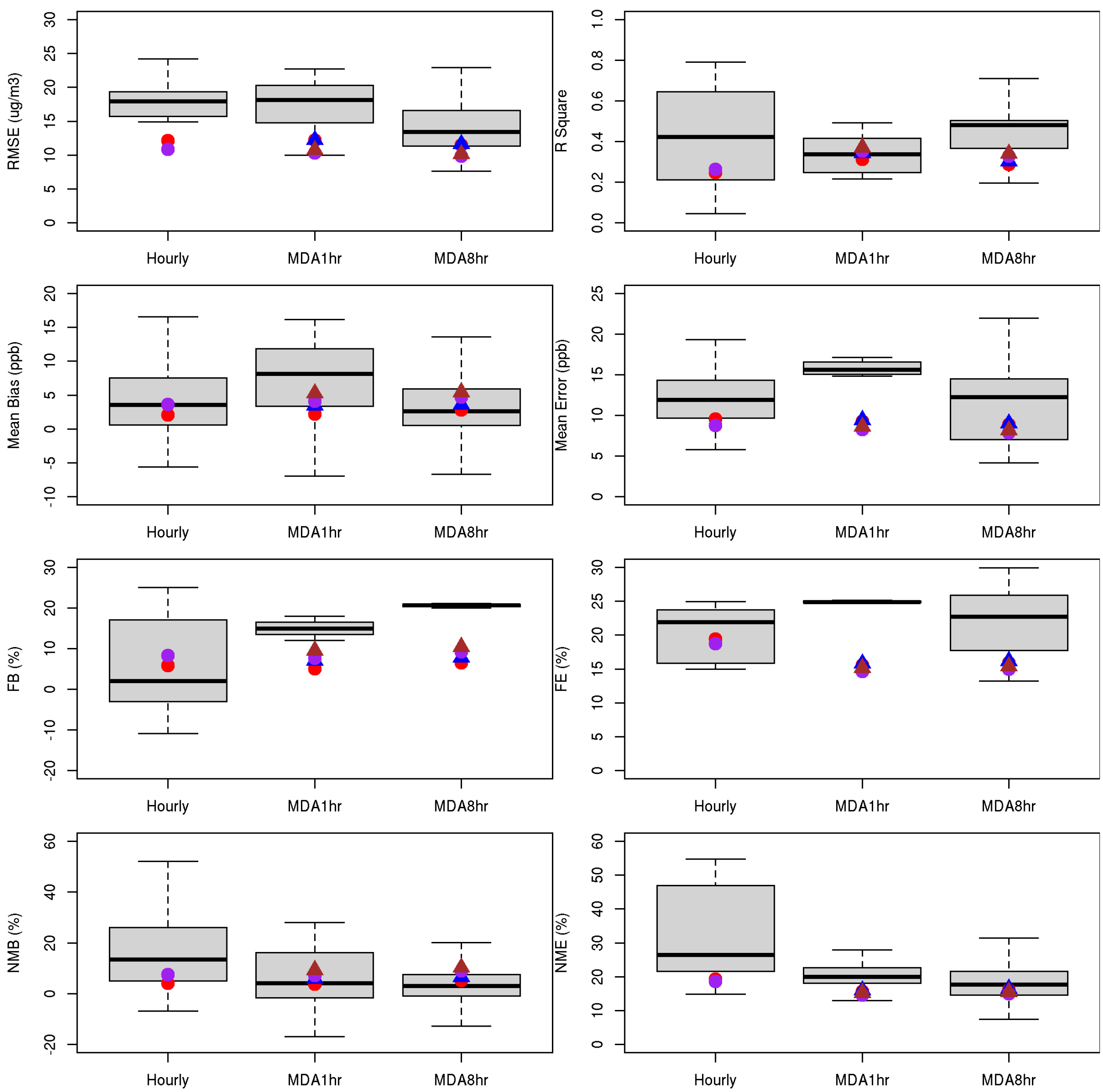
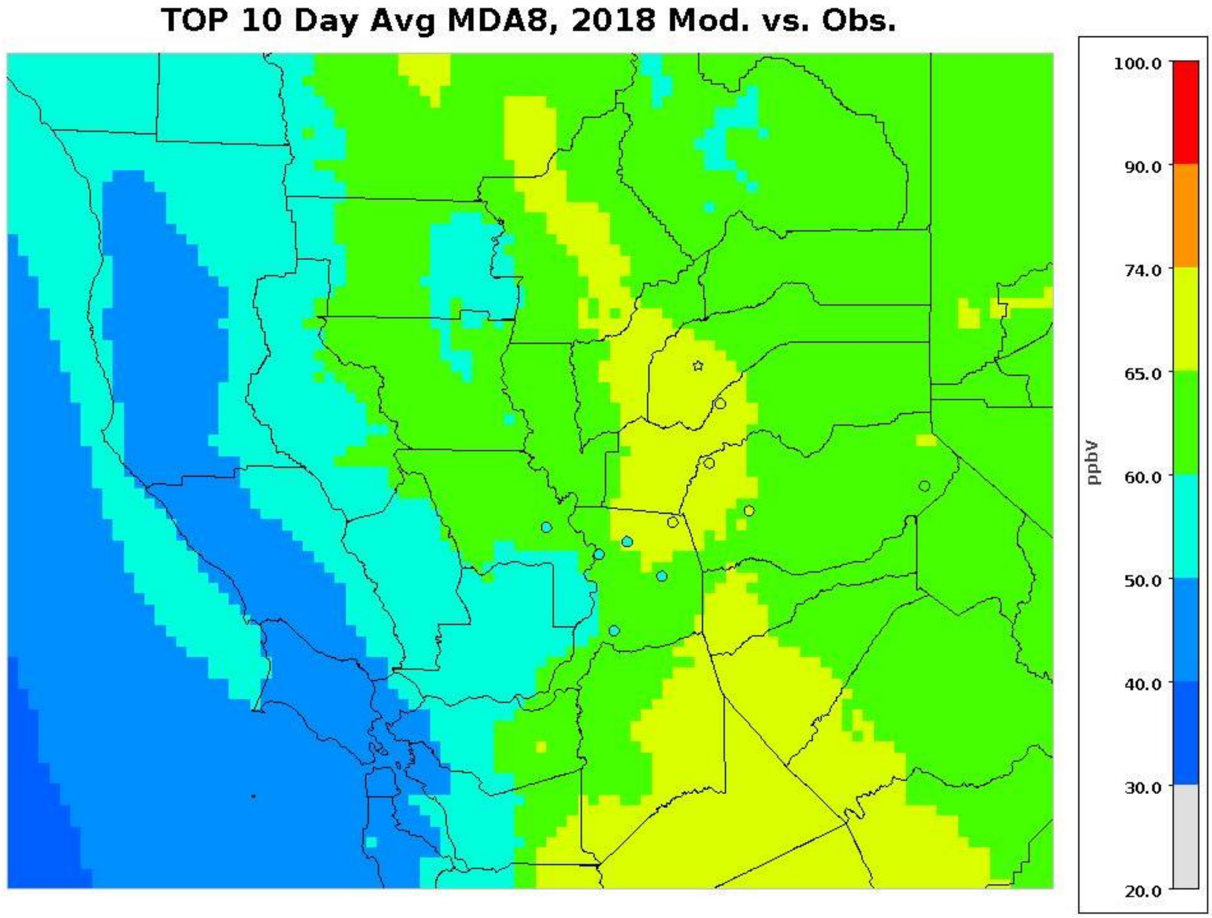


Figure 16. Average MDA8 ozone for the top 10 ozone days in 2018 from the model simulations overlaid with observation data (Sacramento sites marked as circle, Grass Valley marked as star), where the top 10 days from the observations were chosen based on the Grass Valley-Litton Building site.



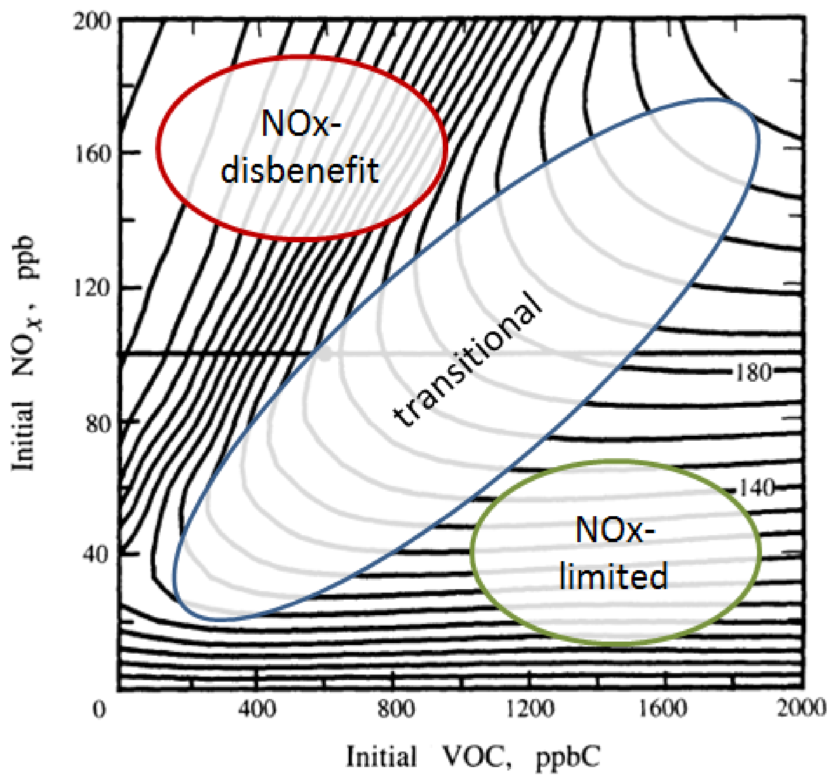
Air Quality Model Diagnostic Evaluation

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 can reproduce observed 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 many major urbanized areas where emissions of NO_x are substantially lower on weekends than on weekdays due to reduced truck activity but measured levels of ozone are higher. This is due to the complex and non-linear relationship between NO_x and ROG precursors and ozone (Sillman 1999).

In general terms, under ambient conditions of high-NO_x and low-ROG (NO_x-disbenefit region in **Figure 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 17.**), ozone formation shows a benefit to reductions in NO_x emissions, while changes in ROG emissions result in only minor decreases in ozone. These two distinct "ozone chemical regimes" are illustrated in **Figure 17.** along with a transitional regime that can exhibit characteristics of both the NO_x-disbenefit and NOx-limited regimes. Note that **Figure 17.** is shown for illustrative purposes only and does not represent the actual ozone sensitivity within the WNNA for a given combination of NO_x and ROG (VOC) emissions.

Figure 17. Illustrates 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).



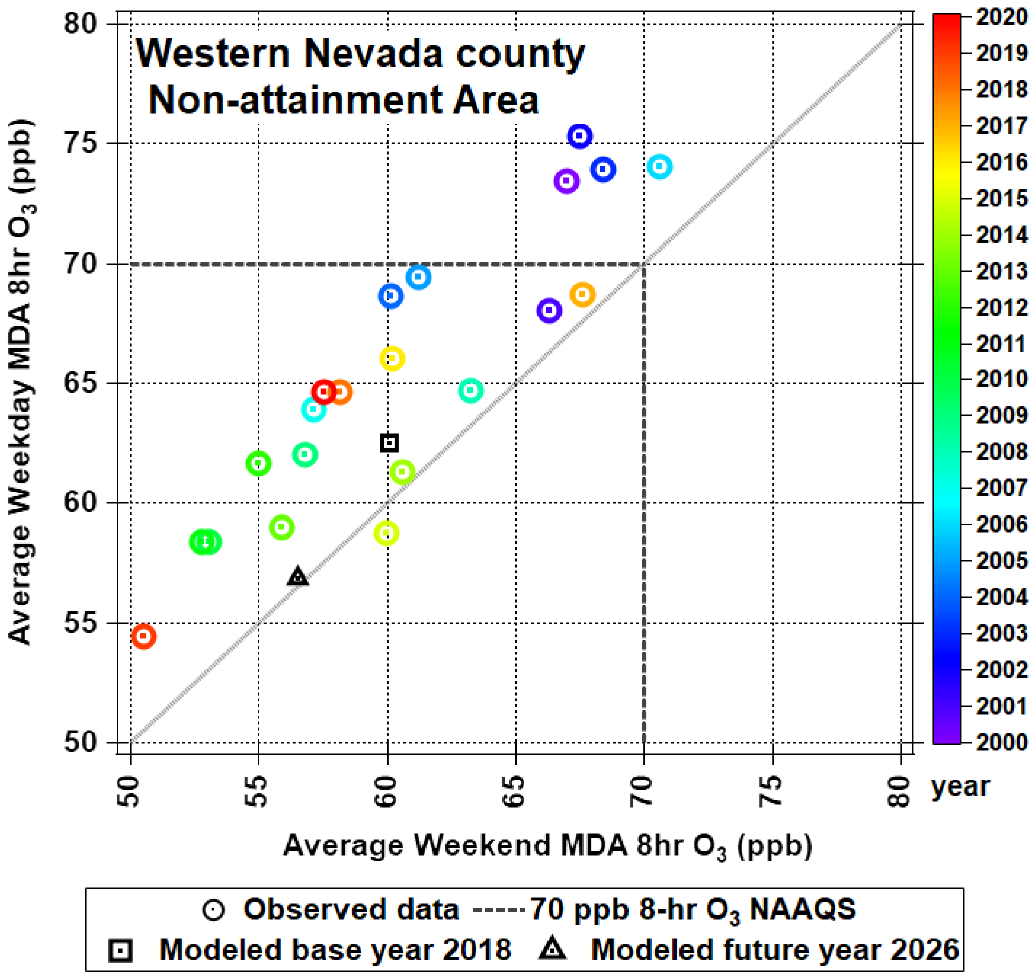
In this context, the prevalence of a weekend effect in a region suggests that the region is in a NO_x-disbenefit regime (Heuss et al., 2003). A lack of a weekend effect (i.e., no pronounced high O_3 occurrences during weekends) would suggest that the region is in a transition regime and moving between exhibiting a NO_x-disbenefit and being NO_x-limited. A reversed 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 WNNA and how well it is represented in the modeling. The trend in day-of-week dependence in the WNNA 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 18**). Different definitions of weekday and weekend days were also investigated and did not show appreciable differences from the Wednesday/Thursday and Sunday definitions.

A key observation in **Figure 18** is that the summertime average weekday and weekend MDA8 ozone levels have steadily declined between 2000 and 2020. Along with the declining ozone, it is evident that the WNNA has been in a NO_x limited regime at least since 2000, as seen from the greater weekday ozone when compared to weekend ozone. This region is in close vicinity of biogenic ROG emissions sources and farther away from the anthropogenic NO_x sources, such that low NO_x and high ROG reactivity conditions are prevalent, which is consistent with the region being in a NO_x-limited regime. The occasional shift in weekday/weekend ozone levels closer to the 1:1 dashed line (and in some years crossing over the line) is likely due to interannual variability in meteorological conditions and its impact on the regional transport patterns and local biogenic ROG emissions.

The simulated baseline 2018 weekday/weekend values (black square marker in Figure 18) from the attainment demonstration modeling shows greater weekday ozone compared to weekend ozone, which is consistent with observed findings in 2018 that show a prevalence of NO_x-limited conditions in the WNNA. The predicted future 2026 value (black triangle marker in **Figure 18**) clearly shows that weekday and weekend ozone decline significantly (all values are below 65 ppb) suggesting that NO_x controls will be more effective than corresponding ROG controls in lowering the ozone levels in the WNNA.

Figure 18. Site-specific average weekday and weekend maximum daily average 8-hour ozone for each year from 2000 to 2020 in the WNNA. The colored circle markers denote observed values while the black square and triangle markers denote the simulated baseline 2018 and future year 2026 values. Points falling below the 1:1 dashed line represent a NOx-disbenefit regime, those on the 1:1 dashed line represent a transitional regime, and those above the 1:1 dashed line represent a NOx-limited regime.



Relative Response Factors and Future Year Design Values

The RRFs and future year design values for the Grass Valley-Litton Building site in the WNNA were calculated using the procedures outlined in the corresponding sections and are summarized in **Table 14.** The projected ozone design value in 2026 is 69 ppb at the site when the fire impacted days were excluded in the baseline design value calculation.

Table 14. Summary of key parameters related to the calculation of future year 2026 8-hour ozone design values (DV), using the method defined in the U.S. EPA guidance, at the Grass Valley-Litton Building monitoring site in the WNNA.

Days in Base DV Calculation	RRF	2018 Average DV (ppb)	2026 DV (ppb)	2026 DV Truncated (ppb)
All	0.9035	86.0	77.7	77
Fire Days Excluded	0.9035	77.3	69.8	69

NOx/VOC Sensitivity Analysis for Reasonable Further Progress (RFP)

For the Clean Air Act 182(c)(2)(B) RFP requirement for areas classified as serious nonattainment and above, U.S. 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 U.S. EPA guidance states that certain conditions are needed to use NO_x substitution in an RFP demonstration (U.S. 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 27% (3% for each of the 9 years between the designation year of 2017 and attainment year of 2026) 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 15** summarizes the design values calculated for the 27% NO_x and ROG sensitivity simulations. At the Grass Valley-Litton Building site, the ratio of the change in ozone design value to the NO_x emissions change ($\Delta O_3/\Delta\ NO_x$) are greater than that of the ROG emissions change ($\Delta O_3/\Delta ROG$). 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 15. Summary of the ozone improvement from the 27% emissions reductions at the Grass Valley-Litton Building site in the WNNA.

Site	2018 Average DV (ppb)	DV After 27% NOx Reductions (ppb)	$\Delta O_3/\Delta NOx$ (ppb/tpd)	DV After 27% ROG Reductions (ppb)	$\Delta O_3/\Delta ROG$ (ppb/tpd)
Grass Valley-Litton Building	86.0	85.9	0.1230	86.0	0.0000

Unmonitored Area Analysis

The unmonitored area analysis is used to ensure that there are no regions outside of the existing monitoring network that would exceed the NAAQS if a monitor was present (U.S. EPA, 2018). U.S. EPA recommends combining spatially interpolated design value fields with modeled ozone gradients and grid-specific RRFs in order to generate gridded future year gradient adjusted design values.
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 ARB, were utilized in this analysis.

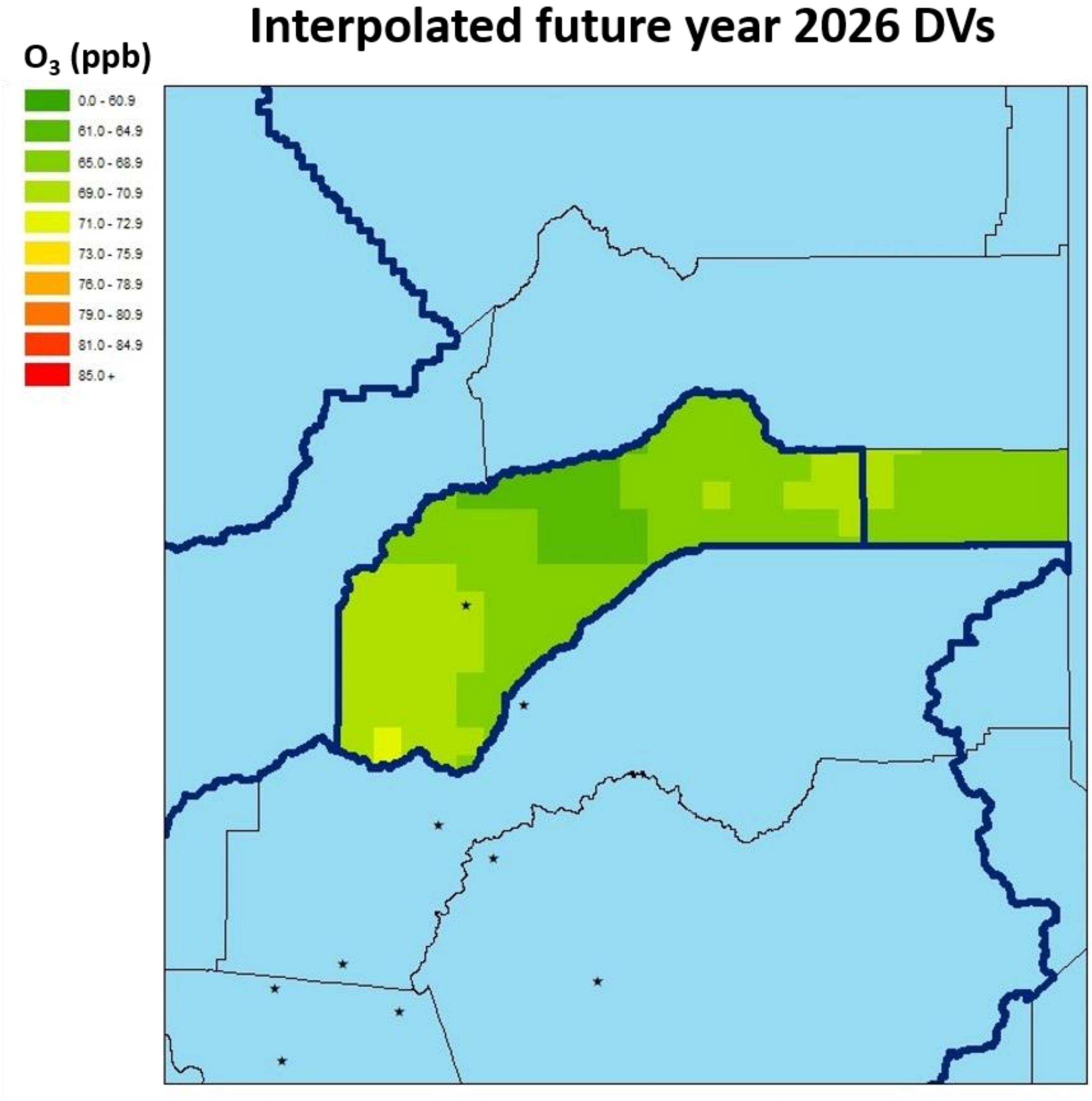
The unmonitored area analysis was conducted using the 8-hr O_3 weighted DVs from all the available sites that fall within the 4-km inner modeling domain along with the reference year 2018 and future year 2026 4 km CMAQ model outputs. The steps followed in the unmonitored area analysis are as follows:

> **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 Section II, 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 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 19 shows the spatial distribution of gridded DVs in 2026 for the WNNA based on the unmonitored area analysis described above. The black colored star markers denote the monitoring sites, which had valid reference year DVs and were used in the analysis. The unmonitored area analysis in the WNNA showed that most non-attainment area has future year 2026 DVs less than 70 ppb. The only area/grid with interpolated future DVs over 70 ppb shown in the figure is located in the lower left corner, which is next to Auburn urban area and lies directly downwind of Sacramento metro region, where the regional transport patterns significantly contribute to observed ozone levels.

Figure 19. Spatial distribution of the future 2026 DVs based on the unmonitored area analysis in the WNNA. Color scale is in ppb of ozone.



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Supplemental Materials

Supplemental Materials List of Figures

Meteorological Time series and Mean Bias/Error Distribution Plots

Figure S 1. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in April 2018.

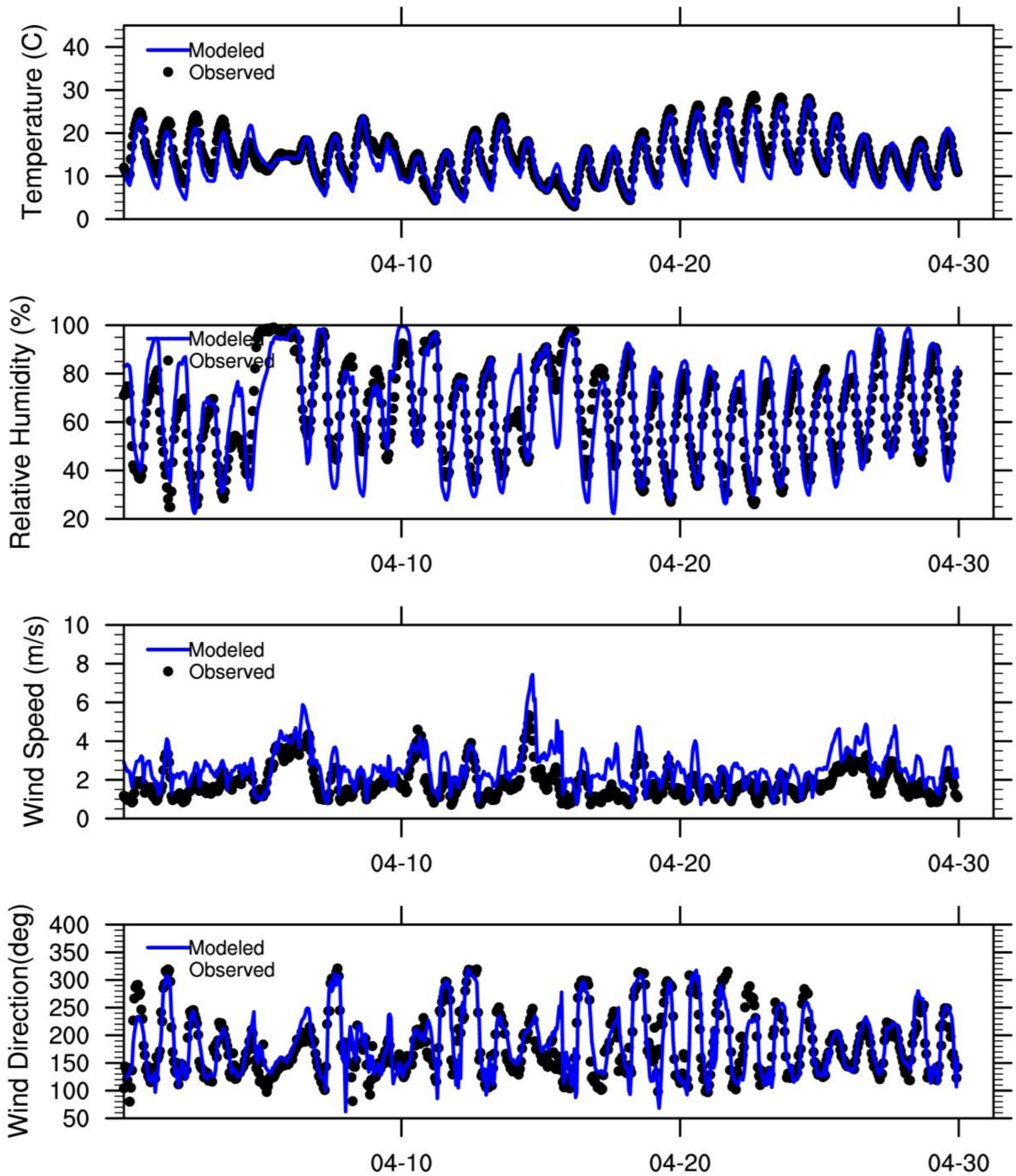


Figure S 2. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in May 2018.

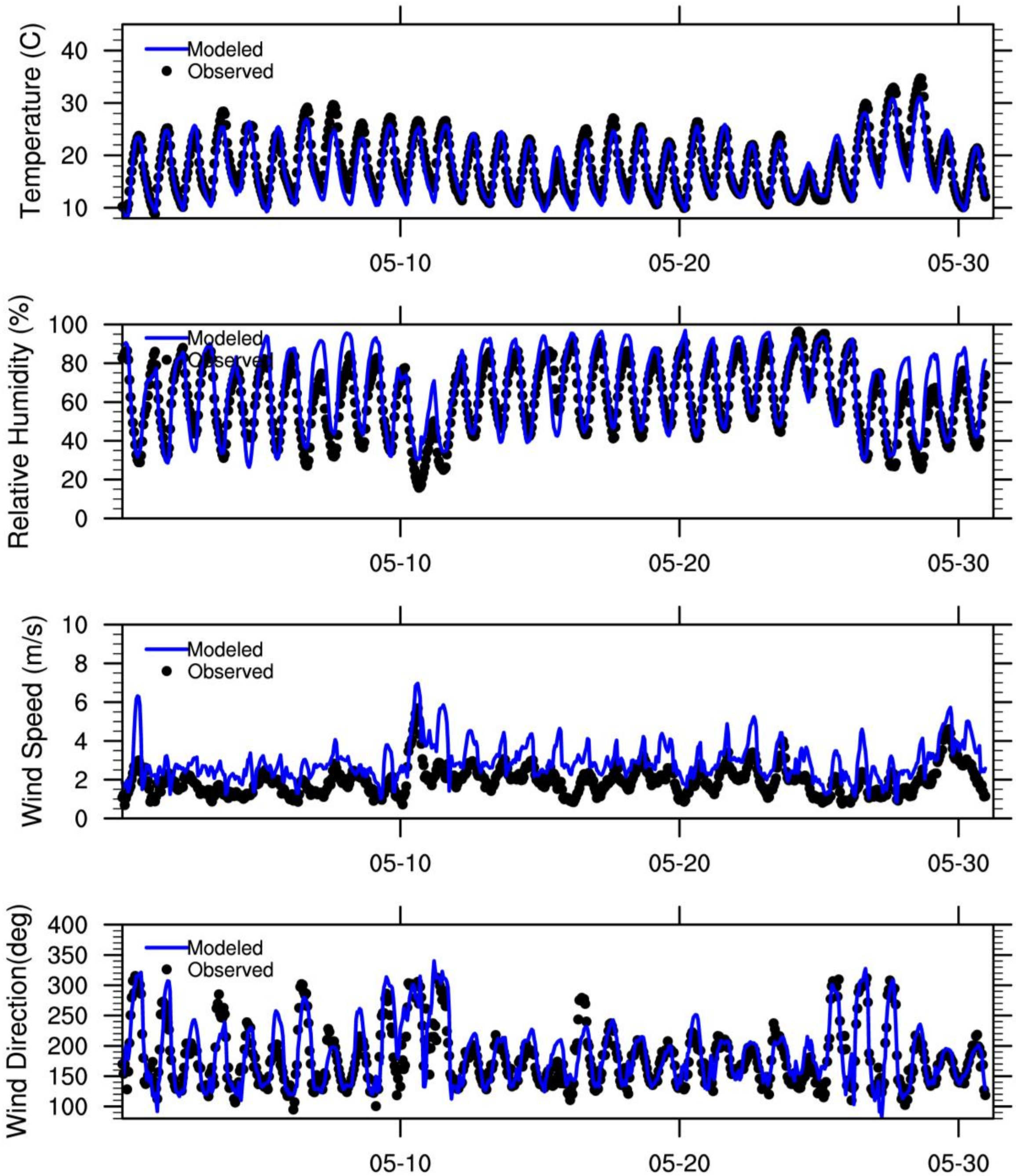


Figure S 3. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in June 2018.

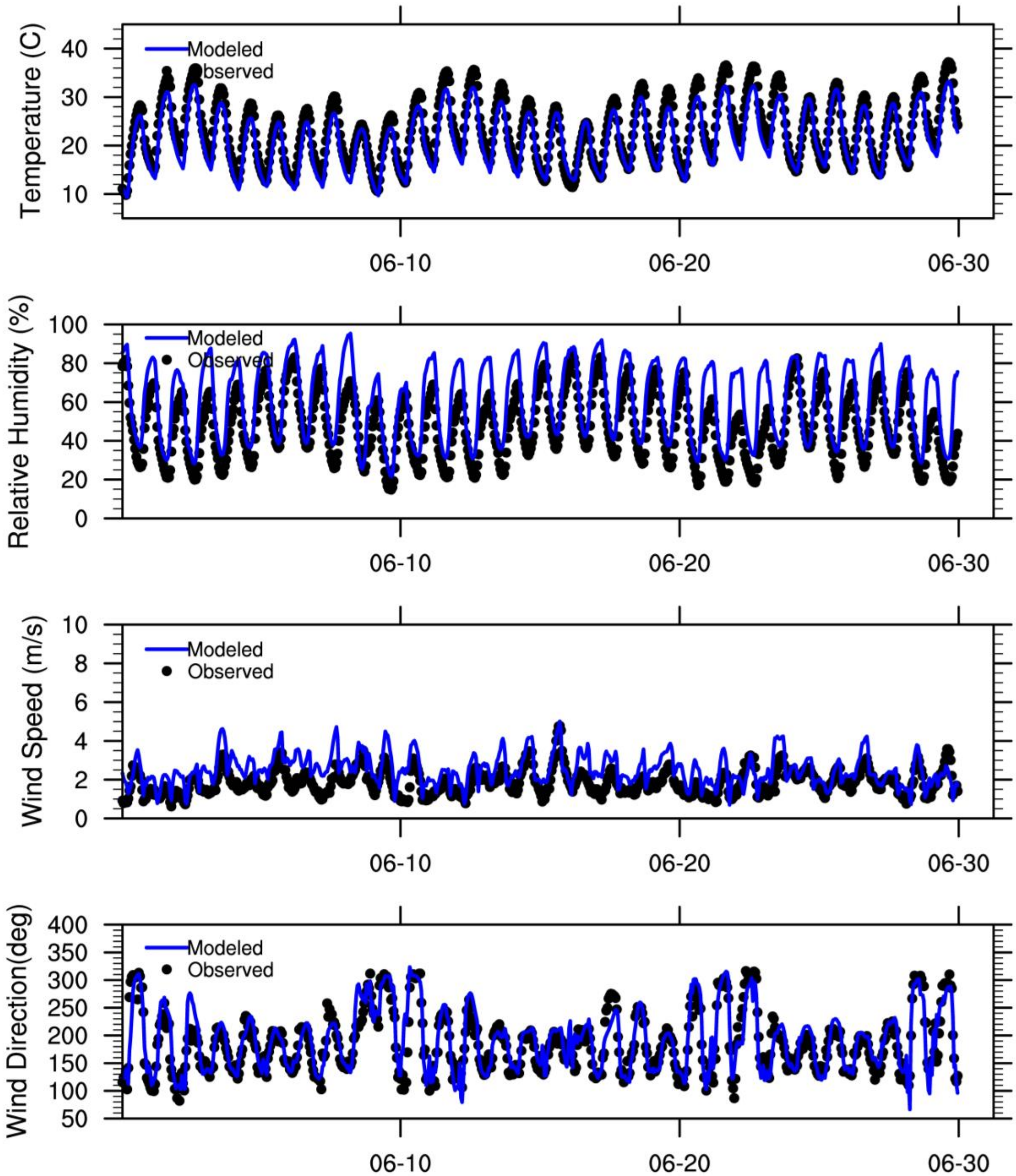


Figure S 4. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in July 2018.

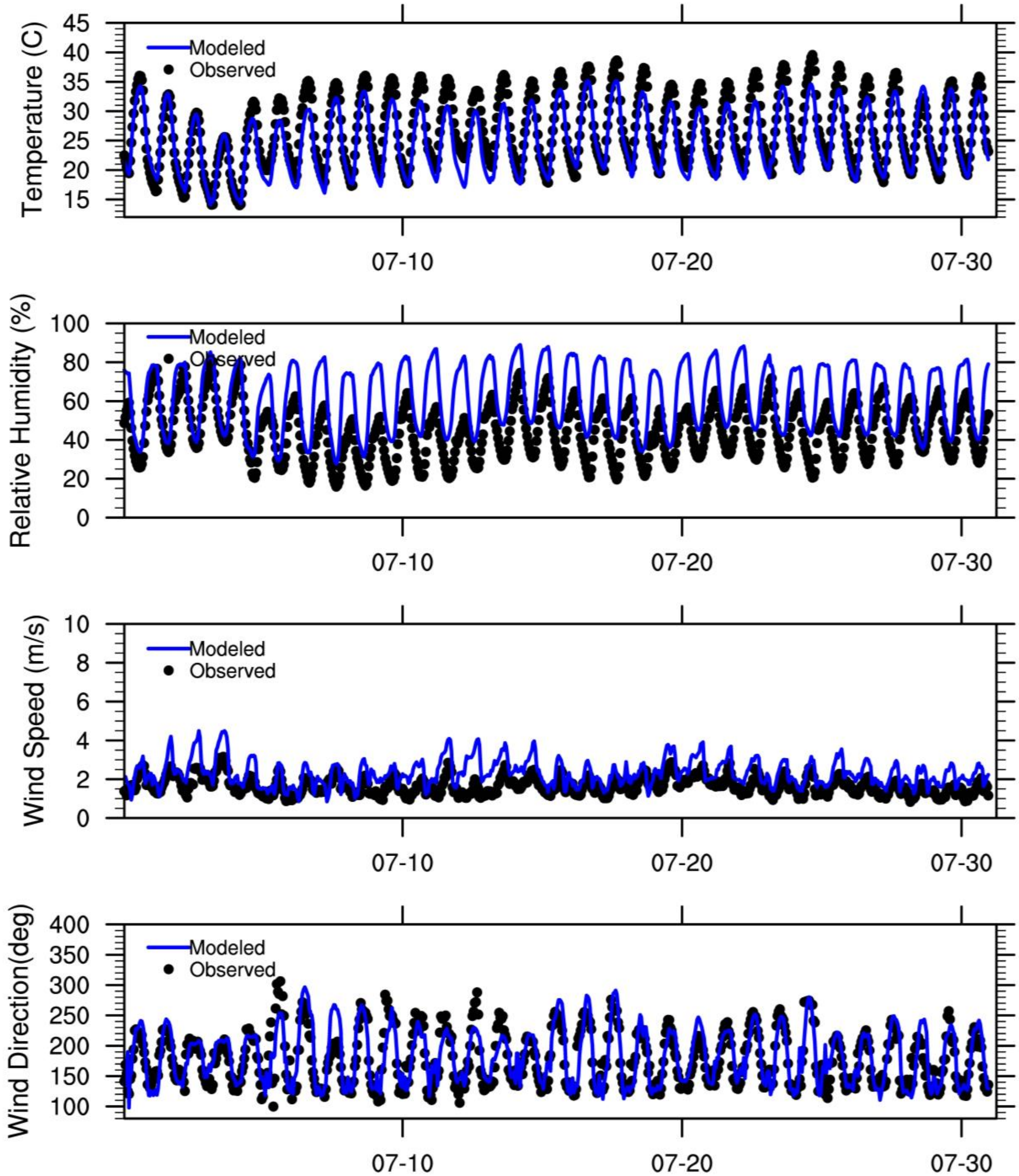


Figure S 5. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in August 2018.

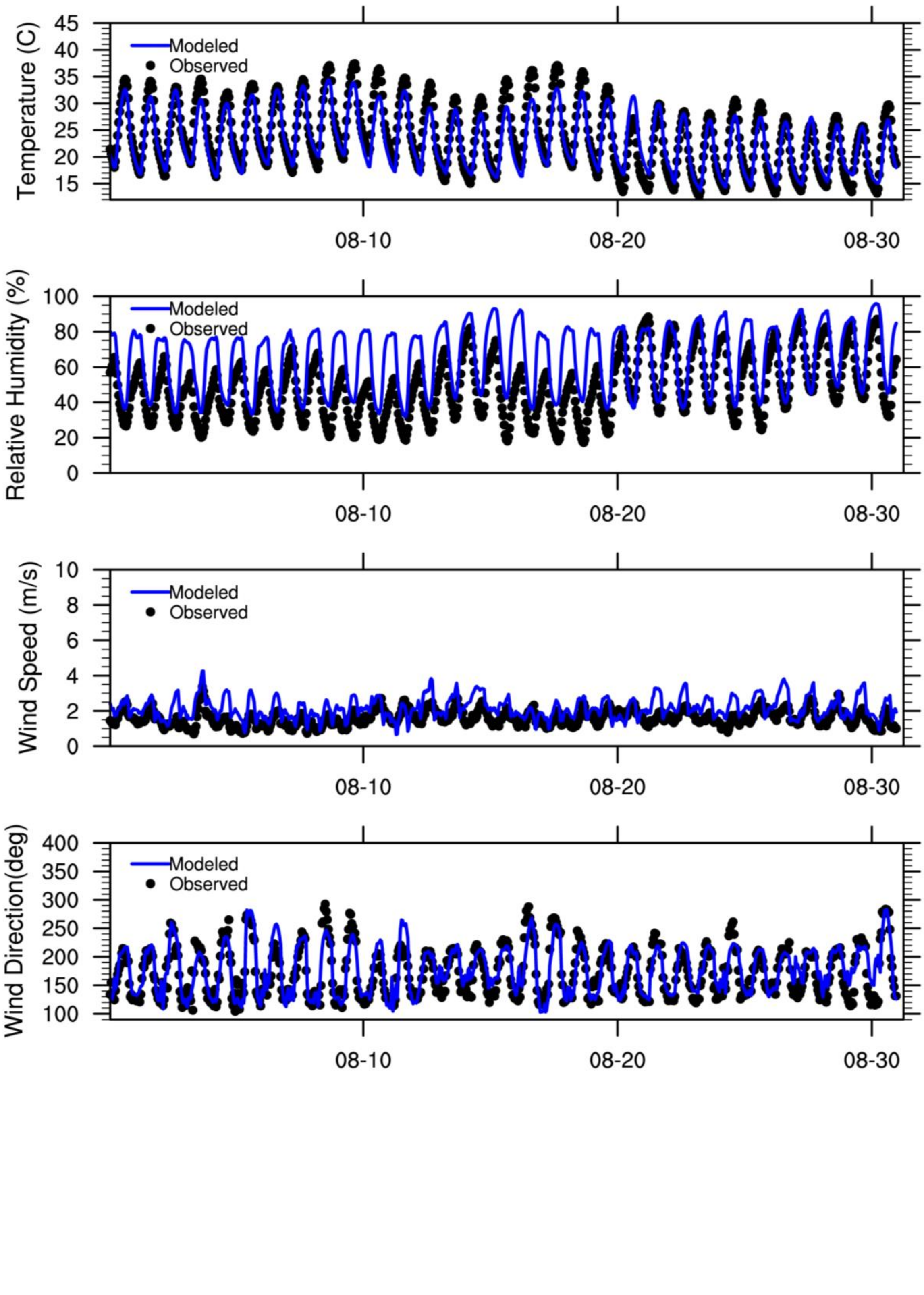


Figure S 6. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in September 2018.

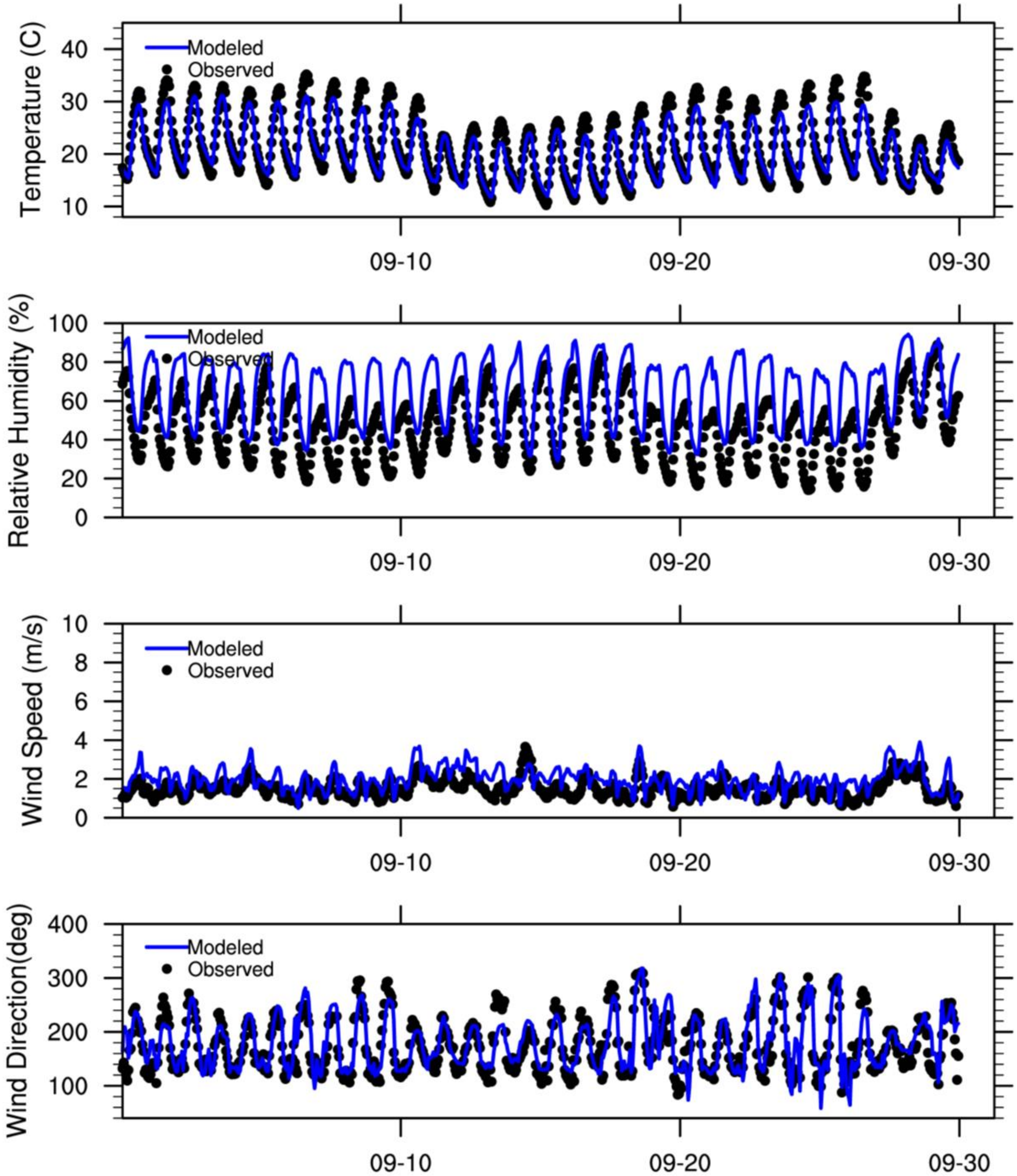


Figure S 7. Time series of average temperature, relative humidity, wind speed and wind direction of all sites in October 2018.

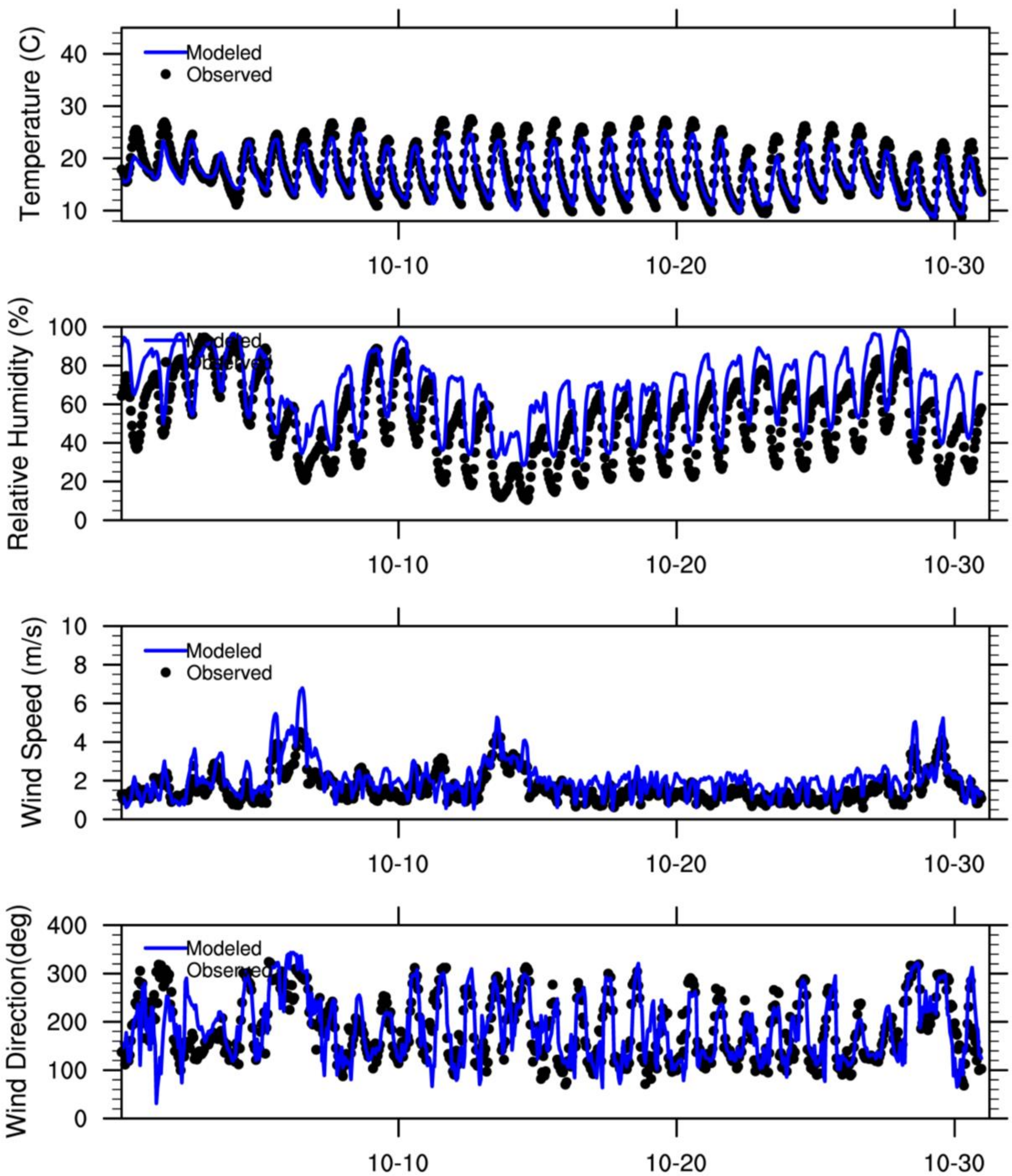


Figure S 8. Wind speed mean bias (m/s) for April- October, 2018.

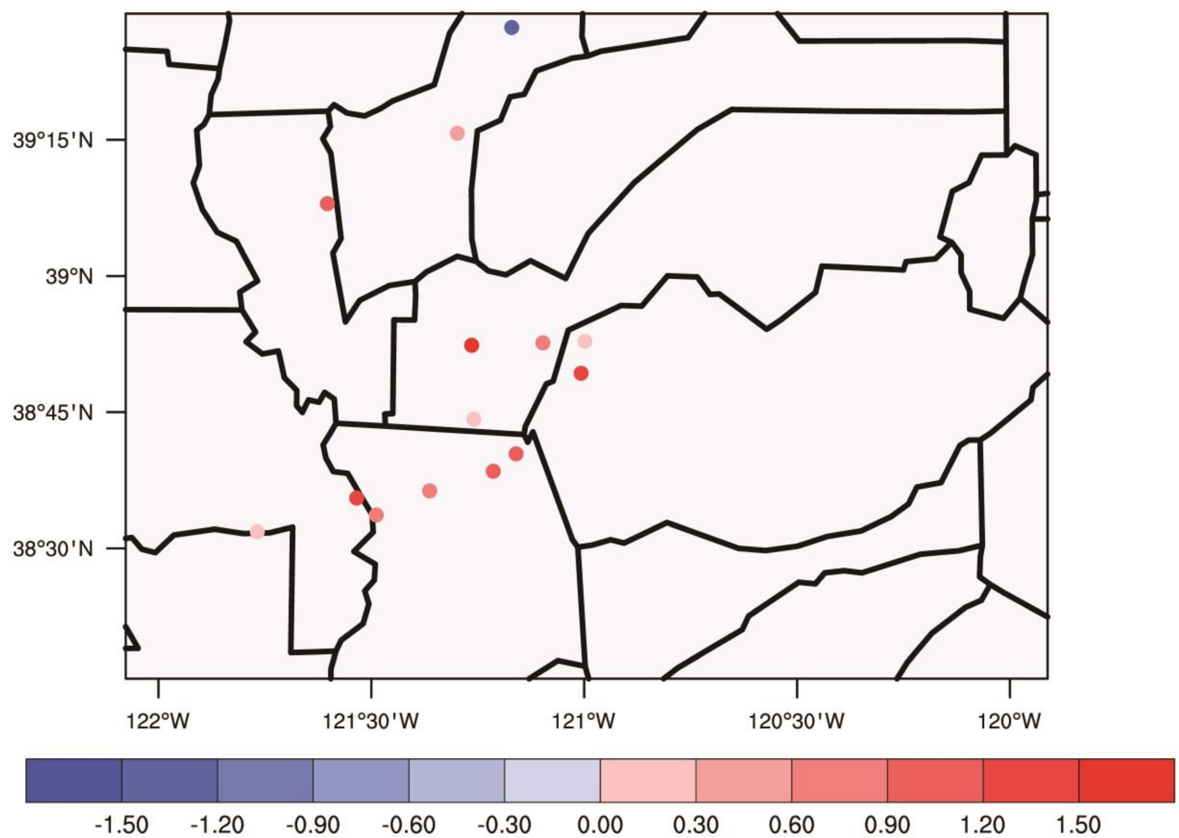


Figure S 9. Wind speed mean error (m/s) for April-October, 2018.

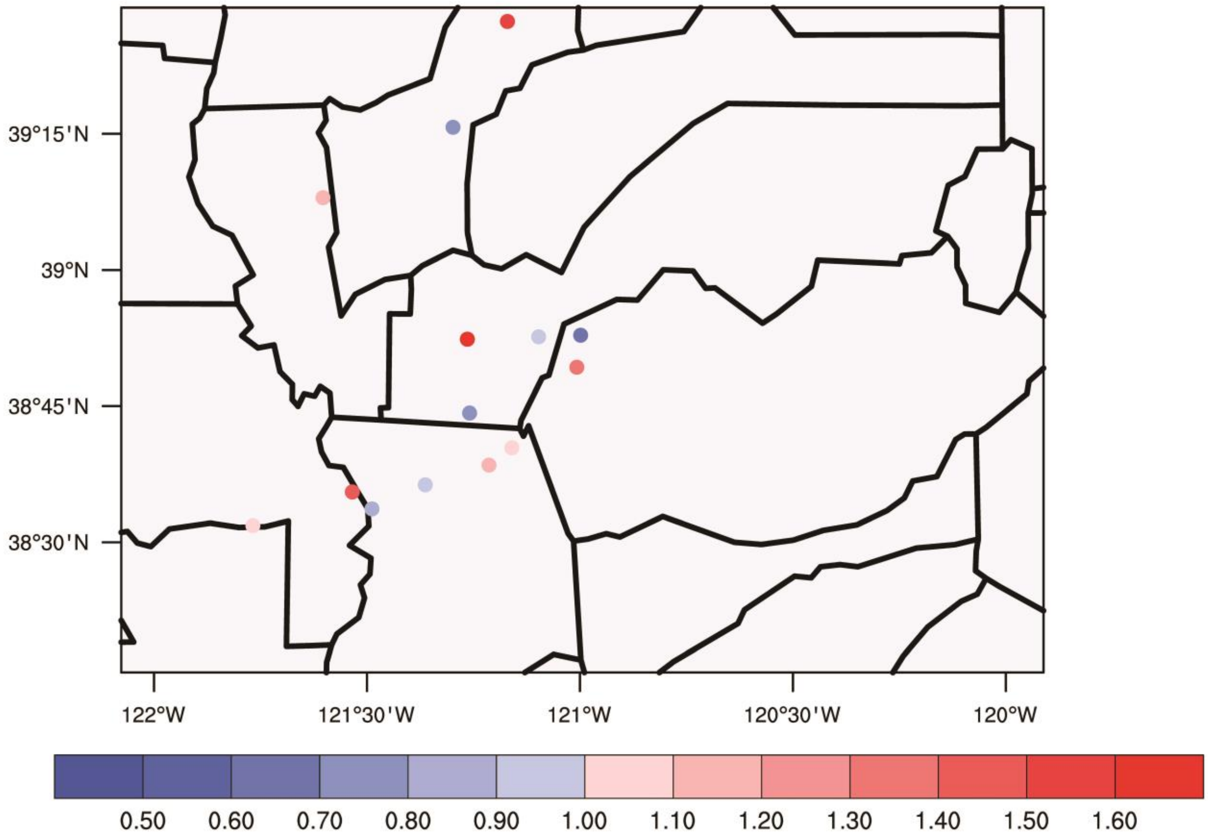


Figure S 10. Temperature mean bias (°C) for April-October, 2018.

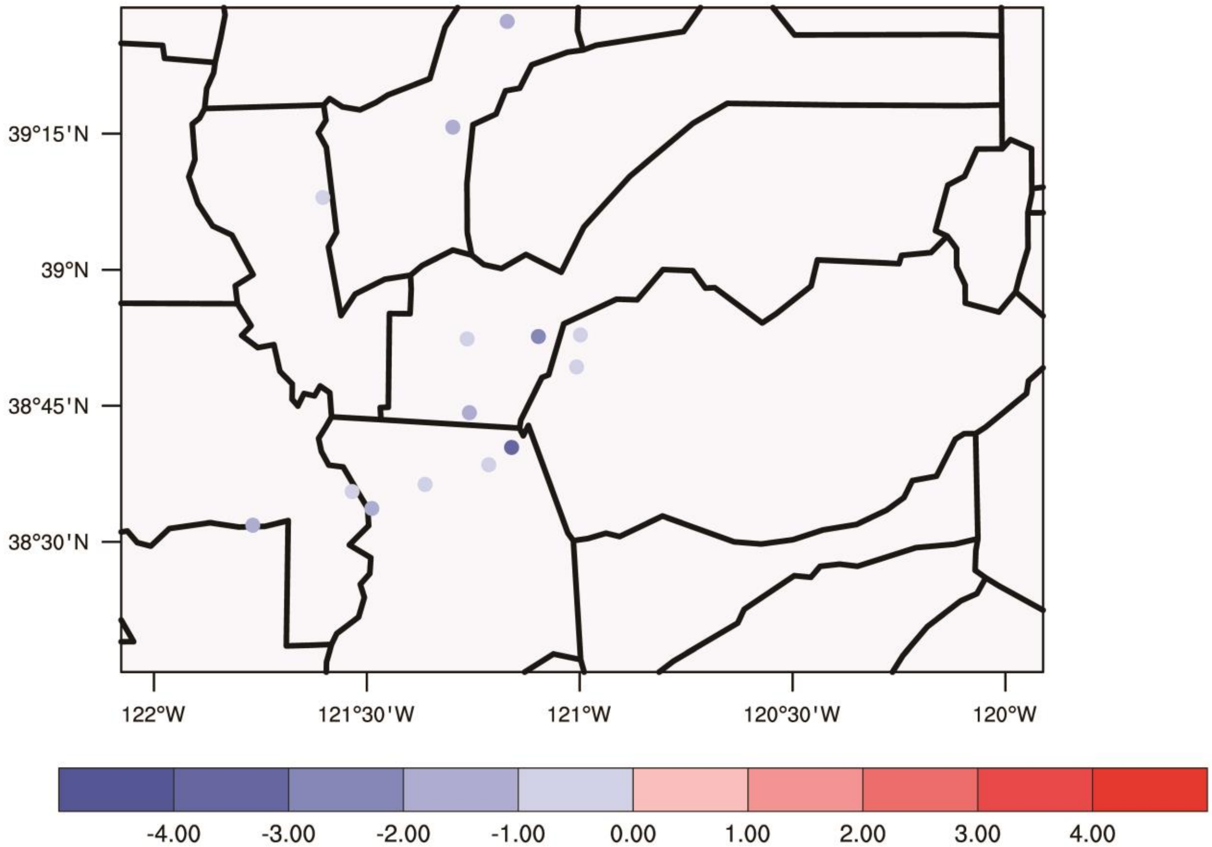


Figure S 11. Temperature mean error (°C) for April-October, 2018.

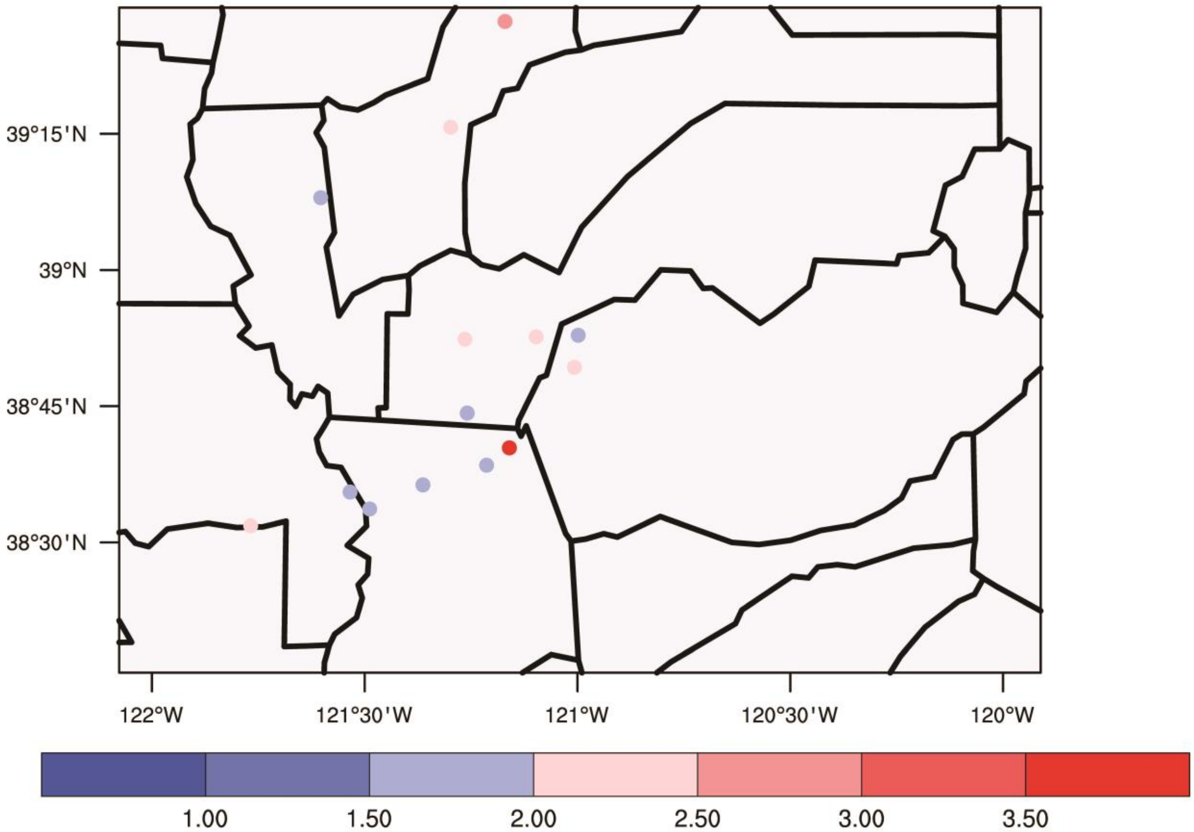


Figure S 12. Relative humidity mean bias (%) for April-October, 2018.

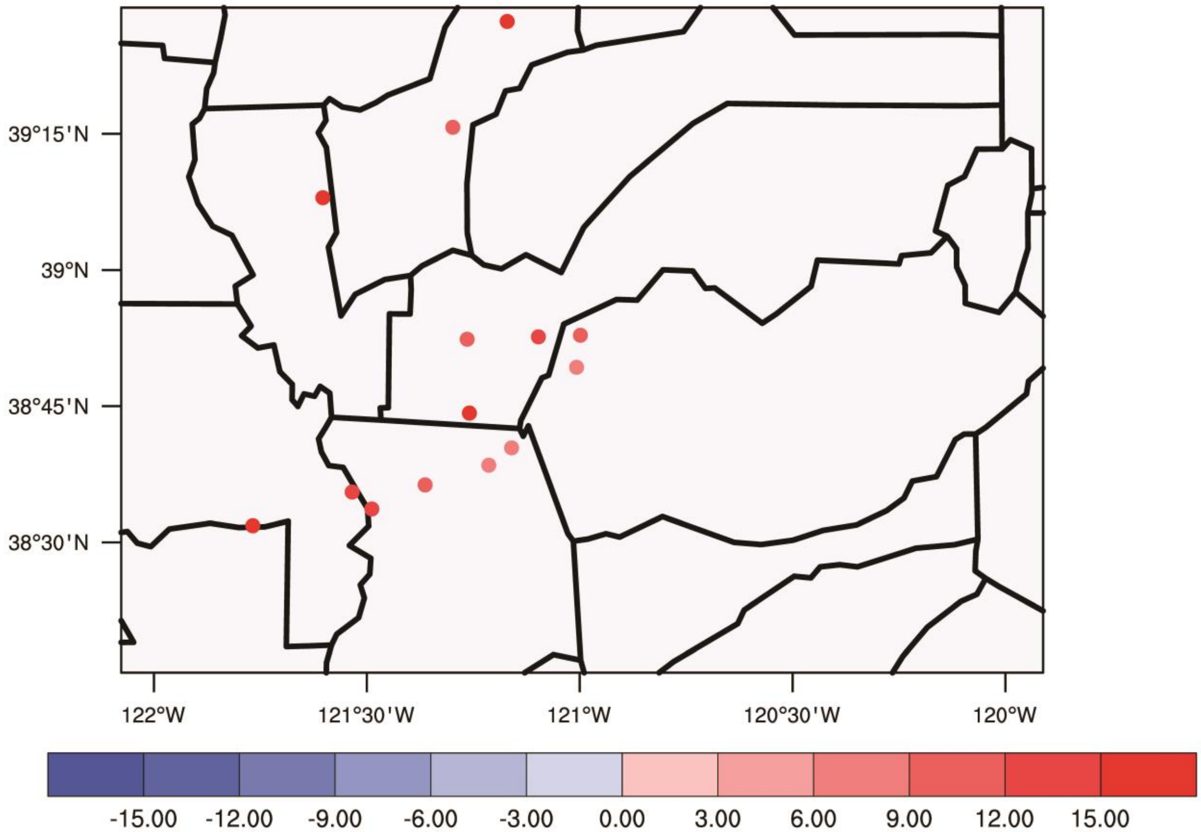
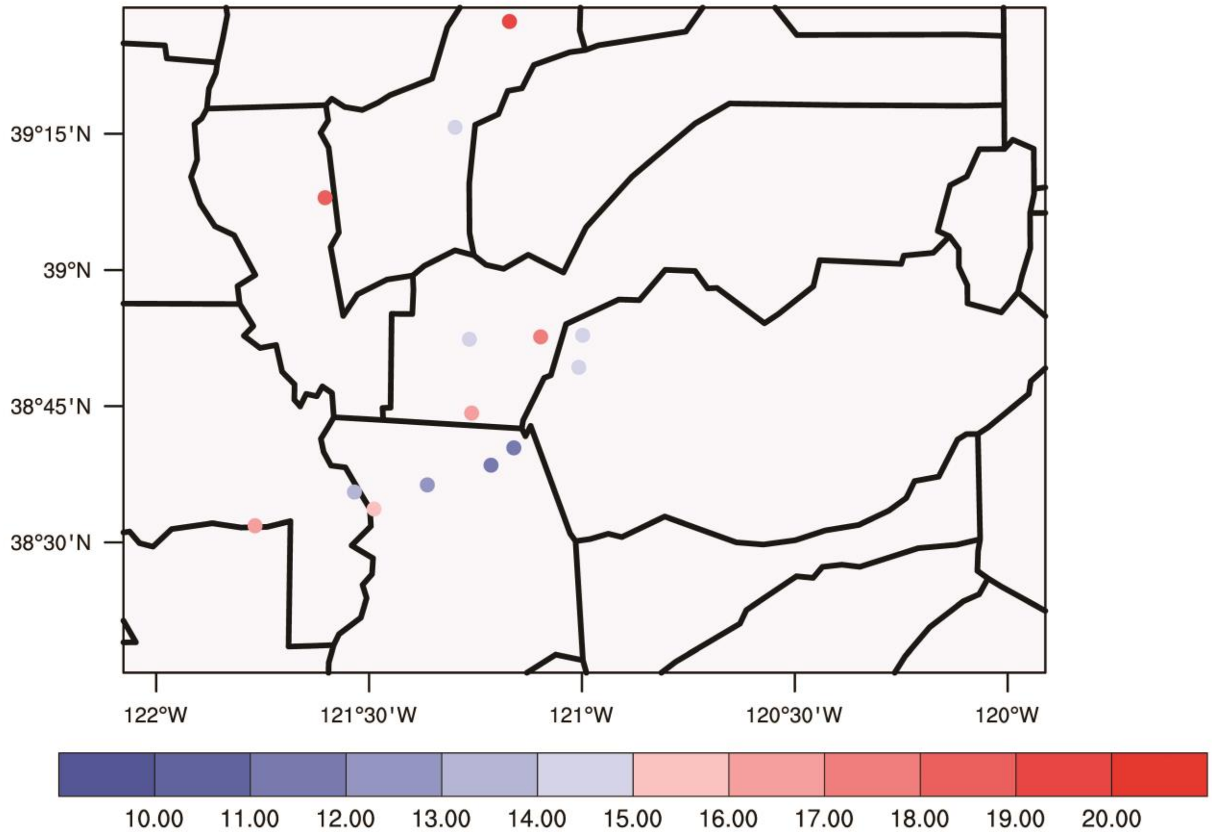


Figure S 13. Relative humidity mean error (%) for April-October, 2018.



Ozone and Nitrogen Oxides Plots

Figure S 14. Observed and modeled ozone frequency distribution for the ozone season at the Grass Valley-Litton Building site (All days in April – October 2018).

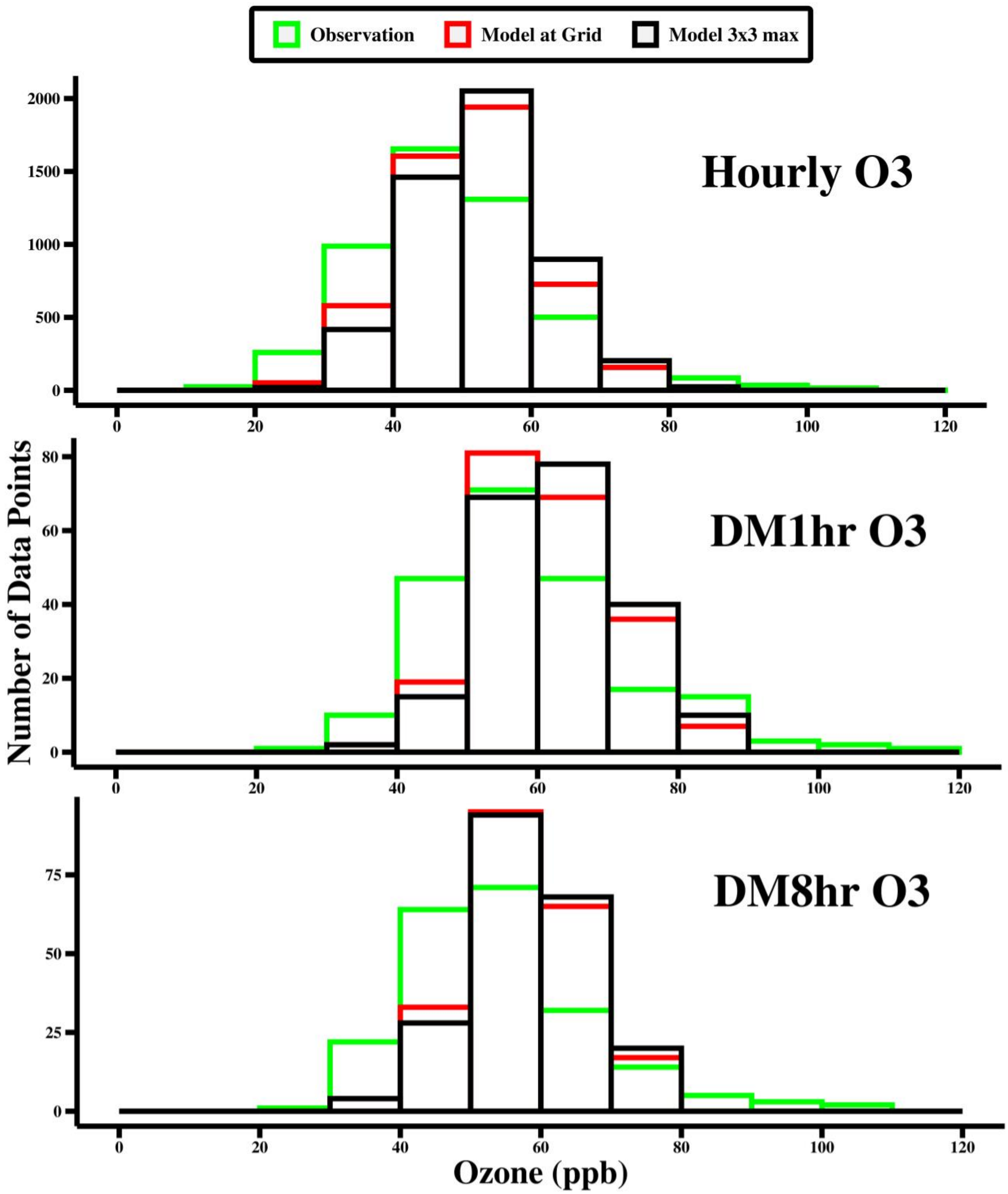


Figure S 15. Observed and modeled ozone frequency distribution for the ozone season at the Grass Valley-Litton Building site (Fire days excluded in April – October 2018)

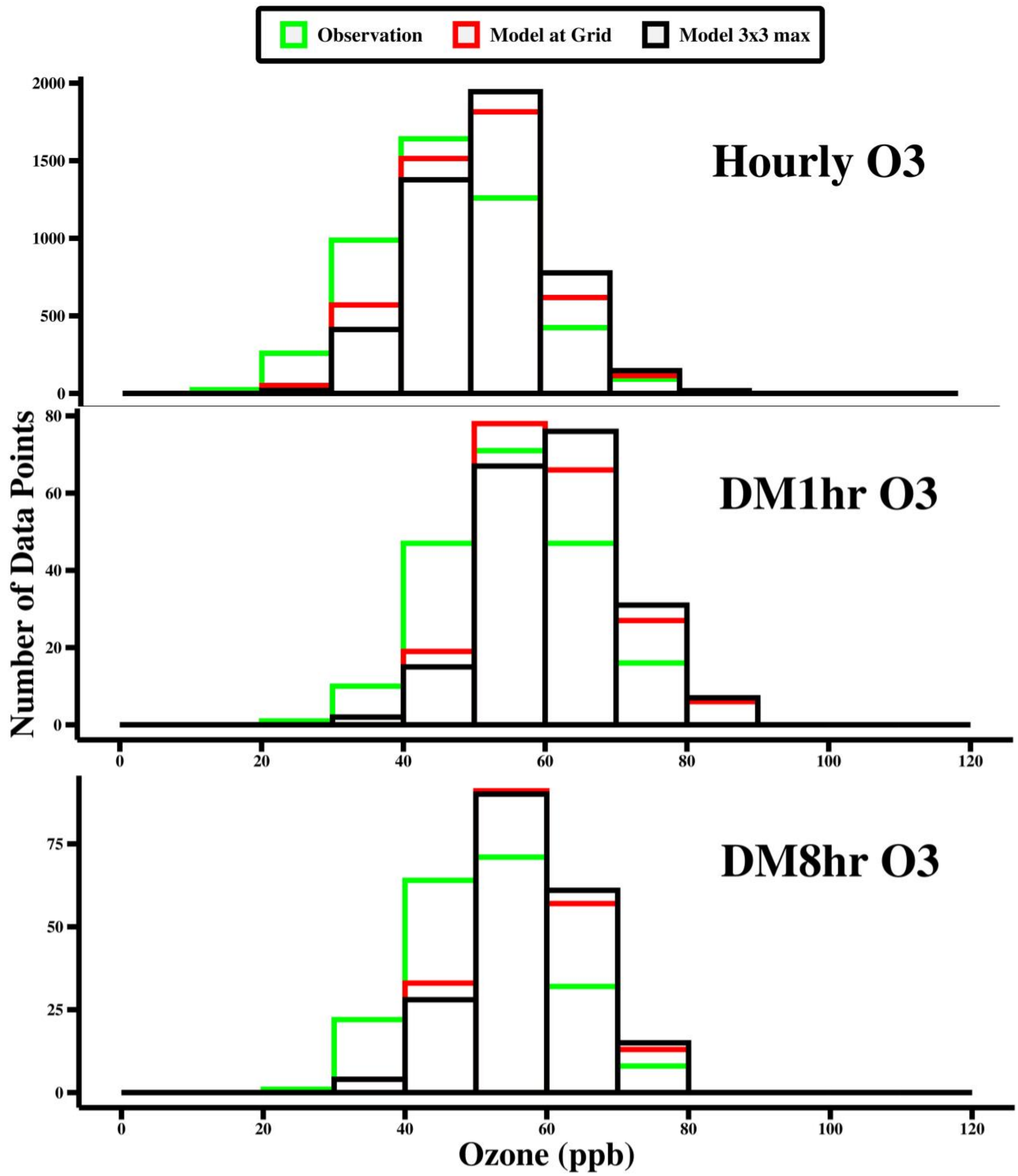


Figure S 16. Observed and modeled ozone scatter plots for the ozone season at the Grass Valley-Litton Building site with fire days values shown in red (April – October 2018).

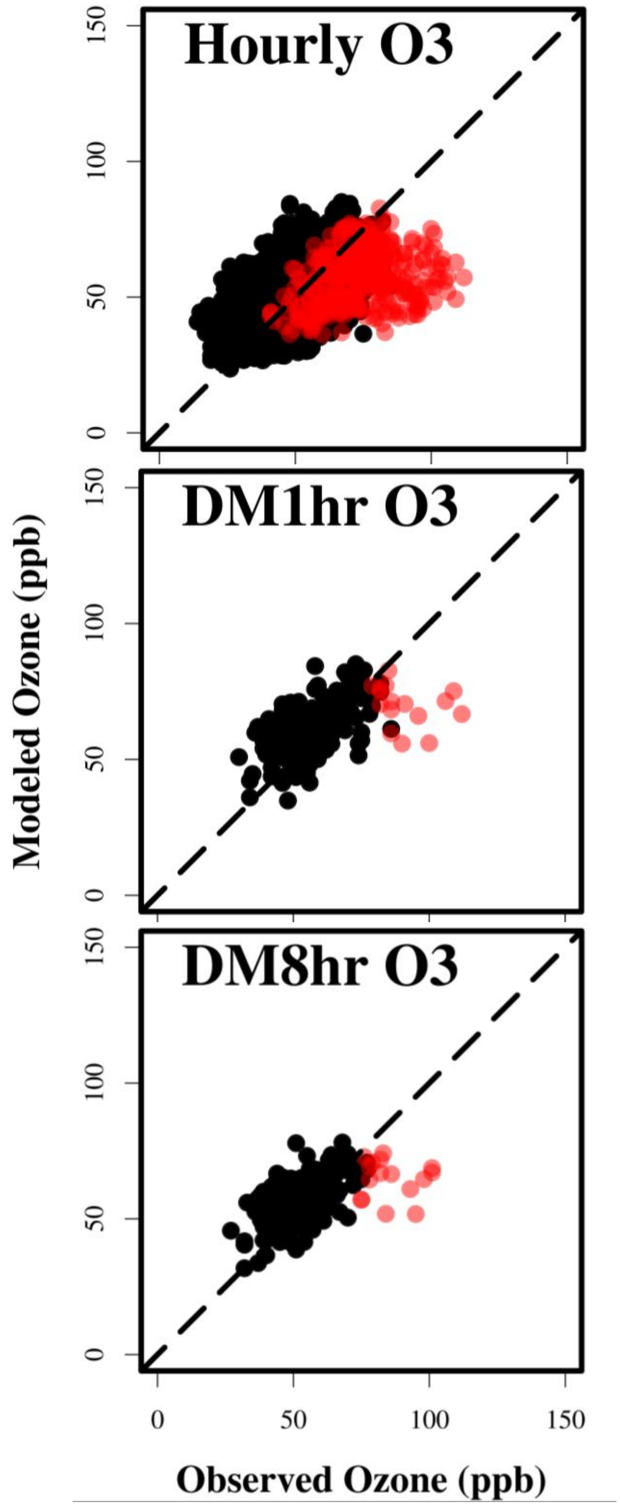


Figure S 17. Time-series of hourly ozone at the Grass Valley-Litton Building site for the ozone season (April-October 2018).

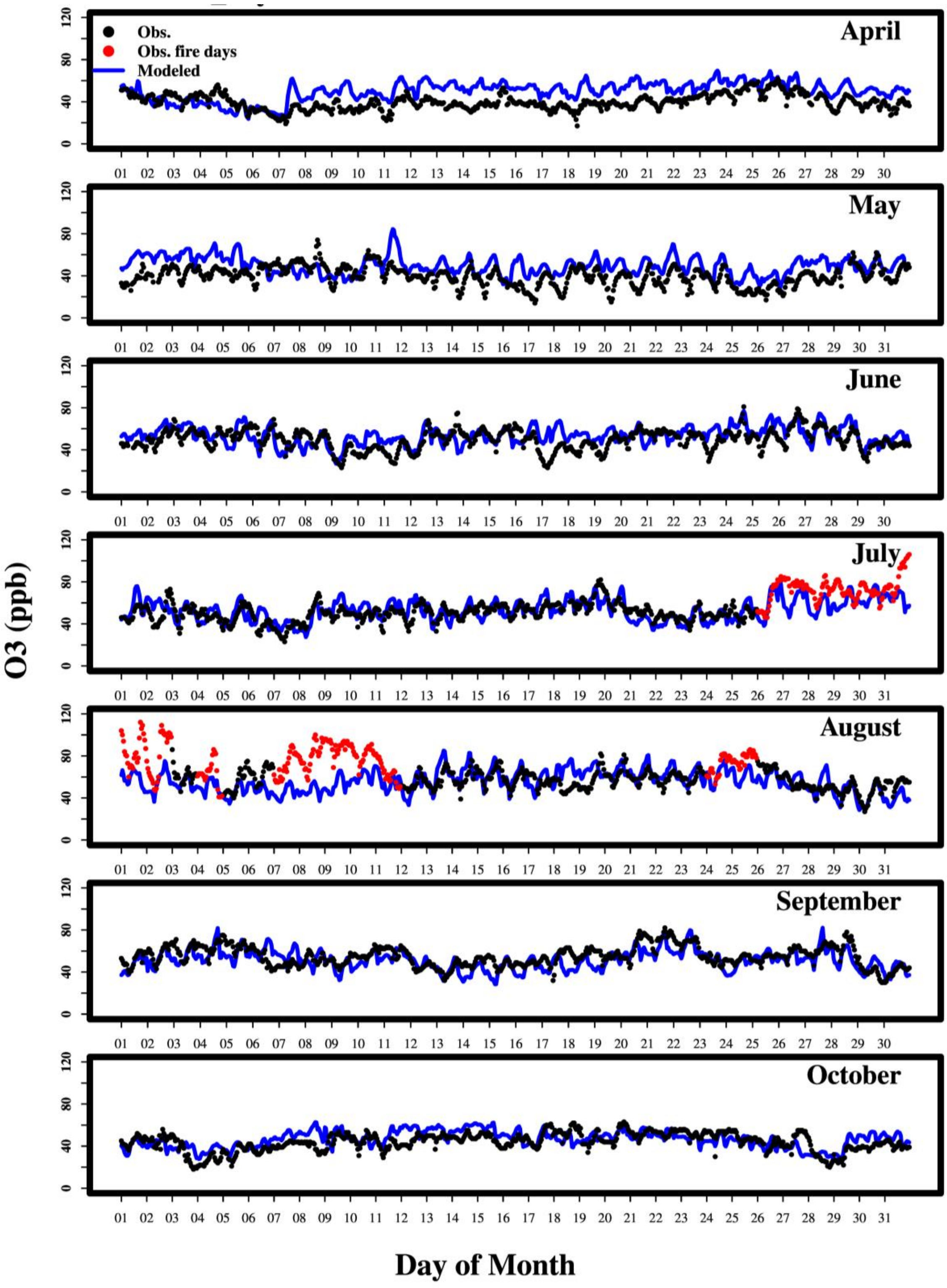


Figure S 18. Time-series of maximum daily average 1-hour ozone at Grass Valley-Litton Building site for the ozone season (April-October 2018).

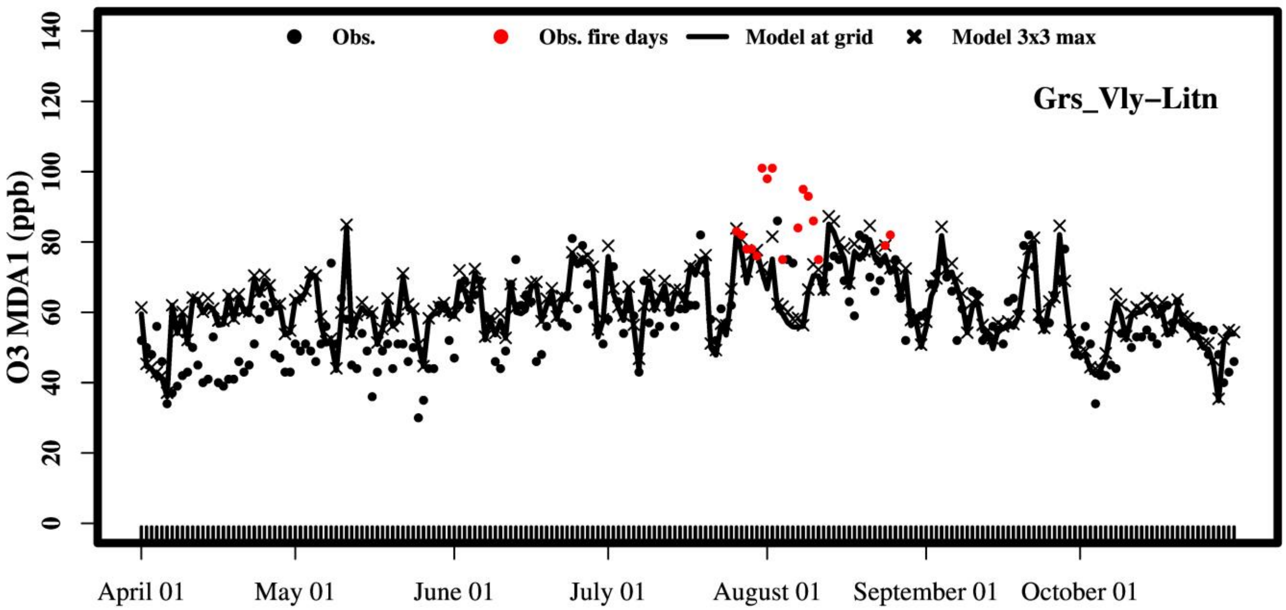


Figure S 19. Time-series of maximum daily average 8-hour ozone at the Grass Valley-Litton Building site for the ozone season (April-October 2018).

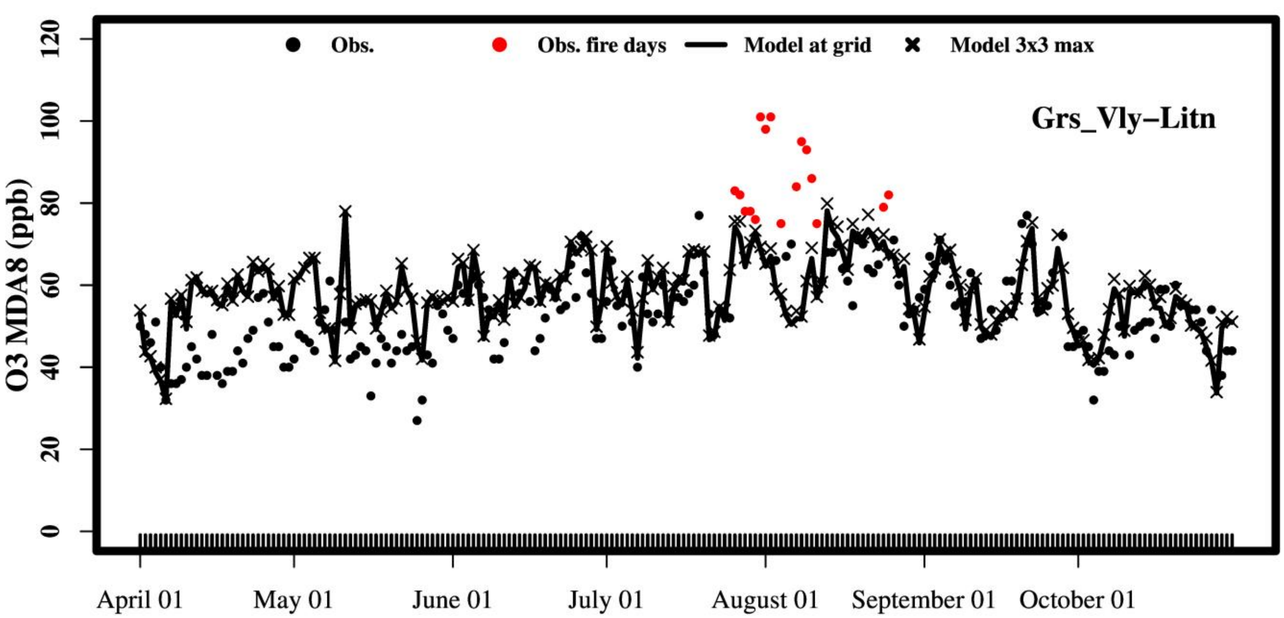


Figure S 20. Time-series of hourly NOx at the Roseville site for the ozone season (April-October 2018).

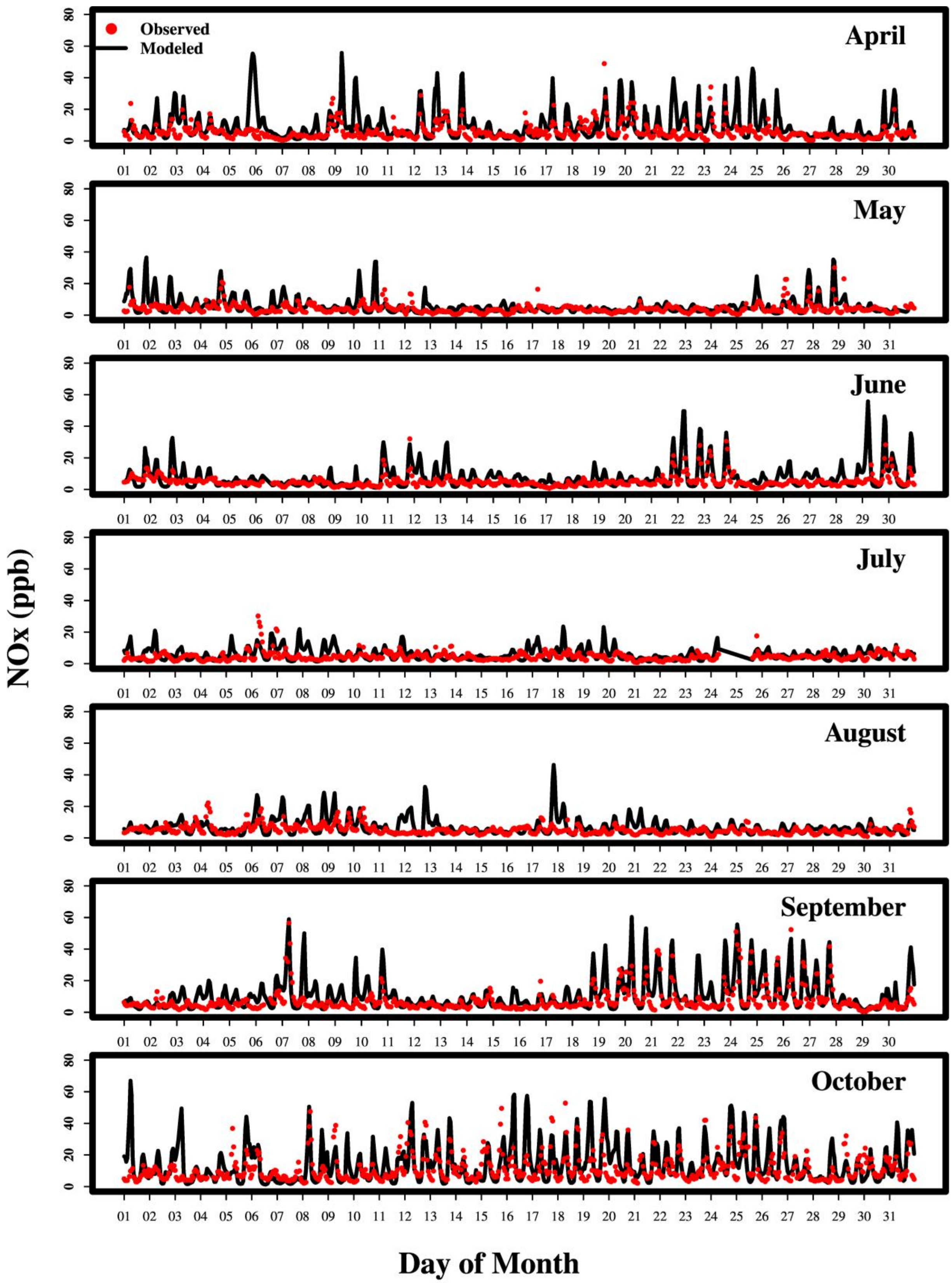
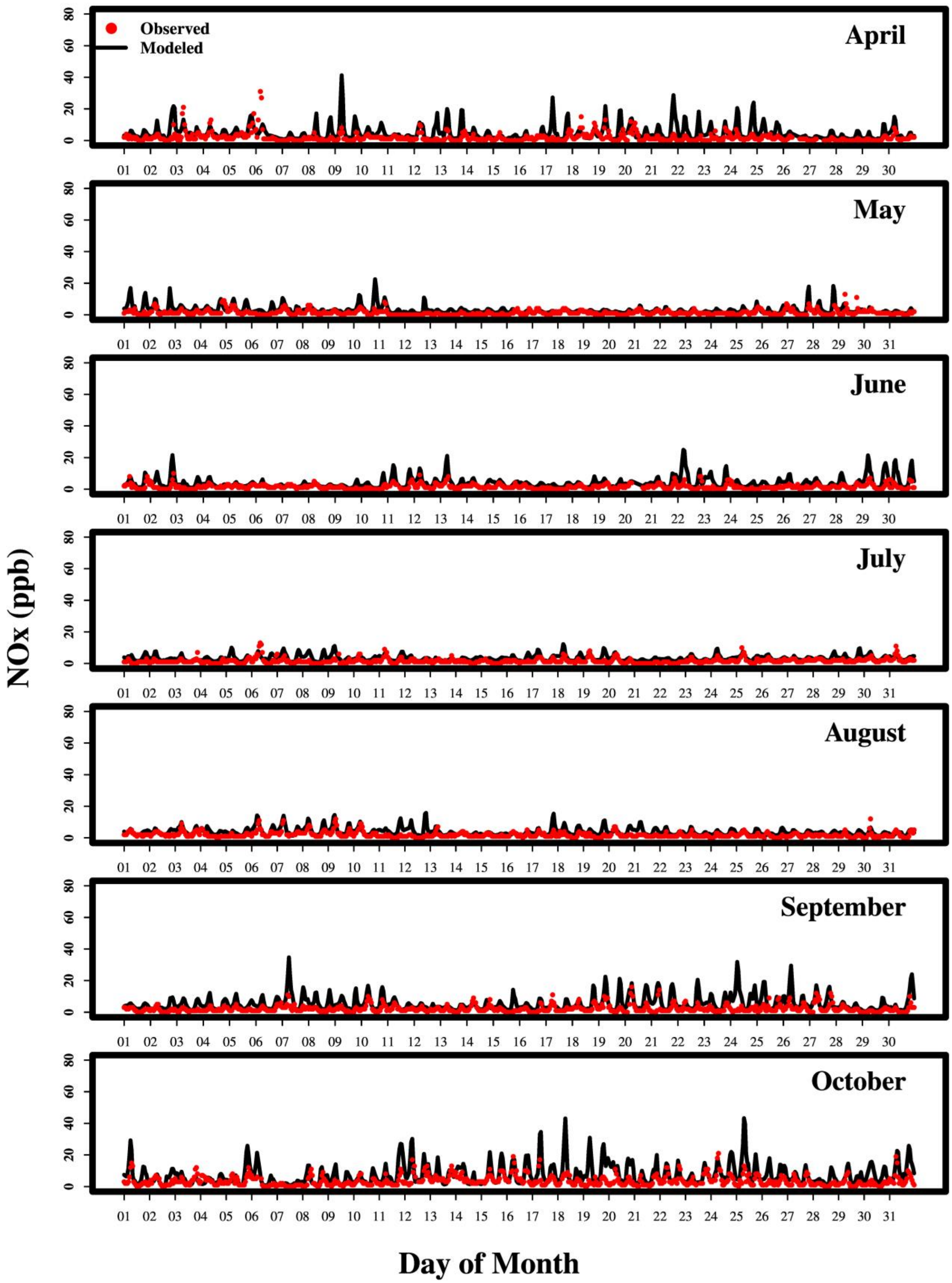


Figure S 21. Time-series of hourly NOx at the Folsom site for the ozone season (April-October 2018).



Appendix F

Modeling Emission Inventory for the 8-Hour Ozone State Implementation Plan in Western Nevada County Nonattainment Area (WNNA)

Modeling Emission Inventory for the Ozone State Implementation Plan
October 2022

Prepared by
California Air Resources Board
Northern Sierra Air Quality Management District

Prepared for
United States Environmental Protection Agency Region IX
October 2022

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I. 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

ERG – Eastern Research Group

MPO – Metropolitan Planning Organization

NLCD – National Land Cover Database

NOx – Oxides of Nitrogen

OGV – Ocean Going Vessel

PM – Particulate Matter

PM10 – Particulate Matter 10 micrometers in diameter and smaller

PM2.5 – 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

TOG – Total Organic Gases

II. Development of Ozone Emissions Inventories

Emission inputs for air quality modeling (commonly and interchangeably referred to as "modeling inventories" or "gridded inventories") have been developed by the California Air Resources Board (CARB) and staff from multiple air districts. These inventories support multiple State Implementation Plans (SIP)s across California to address nonattainment of the federal ozone (O3) standards. CARB maintains an electronic database of emissions and other useful information to generate aggregate emission estimates at the county, air basin, and district level. This database is called the California Emission Inventory Development and Reporting System (CEIDARS). CEIDARS provides a foundation for the development of a more refined (hourly, grid cell-specific) set of emission inputs that are required by air quality models. The CEIDARS base year inventory is a primary input to the state's emission forecasting system, known as the California Emission Projection Analysis Model (CEPAM). CEPAM produces the projected emissions that are then 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.

III. 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 PM10 (particulate matter 10μm in diameter and smaller) /PM2.5 Air Quality Study (CRPAQS).

IV. 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 (U.S. EPA, 2016). More commonly, a generic emission factor is developed by averaging the results of emission tests from similar processes at several different facilities. This generic factor is then used to estimate emissions from similar types of processes when a facility-specific emission factor is not available. Activity levels from stationary sources can be derived from the amount of product produced, solvent used, or fuel used.

The district-reported and CARB-estimated emissions totals are stored in the CEIDARS database for any given pollutant. Both criteria 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 PM10 and PM2.5 are estimated from total particulate matter (PM). Details about chemical and size resolved speciation of emissions for modeling can be found in Section XXIII. Additional information on CARB emission inventories can be found at CARB Emission Inventory Activities.

V. Inventory Years

The emission inventory scenarios used for air quality modeling must be consistent with U.S. EPA's Modeling Guidance (U.S. EPA, 2014). Since changes in the emissions inventory can affect the calculation of the relative response factors (RRFs) used to project air quality to future years, the terms used in the preparation of the emission inventory scenarios must be clearly defined. In this document, the following inventory definitions will be used.

VI. 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.

VII. 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.

VIII. Future Year Modeling Inventory (2026)

Future year modeling inventories, along with the reference year modeling inventory, are used in the model-derived RRF calculation. Projected inventory year 2026 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 2026 inventory include the 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.

IX. 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 1.

Figure 2 illustrates an enlarged imageof the Western Nevada County Nonattainment area in Northern California (highlighted in yellow) in the statewide 4k modeling grid.

Figure 1. Spatial coverage of emissions grid with nonattainment area highlighted in yellow

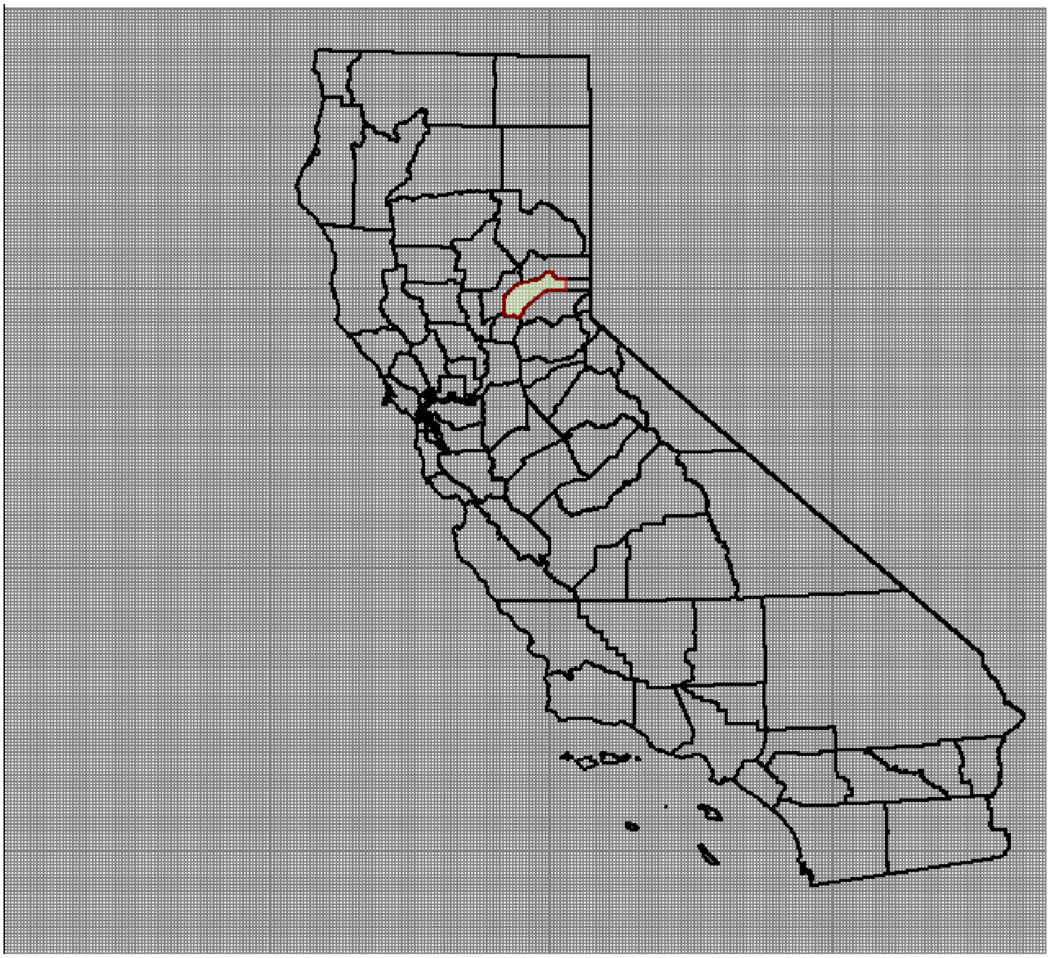
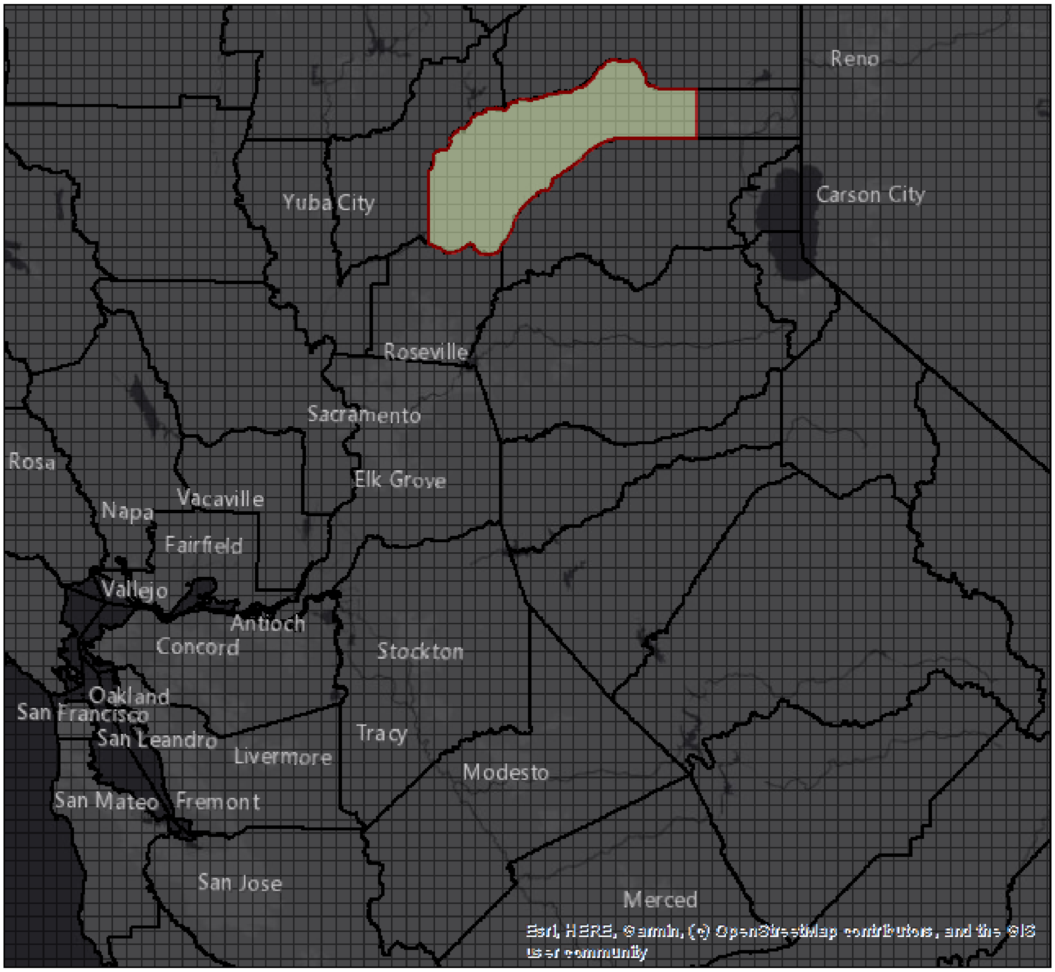


Figure 2: Western Nevada County Nonattainment area highlighted in Northern California with statewide 4k grid overlayed



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 1.

Table 1: 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

Parameter	Statewide domain
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	4km x 4km
Number of cells	291 x 321 cells
Lambert origin	(-684,000 m, -564,000 m)
Geographic center	-120.5° Lat and 37.0° Lon

X. Estimation of Base Year Modeling Inventory

As mentioned in Section VI, 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.

XI. 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 2 summarizes the difference in the terms as both sets of terms are used in this document. In modeling terminology, "point sources" traditionally refer to elevated emission sources that exit from a stack and have an associated plume rise. 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 2: Inventory terms for emission source types

Modeling Term	Emission Inventory Term	Examples
Point	Stationary – Point Facilities	Stacks at Individual Facilities

Modeling Term	Emission Inventory Term	Examples
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.

XII. 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 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 GSE in South Coast

The resulting modeling inventory matches totals from CEPAM 2019 v1.04.

XIII. 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 XXVI, XXXIV, and XXXVI. The temporal distribution of residential wood combustion (RWC) and agricultural ammonia sectors are described in Section XLI and Section XLII, 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.

XIV. 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.

XV. 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 3 shows the current DPWK codes.

Table 3: Day of week variation factors

Code	WEEKLY CYCLE CODE DESCRIPTION	M	T	W	TH	F	S	S
1	One day per week	1	1	1	1	1	0	0
2	Two days per week	1	1	1	1	1	0	0
3	Three days per week	1	1	1	1	1	0	0
4	Four days per week	1	1	1	1	1	0	0
5	Five days per week - Uniform activity on 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
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

Code	WEEKLY CYCLE CODE DESCRIPTION	M	T	W	TH	F	S	S
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

XVI. 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 4 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 XLI. Additional temporal profiles are shown in Section LVI.

Table 4: Daily variation factors

Code	CODE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
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

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
16	16 HOURS PER DAY - UNIFORM ACTIVITY FROM 8 A.M. TO MIDNIGHT (2 WORKING SHIFTS)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	17 HOURS PER DAY	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	18 HOURS PER DAY	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	19 HOURS PER DAY	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
20	20 HOURS PER DAY	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
21	21 HOURS PER DAY	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
22	22 HOURS PER DAY	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
23	23 HOURS PER DAY	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
24	24 HOURS PER DAY - UNIFORM ACTIVITY DURING THE DAY	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
31	MAJOR ACTIVITY 5-9 P.M., AVERAGE DURING DAY, MINIMAL IN EARLY A.M.(GAS STATIONS)	3	1	1	1	1	1	1	5	5	5	5	5	5	5	5	5	5	10	10	10	10	7	7	3
33	MAX ACTIVITY 7-9 A.M. & 7-11 P.M.,AVERAGE DURING DAY, LOW AT NIGHT (RESIDENTIAL FUEL COMBUSTION)	2	2	2	2	2	2	2	10	10	6	6	5	5	5	5	5	5	5	5	10	10	10	10	2
34	ACTIVITY 1 TO 9 A.M.; NO ACTIVITY REMAINDER OF DAY (i.e. ORCHARD HEATERS)	0	8	8	8	8	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	MAX ACTIVITY 7 A.M. TO 1 A.M., REMAINDER IS LOW (i.e. COMMERCIAL AIRCRAFT)	10	1	1	1	1	1	1	8	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

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
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

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
58	MAX ACTIVITY 7 A.M. TO NOON.;REDUCED ACTIVITY NOON TO 6 P.M. (AUTO REFINISHING)	0	0	0	0	0	0	0	10	10	10	10	10	8	8	8	8	8	8	0	0	0	0	0	0
59	MAXIMUM ACTIVITY FROM 7:00 AM TO 3:00 PM; REDUCED ACTIVITY FROM 3:00 TO 6:00 PM.(CONSTRUCTION EQUIPMENT ON NORMAL DAYS)	0	0	0	0	0	0	2	10	10	10	10	10	10	10	10	7	3	1	1	0	0	0	0	0
60	MAXIMUM ACTIVITY FROM NOON TO 7:00 PM; REDUCED ACTIVITY EVENING AND MORNING HOURS (RECREATIONAL BOAT EXHAUST)	0	0	0	0	0	0	0	2	4	6	7	9	10	10	10	10	10	10	10	7	5	3	1	0
81	MAX ACTIVITY 9 AM TO 3 PM; HALF THE ACTIVITY REMAINING HOURS (WASTE FROM DAIRY CATTLE)	7	6	6	5	4	4	4	5	7	8	9	10	10	10	7	3	3	3	4	4	5	6	7	7
82	ACTIVITY FROM 10 AM TO 9 PM RISING TO PEAK AT 3; NO ACTIVITY REMAINDER OF DAY (WASTE FROM POULTRY)	0	0	0	0	0	0	0	0	0	3	3	7	7	7	10	10	7	3	3	3	3	0	0	0
83	ACTIVITY FROM 9 AM TO 12 AM RISING TO PEAK AT 3; MINIMUM ACTIVITY REMAINDER OF DAY (WASTE FROM SWINE)	0	0	0	0	0	0	0	1	1	2	4	6	8	8	9	10	8	4	3	3	2	1	1	1
84	MAJOR ACTIVITY FROM 11AM TO 6PM; REDUCED OTHER HOURS (EVAP-COASTAL COUNTIES)	7	7	6	6	6	6	6	7	8	8	9	9	10	10	10	10	9	9	8	8	7	7	7	7
85	MAJOR ACTIVITY FROM 11AM TO 6PM; REDUCED OTHER HOURS (EVAP-NON-COASTAL COUNTIES)	5	5	5	5	4	4	5	5	6	7	8	9	9	10	10	10	9	9	8	7	6	6	6	5

XVII. 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 (MPO)s 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 Western Nevada County Nonattainment Area 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, 2021). This working snapshot includes all previous updates noted in surrogate snapshot 2020-10-01 (AMSS, 2020), as well as recent improvements outlined below. A summary of the primary spatial surrogates by EICSUM is provided in Section LVII.

- 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.

XVIII. 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 4km statewide modeling domain. Examples of surrogates include population, land use, and other data with known geographic distributions for allocating emissions to grid cells, as described above.

XIX. 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 in order to reduce the number of calculations performed by the CMAQ in-line plume rise module. SMOKE will then output the emissions by grouped sources and the accompanying stack/facility coordinates and stack parameters for CMAQ's in-line plume rise module to handle the vertical allocation of the elevated sources.

XX. 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 XXXVIII.

XXI. 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.

XXII. 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 XXIX.

XXIII. 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, NH3, NOx, SOx, total organic gases (TOG) and particulate matter (PM). CO and NH3 each are single species; NOx emissions are composed of NO, NO2 and HONO; and SOx emissions are composed of SO2 and SO3. 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, CO2, carbonic acid, metallic carbides or carbonates, and ammonium carbonate. TOG emissions reported in the CARB's emission inventory are the basis for deriving the reactive organic gas (ROG) emission components, which are also reported in the inventory. ROG is defined as TOG minus CARB's exempt compounds (e.g., methane, ethane, various chlorinated fluorocarbons, acetone, perchloroethylene, volatile methyl siloxanes, etc.). ROG is nearly identical to U.S. EPA's Volatile Organic Compounds (VOC), which is based on EPA's exempt list. For all practical purposes, use of the terms ROG and VOC are interchangeable.

The OG speciation profiles are applied to estimate the amounts of various organic compounds that make up TOG emissions. A speciation profile contains a list of organic compounds and the weight fraction that each compound comprises of the TOG emissions from a particular source type. In addition to the chemical name for each chemical constituent, the file also shows the 5-digit CARB internal identification chemical code. The speciation profiles are applied to TOG to develop both the photochemical model inputs and the emission inventory for ROG. It should be noted that districts are allowed to report their own reactive fraction of TOG that is used to calculate ROG rather than use the information from the assigned OG speciation profiles. These district-reported fractions are not used in developing modeling inventories because the information needed to calculate the amount of each organic compound is not available.

The PM emissions are size-fractionated by using PM size distribution profiles, which contain the total weight fraction for PM2.5 and PM10 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 PM2.5, PM10, 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 also can 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
    - Gasoline vehicle exhaust
    - On-road diesel exhaust
    - Off-road diesel exhaust
    - Ocean going vessel exhaust
    - Aircraft exhaust
    - Concrete batching
    - Commercial cooking
    - Residential fuel combustion-natural gas
    - Coating/painting
    - Cotton ginning
    - Stationary combustion
    - OGV auxiliary boiler combustion
    - Compressed Natural Gas (CNG) vehicle running exhaust

XXIV. Methodology for Developing Base Case, Baseline, and Future Projected Emissions Inventories

As mentioned in Section V, 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 XXXVII.

Sections XXV through XLIV 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.

XXV. 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 XLVI. 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 3 and Table 4 are reformatted into an input-ready format as explained in the SMOKE user's manual. Chemical speciation profiles, as described in Section XXIII, and emissions source cross-reference files used as inputs for SMOKE are developed by CARB staff. SMOKE uses the files for the chemical speciation of NOx, SOx, TOG, and PM to produce the species needed by photochemical air quality models.

Emissions for area sources are allocated to grid cells as stated by the modeling grid domain defined in Section IX. Emissions are spatially disaggregated using spatial surrogates as described in Section XVII. 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.

XXVI. Estimation of On-road Motor Vehicle Emissions

XXVII. General Methodology

The EMFAC2017 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.

XXVIII. 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.

XXIX. 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, 2021). For regions where no local travel demand model data are available, data from the Caltrans California Statewide Travel Demand Model (CSTDM) are used (Caltrans, 2020). 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 5 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 5: 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

Network	Counties in Network	Data Vintage
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 6 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, 2013) dataset was used to clip the census block group into areas with active population.

Table 6: 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

XXX. Temporal Adjustment (Day-of-week adjustments for EMFAC daily totals)

EMFAC2017 produces average day-of-week (DOW) estimates that represent Tuesday, Wednesday, and Thursday. In order to more accurately represent daily emissions, DOW adjustments are made to all emissions estimated on a Friday, Saturday, Sunday or Monday. The DOW adjustment factors were developed using CalVAD data. The California Vehicle Activity Database (CalVAD), developed by UC Irvine for CARB, is a system that fuses available data sources to produce a “best estimate” of vehicle activity by class. The 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. In order to fill the missing 24 counties’ data to cover all of California, a county which is nearby and similar in geography is selected 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 7 also shows the corresponding assignment to each vehicle type. Furthermore, the CalVAD fractions are scaled so that a typical workday (Tuesday, Wednesday, or Thursday) gets a scaling factor of 1.0. All other days of the week receive a scaling factor where their VMT is related back to the typical workday. This means there are a total of five weekday scaling factors. Lastly, the CalVAD data were used to create a typical holiday, because the traffic patterns for holidays are quite different than a typical weekday. Thus, in the end, there are six daily fractions for each of the three vehicle classes, for all 58 counties. The DOW factors and vehicle type can be found in Section 0.

Table 7: 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

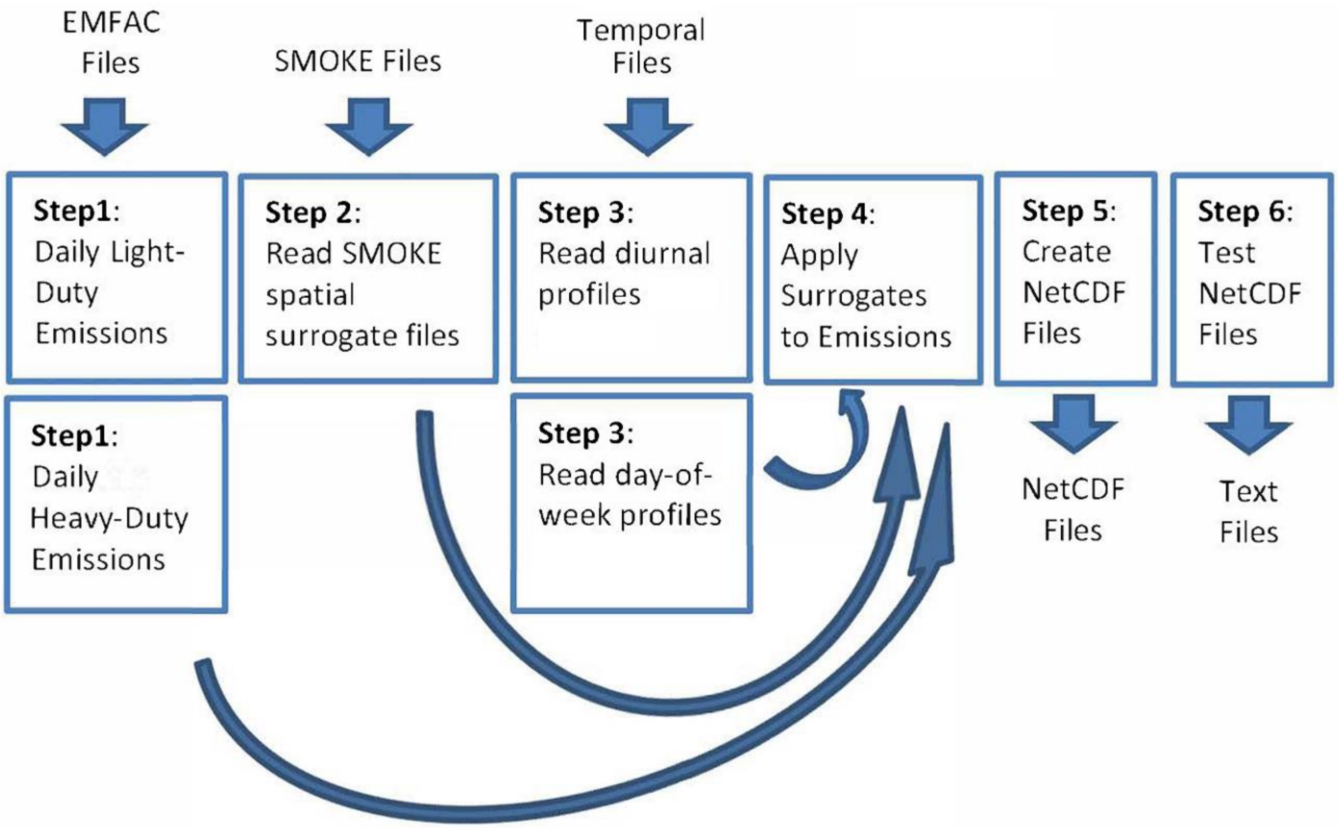
XXXI. Temporal Adjustment (Hour-of-day profiles for EMFAC daily totals)

EMFAC produces emission estimates for an average weekday and lacks the day-of-week hour-of-day temporal variations that are known to occur on specific days of the week. To rectify this, the CalVAD data were used to develop hour-of-day profiles for Friday through Monday, a typical weekday and a typical holiday. The hour-of-day profiles for passenger cars (LD), light- and medium-duty trucks (LM), and heavy heavy-duty trucks (HH) can be found in Appendix B: Hour-of-day Profiles by Vehicle Type and County.

XXXII. 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 3. 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 3: Workflow for spatial and temporal allocation of on-road emissions



XXXIII. 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 NOx Standard (CARB, Heavy-Duty Low NOx, 2020), Advanced Clean Truck (ACT) (CARB, Advanced Clean Trucks, 2020), and Heavy Duty Inspection and Maintenance Regulation (CARB, Heavy-Duty Inspection and Maintenance Regulation, 2021). The combined factors for 2026 are shown in **Table 8**.

Table 8: NOx Reductions (TPD) by Air Basin and Program for 2026

Region	NOx Reductions (Tpd)
Nevada County	0.34
Mountain Counties Basin	0.86

Sacramento Valley Basin	5.23
Total Statewide reductions	65.8

XXXIV. Estimation of Gridded Biogenic Emissions

Biogenic emissions were generated using the MEGAN3.0 biogenics 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.

XXXV. Aircraft Emissions

Aircraft emissions were generated using the Gridded Aircraft Trajectory Emissions Model (GATE) developed by CARB (AQPSD CARB, 2019). The GATE model distributes aircraft emissions in three dimensions. The GATE model takes annual, ungridded aircraft emissions during: landing, taxiing, and take-off. GATE converts this data into gridded, hourly files with the following steps:

- 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.

XXXVI. 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, 2015). For transit, maneuvering, and anchorage, emissions are distributed evenly in two vertical layers (2 and 3) (Kwok, 2015).

XXXVII. 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.

XXXVIII. 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 N. G., 2006). A series of pre-processing steps were performed using GIS to develop fuel loading and fuel moisture inputs to the First Order Fire Effects (FOFEM) fire emission model (Lutes, et al., 2012). Polygons from a statewide interagency fire perimeters geodatabase (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 (NH3, TNMHC, and N2O) in addition to the seven species native to FOFEM (CO, CO2, PM2.5, PM10, CH4, NOx, and SO2), and to calculate total emissions (tons) by pollutant species for each fire. Emission estimates for NH3, TNMHC, and N2O were based on mass ratios to emitted CO and CO2 (Gong P. C., 2003).

Fire polygon emissions were apportioned to CMAQ model grid cells using area fractions, developed using GIS software, by intersecting fire polygons to the grid domain.

Another set of post-processing steps were applied to allocate fire polygon emissions by date and hour of the day. Fire polygon emissions were allocated evenly between fire start and end dates, taken from the fire perimeters geodatabase. Daily emissions were then allocated to hour of day and to the model grid cells by using a script developed by CARB. A stack file and a 2-D hourly emissions file are generated for each day that has fire emissions. The stack file includes the fire locations, stack parameters and the number of acres burned for a fire in one day. The 2-D hourly emissions file includes the emissions for each specie and the heat flux (BTU/hr). CMAQ's in-line plume rise module will handle the vertical allocation of the fire emissions.

XXXIX. 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 matrix.

XL. Agricultural Burning

Agricultural burn 2018 data processed were reported by air districts. The tons burned provided in the data 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.

XLI. 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 taking into account average temperature by grid cell (UNC Chapel Hill - The Institute for the Environment, 2016). 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 a county wood burning emissions are reduced by 51%.

Areas under Sacramento Metropolitan AQMD (SACAQMD) 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.

XLII. 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 based on WRF's two-meter temperature and ten-meter wind speed. For livestock, WRF's ground temperature and aerodynamic resistance drive variations in emissions. Through GenTpro these meteorological factors are averaged by county before creating year-long hourly profiles for each of the respective sectors. All algorithms are described in the SMOKE Manual 4. (UNC Chapel Hill - The Institute for the Environment, 2016), 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, 2016). 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.

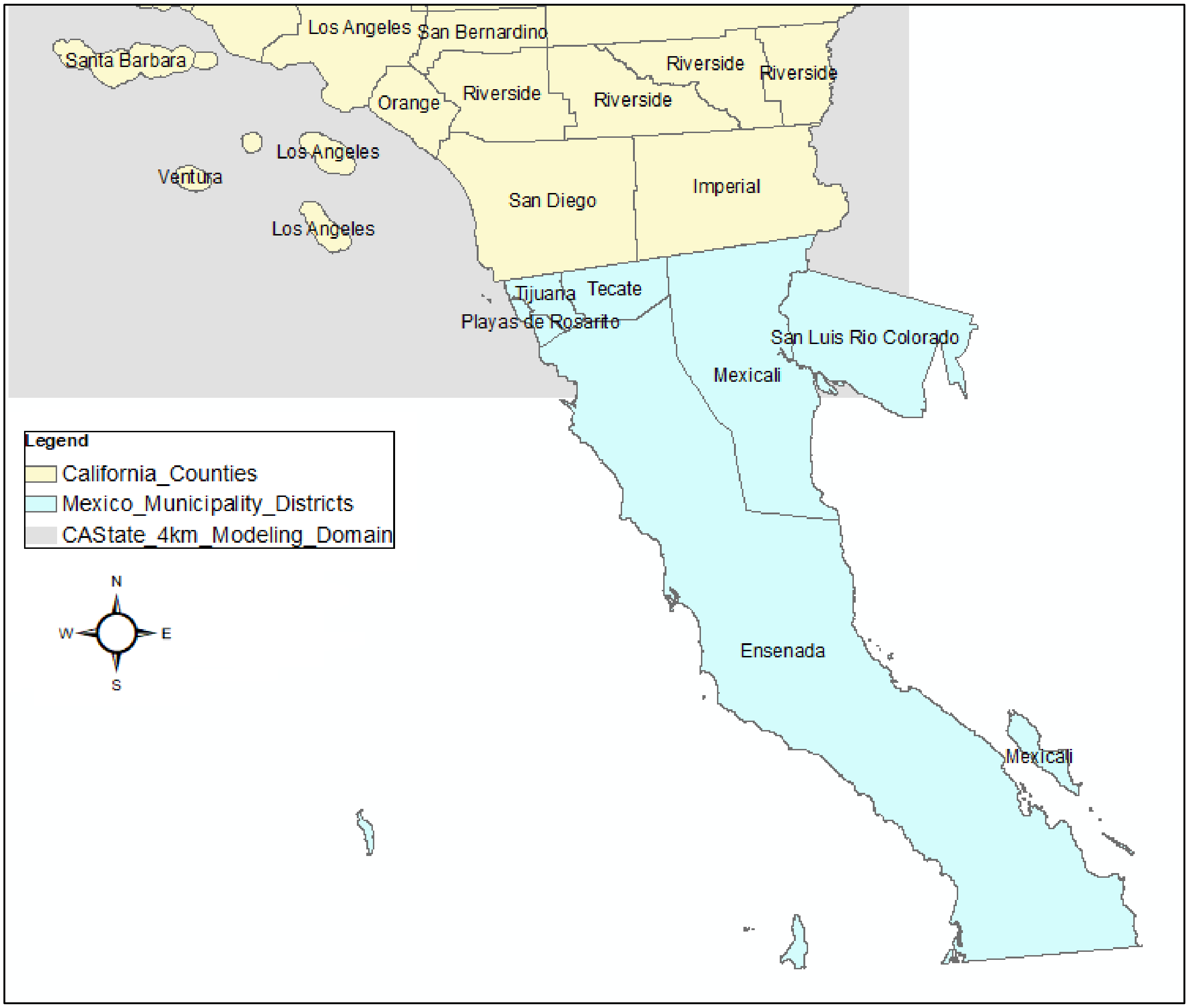
XLIII. Northern Mexico Emissions

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, 2019). Base year 2017 emission estimates were developed by projecting the 2014 emissions to 2017. Future year 2026 emissions estimates were developed by interpolating 2014, 2020 and 2025 emission estimates to 2026.

For mobile sources, the U.S. EPA on-road emissions model SMOKE-MOVES Mexico (Sparse Matrix Operator Kernel Emissions – Motor Vehicle Emission Simulator) was used to produce an on-road emissions inventory. The on-road sector is reflective of true 2017 emissions. Future year 2026 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 2014MNEI, and after discussions with U.S. EPA it was suggested to use SMOKE-MOVES over the 2014 MNEI estimates.

Figure 4: 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, 2019). 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, 2019). These updates have been included in the base and future year inventories and the surrogates used are listed in Table 9.

EPA's National Emission Inventory (NEI) has been used by ARB as a foundation for finding spatial surrogates that will aid in allocating emissions in the northern part of Mexico. While searching for improved surrogates, different online databases were investigated to find shapefiles relevant to established source sectors. The updated population surrogate was pulled from Instituto Nacional de Estadística y Geografía (INEGI) using information from Mexico's 2010 Population and Housing Census. INEGI provides spatial information about Mexico such as resources, population, and land use. The population surrogate was also used to update the following residential heating sources: wood, distillate oil, coal, and LP gas. The total road miles surrogate that is used to spatially allocate 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 10 lists the EPA-based Mexico surrogates dated as of May 2018.

Table 9: 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

Spatial Surrogate ID	Description	Year
232	Urban Population	2014
240	Ports	2014
250	Railroads	2014
260	Wastewater	2014
270	Windblown Dust	2014

Table 10: 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

#	Surrogate	Year	Shapefile	Weight field
38	Commercial plus Industrial Land	1999	com_ind_viv_MM5.shp	A515_2000
40	Residential Commercial Industrial Institutional	1999	com_ind_viv_MM5.shp	a535_2000
42	Personal Repair	1999	REP_CRUCES_MM5.shp	a545_1999
44	Airports Area	1999	mexico_air_MM5.shp	WEIGHT
46	Marine Ports	1999	mexico_ports_MM5.shp	VALUE
48	Brick Kilns	1999	BOSQUE_LAD_MM5.shp	LAD_2000
50	Mobile Sources Border Crossing	2014	Border_Crossing_Years_MM5.shp	Y20**

XLIV. 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 future year 2026 were developed with "2011v3 NEI 2028el_cb6v2_v6_11g" which are 2028 projections from the 2011 national emissions inventory version three. Spatial and temporal allocations were applied using the U.S. EPA ancillary files however, all spatial surrogates were processed through the spatial allocator tool with the California statewide map projection applied.

XLV. Quality Assurance of Modeling Inventories

As mentioned in Section VI., 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.

XLVI. 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

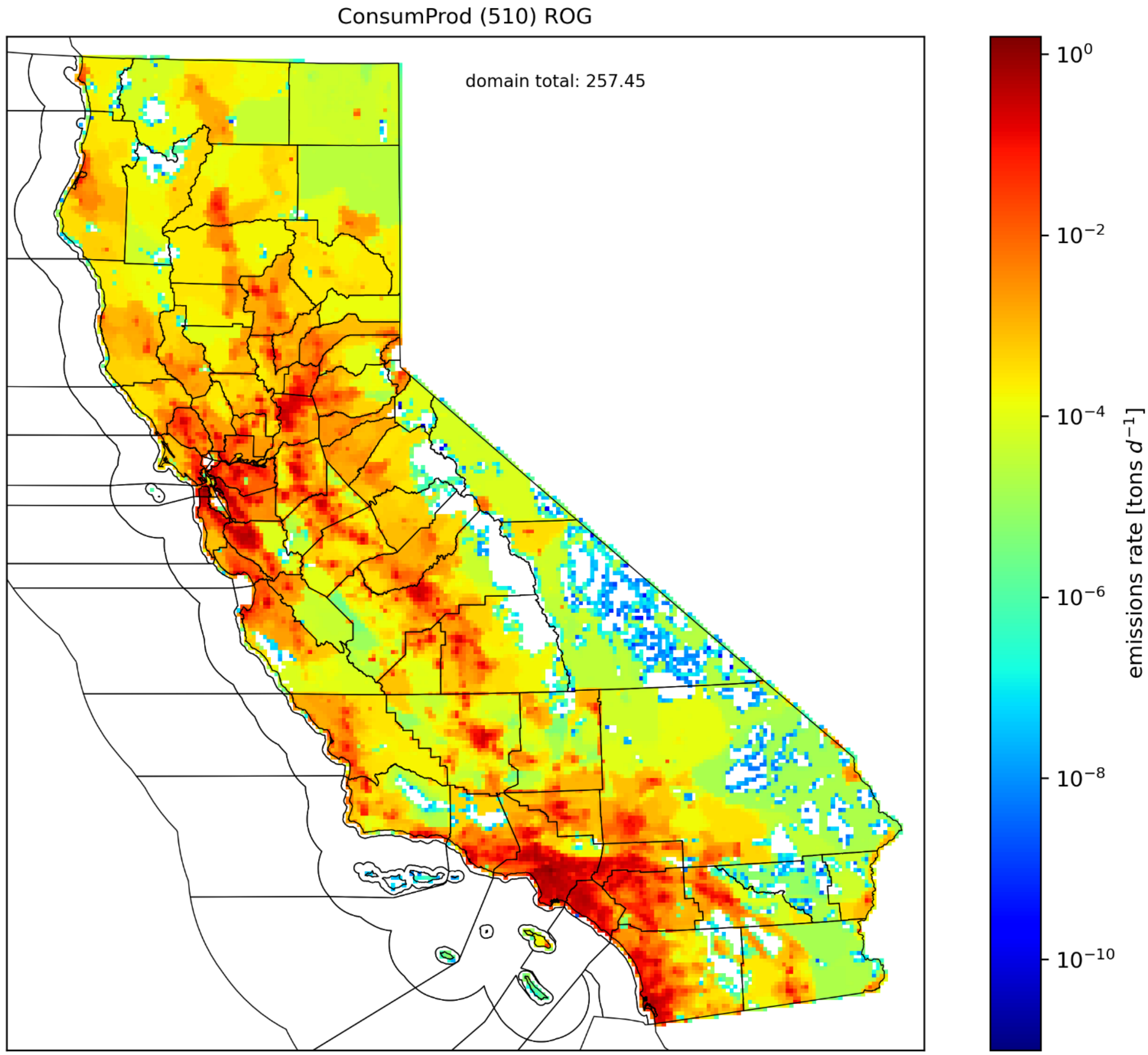
[1] All inventory and ancillary files for spatial and temporal allocation are available for download at: ftp://newftp.epa.gov/air/emismod/2011/v3platform/ (U.S. EPA, 2018).

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 XII. 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 5 are carefully screened for proper spatial distribution of emissions.

Figure 5: 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, creating and analyzing time series plots, and comparing 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, and commercial harbor craft sectors are among the source categories included in the application of adjustments to temporal allocation.

XLVII. 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.

XLVIII. 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.

XLIX. Day-specific Sources

L. 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. In order to check the location of the fires and the daily total emissions, a script is used to make a netCDF file from the stack file and the 2-D hourly emissions file for each day. The spatial plot and the daily total emissions from processing the netCDF file are then compare to the raw fire emissions data to check for accuracy.

LI. Agricultural Burning

Checks were done to verify the quality of the agricultural burn data. The day-specific emissions from agricultural burning were compared to the emissions from CEPAM for each county to check for reasonableness. Time series plots were reviewed for each county to see that days when burning occurred matched the days provided by the local air district. For each county, a few individual fires were calculated by hand starting from the raw data through all the steps to the final model-ready emissions files to make sure the calculations were done correctly. Spatial plots were made to double check the location of each burn.

LII. 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 XXVI; since weekend travel is generally less than weekday travel, modeling inventory emissions are usually lower when compared to annual average inventories from CEPAM. Figure 6 is an example of a QA report that summarizes NOx emissions by category for EIC3 10 through 499 for Nevada County. 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 6: Comparison of inventories report

Basin:*MC* County:*29* Spec:*NOx*

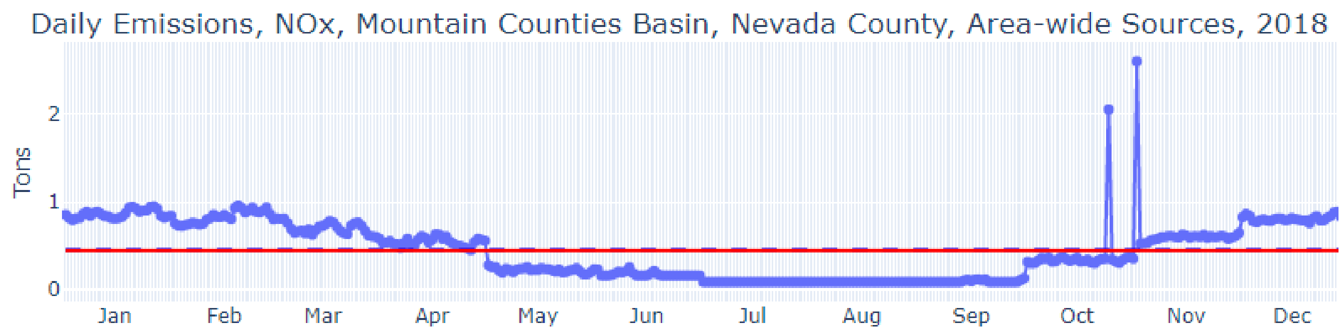
EIC	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	RF3064_19v1.02	RF3084_19v1.03	RF3108_19v1.04	RF3089_22v1.01
10	Electric Utilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Cogeneration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	Oil And Gas Production (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
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	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
52	Food And Agricultural Processing	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
60	Service And Commercial	0.07	0.06	0.06	0.06	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.07	0.05	0.05	0.05	0.06	0.06
99	Other (Fuel Combustion)	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.03
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	0.00	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
130	Incinerators	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
140	Soil Remediation	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
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	0.00	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
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	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
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	0.00	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
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	0.00	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
420	Food And Agriculture	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
430	Mineral Processes	0.02	0.02	0.03	0.04	0.04	0.04	0.03	0.04	0.03	0.04	0.03	0.02	0.03	0.03	0.03	0.03	0.03
440	Metal Processes	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
450	Wood And Paper	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
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)	0.00	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

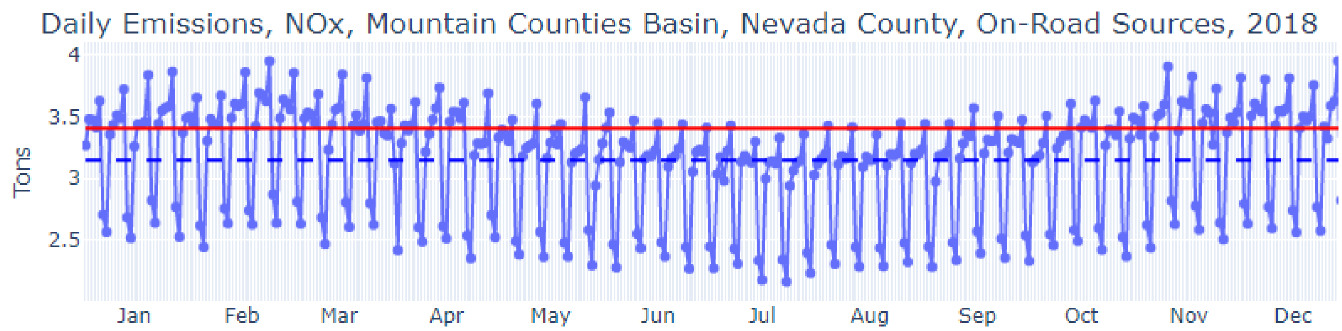
Notes:

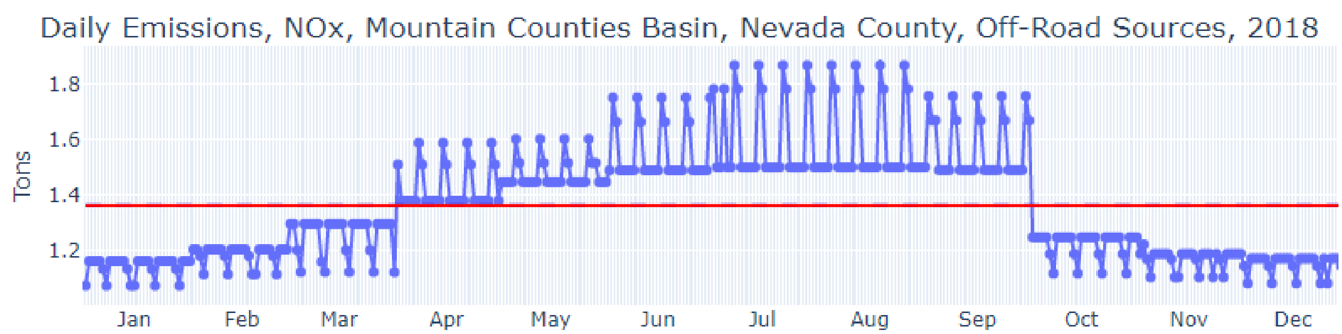
- CEPAM refers to annual average emissions from 2019 SIP Baseline Emission Inventory Tool with external adjustments: [CEPAM External Adjustment Reporting Tool]
- Monthly gridded emissions come from GeoVAST mo-yr/avg tabular summary - gid 657

Staff also review how modeling emissions vary over a year. Figure 7provides an example of a modeling inventory time series plot for San Luis Obispo County for area-wide sources, on-road sources and off-road sources. Again, this figure is only an example.

Figure 7: Daily variation of NOx emissions for sources in Nevada County


Daily Emissions, NOx, Mountain Counties Basin, Nevada County, Area-wide Sources, 2018
Tons
0
1
2
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Daily Emissions, NOx, Mountain Counties Basin, Nevada County, On-Road Sources, 2018
Tons
2.5
3
3.5
4
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Daily Emissions, NOx, Mountain Counties Basin, Nevada County, Off-Road Sources, 2018
Tons
1.2
1.4
1.6
1.8
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

LIII. 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 8 is an example of a QA plot from the processed inventory. The share of area, on-road, and point sources contribution to annual NOx emissions are shown for Western Nevada Nonattainment area in 2018. These same sources are shown as a daily timeseries for Western Nevada Nonattainment area in

Figure 9. These figures are only examples and do not reflect the inventory totals used for SIP attainment modeling.

Figure 8: Annual processed emissions example for 2018 Western Nevada Nonattainment Area NOx for area, on-road, and point sources

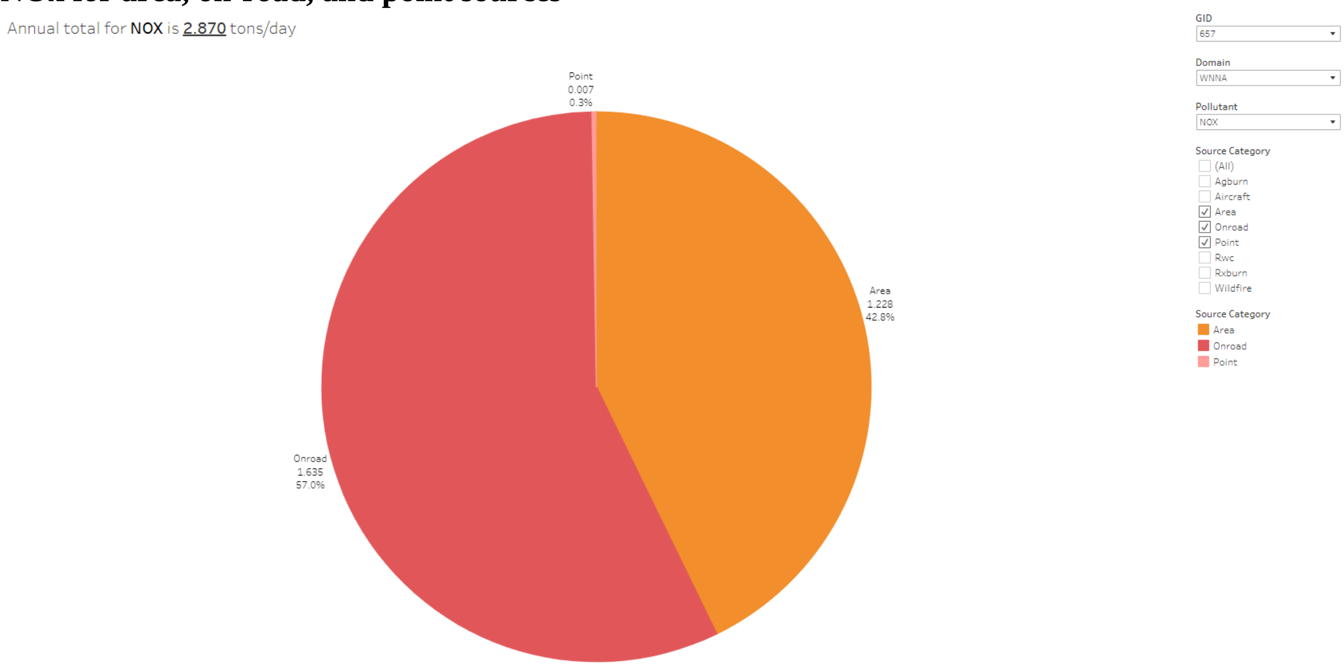
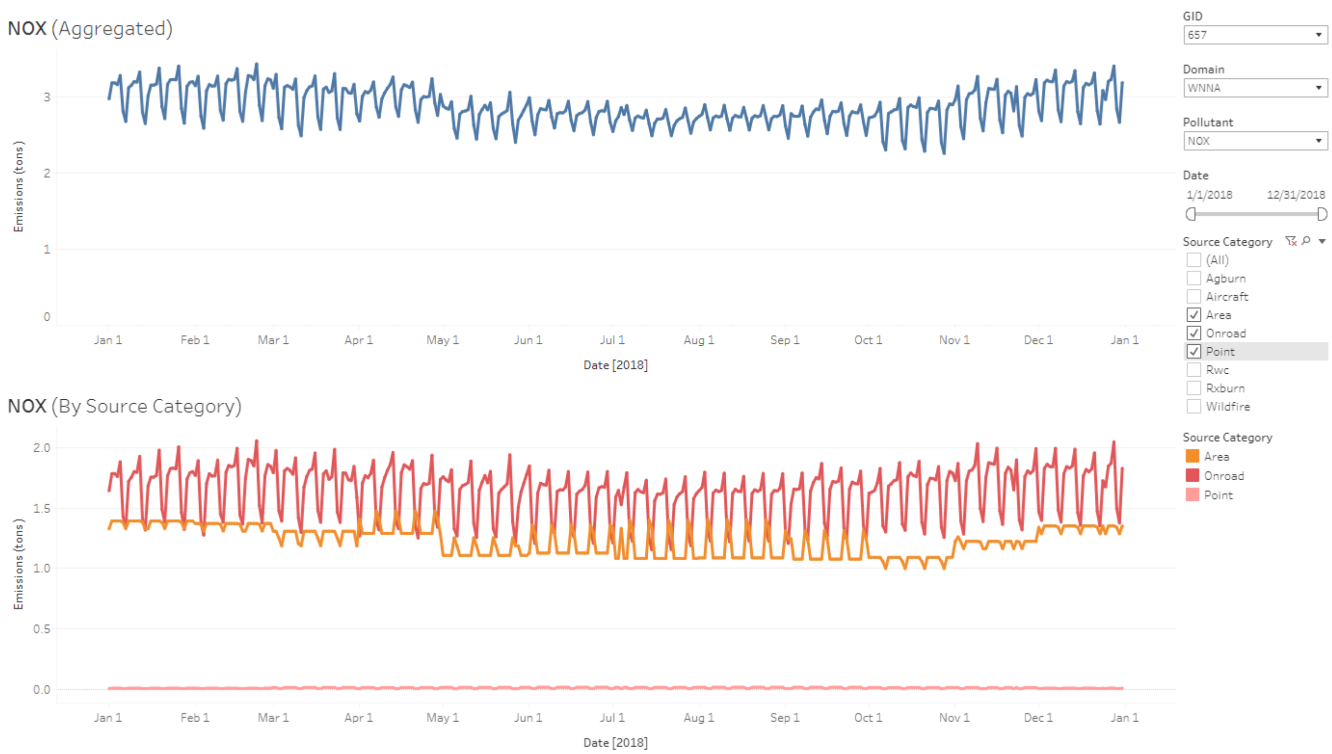


Figure 9: Example timeseries plot for daily 2018 NOx emissions from area, on-road, and point sources for Western Nevada Nonattainment Area



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.

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LIV. Appendix A: Day-of-week Redistribution Factors by Vehicle Type and County

The factors shown in Table 11 represent the "day-of-week" factors for each county for a broad vehicle class: LD is Light-Duty, LM is Light- and Medium-Duty Trucks and HH is Heavy Heavy-Duty Trucks.

Table 11: Day-of-week adjustment by vehicle class and county

County	Day of Week	LD	LM	HH
Nevada	Sunday	0.972	0.668	0.602
Nevada	Monday	0.988	0.977	0.943
Nevada	Tues/Wed/Thurs	1.000	1.000	1.000
Nevada	Friday	1.178	1.101	0.963
Nevada	Saturday	1.037	0.786	0.575
Nevada	Holiday	0.971	0.933	0.921
Placer	Sunday	0.972	0.668	0.602
Placer	Monday	0.988	0.977	0.943
Placer	Tues/Wed/Thurs	1.000	1.000	1.000
Placer	Friday	1.178	1.101	0.963
Placer	Saturday	1.037	0.786	0.575
Placer	Holiday	0.971	0.933	0.921
Sierra	Sunday	0.972	0.668	0.602
Sierra	Monday	0.988	0.977	0.943
Sierra	Tues/Wed/Thurs	1.000	1.000	1.000
Sierra	Friday	1.178	1.101	0.963
Sierra	Saturday	1.037	0.786	0.575
Sierra	Holiday	0.971	0.933	0.921

County	Day of Week	LD	LM	HH
Yuba	Sunday	0.972	0.668	0.602
Yuba	Monday	0.988	0.977	0.943
Yuba	Tues/Wed/Thurs	1.000	1.000	1.000
Yuba	Friday	1.178	1.101	0.963
Yuba	Saturday	1.037	0.786	0.575
Yuba	Holiday	0.971	0.933	0.921

LV. Appendix B: Hour-of-day Profiles by Vehicle Type and County

The factors shown in the table below represent the differently hourly profiles for different days of the week for each county for a broad vehicle class: LD is Light-Duty, LM is Light- and Medium-Duty Trucks and HH is Heavy Heavy-Duty Trucks.

Table 12: Hour-of-day profiles by vehicle type and county

Day of Week	Hour	Nevada LD	Nevada LM	Nevada HH	Placer LD	Placer LM	Placer HH	Sierra LD	Sierra LM	Sierra HH	Yuba LD	Yuba LM	Yuba HH
Sunday	0	0.013	0.020	0.031	0.013	0.020	0.031	0.013	0.020	0.031	0.013	0.020	0.031
Sunday	1	0.008	0.016	0.028	0.008	0.016	0.028	0.008	0.016	0.028	0.008	0.016	0.028
Sunday	2	0.006	0.013	0.026	0.006	0.013	0.026	0.006	0.013	0.026	0.006	0.013	0.026
Sunday	3	0.005	0.012	0.025	0.005	0.012	0.025	0.005	0.012	0.025	0.005	0.012	0.025
Sunday	4	0.005	0.012	0.025	0.005	0.012	0.025	0.005	0.012	0.025	0.005	0.012	0.025
Sunday	5	0.008	0.015	0.027	0.008	0.015	0.027	0.008	0.015	0.027	0.008	0.015	0.027
Sunday	6	0.013	0.020	0.030	0.013	0.020	0.030	0.013	0.020	0.030	0.013	0.020	0.030
Sunday	7	0.022	0.028	0.034	0.022	0.028	0.034	0.022	0.028	0.034	0.022	0.028	0.034
Sunday	8	0.034	0.041	0.040	0.034	0.041	0.040	0.034	0.041	0.040	0.034	0.041	0.040
Sunday	9	0.048	0.055	0.046	0.048	0.055	0.046	0.048	0.055	0.046	0.048	0.055	0.046
Sunday	10	0.064	0.068	0.052	0.064	0.068	0.052	0.064	0.068	0.052	0.064	0.068	0.052
Sunday	11	0.075	0.075	0.055	0.075	0.075	0.055	0.075	0.075	0.055	0.075	0.075	0.055
Sunday	12	0.082	0.079	0.058	0.082	0.079	0.058	0.082	0.079	0.058	0.082	0.079	0.058
Sunday	13	0.084	0.079	0.058	0.084	0.079	0.058	0.084	0.079	0.058	0.084	0.079	0.058
Sunday	14	0.084	0.077	0.057	0.084	0.077	0.057	0.084	0.077	0.057	0.084	0.077	0.057
Sunday	15	0.082	0.073	0.057	0.082	0.073	0.057	0.082	0.073	0.057	0.082	0.073	0.057
Sunday	16	0.079	0.068	0.055	0.079	0.068	0.055	0.079	0.068	0.055	0.079	0.068	0.055
Sunday	17	0.072	0.062	0.053	0.072	0.062	0.053	0.072	0.062	0.053	0.072	0.062	0.053
Sunday	18	0.060	0.052	0.049	0.060	0.052	0.049	0.060	0.052	0.049	0.060	0.052	0.049
Sunday	19	0.050	0.043	0.045	0.050	0.043	0.045	0.050	0.043	0.045	0.050	0.043	0.045

Day of Week	Hour	Nevada LD	Nevada LM	Nevada HH	Placer LD	Placer LM	Placer HH	Sierra LD	Sierra LM	Sierra HH	Yuba LD	Yuba LM	Yuba HH
Sunday	20	0.041	0.035	0.042	0.041	0.035	0.042	0.041	0.035	0.042	0.041	0.035	0.042
Sunday	21	0.031	0.026	0.039	0.031	0.026	0.039	0.031	0.026	0.039	0.031	0.026	0.039
Sunday	22	0.021	0.019	0.036	0.021	0.019	0.036	0.021	0.019	0.036	0.021	0.019	0.036
Sunday	23	0.013	0.015	0.033	0.013	0.015	0.033	0.013	0.015	0.033	0.013	0.015	0.033
Monday	0	0.008	0.014	0.027	0.008	0.014	0.027	0.008	0.014	0.027	0.008	0.014	0.027
Monday	1	0.005	0.012	0.025	0.005	0.012	0.025	0.005	0.012	0.025	0.005	0.012	0.025
Monday	2	0.004	0.012	0.025	0.004	0.012	0.025	0.004	0.012	0.025	0.004	0.012	0.025
Monday	3	0.006	0.014	0.027	0.006	0.014	0.027	0.006	0.014	0.027	0.006	0.014	0.027
Monday	4	0.011	0.019	0.030	0.011	0.019	0.030	0.011	0.019	0.030	0.011	0.019	0.030
Monday	5	0.023	0.030	0.036	0.023	0.030	0.036	0.023	0.030	0.036	0.023	0.030	0.036
Monday	6	0.042	0.047	0.043	0.042	0.047	0.043	0.042	0.047	0.043	0.042	0.047	0.043
Monday	7	0.060	0.061	0.048	0.060	0.061	0.048	0.060	0.061	0.048	0.060	0.061	0.048
Monday	8	0.059	0.062	0.050	0.059	0.062	0.050	0.059	0.062	0.050	0.059	0.062	0.050
Monday	9	0.056	0.061	0.050	0.056	0.061	0.050	0.056	0.061	0.050	0.056	0.061	0.050
Monday	10	0.058	0.064	0.051	0.058	0.064	0.051	0.058	0.064	0.051	0.058	0.064	0.051
Monday	11	0.062	0.066	0.053	0.062	0.066	0.053	0.062	0.066	0.053	0.062	0.066	0.053
Monday	12	0.066	0.068	0.054	0.066	0.068	0.054	0.066	0.068	0.054	0.066	0.068	0.054
Monday	13	0.067	0.067	0.054	0.067	0.067	0.054	0.067	0.067	0.054	0.067	0.067	0.054
Monday	14	0.070	0.069	0.055	0.070	0.069	0.055	0.070	0.069	0.055	0.070	0.069	0.055
Monday	15	0.073	0.069	0.055	0.073	0.069	0.055	0.073	0.069	0.055	0.073	0.069	0.055
Monday	16	0.075	0.067	0.054	0.075	0.067	0.054	0.075	0.067	0.054	0.075	0.067	0.054
Monday	17	0.073	0.061	0.052	0.073	0.061	0.052	0.073	0.061	0.052	0.073	0.061	0.052

Day of Week	Hour	Nevada LD	Nevada LM	Nevada HH	Placer LD	Placer LM	Placer HH	Sierra LD	Sierra LM	Sierra HH	Yuba LD	Yuba LM	Yuba HH
Monday	18	0.056	0.046	0.045	0.056	0.046	0.045	0.056	0.046	0.045	0.056	0.046	0.045
Monday	19	0.040	0.031	0.039	0.040	0.031	0.039	0.040	0.031	0.039	0.040	0.031	0.039
Monday	20	0.031	0.022	0.035	0.031	0.022	0.035	0.031	0.022	0.035	0.031	0.022	0.035
Monday	21	0.025	0.017	0.032	0.025	0.017	0.032	0.025	0.017	0.032	0.025	0.017	0.032
Monday	22	0.017	0.012	0.030	0.017	0.012	0.030	0.017	0.012	0.030	0.017	0.012	0.030
Monday	23	0.012	0.009	0.030	0.012	0.009	0.030	0.012	0.009	0.030	0.012	0.009	0.030
Tues/Wed/Thurs	0	0.008	0.014	0.029	0.008	0.014	0.029	0.008	0.014	0.029	0.008	0.014	0.029
Tues/Wed/Thurs	1	0.004	0.011	0.027	0.004	0.011	0.027	0.004	0.011	0.027	0.004	0.011	0.027
Tues/Wed/Thurs	2	0.004	0.011	0.027	0.004	0.011	0.027	0.004	0.011	0.027	0.004	0.011	0.027
Tues/Wed/Thurs	3	0.005	0.013	0.029	0.005	0.013	0.029	0.005	0.013	0.029	0.005	0.013	0.029
Tues/Wed/Thurs	4	0.010	0.018	0.031	0.010	0.018	0.031	0.010	0.018	0.031	0.010	0.018	0.031
Tues/Wed/Thurs	5	0.022	0.029	0.037	0.022	0.029	0.037	0.022	0.029	0.037	0.022	0.029	0.037
Tues/Wed/Thurs	6	0.042	0.047	0.044	0.042	0.047	0.044	0.042	0.047	0.044	0.042	0.047	0.044
Tues/Wed/Thurs	7	0.060	0.061	0.050	0.060	0.061	0.050	0.060	0.061	0.050	0.060	0.061	0.050
Tues/Wed/Thurs	8	0.060	0.062	0.051	0.060	0.062	0.051	0.060	0.062	0.051	0.060	0.062	0.051
Tues/Wed/Thurs	9	0.055	0.060	0.050	0.055	0.060	0.050	0.055	0.060	0.050	0.055	0.060	0.050
Tues/Wed/Thurs	10	0.056	0.061	0.051	0.056	0.061	0.051	0.056	0.061	0.051	0.056	0.061	0.051
Tues/Wed/Thurs	11	0.059	0.064	0.052	0.059	0.064	0.052	0.059	0.064	0.052	0.059	0.064	0.052
Tues/Wed/Thurs	12	0.061	0.065	0.053	0.061	0.065	0.053	0.061	0.065	0.053	0.061	0.065	0.053
Tues/Wed/Thurs	13	0.064	0.066	0.053	0.064	0.066	0.053	0.064	0.066	0.053	0.064	0.066	0.053
Tues/Wed/Thurs	14	0.068	0.068	0.053	0.068	0.068	0.053	0.068	0.068	0.053	0.068	0.068	0.053
Tues/Wed/Thurs	15	0.073	0.069	0.053	0.073	0.069	0.053	0.073	0.069	0.053	0.073	0.069	0.053

Day of Week	Hour	Nevada LD	Nevada LM	Nevada HH	Placer LD	Placer LM	Placer HH	Sierra LD	Sierra LM	Sierra HH	Yuba LD	Yuba LM	Yuba HH
Tues/Wed/Thurs	16	0.075	0.067	0.052	0.075	0.067	0.052	0.075	0.067	0.052	0.075	0.067	0.052
Tues/Wed/Thurs	17	0.074	0.063	0.050	0.074	0.063	0.050	0.074	0.063	0.050	0.074	0.063	0.050
Tues/Wed/Thurs	18	0.059	0.048	0.044	0.059	0.048	0.044	0.059	0.048	0.044	0.059	0.048	0.044
Tues/Wed/Thurs	19	0.043	0.034	0.038	0.043	0.034	0.038	0.043	0.034	0.038	0.043	0.034	0.038
Tues/Wed/Thurs	20	0.035	0.025	0.034	0.035	0.025	0.034	0.035	0.025	0.034	0.035	0.025	0.034
Tues/Wed/Thurs	21	0.029	0.019	0.031	0.029	0.019	0.031	0.029	0.019	0.031	0.029	0.019	0.031
Tues/Wed/Thurs	22	0.020	0.013	0.029	0.020	0.013	0.029	0.020	0.013	0.029	0.020	0.013	0.029
Tues/Wed/Thurs	23	0.013	0.009	0.028	0.013	0.009	0.028	0.013	0.009	0.028	0.013	0.009	0.028
Friday	0	0.007	0.014	0.032	0.007	0.014	0.032	0.007	0.014	0.032	0.007	0.014	0.032
Friday	1	0.005	0.011	0.030	0.005	0.011	0.030	0.005	0.011	0.030	0.005	0.011	0.030
Friday	2	0.004	0.011	0.030	0.004	0.011	0.030	0.004	0.011	0.030	0.004	0.011	0.030
Friday	3	0.005	0.012	0.030	0.005	0.012	0.030	0.005	0.012	0.030	0.005	0.012	0.030
Friday	4	0.008	0.016	0.033	0.008	0.016	0.033	0.008	0.016	0.033	0.008	0.016	0.033
Friday	5	0.017	0.026	0.038	0.017	0.026	0.038	0.017	0.026	0.038	0.017	0.026	0.038
Friday	6	0.033	0.040	0.045	0.033	0.040	0.045	0.033	0.040	0.045	0.033	0.040	0.045
Friday	7	0.049	0.054	0.050	0.049	0.054	0.050	0.049	0.054	0.050	0.049	0.054	0.050
Friday	8	0.051	0.057	0.052	0.051	0.057	0.052	0.051	0.057	0.052	0.051	0.057	0.052
Friday	9	0.050	0.057	0.052	0.050	0.057	0.052	0.050	0.057	0.052	0.050	0.057	0.052
Friday	10	0.054	0.061	0.054	0.054	0.061	0.054	0.054	0.061	0.054	0.054	0.061	0.054
Friday	11	0.060	0.066	0.055	0.060	0.066	0.055	0.060	0.066	0.055	0.060	0.066	0.055
Friday	12	0.063	0.067	0.055	0.063	0.067	0.055	0.063	0.067	0.055	0.063	0.067	0.055
Friday	13	0.066	0.068	0.054	0.066	0.068	0.054	0.066	0.068	0.054	0.066	0.068	0.054

Day of Week	Hour	Nevada LD	Nevada LM	Nevada HH	Placer LD	Placer LM	Placer HH	Sierra LD	Sierra LM	Sierra HH	Yuba LD	Yuba LM	Yuba HH
Friday	14	0.070	0.070	0.054	0.070	0.070	0.054	0.070	0.070	0.054	0.070	0.070	0.054
Friday	15	0.073	0.070	0.052	0.073	0.070	0.052	0.073	0.070	0.052	0.073	0.070	0.052
Friday	16	0.074	0.067	0.050	0.074	0.067	0.050	0.074	0.067	0.050	0.074	0.067	0.050
Friday	17	0.072	0.063	0.047	0.072	0.063	0.047	0.072	0.063	0.047	0.072	0.063	0.047
Friday	18	0.063	0.051	0.042	0.063	0.051	0.042	0.063	0.051	0.042	0.063	0.051	0.042
Friday	19	0.050	0.039	0.035	0.050	0.039	0.035	0.050	0.039	0.035	0.050	0.039	0.035
Friday	20	0.041	0.029	0.030	0.041	0.029	0.030	0.041	0.029	0.030	0.041	0.029	0.030
Friday	21	0.037	0.023	0.028	0.037	0.023	0.028	0.037	0.023	0.028	0.037	0.023	0.028
Friday	22	0.030	0.017	0.026	0.030	0.017	0.026	0.030	0.017	0.026	0.030	0.017	0.026
Friday	23	0.019	0.011	0.024	0.019	0.011	0.024	0.019	0.011	0.024	0.019	0.011	0.024
Saturday	0	0.013	0.019	0.038	0.013	0.019	0.038	0.013	0.019	0.038	0.013	0.019	0.038
Saturday	1	0.008	0.015	0.034	0.008	0.015	0.034	0.008	0.015	0.034	0.008	0.015	0.034
Saturday	2	0.006	0.014	0.032	0.006	0.014	0.032	0.006	0.014	0.032	0.006	0.014	0.032
Saturday	3	0.006	0.013	0.031	0.006	0.013	0.031	0.006	0.013	0.031	0.006	0.013	0.031
Saturday	4	0.007	0.014	0.032	0.007	0.014	0.032	0.007	0.014	0.032	0.007	0.014	0.032
Saturday	5	0.011	0.018	0.034	0.011	0.018	0.034	0.011	0.018	0.034	0.011	0.018	0.034
Saturday	6	0.019	0.026	0.039	0.019	0.026	0.039	0.019	0.026	0.039	0.019	0.026	0.039
Saturday	7	0.032	0.038	0.046	0.032	0.038	0.046	0.032	0.038	0.046	0.032	0.038	0.046
Saturday	8	0.045	0.051	0.052	0.045	0.051	0.052	0.045	0.051	0.052	0.045	0.051	0.052
Saturday	9	0.057	0.062	0.056	0.057	0.062	0.056	0.057	0.062	0.056	0.057	0.062	0.056
Saturday	10	0.067	0.071	0.060	0.067	0.071	0.060	0.067	0.071	0.060	0.067	0.071	0.060
Saturday	11	0.074	0.076	0.061	0.074	0.076	0.061	0.074	0.076	0.061	0.074	0.076	0.061

Day of Week	Hour	Nevada LD	Nevada LM	Nevada HH	Placer LD	Placer LM	Placer HH	Sierra LD	Sierra LM	Sierra HH	Yuba LD	Yuba LM	Yuba HH
Saturday	12	0.075	0.075	0.060	0.075	0.075	0.060	0.075	0.075	0.060	0.075	0.075	0.060
Saturday	13	0.075	0.074	0.057	0.075	0.074	0.057	0.075	0.074	0.057	0.075	0.074	0.057
Saturday	14	0.074	0.071	0.055	0.074	0.071	0.055	0.074	0.071	0.055	0.074	0.071	0.055
Saturday	15	0.072	0.068	0.051	0.072	0.068	0.051	0.072	0.068	0.051	0.072	0.068	0.051
Saturday	16	0.070	0.064	0.048	0.070	0.064	0.048	0.070	0.064	0.048	0.070	0.064	0.048
Saturday	17	0.066	0.057	0.044	0.066	0.057	0.044	0.066	0.057	0.044	0.066	0.057	0.044
Saturday	18	0.056	0.047	0.038	0.056	0.047	0.038	0.056	0.047	0.038	0.056	0.047	0.038
Saturday	19	0.046	0.037	0.033	0.046	0.037	0.033	0.046	0.037	0.033	0.046	0.037	0.033
Saturday	20	0.040	0.030	0.028	0.040	0.030	0.028	0.040	0.030	0.028	0.040	0.030	0.028
Saturday	21	0.035	0.025	0.025	0.035	0.025	0.025	0.035	0.025	0.025	0.035	0.025	0.025
Saturday	22	0.028	0.019	0.023	0.028	0.019	0.023	0.028	0.019	0.023	0.028	0.019	0.023
Saturday	23	0.020	0.014	0.021	0.020	0.014	0.021	0.020	0.014	0.021	0.020	0.014	0.021
Holiday	0	0.010	0.016	0.028	0.010	0.016	0.028	0.010	0.016	0.028	0.010	0.016	0.028
Holiday	1	0.006	0.013	0.027	0.006	0.013	0.027	0.006	0.013	0.027	0.006	0.013	0.027
Holiday	2	0.004	0.012	0.026	0.004	0.012	0.026	0.004	0.012	0.026	0.004	0.012	0.026
Holiday	3	0.005	0.013	0.027	0.005	0.013	0.027	0.005	0.013	0.027	0.005	0.013	0.027
Holiday	4	0.008	0.016	0.029	0.008	0.016	0.029	0.008	0.016	0.029	0.008	0.016	0.029
Holiday	5	0.014	0.023	0.032	0.014	0.023	0.032	0.014	0.023	0.032	0.014	0.023	0.032
Holiday	6	0.025	0.033	0.036	0.025	0.033	0.036	0.025	0.033	0.036	0.025	0.033	0.036
Holiday	7	0.036	0.044	0.042	0.036	0.044	0.042	0.036	0.044	0.042	0.036	0.044	0.042
Holiday	8	0.046	0.053	0.048	0.046	0.053	0.048	0.046	0.053	0.048	0.046	0.053	0.048
Holiday	9	0.054	0.059	0.050	0.054	0.059	0.050	0.054	0.059	0.050	0.054	0.059	0.050

Day of Week	Hour	Nevada LD	Nevada LM	Nevada HH	Placer LD	Placer LM	Placer HH	Sierra LD	Sierra LM	Sierra HH	Yuba LD	Yuba LM	Yuba HH
Holiday	10	0.065	0.069	0.053	0.065	0.069	0.053	0.065	0.069	0.053	0.065	0.069	0.053
Holiday	11	0.074	0.074	0.057	0.074	0.074	0.057	0.074	0.074	0.057	0.074	0.074	0.057
Holiday	12	0.077	0.074	0.056	0.077	0.074	0.056	0.077	0.074	0.056	0.077	0.074	0.056
Holiday	13	0.076	0.074	0.058	0.076	0.074	0.058	0.076	0.074	0.058	0.076	0.074	0.058
Holiday	14	0.075	0.073	0.056	0.075	0.073	0.056	0.075	0.073	0.056	0.075	0.073	0.056
Holiday	15	0.074	0.070	0.055	0.074	0.070	0.055	0.074	0.070	0.055	0.074	0.070	0.055
Holiday	16	0.072	0.066	0.054	0.072	0.066	0.054	0.072	0.066	0.054	0.072	0.066	0.054
Holiday	17	0.068	0.059	0.051	0.068	0.059	0.051	0.068	0.059	0.051	0.068	0.059	0.051
Holiday	18	0.057	0.049	0.045	0.057	0.049	0.045	0.057	0.049	0.045	0.057	0.049	0.045
Holiday	19	0.047	0.036	0.041	0.047	0.036	0.041	0.047	0.036	0.041	0.047	0.036	0.041
Holiday	20	0.039	0.029	0.037	0.039	0.029	0.037	0.039	0.029	0.037	0.039	0.029	0.037
Holiday	21	0.030	0.020	0.033	0.030	0.020	0.033	0.030	0.020	0.033	0.030	0.020	0.033
Holiday	22	0.023	0.015	0.031	0.023	0.015	0.031	0.023	0.015	0.031	0.023	0.015	0.031
Holiday	23	0.015	0.010	0.029	0.015	0.010	0.029	0.015	0.010	0.029	0.015	0.010	0.029

LVI. Appendix 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 2015 through 2019 data from the Marine Cadastre Automatic Identification System (AIS). All vessel types were grouped by port area boundary and divided into day of week and monthly activity fractions (**Table 13** and **Table 14**). 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.

Table 13: 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 areas/waters	Profile ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 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 14: 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

LVII. Appendix D: Spatial Surrogate Assignments

The primary spatial surrogate for each EICSUM and the corresponding data source are listed in **Table 15** below.

Table 15: 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
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	Calrecycle - Solid Waste Information System (Swis) Dataset

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
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	Calrecyle - 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)
240	Printing	731	Print	Dun & Bradstreet's Market Insight Database
250	Adhesives and Sealants	302	UCD Industrial	Longitudinal Employer-Household Dynamics (LEHD)

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
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

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
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
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

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
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
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)

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
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)
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)

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
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

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
810	Aircraft	140	Commercial Airports	Federal Aviation Administration, National Transportation Atlas Database (NTAD)
810	Aircraft	320	Irrigated Cropland	National Land Cover Database (NLCD)
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

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
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
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

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
850	Off-Road Recreational Vehicles	651	UCD Single Family Housing	Metropolitan Planning Organization (MPO)/Council of Government (COG) Data /California Statewide Travel Demand Model (CSTDM) Data
850	Off-Road Recreational Vehicles	660	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
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

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
				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)

EICSUM	EICSUM Name	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
920	Geogenic Sources	432	Oil Seep	U.S. Geological Survey (USGS) – Pacific Coastal & Marine Science
930	Wildfires	190	Forestland	National Land Cover Database (NLCD)
930	Wildfires	391	Pasture	Sierra Research Agtool Contract
940	Windblown Dust	412	Fugitive Dust	National Land Cover Database (NLCD)

Appendix G

Weight of Evidence for Western Nevada County

Nonattainment Area (WNNA)

Introduction

The Western Nevada nonattainment area comprises the portion of Nevada County from the western boundary with Yuba and Placer counties up to the crest of the Sierra Nevada Mountains.

Western Nevada County was designated as a serious nonattainment area for the federal 2015 8-hour ozone standard of 0.070 parts per million (ppm). Ozone concentrations have decreased significantly over the past two decades, and 8-hour ozone design values were 0.076 ppm in 2012 and 2013, within 10 percent of the ozone standard. Although there was a slight increase in ozone concentrations in the Grass Valley region of Western Nevada County from 2013-2017 due to various reasons that will be discussed in this document, the ozone concentrations turned back to the downward trend since 2018.

To address the uncertainties inherent to modeling assessment, the U.S. Environmental Protection Agency (U.S. EPA) has released guidance, Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze.[1] This guidance recommends that supplemental analyses accompany all modeled attainment demonstrations. The weight of evidence (WOE) analyses presented in this report complement the regional photochemical modeling analyses included in the Western Nevada State Implementation Plan (SIP).

Currently, Nevada County has an ozone monitoring site in Grass Valley that operates year-round. Through 2015, the nonattainment area also had a seasonal site at White Cloud Mountain, operated by California Air Resources Board (CARB), however the site has not operated since the end of 2015 due to logistic issues. A date for the relocation or startup of a new site is unknown at this time. These two sites are at elevations of 2,600 and 3,500 feet. respectively as shown in Figure 1. Locations for these and other ozone monitoring sites in Sacramento and San Francisco Bay Area are indicated in Figure 1 and identified in Table 1, together with information about the county and air district in which these monitors are located.

The following WOE demonstration includes a conceptual model of conditions that contribute to the exceedances of the 0.070 ppm 8-hour ozone standard in Western Nevada, together with detailed analysis of ambient ozone levels and trends, regional ozone transport using back trajectories, ozone weekday and weekend analyses, and precursor emissions trends.

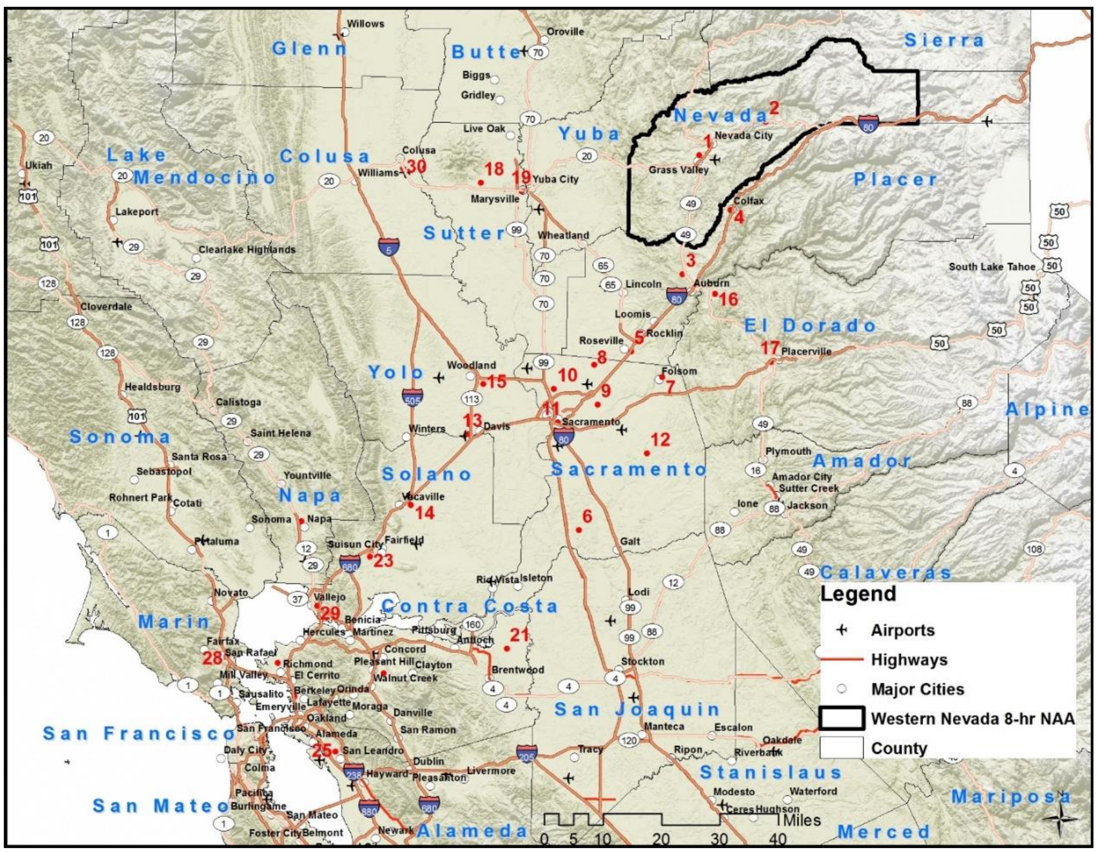
[1] https://www.epa.gov/sites/default/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf.

Area Description

Nevada County is drained by the Middle and South Yuba rivers. The western part of the county is defined by the course of several rivers and the irregular boundaries of adjoining counties.

The city of Grass Valley is the largest city in the western region of Nevada County. Situated at roughly 2,500 feet elevation in the western foothills of the Sierra Nevada mountain range, this historic northern gold country city is located about 60 miles north-northwest from the State capitol in Sacramento. As of the 2020 United States Census, the population of Grass Valley was 14,016[2]. Grass Valley has a hot summer Mediterranean climate with warm to hot, dry summers and wet, cool, winters. Summer is very dry, and the winter rains contribute to a heavy fuel-loading of brush and grass, which dry out during the summer, posing a wildfire hazard. In 2018 and 2020, air quality at Grass Valley was heavily impacted by forest fires in the region during the summer ozone season. High fine particulate matter ($PM_{2.5}$) and ozone concentrations were observed in the region during these forest fire days.

Figure 1. Ozone Monitoring Sites in Western Nevada County



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[2] U.S. Census Bureau QuickFacts: Grass Valley city, California; United States

Table 1. List of Ozone Monitoring Sites in Figure 1

Site Number	Site Name	County	Air District
1	Grass Valley-Litton Building	Nevada	Northern Sierra AQMD
2	White Cloud Mountain	Nevada	Northern Sierra AQMD
3	Auburn-Dewitt-C Avenue	Placer	Placer County APCD
4	Colfax-City Hall	Placer	Placer County APCD
5	Roseville-N Sunrise Blvd	Placer	Placer County APCD
6	Elk Grove-Bruceville Road	Sacramento	Sacramento Metropolitan AQMD
7	Folsom-Natoma Street	Sacramento	Sacramento Metropolitan AQMD
8	North Highlands-Blackfoot Way	Sacramento	Sacramento Metropolitan AQMD
9	Sacramento-Del Paso Manor	Sacramento	Sacramento Metropolitan AQMD
10	Sacramento-Goldenland Court	Sacramento	Sacramento Metropolitan AQMD
11	Sacramento-T Street	Sacramento	Sacramento Metropolitan AQMD
12	Sloughhouse	Sacramento	Sacramento Metropolitan AQMD
13	Davis-UCD Campus	Yolo	Yolo-Solano County AQMD
14	Vacaville-Ulatis Drive	Solano	Yolo-Solano County AQMD
15	Woodland-Gibson Road	Yolo	Yolo-Solano County AQMD
16	Cool-Highway 193	El Dorado	El Dorado County AQMD
17	Placerville-Gold Nugget Way	El Dorado	El Dorado County AQMD
18	Sutter Buttes-S Butte	Sutter	Feather River AQMD
19	Yuba City-Almond Street	Sutter	Feather River AQMD
20	Berkeley-6th Street	Alameda	Bay Area AQMD
21	Bethel Island Road	Contra Costa	Bay Area AQMD
22	Concord-2975 Treat Blvd	Contra Costa	Bay Area AQMD
23	Fairfield-Chadbourne Road	Solano	Bay Area AQMD
24	Napa-Jefferson Avenue	Napa	Bay Area AQMD
25	Oakland-9925 International Blvd	Alameda	Bay Area AQMD
26	San Francisco-Arkansas Street	San Francisco	Bay Area AQMD
27	San Pablo-Rumrill Blvd	Contra Costa	Bay Area AQMD
28	San Rafael	Marin	Bay Area AQMD
29	Vallejo-304 Tuolumne Street	Solano	Bay Area AQMD
30	Colusa-Sunrise Blvd	Colusa	Colusa County APCD

APCD: Air Pollution Control District; AQMD: Air Quality Management District

Conceptual Model

Transport of ozone and ozone precursors from the upwind urban regions including Sacramento and the San Francisco Bay Area, local anthropogenic emissions, varied terrain, and meteorological conditions favorable for the formation and buildup of ozone all contribute to the ozone air quality challenges in the Western Nevada County.

Ozone concentrations within the Western Nevada nonattainment area are directly the result of emissions and pollutant formation within metropolitan areas to the southwest, flowing up into the foothills during most summer days with a moderate to strong Delta Breeze. The formation of an inversion nearly every night, combined with mountain valleys, has the potential to trap air for extended periods of time.

Terrain and Meteorology

Nevada County is in the foothills and mountains of the Sierra Nevada mountain range and is located entirely within the Mountain Counties Air Basin (MCAB). The MCAB consists of gradual foothills rising out of California's Central Valley on the western side of the basin that transition to steeper, more complex terrain with high mountain peaks and a broad range of valleys spanning the full north-south extent of the air basin on the eastern side. Elevations within Nevada County increase from roughly 300 feet above mean sea level in the west to over 9,000 feet in the east with the eastern edge of the nonattainment area approximately 20 miles from the Sierra Nevada crest.

Nevada County is characterized by river valleys running roughly east-northeast to west-southwest, separated by mountain ridges. This tends to inhibit north-south air flow, but to allow east-west upslope and downslope flow. The western portion of the County, which makes up the Western Nevada ozone nonattainment area, is defined as the portion of the County that lies to the west of the crest of the Sierra Nevada mountain range. This ridgeline also represents the hydrographic boundary between the Lake Tahoe watershed and the watersheds to the west. The eastern portion of the County would not be expected to be influenced regularly by conditions in or transport from the Sacramento Valley or even the western portion of Nevada County itself, since it is on the other side of the crest of the Sierra Nevada mountain range, which is 14,000 feet in elevation.

The foothills of the Sierra Nevada allow air to flow easily into the basin from the west under normal summertime Delta breeze conditions, but the rugged terrain on the eastern side of the MCAB requires much stronger winds, associated with large-scale low-pressure systems, to transport air over the crest of the Sierras. As a result, Western Nevada County experiences the daily recirculation of air up the slope during the day and back down the slope at night, especially between the Central Valley floor and Highway 49, which travels along the foothills from north to south at an elevation of about 1,000-2,000 feet. Days with a moderate to strong Delta Breeze see the valley air reach up into Grass Valley and Nevada City.

As is the case elsewhere in the MCAB during the summer, ozone can be transported up into the Western Nevada County and become trapped in mountain valleys. With nothing to break down ozone in the atmosphere, ozone concentrations have the potential to remain high for as long as 24-48 hours straight until a weather system with strong winds is able to vent the valleys.

Another weather pattern that is mostly limited to the eastern half of California and frequently impacts the MCAB is monsoonal flow from the south in the summertime. Upper-level high pressure over the four corner states (Arizona, Utah, Colorado, and New Mexico) is a common feature during the summer and the clockwise flow of air around it pulls moisture from the Gulf of Mexico into the western U.S. On occasion, the moisture moves far enough to the west that thunderstorms will form over the Sierra Nevada Mountains. Residual clouds from thunderstorms formed the previous day in southern California will also flow into the MCAB. In both cases, the clouds block sunlight and limit ozone formation. Wind and rain showers associated with some of the storms will also help to prevent the formation and buildup of pollutant concentrations. However, in cases where the storms only produce dry lightning, the chance for wildfires is greatly increased, leading to a higher potential for smoke and both particulate matter and ozone impacts in the MCAB and neighboring air basins, depending on winds and drainage flows.

Regional Transport

As the area is located downwind of the populated urban areas of Sacramento and the San Francisco Bay Area, ozone in the Western Nevada County is mostly impacted by regional transport of ozone and ozone precursors.

Diurnal ozone patterns

Ozone forms as a result of photochemical reactions by precursor emissions under certain meteorological conditions. Measured ozone can be due to local precursor emissions and/or due to regional transported ozone and ozone precursors. In general, within large urban areas, ozone concentrations rise from sunrise and continue to peak after noon; then start falling in the evening and declining to minimum concentrations during the night. Areas impacted by transport generally show ozone concentrations peaking in the late afternoon or evening. Diurnal patterns of average hourly ozone concentrations were analyzed. For this analysis, hourly ozone concentrations for the summer months (May to October) were considered because the number of hours of daylight during these months is similar, ranging from 13 to 14 hours each day. All data collected during the month for the year of interest were included in the analysis to provide a robust sample size.

Figure 2 shows the average hourly ozone concentrations for the years 2011 onwards, at the Grass Valley and White Cloud Mountain sites. The diurnal patterns for Grass Valley show maximum daily values occurring in the late afternoon/evening. This is unlike typical patterns for photochemical production of ozone from local sources which have a bell curve-shaped peak in the early afternoon. The flat diurnal ozone pattern is more prominent at the White Cloud Mountain site than the Grass Valley site, as the White Cloud Mountain site has fewer local emissions. Lower concentrations occurring at White Cloud Mountain are consistent with that site's higher elevation and greater distance from contributing urban areas. In general, both sites have a typical diurnal ozone pattern for sites located in remote rural areas.

As mentioned above, a factor leading to persistently elevated ozone concentrations at the Grass Valley and White Cloud Mountain monitors is the lack of widespread fresh NOx emissions from combustion, which would break down ozone during the nighttime hours. Without the continuous influx of fresh NOx emissions that are emitted in metropolitan areas, ozone concentrations remain elevated overnight, requiring fewer hours to reach higher concentrations the following day.

Because locally generated emissions in Western Nevada County are lower than in upwind metropolitan areas, late morning and early afternoon ozone concentrations in the Western Nevada ozone nonattainment area are lower than they would be in the upwind Sacramento metropolitan area.

Ozone diurnal patterns are similar at the Grass Valley site in all these years. However, average hourly ozone in 2017 was significantly higher than the rest of the years at Grass Valley at all hours, highlighting the unusual levels of ozone observations at this site in that year. The potential reasons for the anomalous ozone data in 2017 will be discussed later in this document.

Wind flow on high ozone days

Evaluation of meteorological data helps to assess the fate and transport of emissions contributing to ozone concentrations and to identify areas potentially contributing to the monitored violations.

CARB staff used the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model to calculate 36 hour back trajectories. This analysis shed light on how meteorological conditions, including, but not limited to, weather, transport patterns, and stagnation conditions, could affect the fate and transport of ozone and precursor emissions from sources in the region.

In Western Nevada County, carryover ozone is of prime concern. As discussed in the previous section, ozone concentrations are higher during the night hours resulting in higher levels to start the following day.

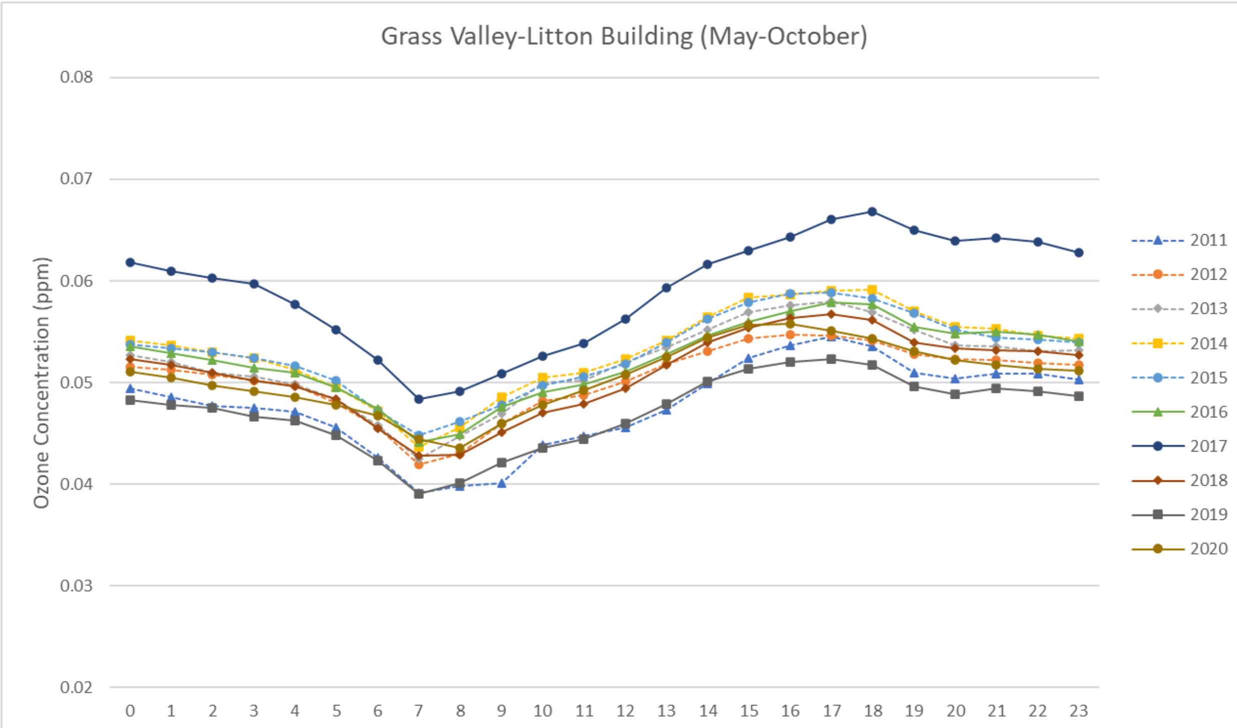
Back trajectory analysis for days exceeding the 0.070 ppm standard points to transport mostly from the Sacramento and San Francisco Bay Area regions, with comparatively little transport from within Nevada County and almost no transport from the eastern half of Nevada County. As shown in Figure 3, 10 of the 14 exceedance days in 2020 featured an air parcel coming from the San Francisco Bay Area and/or the Sacramento area. Trajectories at 1000 meters above ground level points to occasional transport from north or south of Nevada County. On the remaining four exceedance days, the air parcel traversed the surrounding area of the site indicating stable amospheric conditions, with limitedair circulation and local stagnation within the Grass Valley area. This is consistent with downslope flow in the evening preceding the exceedances, followed by upslope flow on the day of the exceedance, and may indicate recirculation of pollutants, possibly transported to Nevada County during preceding days.

Back-trajectories were consistent for years 2018 and 2019 as shown in Appendix A3.

Results of HYSPLIT analyses have been used to inform the determination of nonattainment area boundaries. In support of area designations for the 0.070 ppm ozone standard, U.S. EPA evaluated 2014-2016 HYSPLIT trajectories at 100, 500, and 1000 meters above ground level, and arrived at similar conclusions to those described above.

Forward trajectory analyses demonstrating how emissions from the wildfires were transported toward the monitor can be found in the CARB Exceptional Events Demonstration for Ozone Exceedances reports at https://ww2.arb.ca.gov/our-work/programs/state-and-federal-area-designations/exceptional-events.

Figure 2. Average Diurnal Profiles for 1-Hour Ozone Concentrations at the Grass Valley and White Cloud Mountain Sites



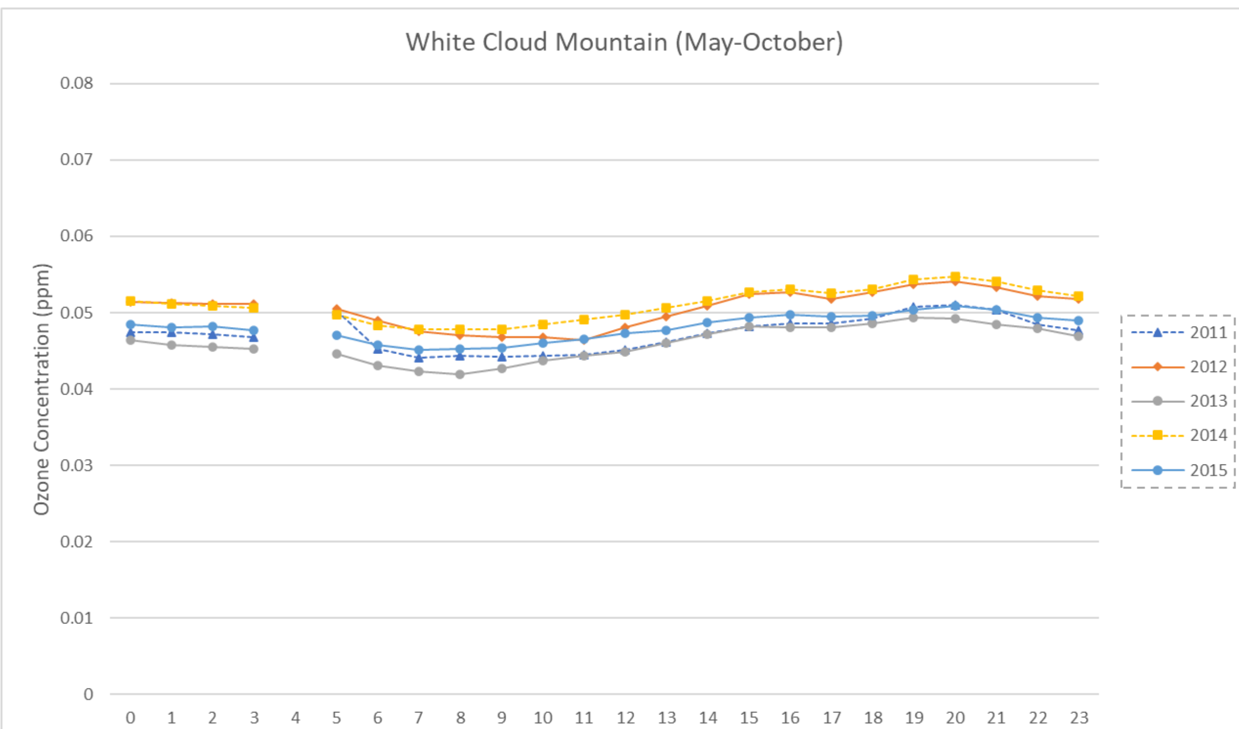
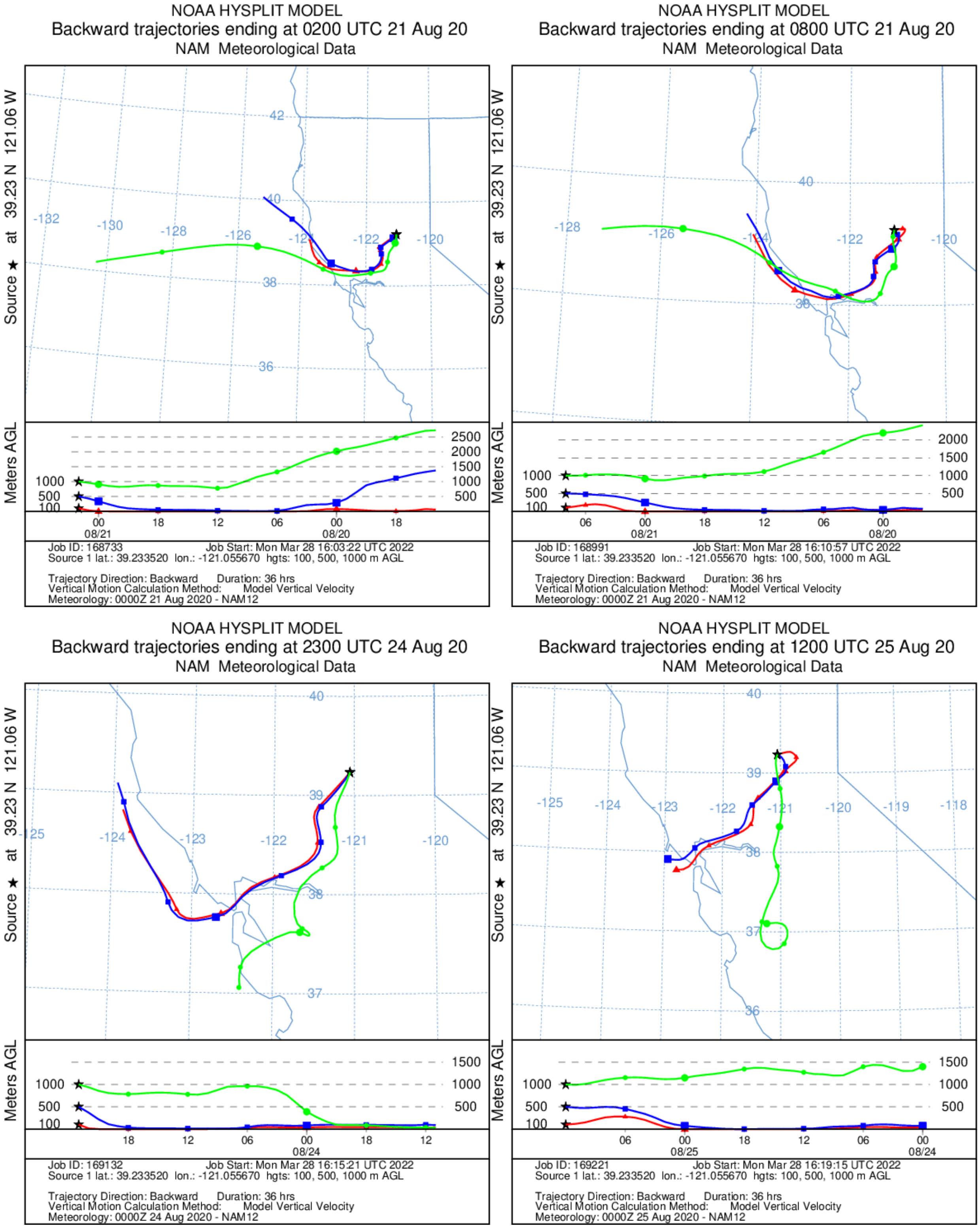
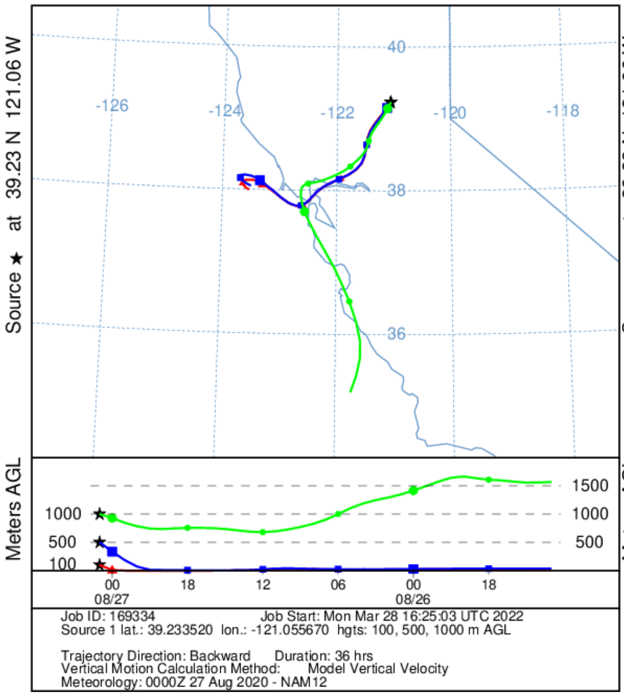


Figure 3. 36-hour Back Trajectories at Time of Maximum Ozone Concentration for High Ozone Days (>0.070 ppm) at Western Nevada Sites for the Year 2020



NOAA HYSPLIT MODEL
Backward trajectories ending at 0100 UTC 27 Aug 20
NAM Meteorological Data



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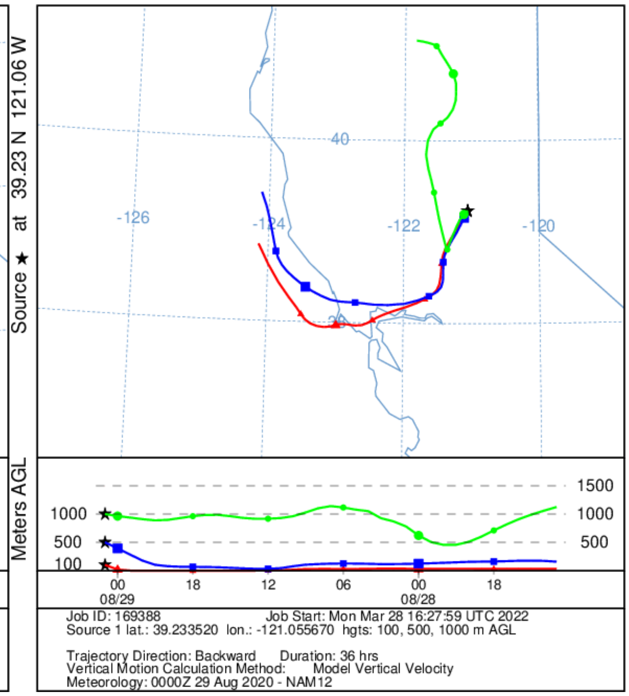

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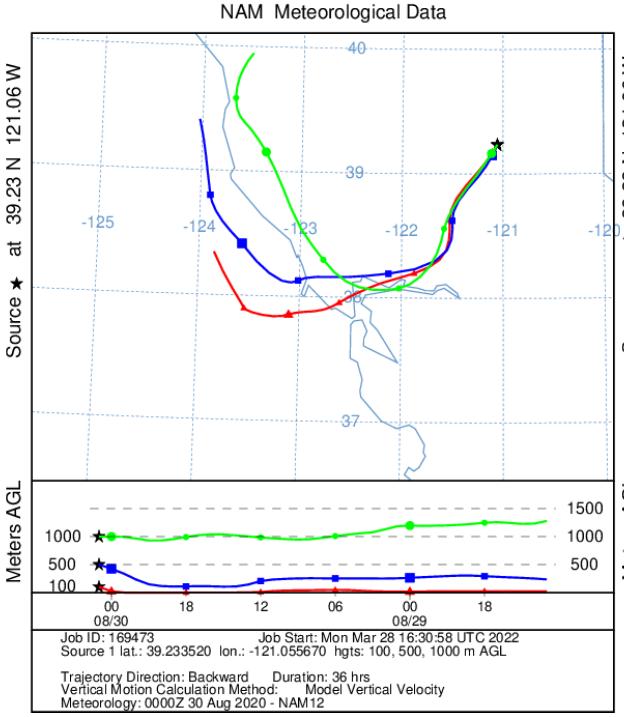

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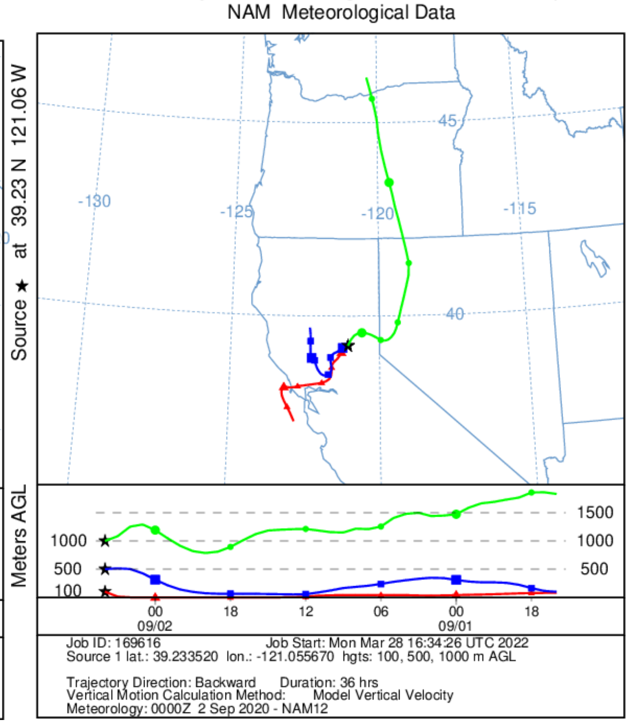

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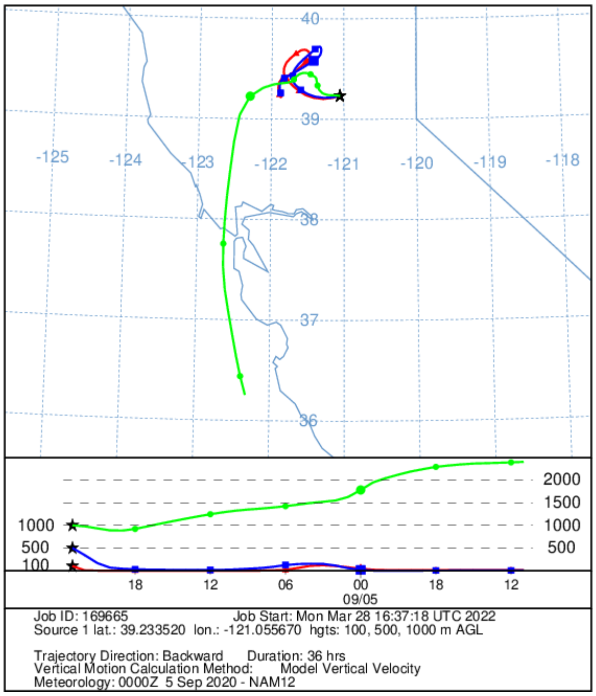

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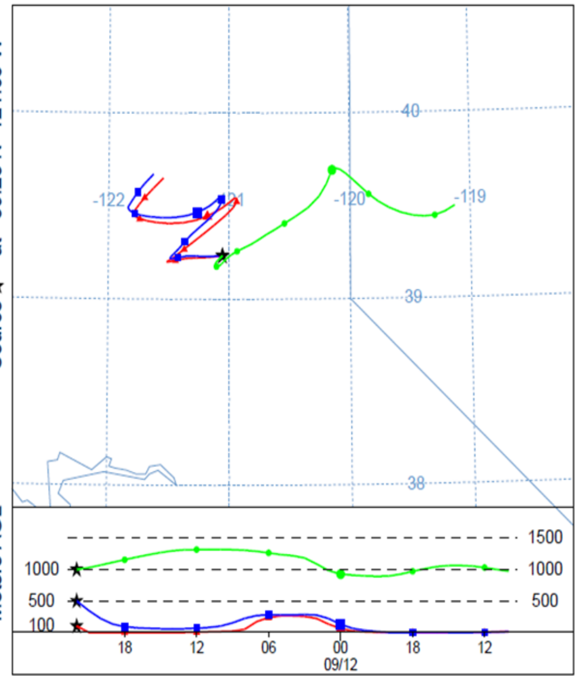

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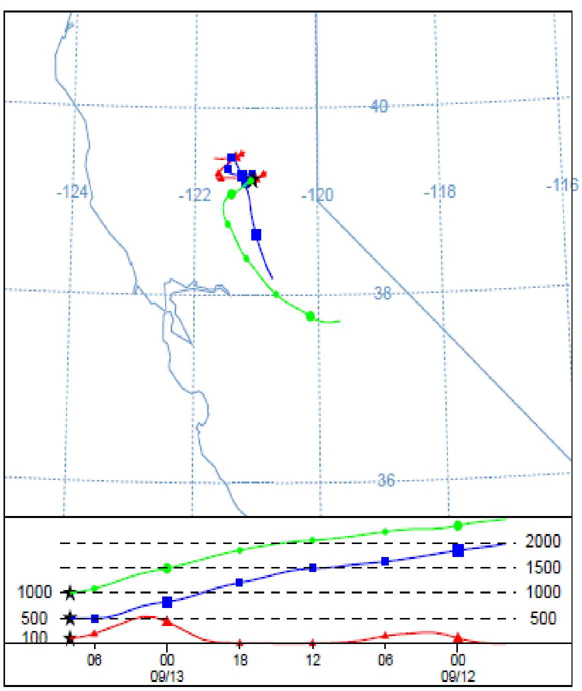

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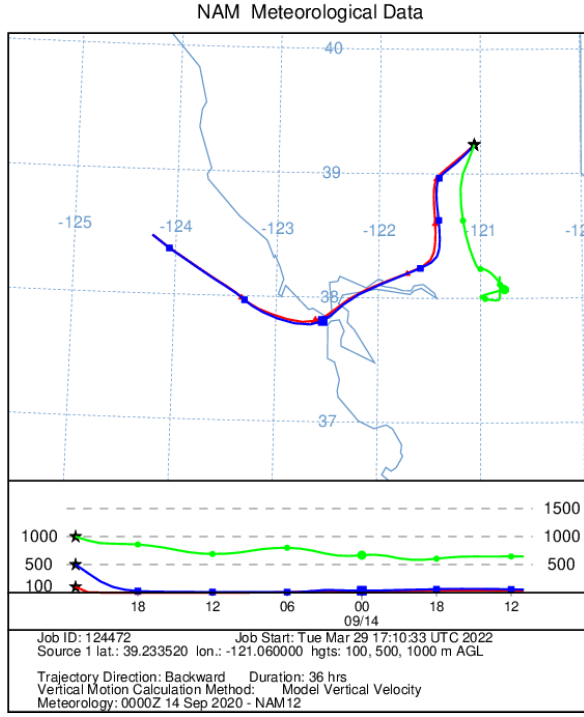

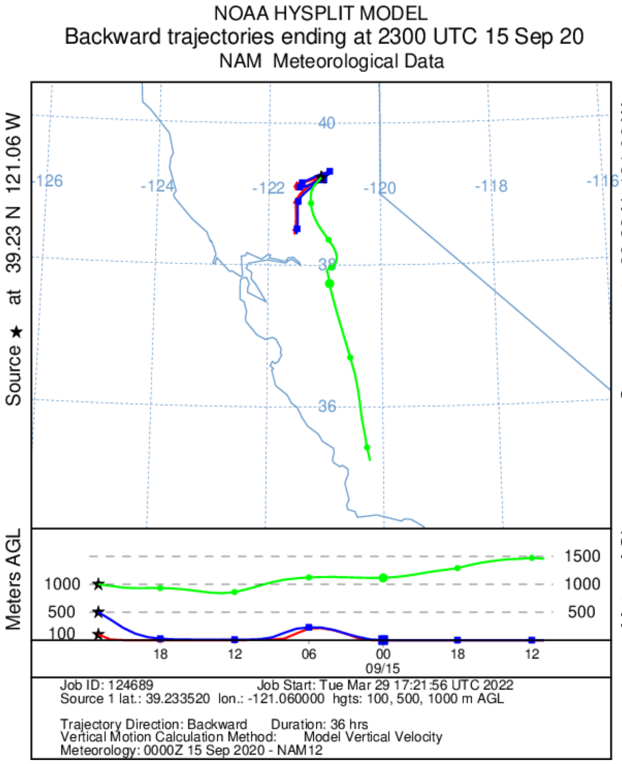
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Meters AGL
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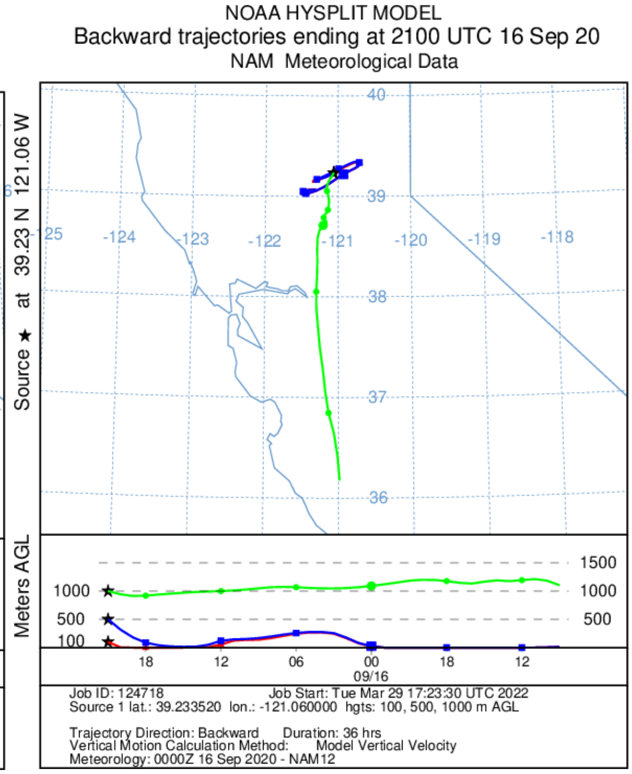
Trajectory Direction: Backward Duration: 36 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 15 Sep 2020 - NAM12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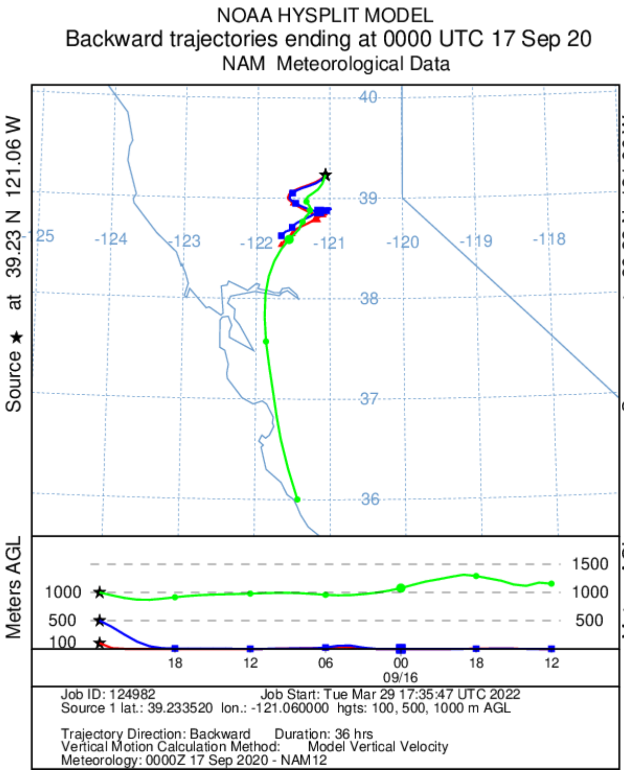
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 16 Sep 2020 - NAM12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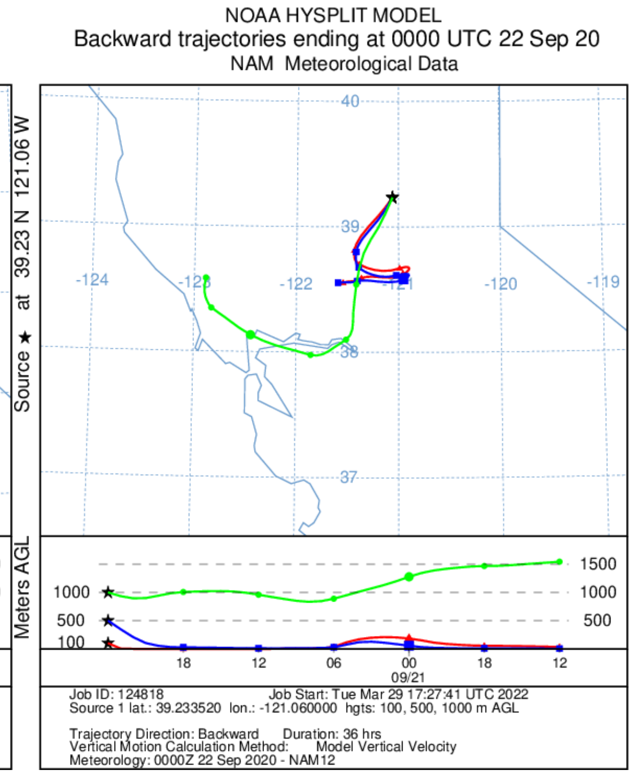
Meteorology: 0000Z 17 Sep 2020 - NAM12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Trajectory Direction: Backward Duration: 36 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 22 Sep 2020 - NAM12

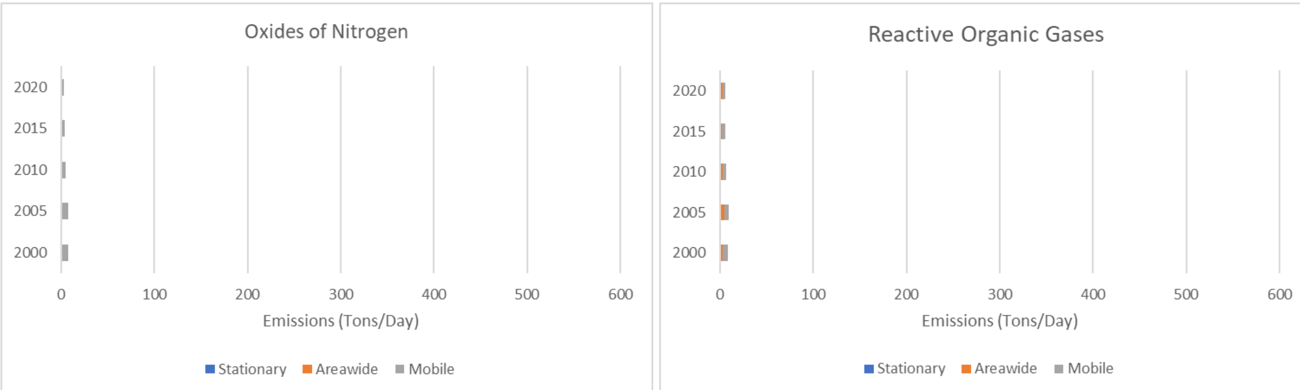
Regional Distribution of Precursor Emissions

Precursor emissions generated in the upwind Sacramento and Bay Area nonattainment areas overshadow those from Western Nevada County. The emissions inventory, summarized in Figure 4, indicates that the emissions of oxides of nitrogen (NOx) and reactive organic gases (ROG) in Western Nevada County are a fraction of emissions generated in the two large upwind metropolitan nonattainment areas. Western Nevada's NOx and ROG emissions amounted to about 5 percent of Sacramento nonattainment area emissions in 2020. Similarly, Western Nevada's 2020 NOx and ROG emissions are only 2 percent of those from the Bay Area. The difference in emissions between these upwind, contributing areas and Western Nevada County helps explain the important role of transport in Western Nevada County's ozone air quality.

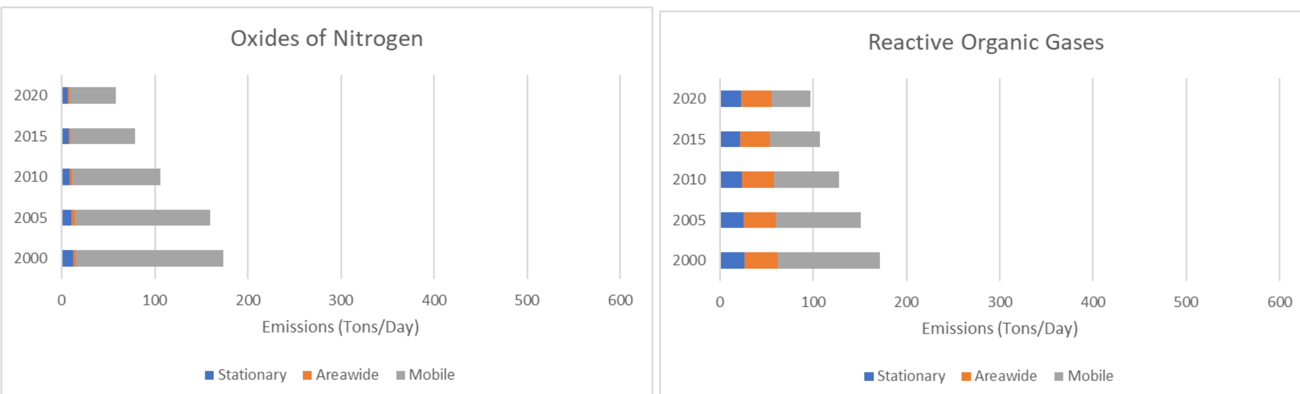
The connection between ozone, a secondary pollutant, and emissions of ozone precursor compounds is characterized by considerable temporal and spatial variability. In general, as air masses travel downwind, entrainment of fresh emissions, atmospheric reactions, depositional processes, and dilution increase the ROG/NOx ratio. As a result, ozone formation in suburban and rural areas downwind of major urban areas is generally regarded as NOx limited (cf. Finlayson-Pitts and Pitts, 1993; Finlayson-Pitts and Pitts, 2000). Given Western Nevada County's location, downwind of two large metropolitan nonattainment areas, ozone formation would be expected to be limited by available NOx. The demonstrated role of transport indicates that a substantial portion of ozone measured in Western Nevada County is derived from precursor emissions in upwind areas. Thus, attainment in Western Nevada County is directly linked to emission reduction strategies upwind in the Sacramento and San Francisco Bay Area nonattainment areas.

Figure 4. Emission Inventories for Western Nevada, Sacramento, and San Francisco Bay Area by Source Category

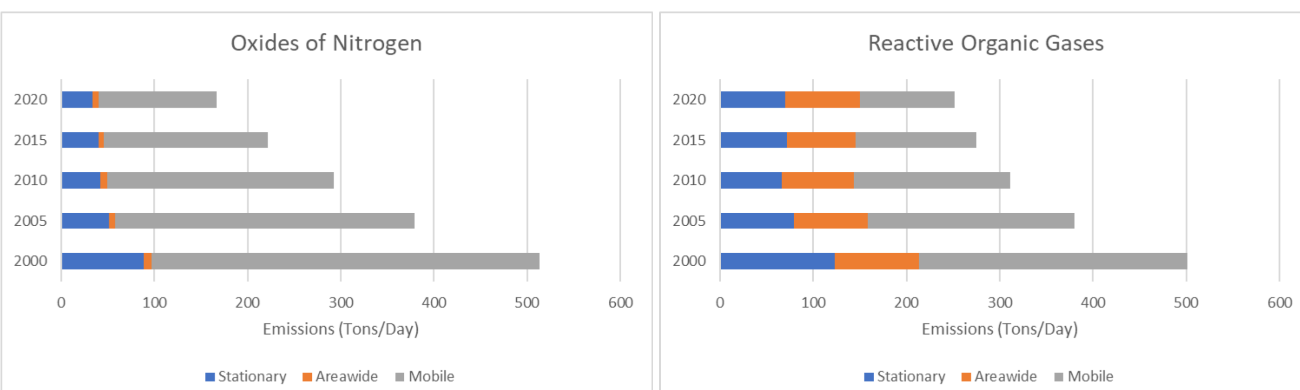
Western Nevada



Sacramento



San Francisco Bay Area



Conceptual Model Summary

Meeting the 0.070 ppm 8-hour ozone standard is a complex challenge in the Western Nevada nonattainment area. A diverse suite of precursor emissions, largely from upwind nonattainment areas, results from upwind urban areas 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. A thermally driven afternoon Delta breeze wind and a nighttime, downslope drainage flow recirculation pattern complete the picture. Together, they serve to routinely transport emissions from upwind areas into the foothills of Western Nevada 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 NOx-focused control strategy. This strategy is already in place in the upwind contributing areas.

Anthropogenic Emission Trends

Tropospheric ozone is a secondary pollutant that is formed by NOx and VOCs (also referred to as reactive organic gases, or ROG) through complex non-linear photochemical reactions. Anthropogenic emissions from mobile sources, industrial facilities and electric utilities, gasoline vapors, and chemical solvents are some of the major sources of NOx and ROG. Vegetation is also a major source of ROG emissions.

Emissions control programs have substantially reduced the amounts of both NOx and ROG emitted by various sources throughout the Western Nevada nonattainment area. Emissions trends, excluding emissions from natural sources, for NOx and ROG in the Western Nevada, Sacramento, and San Francisco Bay Area nonattainment areas are shown in Figure 5. All emission inventory values are based on CARB's California Emission Projection Analysis Model (CEPAM) for the 2019 Ozone SIP, version 1.03 with external emission adjustments, which uses 2017 as the inventory base year. The figure shows that from 2001 to 2020, anthropogenic NOx emissions decreased by 65 percent and ROG emissions decreased by 37 percent in Western Nevada.

As Western Nevada is progressing towards attainment, the quantity and composition of precursors have changed. In recent years, NOx has been the primary focus of control efforts. State of the art photochemical modeling assessments are necessary to understand the current and future mechanisms that will control ozone concentrations in the Western Nevada nonattainment area. The most recent modeling indicates that the dominant precursor controlling ozone production is NOx, and that by means of a NOx focused control strategy, the Western Nevada nonattainment area will be able to achieve the 0.070 ppm standard by 2026. This is also supported by the air quality trend analysis presented in this document when wildfire impacted days in 2018 and 2020 were excluded from the ozone design value calculations. Wildfire effects on ozone concentration in the Western Nevada nonattainment area is discussed later in this document, and more detailed analysis also can be found in the CARB Exceptional Events Demonstration for Ozone Exceedances report.

Aggregated source category trends for anthropogenic emissions are shown in Figures 6 and 7 for NOx and ROG, respectively. Mobile source emissions are the largest category of NOx in Western Nevada County. NOx emissions due to CARB's emissions reduction strategies is decreased by 67 percent. A similar trend for ROG emissions is shown in Figure 7, with a significant decrease in mobile ROG of 55 percent. However, the areawide and stationary NOx and ROG emissions has shown less pronounced trend. There were some increases in areawide ROG emissions due to the increase of managed burning (and disposal) activity in 2005 and 2009. Biogenic ROG emissions have been a dominant source in the Western Nevada County. For instance, biogenic ROG emissions in summer 2018 was 32 tons/day, which is 6 times larger than anthropogenic ROG emissions in the same period.

Figure 5. Trends of ozone precursor emissions in Western Nevada, Sacramento, and San Francisco Bay Area Areas

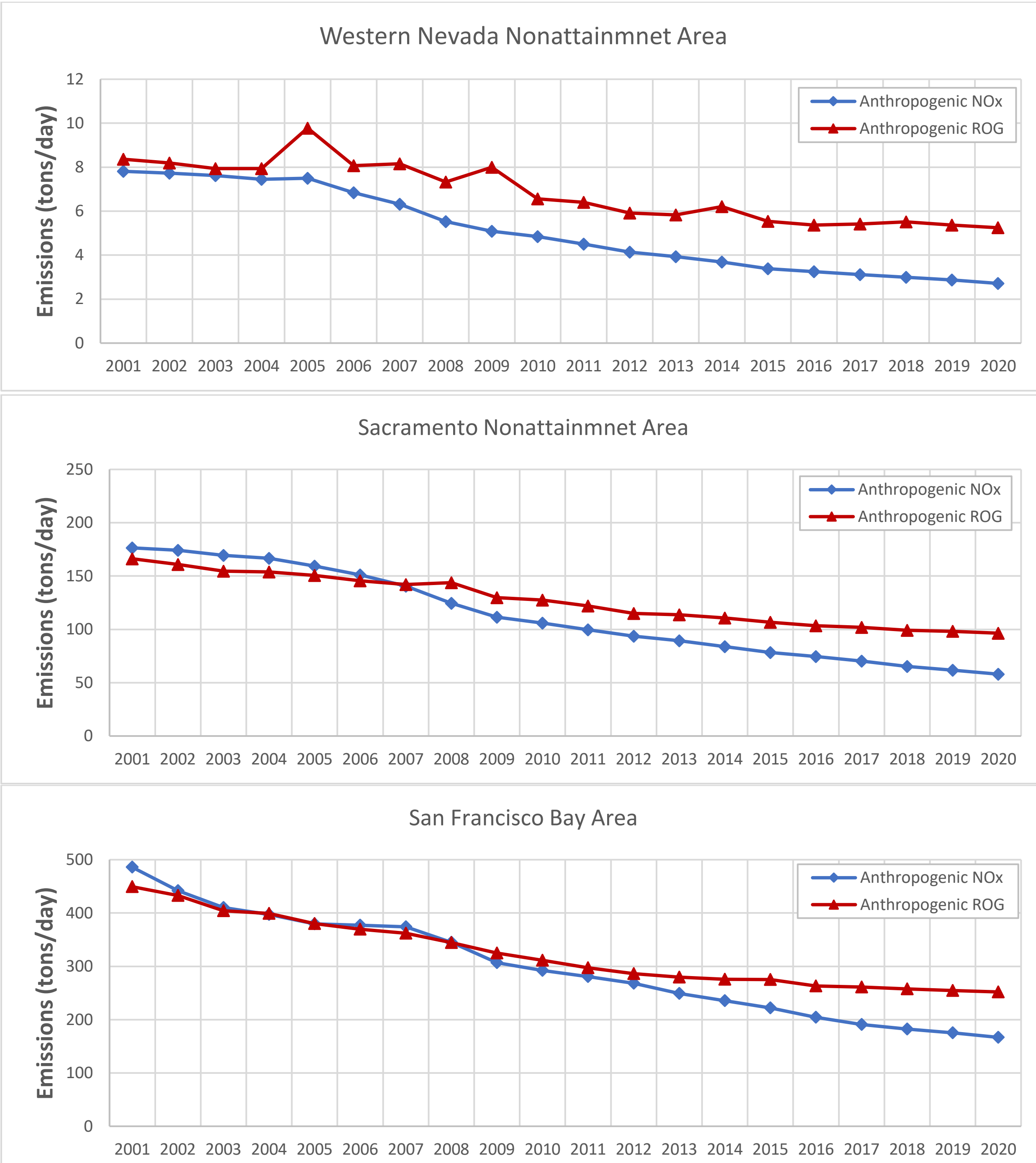


Figure 6. NOx emissions inventory categories for Western Nevada

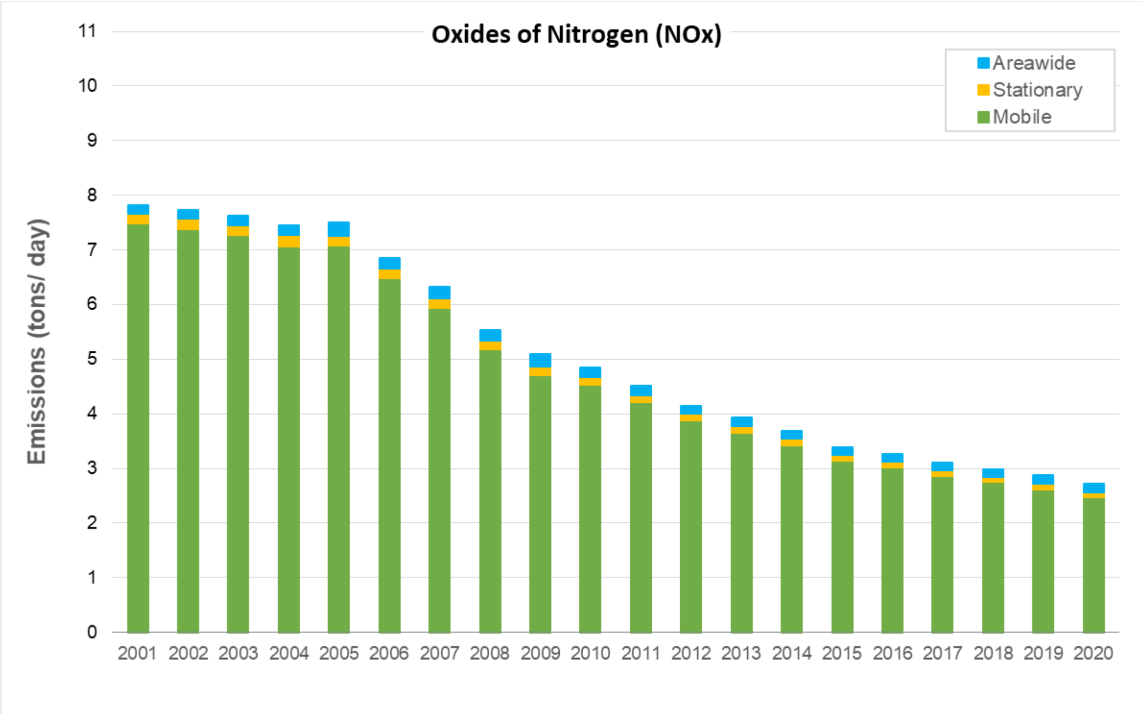
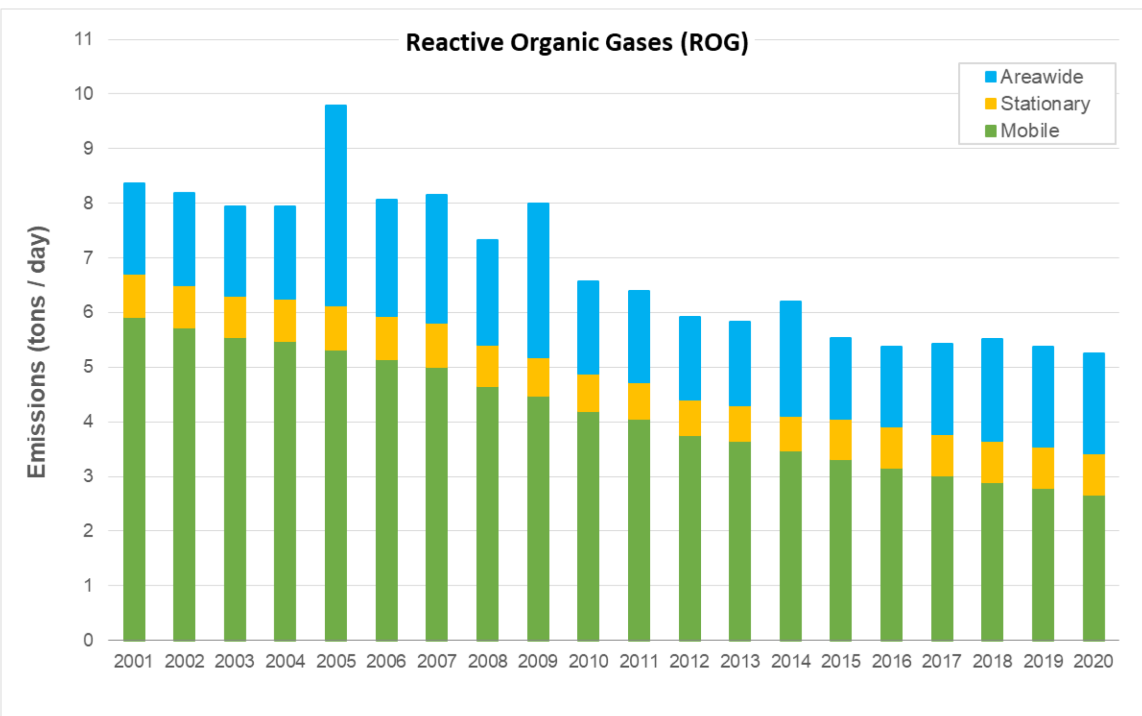


Figure 7. ROG emissions inventory categories for Western Nevada



Ozone Air Quality

As a consequence of implementing an emission control program for decades, ozone monitors throughout Northern California have recorded long-term improvement in ozone air quality. These improvements can be tracked using a variety of metrics, including design value trends, number and timing of exceedance days, magnitude of concentrations on weekday and weekend exceedance days, and ozone trends in neighboring nonattainment areas. As with all areas, inter-annual variability of ozone levels due to meteorology and wildfires must be recognized in such analyses.

Ozone Design Value Trends

The design value is the key metric for assessing the state of ozone air quality in a region and is compared to the federal 8-hour ozone standard for the purpose of determining federal attainment status. The design value is computed as the three-year average of the fourth highest 8-hour ozone concentrations from each year and is determined for each monitoring site in the region. For any area, the design value is calculated across all sites within the area, and then, the maximum of the design values across all sites is the area's design value. The 8-hour ozone design value trends from 2001 to 2020 are shown in Figure 8.

The White Cloud Mountain site has shown declining trends in design values and exceedances since 2003. The site has not operated since the end of 2015, when it was close to meeting the 0.070 ppm 8-hour ozone standard.

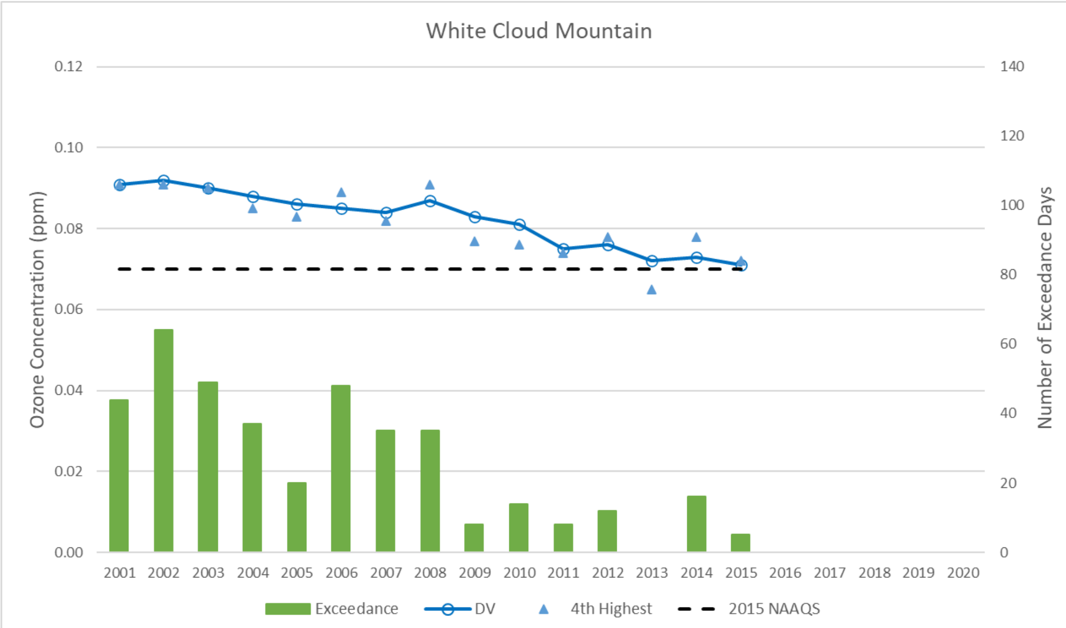
The Grass Valley site has also shown a declining trend from 2003 to 2013, an upward trend after 2013 and through 2018, and then, a downward trend again. Two sets of design values are calculated for 2018, 2019 and 2020, including or excluding wildfire impacted days. The site has shown a significant decline in the design value from 2018 to 2020 when excluding the high ozone days impacted by wildfires.

The number of days exceeding the 2015 8-hour ozone standard of 0.070 ppm for the two Nevada County sites are also shown in Figure 8. After a significant decrease in the number of exceedance days from 2002, the number of exceedances has shown an increasing trend between 2011 and 2017, and then a downward trend again from 2018 at the site. The 78 exceedances in 2017 were the highest number of exceedance days in the region since 2001, which is very unusual for the recent 10 years for this site. The number of exceedance days in 2018 and 2020, 22 and 16, respectively, has dropped down to 7 and 3 when excluding wildfire impacted days, respectively.

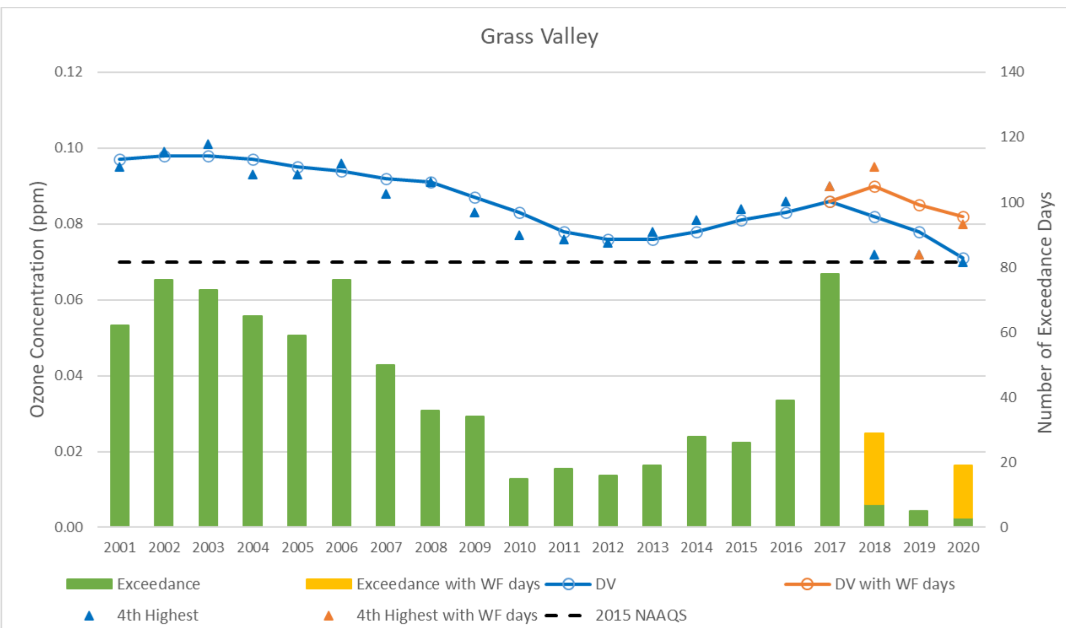
Figure 9 shows the 8-hour ozone design value trends, with and without wildfire impacted days, extended to the 2026 attainment deadline for the Grass Valley site. The trends indicate that, after excluding the wildfire impacts, the area is anticipated to meet the 2015 8-hour ozone standard of 0.070 ppm in 2026.

Figure 10 shows the 8-hour ozone design values of sites close to Grass Valley. The design values of nearby sites are very close to each other and follows a trend. In general, ozone concentrations have decreased significantly in this region until recent years when ozone trends were mostly flat or slightly increased. This increase is likely due to variations in large-scale meteorological patterns during the summer months and the increased number of wildfires throughout the northern California in recent years. In other words, some of the variability in the design values during the past ten years can be attributed to three of the cleanest years ever for ozone in the Sacramento Region in 2013, 2015 and 2019, when large-scale weather patterns for those years favored moderate to strong Delta breezes, cooler temperatures, and increased dispersion of emissions; and two of the high ozone concentration years due to extreme wildfire season in 2018 and 2020.

Figure 8. 8-hour ozone design values at Western Nevada sites



White Cloud Mountain
Ozone Concentration (ppm)
Number of Exceedance Days
0.12
0.10
0.08
0.06
0.04
0.02
0.00
140
120
100
80
60
40
20
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Exceedance
DV
4th Highest
2015 NAAQS



Grass Valley
Ozone Concentration (ppm)
Number of Exceedance Days
0.12
0.10
0.08
0.06
0.04
0.02
0.00
140
120
100
80
60
40
20
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Exceedance
Exceedance with WF days
DV
DV with WF days
4th Highest
4th Highest with WF days
2015 NAAQS

Figure 9. 8-hour ozone design values projection for 2026 at Grass Valley

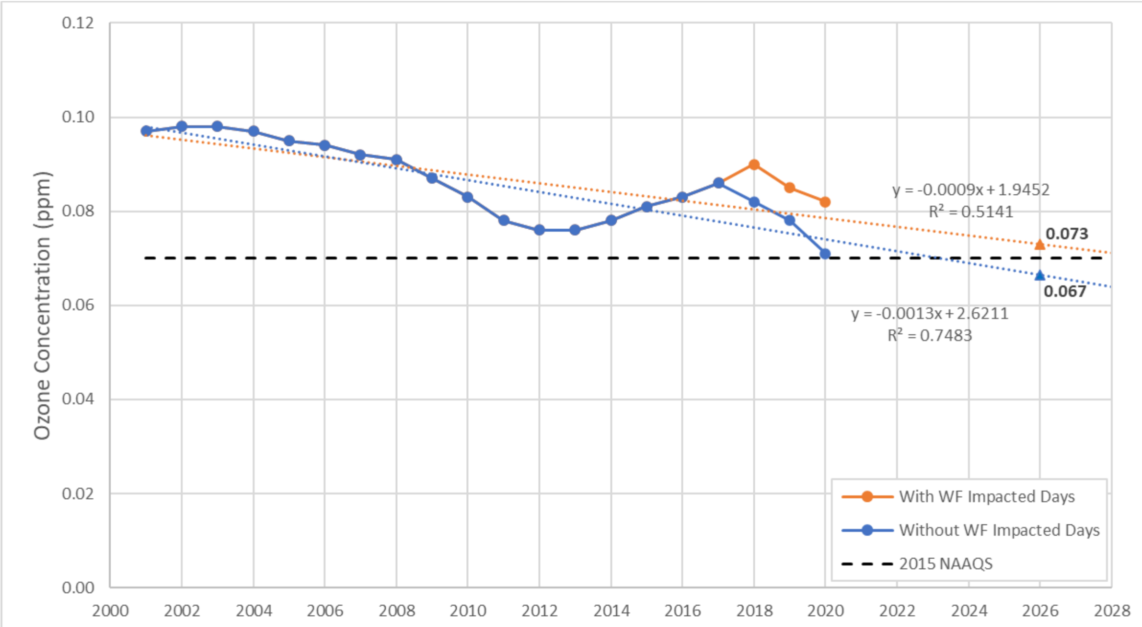
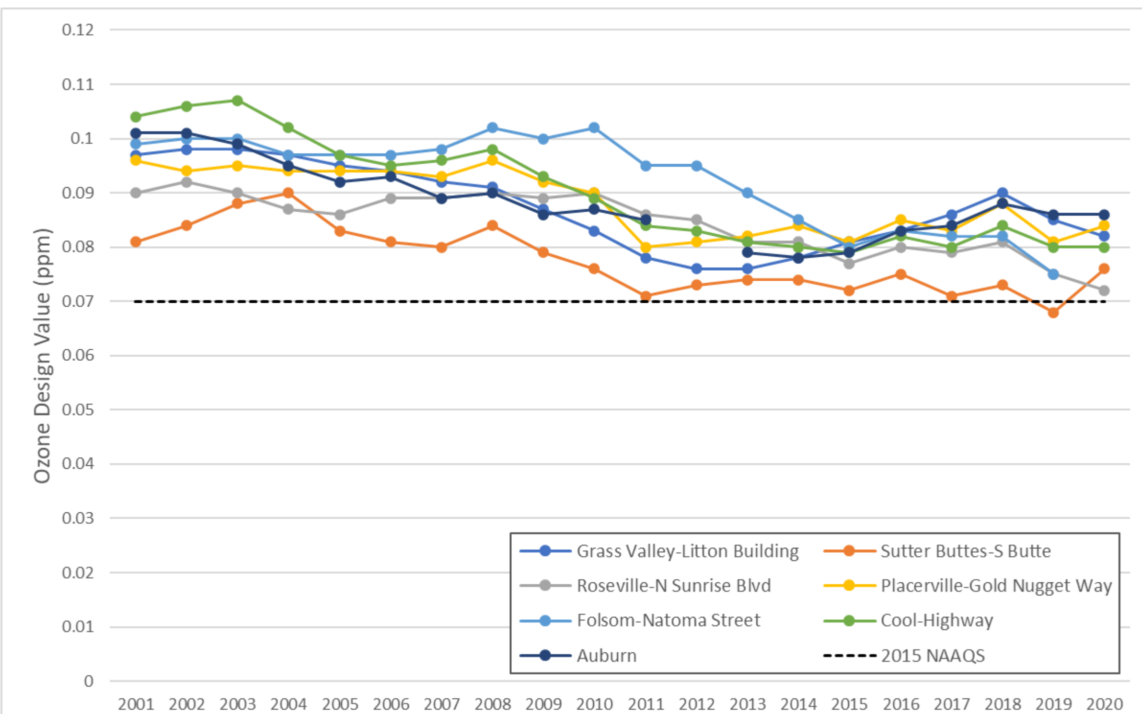


Figure 10. 8-hour ozone design values of select regional sites (including preliminary 2018 design values with and without fire days)

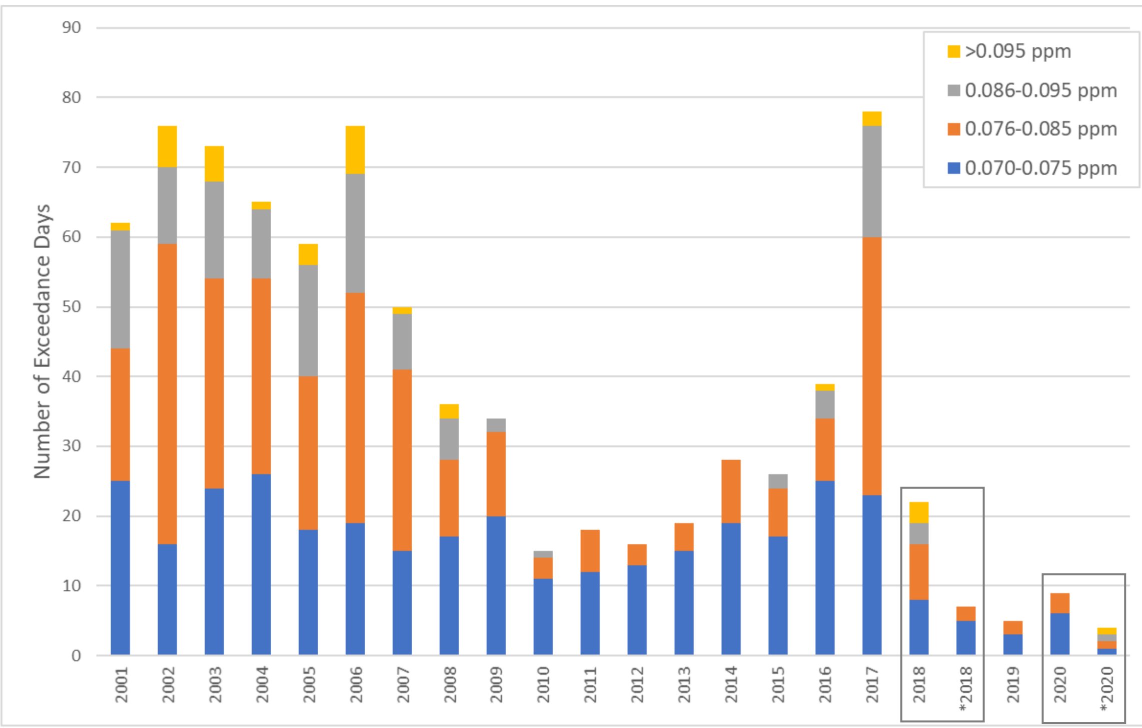


Exceedance Day Trends

Significant progress has occurred in reducing the magnitude as well as frequency of 8-hour average ozone exceedance days in the Grass Valley site over the past 20 years. In terms of frequency, the average annual number of exceedance days for the site decreased by 80 percent from 70 in the period of 2001-2003 to 14 in the more recent period of 2018-2020.

Figure 11 illustrates the dramatic progress made in reducing the number of exceedance days and the magnitude of ozone concentrations on those days. During the recent 3 years, there were a maximum of 22 exceedances with wildfire impacted days included and only 7 exceedances when excluding wildfire impacted days in 2018. The magnitude of exceedance days also has declined significantly with the majority of exceedances falling below 0.085 ppm since 2009 except 2017.

Figure 11. Number of 8-hour exceedance days (2015 Standard)

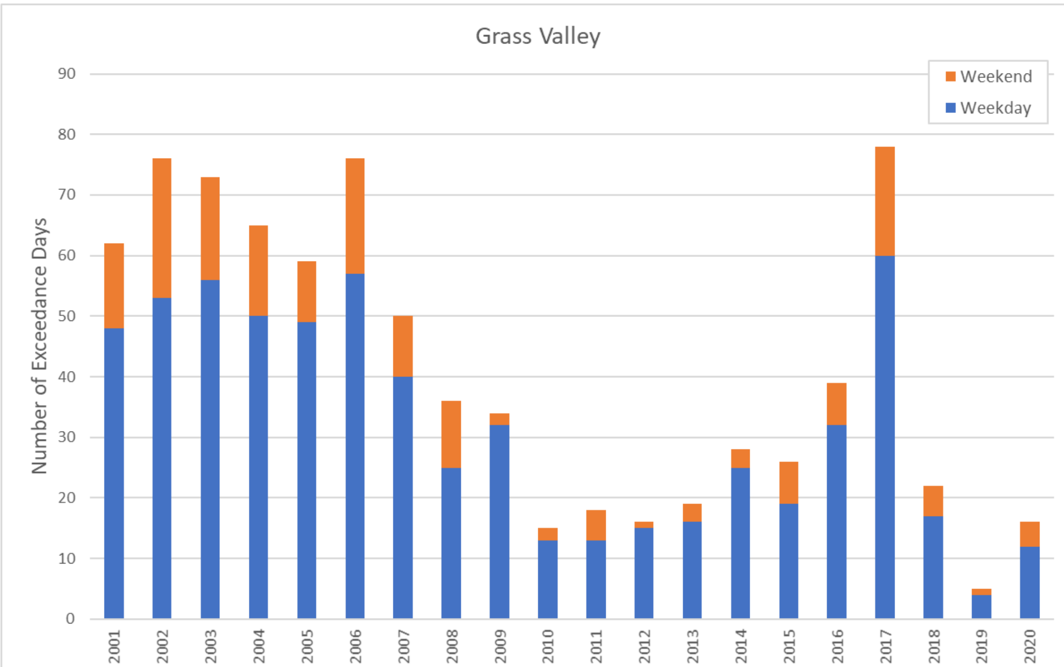


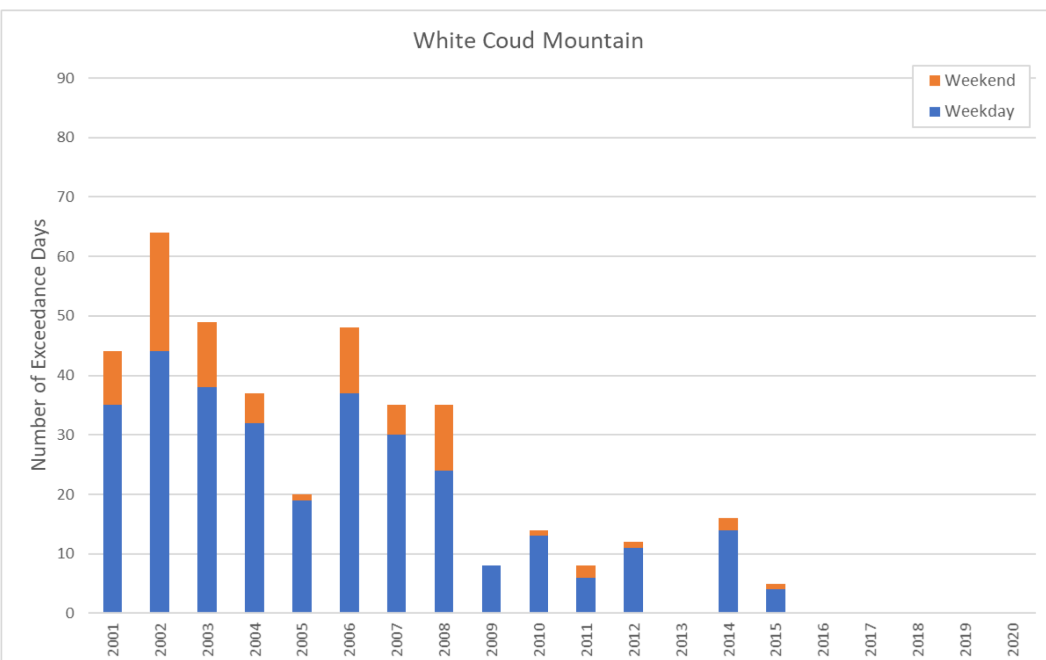
Note: * indicates wildfire impacted days excluded

Weekday/Weekend Trends

Exceedance days during weekends and weekdays were also analyzed at the two Western Nevada County monitoring sites. As shown in Figure 12, exceedance days were occurring more often on weekdays than on weekends. Number of exceedance days on weekdays were 2 to 19 times larger than those on weekends for both sites.

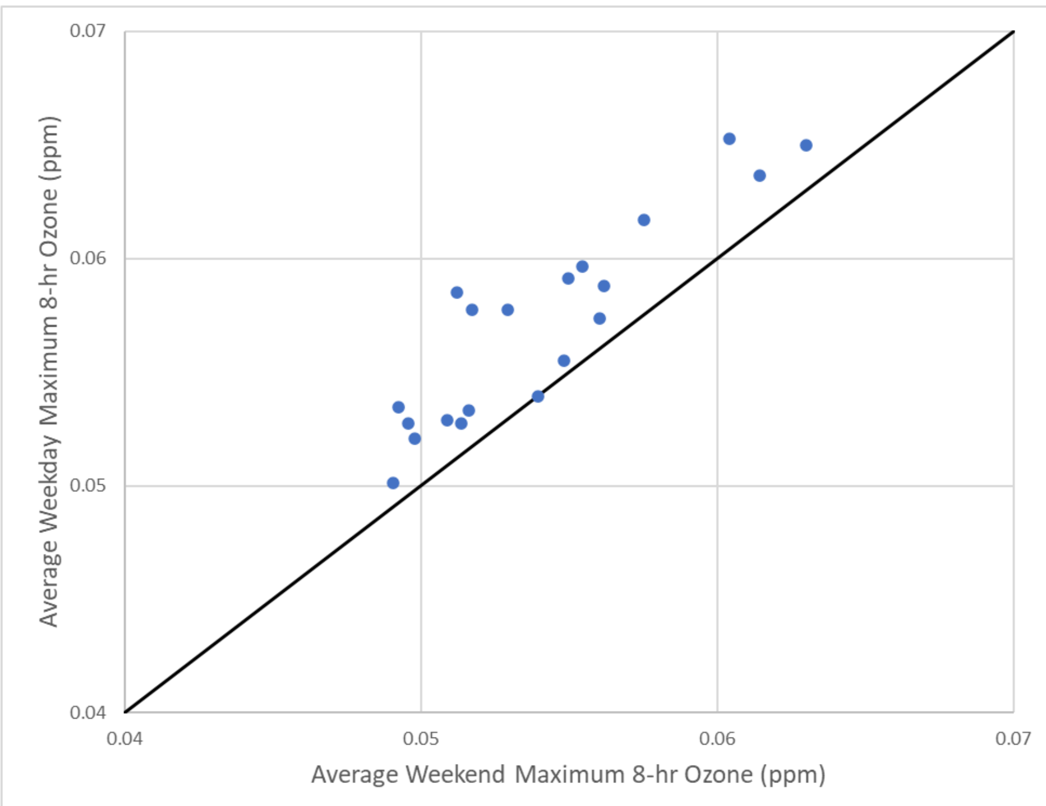
Figure 12. Number of 8-hour exceedance days during weekdays and weekends





While it is challenging to determine if the number of exceedance days were correlated with weekdays and/or weekends, the day-of-week dependence of ozone in the Western Nevada County was also investigated using the average weekday (Wednesday and Thursday) and weekend (Sunday) maximum daily average (MDA) 8-hr ozone values observed in the ozone season (May through October) from 2001-2020. Results of this analysis are shown in Figure 13, which indicates that the Western Nevada County has generally been in a NOx-limited regime, with higher ozone occurring on weekdays than on weekends when NOx emissions are lower. As discussed above, this region is in close proximity to biogenic ROG emission sources and further away from large anthropogenic NOx sources in the Sacramento and San Francisco Bay Area. The occasional shift in weekday/weekend ozone levels closer to the 1:1 line, is likely due to inter-annual variability in meteorological conditions and its impact on the regional transport patterns and local biogenic ROG emissions.

Figure 13. Average weekday (Wednesday and Thursday) and weekend (Sunday) maximum daily average (MDA) 8-hour ozone for each year from 2001 to 2020 for the Grass Valley Site. Points falling above the 1:1 dashed line represent a NOx-limited regime, those on the 1:1 line represent a transitional regime, and those below the 1:1 line represent a VOC-limited regime.



2017 Anomalous Ozone Data

As discussed above, unusually high ozone concentrations were recorded at the Grass Valley monitoring site in 2017. Monitored readings at Grass Valley in 2017 outpaced other sites in the region in terms of ozone concentrations and in particular, number of exceedance days for the 0.070 ppm 8-hour ozone standard. There were 78 exceedance days recorded at the Grass Valley site in 2017, which is the highest number of ozone exceedance days at any one site within both the Western Nevada and Sacramento nonattainment areas during the last 20 years except the 97 exceedance days observed at the Cool site in 2002. The Grass Valley site has been averaging between 3-39 exceedances annually in the recent 10 years.

CARB staff evaluated the recent high ozone concentrations recorded by the Grass Valley monitor. Staff found that multiple factors likely played a role:

- Ozone levels at air quality monitors across the Sierra Nevada foothills increased slightly from 2015 to 2016 and 2017. Staff found this to be a function of synoptic meteorological patterns that were conducive to ozone formation and buildup. While the meteorology-related elevated ozone levels throughout northern California contributed to some of the exceedance days at Grass Valley in 2017, large increases in exceedance days occurring at Grass Valley were not shared by other regional monitors that experienced the same synoptic meteorological patterns. Therefore, the meteorological conditions could not have caused the sundden increase in exceedance days at Grass Valley.

- The summer of 2017 was not marked with much wildfire activity that affected ozone levels in the region.

- The upwind Sacramento metropolitan area, including the I-80 corridor through Roseville, has seen population growth in recent years. However, other downwind air quality monitors track each other but not the Grass Valley monitor; and did not show the same uptick in ozone design values or exceedances as the Grass Valley monitor.

- There is no evidence of significant increase in locally formed ozone at Grass Valley due to changes in anthropogenic emissions. There were no new large industrial sources of pollution. Traffic counts were not appreciably different than in past years.

- It is possible that the changes in biogenic ROG emissions, including increased ROG emissions as a result of bark beetle infestations, could have played a role. However, Grass Valley is a NOx-limited area with an abundance of ROG emissions, and ozone formation in this area would be limited by the amount of NOx emissions available. Additional biogenic ROG emissions would not be expected to increase ozone at Grass Valley to the extent recorded in 2017. Also, other regional sites have not seen a sharp increase in ozone levels, and they too would be NOx-limited and would be subject to bark beetle infestations.

- Ozone concentrations at Grass Valley during the late 2016 and 2017 time frame, when compared against ozone levels at other nearby monitoring sites, departed sharply from historical patterns that have since resumed in 2018. As shown in Figures in Appendix A4, daily maximum 8-hour ozone levels in 2017 at Grass Valley continued to follow the same peaks and dips as at other neighboring sites; but the concentrations at Grass Valley were much higher than all the neighboring sites, and were also higher than they were in recent years. This suggests a potential positive bias in the ozone monitoring at Grass Valley.

Ozone Air Quality Summary

As a downwind, transport-impacted area, Western Nevada County's future progress towards the federal 8-hour ozone standard is linked to the upwind metropolitan nonattainment areas and their progress in making significant reductions.

Due to effectively designed and implemented emission reduction control programs, both ozone precursor trends and ozone trends in the upwind areas have progressed steadily toward levels supporting attainment. The ozone precursor control strategy focuses on NOx emission reductions. Since Western Nevada County is a NOx-limited area, this strategy is effective in reducing ozone levels in Western Nevada County as well as upwind areas.

Consistent with ozone trends for these upwind areas, the Western Nevada nonattainment area's ozone air quality trends show, despite inter-annual variability, ongoing and measurable progress towards meeting the federal 8-hour ozone standard.

Attainment Projections

The Western Nevada nonattainment area is classified as serious with an attainment year of 2026. Photochemical modeling performed by CARB staff projects a 2026 design value at Grass Valley (the area's design site) at 0.070 ppm, a level in attainment of the standard.

Summary

Western Nevada is currently classified as a serious ozone nonattainment area for the 2015 8-hour ozone standard of 0.070 ppm. This WOE evaluated ambient air quality and emission trends to complement the regional photochemical modeling analyses conducted to assess the Western Nevada's progress toward meeting the 2026 attainment deadline as a serious nonattainment area.

Photochemical modeling analyses indicate that the Western Nevada will be able to meet the 2026 attainment deadline with the currently adopted control measures, which will continue to yield additional emission reductions in future years. No new emission control measures are required for attainment. This WOE supports attainment of the federal 8-hour ozone standard of 0.070 ppm by the 2026 deadline. Below is the summary of WOE findings:

- Western Nevada County comprises the portion of Nevada County from the western boundary with Yuba and Placer counties up to the crest of the Sierra Nevada Mountains. Thermally driven afternoon Delta breeze wind and a nighttime, downslope drainage flow recirculation pattern serves to routinely transport ozone and ozone precursors from southwestern part of the region and keep the ozone trapped in the area.

- Long term trends show that ozone levels have declined in the past 20 years with the exception of few recent years. Linear regression analyses show Western Nevada County will meet the 0.070 ppm federal 8-hour ozone standard by the deadline of 2026 once wildfire impacted days are excluded from calculation.

- Levels of locally generated emissions of ozone precursor emissions are much lower than those released in upwind nonattainment areas. Mobile source emissions make up the largest source of locally generated NOx emissions, with significant contributions from Interstate and State highway traffic.

- Carryover of ozone is of prime concern. Ozone concentrations remain elevated during the night hours, resulting in higher levels at the start of the following day. Due to lack of local NOx emissions, scavenging of ozone is minimal. Back-trajectory analysis, replicating the

Delta breeze, shows the transit of air parcels from the San Francisco Bay Area via Sacramento and nearby areas on the majority of exceedance days.

- Western Nevada County is a NOx-limited area with an abundance of ROG emissions; ozone formation in this area would be limited by reducing the availability of NOx emissions. The NOx emission reduction-focused control strategy deployed in the upwind areas are effective in reducing ozone levels in Western Nevada County.

- Consistent with ozone trends for these upwind areas, the Western Nevada nonattainment area's ozone air quality trends show, despite inter-annual variability, ongoing and measurable progress towards meeting the ozone standard.

- Atypical high ozone concentrations were observed at the Grass Valley site in 2017. CARB staff analysis does not point to specific anthropogenic or biogenic emission increases or meteorology as likely causes for the unusual number of exceedances.

- During 2018-2020, ozone levels were much lower again, with the exception of days likely influenced by wildfire emissions. The projected design value of 2020 at Grass Valley, when excluding wildfire impacted days, drops to 0.071 ppm from 0.082 ppm.

- Photochemical modeling and linear regression analyses performed by CARB staffs project a 2026 design value of the Grass Valley site at 0.070 ppm and 0.067 ppm, respectively, a level in attainment of the 0.070 ppm 8-hour ozone standard. CARB staff's analyses of ozone air quality data concurs that attainment by 2020 is feasible.

Collectively, the air quality analyses included in this WOE indicate that substantial progress has been accomplished in the Western Nevada County; and that the current control measures implemented in the Western Nevada County and in the upwind urban areas should lead the region to attain the 8-hour ozone standard of 0.070 ppm by the serious attainment deadline of 2026.

Appendix A1. Ozone Execeedance Days

Table A1. Days exceeding the 8-hour ozone standard (in ppm) for the Grass Valley site; 2018 and 2020 wildfire impacted days are shaded in yellow.

In addition to the days that were requested as official exceptional events in CARB Exceptional Event Demonstrations[3], four additional wildfire impacted days in 2018 are identified as supported by evidence presented in Appendix A2. Those are 7/30, 8/4, 8/24 and 8/25 as highlighted in orange in Table A1.

These four days were not included in the CARB Exceptional Event Demonstrations due to the reason that excluding these days will not affect the attainment determination for the 2008 75 ppb 8-hour ozone standard for the site.

[3] https://ww2.arb.ca.gov/our-work/programs/state-and-federal-area-designations/exceptional-events

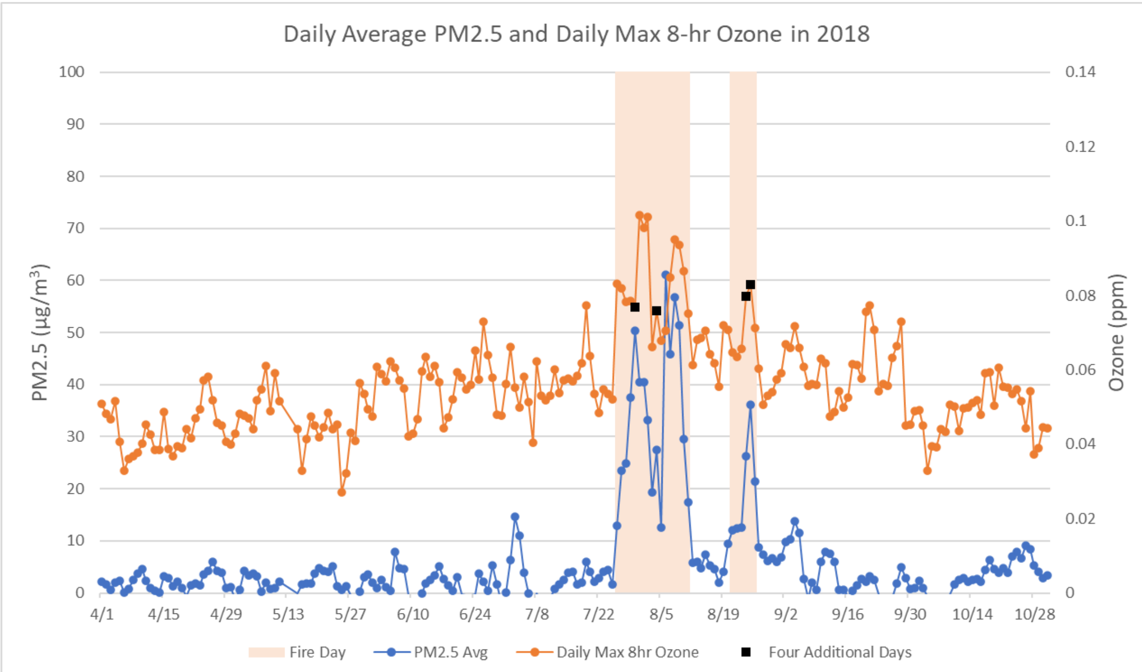
	2016		2017		2018		2019		2020	
Rank	Date	8hr O3	Date	8hr O3	Date	8hr O3	Date	8hr O3	Date	8hr O3
1	6/29/2016	0.097	7/14/2017	0.099	7/31/2018	0.101	9/14/2019	0.077	8/20/2020	0.122
2	7/1/2016	0.093	6/23/2017	0.098	8/2/2018	0.101	8/16/2019	0.076	9/12/2020	0.086
3	7/28/2016	0.093	8/29/2017	0.092	8/1/2018	0.098	6/19/2019	0.074	9/1/2020	0.085
4	8/16/2016	0.086	6/24/2017	0.09	8/8/2018	0.095	7/25/2019	0.072	8/29/2020	0.080
5	8/20/2016	0.086	10/18/2017	0.09	8/9/2018	0.091	7/26/2019	0.071	9/14/2020	0.079
6	8/18/2016	0.084	6/30/2017	0.089	8/10/2018	0.086			9/21/2020	0.079
7	7/15/2016	0.081	7/2/2017	0.088	8/7/2018	0.084			8/24/2020	0.078
8	8/19/2016	0.081	7/19/2017	0.088	7/26/2018	0.083			9/5/2020	0.078
9	7/27/2016	0.08	8/18/2017	0.088	8/25/2018	0.082			9/16/2020	0.078
10	7/29/2016	0.079	9/2/2017	0.088	8/24/2018	0.079			8/26/2020	0.076
11	8/12/2016	0.078	5/22/2017	0.087	7/27/2018	0.078			9/15/2020	0.075
12	8/2/2016	0.077	5/23/2017	0.087	7/28/2018	0.078			8/28/2020	0.074
13	6/30/2016	0.076	6/20/2017	0.087	7/19/2018	0.077			8/10/2020	0.073
14	8/28/2016	0.076	7/13/2017	0.087	9/21/2018	0.077			8/30/2020	0.073
15	6/22/2016	0.075	7/23/2017	0.087	7/29/2018	0.075			8/31/2020	0.071
16	7/2/2016	0.075	8/1/2017	0.087	8/4/2018	0.075			9/17/2020	0.071
17	7/3/2016	0.075	9/1/2017	0.087	9/20/2018	0.075				
18	8/13/2016	0.075	7/22/2017	0.086	7/30/2018	0.074				
19	9/19/2016	0.075	8/2/2017	0.085	6/26/2018	0.072				
20	7/25/2016	0.074	9/4/2017	0.085	9/28/2018	0.072				
21	8/14/2016	0.074	10/17/2017	0.084	8/19/2018	0.071				
22	8/17/2016	0.074	7/20/2017	0.083	9/4/2018	0.071				
23	8/24/2016	0.074	6/19/2017	0.082						
24	9/28/2016	0.074	7/1/2017	0.082						
25	10/9/2016	0.074	7/5/2017	0.082						
26	7/6/2016	0.073	6/6/2017	0.081						
27	9/27/2016	0.073	7/4/2017	0.081						
28	6/6/2016	0.072	7/9/2017	0.081						
29	7/7/2016	0.072	7/25/2017	0.081						
30	8/29/2016	0.072	8/9/2017	0.081						
31	9/9/2016	0.072	6/3/2017	0.08						
32	9/26/2016	0.072	7/24/2017	0.08						
33	4/18/2016	0.071	6/27/2017	0.079						
34	4/19/2016	0.071	7/12/2017	0.079						
35	7/14/2016	0.071	7/26/2017	0.079						
36	7/26/2016	0.071	8/19/2017	0.079						
37	8/11/2016	0.071	10/24/2017	0.079						
38	8/15/2016	0.071	5/24/2017	0.078						
39	8/26/2016	0.071	6/4/2017	0.078						
40			7/3/2017	0.078						
41			8/3/2017	0.078						
42			10/10/2017	0.078						
43			10/16/2017	0.078						
44			10/25/2017	0.078						
45			7/10/2017	0.077						
46			8/4/2017	0.077						
47			8/31/2017	0.077						

48			9/3/2017	0.077						
49			9/17/2017	0.077						
50			10/15/2017	0.077						
51			6/28/2017	0.076						
52			7/11/2017	0.076						
53			8/12/2017	0.076						
54			8/17/2017	0.076						
55			8/24/2017	0.076						
56			6/5/2017	0.075						
57			6/21/2017	0.075						
58			7/15/2017	0.075						
59			7/27/2017	0.075						
60			8/20/2017	0.075						
61			8/22/2017	0.075						
62			9/12/2017	0.075						
63			7/28/2017	0.074						
64			8/11/2017	0.074						
65			10/26/2017	0.074						
66			7/18/2017	0.073						
67			7/21/2017	0.073						
68			8/8/2017	0.073						
6			8/16/2017	0.073						
70			9/28/2017	0.073						
71			6/29/2017	0.072						
72			8/10/2017	0.072						
73			8/25/2017	0.072						
74			8/30/2017	0.072						
75			10/28/2017	0.072						
76			5/21/2017	0.071						
77			6/22/2017	0.071						
78			7/31/2017	0.071						

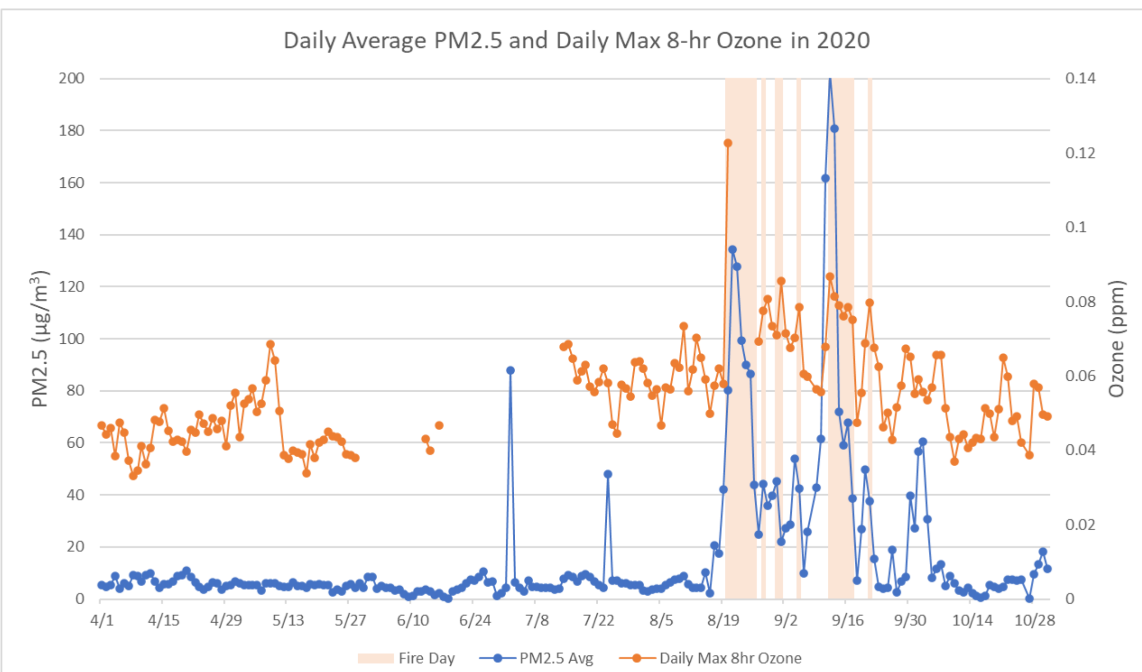
Appendix A2. Evidence of Wildfire Impacts Based on $PM_{2.5}$ Observations

Unusually high daily average $PM_{2.5}$ days at the Grass Valley site were used as a surrogate for days impacted by wildfires near and around Grass Valley in 2018 and 2020. Figure A1 shows daily average $PM_{2.5}$ and daily maximum 8--hour ozone concentrations from April to October, 2018 and 2020. Unusual high daily average $PM_{2.5}$ days are shaded to identify days on which wildfire emissions likely impacted the Grass Valley ozone monitor. From Figure A1 it is evident that many of the 8-hour ozone exceedace days in 2018 and 2020 were likely impacted by wildfire emissions.

Figure A1. Daily $PM_{2.5}$ and Maximum 8-hour Ozone concentrations in 2018 and 2020



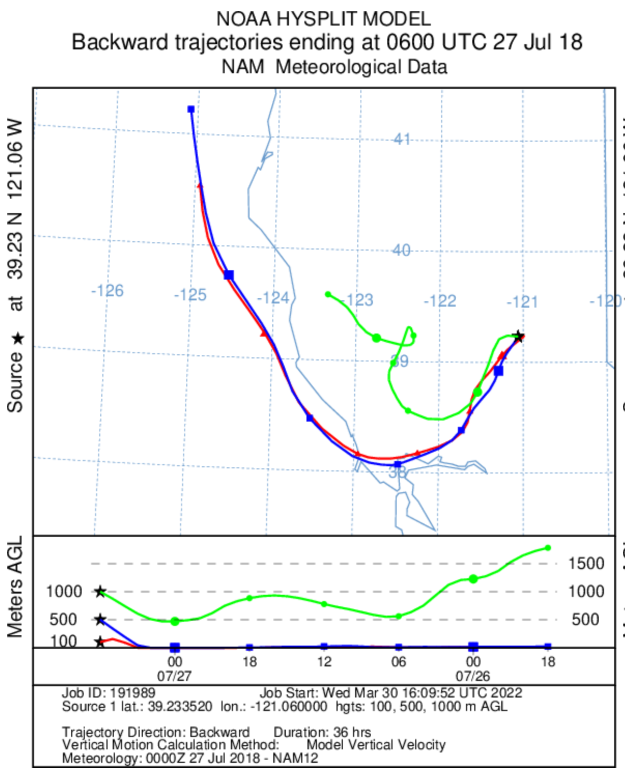
Note: Four additional wildfires impacted days not included in the official Exemptional Event Demonstrations are depicted as black squres.

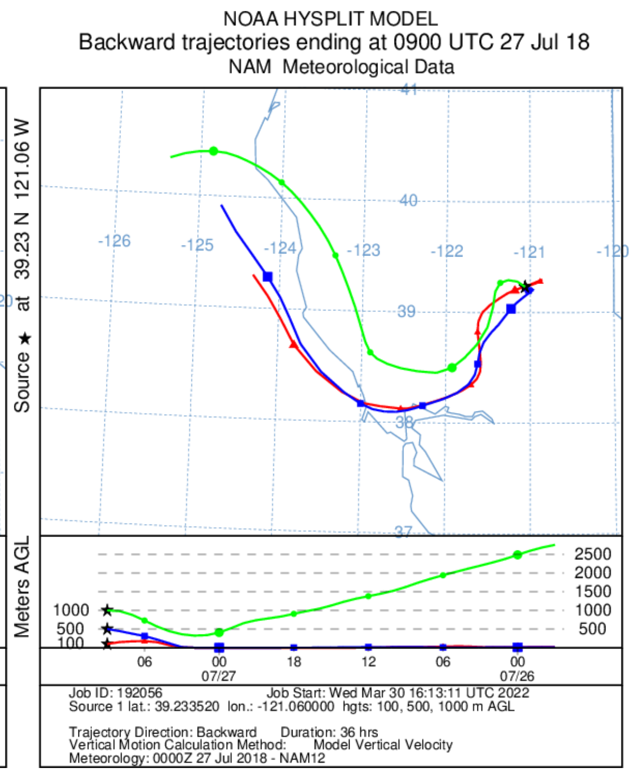


Appendix A3. Ozone Transport-HYSPLIT Backward Trajectory

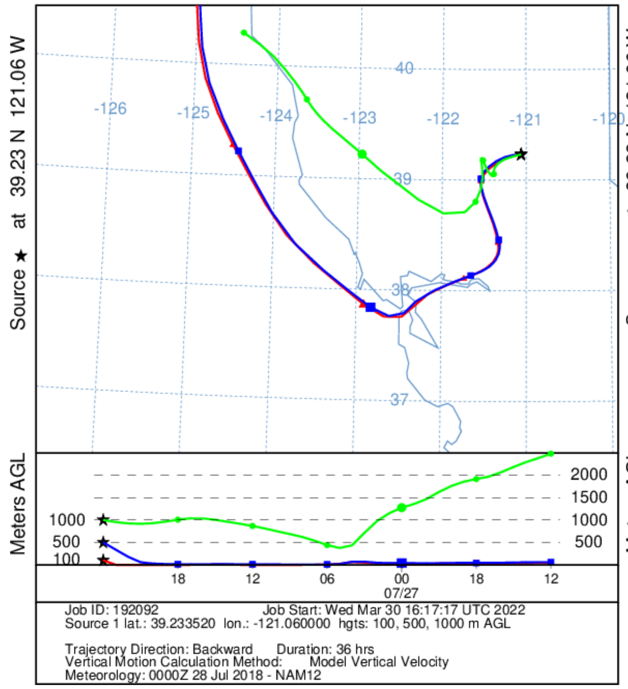
Figure A2. 36-hour back trajectories at100m (red), 500m (blue) and 1000m (green) height for high ozone days (>0.070 ppm) at the Grass Valley-Litton Building site for 2018-2019

2018

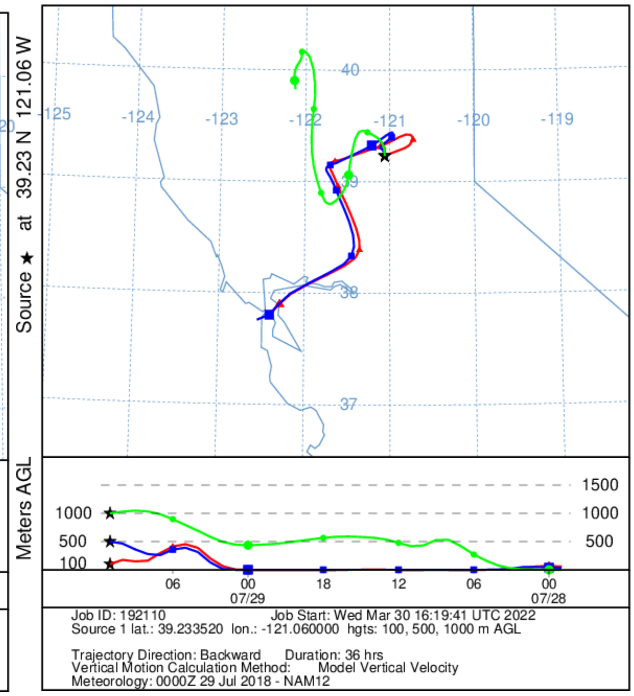




NOAA HYSPLIT MODEL
Backward trajectories ending at 0000 UTC 28 Jul 18
NAM Meteorological Data



NOAA HYSPLIT MODEL
Backward trajectories ending at 1100 UTC 29 Jul 18
NAM Meteorological Data



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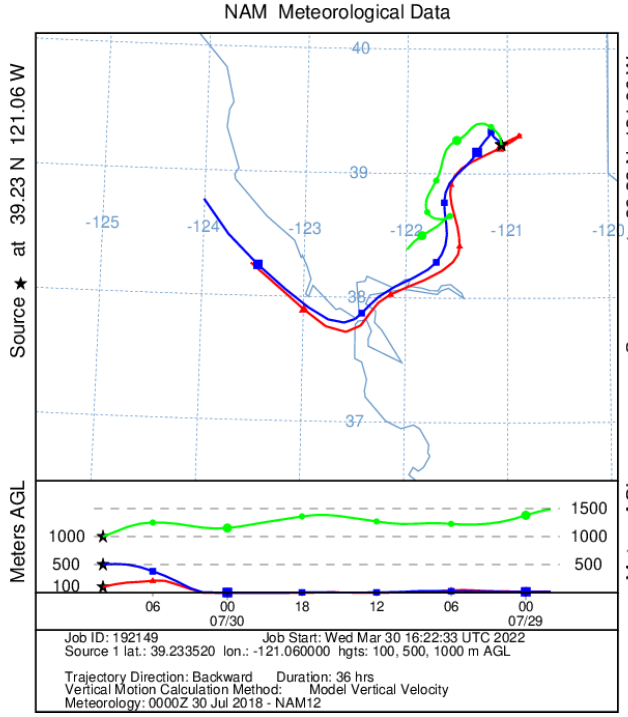
NAM Meteorological Data



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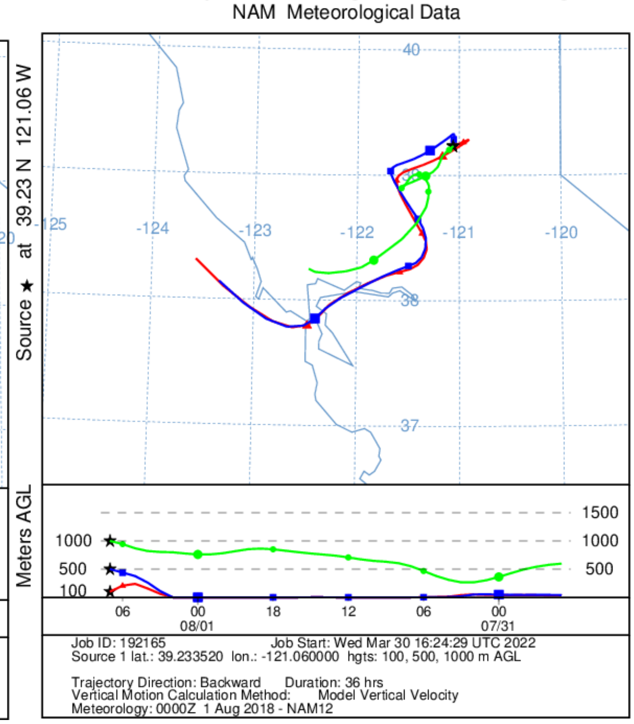
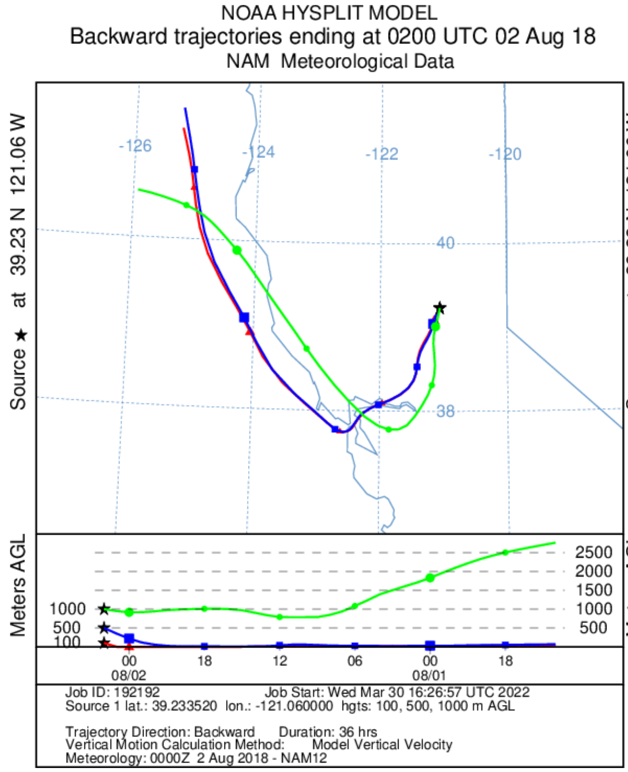
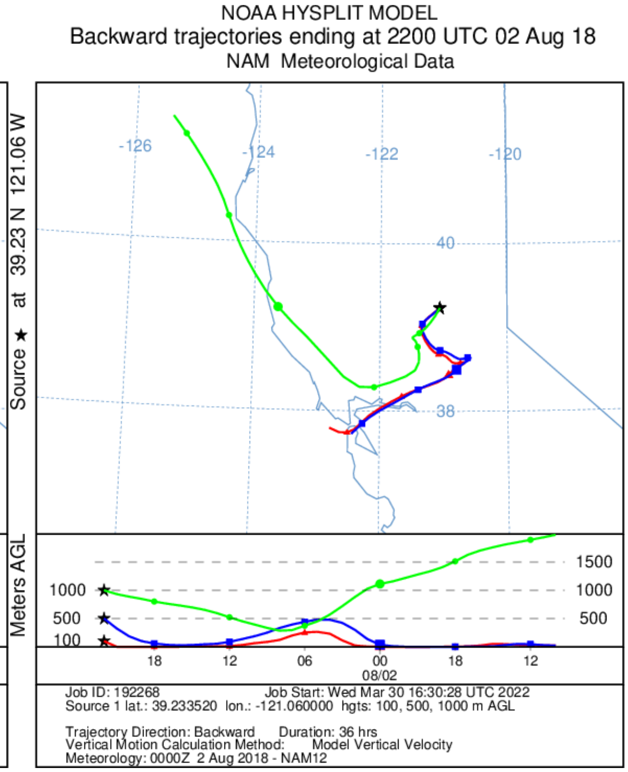
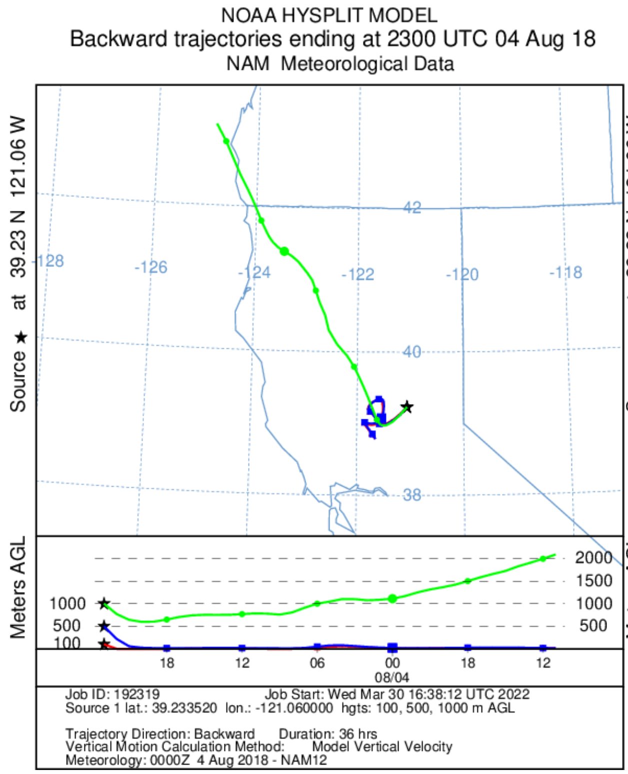
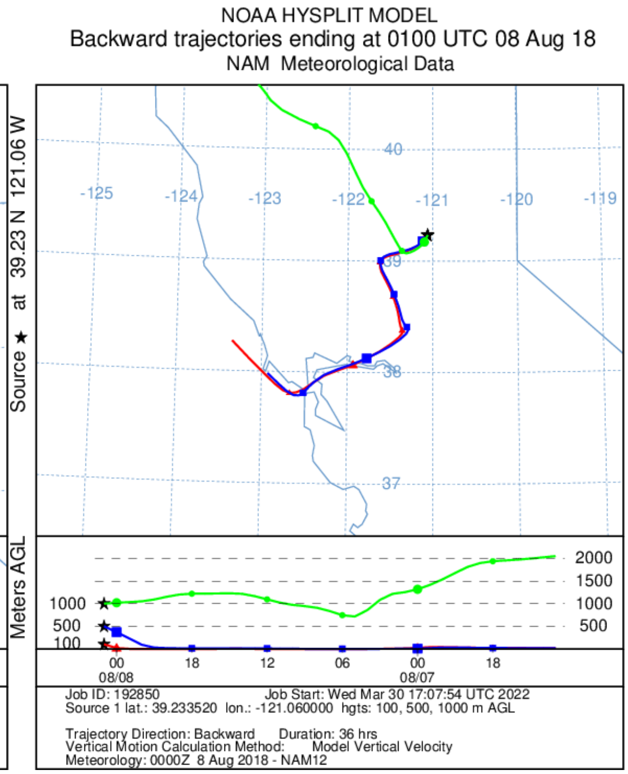
Backward trajectories ending at 0700 UTC 01 Aug 18
NAM Meteorological Data



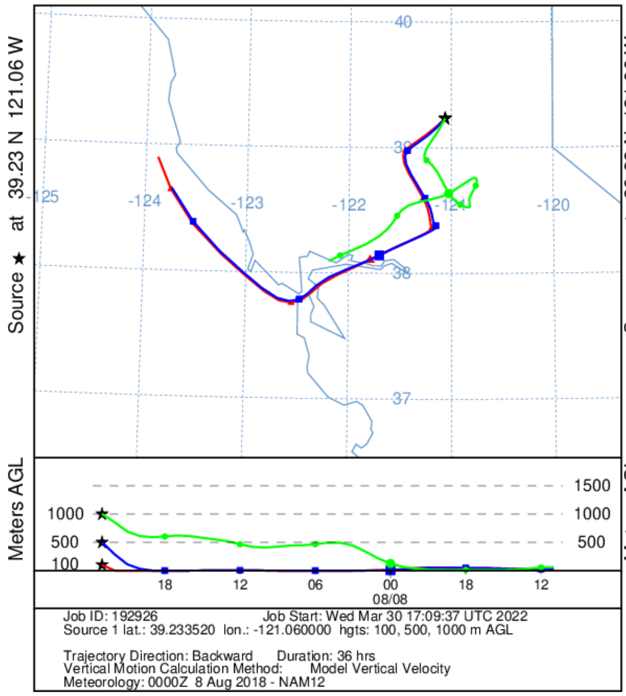

NOAA HYSPLIT MODEL
Backward trajectories ending at 0200 UTC 02 Aug 18
NAM Meteorological Data
Source ★ at 39.23 N 121.06 W
-126
-124
-122
-120
40
38
Meters AGL
2500
2000
1500
1000
500
100
00
08/02
18
12
06
00
08/01
18
Job ID: 192192 Job Start: Wed Mar 30 16:26:57 UTC 2022
Source 1 lat.: 39.233520 lon.: -121.060000 hgts: 100, 500, 1000 m AGL
Trajectory Direction: Backward Duration: 36 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 2 Aug 2018 - NAM12


NOAA HYSPLIT MODEL
Backward trajectories ending at 2200 UTC 02 Aug 18
NAM Meteorological Data
Source ★ at 39.23 N 121.06 W
-126
-124
-122
-120
40
38
Meters AGL
1500
1000
500
100
18
12
06
00
08/02
18
12
Job ID: 192268 Job Start: Wed Mar 30 16:30:28 UTC 2022
Source 1 lat.: 39.233520 lon.: -121.060000 hgts: 100, 500, 1000 m AGL
Trajectory Direction: Backward Duration: 36 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 2 Aug 2018 - NAM12


NOAA HYSPLIT MODEL
Backward trajectories ending at 2300 UTC 04 Aug 18
NAM Meteorological Data
Source ★ at 39.23 N 121.06 W
-128
-126
-124
-122
-120
-118
42
40
38
Meters AGL
2000
1500
1000
500
100
18
12
06
00
08/04
18
12
Job ID: 192319 Job Start: Wed Mar 30 16:38:12 UTC 2022
Source 1 lat.: 39.233520 lon.: -121.060000 hgts: 100, 500, 1000 m AGL
Trajectory Direction: Backward Duration: 36 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 4 Aug 2018 - NAM12


NOAA HYSPLIT MODEL
Backward trajectories ending at 0100 UTC 08 Aug 18
NAM Meteorological Data
Source ★ at 39.23 N 121.06 W
-125
-124
-123
-122
-121
-120
-119
40
39
38
37
Meters AGL
2000
1500
1000
500
100
00
08/08
18
12
06
00
08/07
18
Job ID: 192850 Job Start: Wed Mar 30 17:07:54 UTC 2022
Source 1 lat.: 39.233520 lon.: -121.060000 hgts: 100, 500, 1000 m AGL
Trajectory Direction: Backward Duration: 36 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 8 Aug 2018 - NAM12

NOAA HYSPLIT MODEL
Backward trajectories ending at 2300 UTC 08 Aug 18
NAM Meteorological Data



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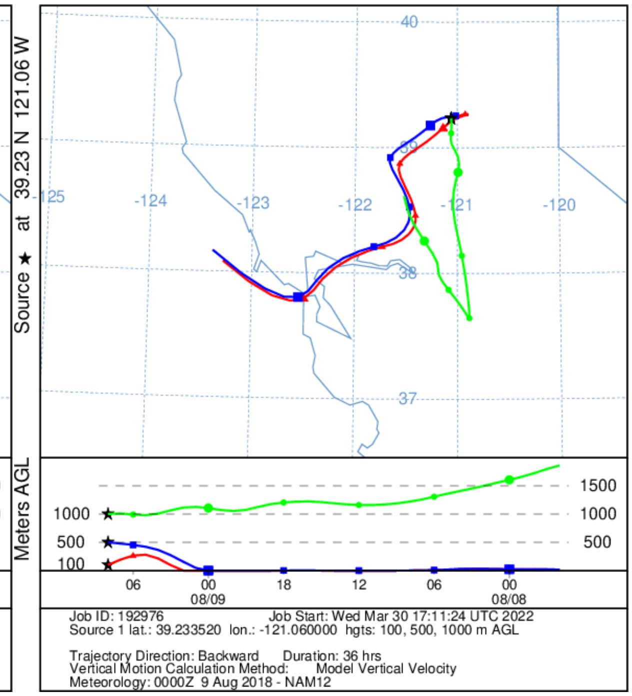
Backward trajectories ending at 0800 UTC 09 Aug 18
NAM Meteorological Data



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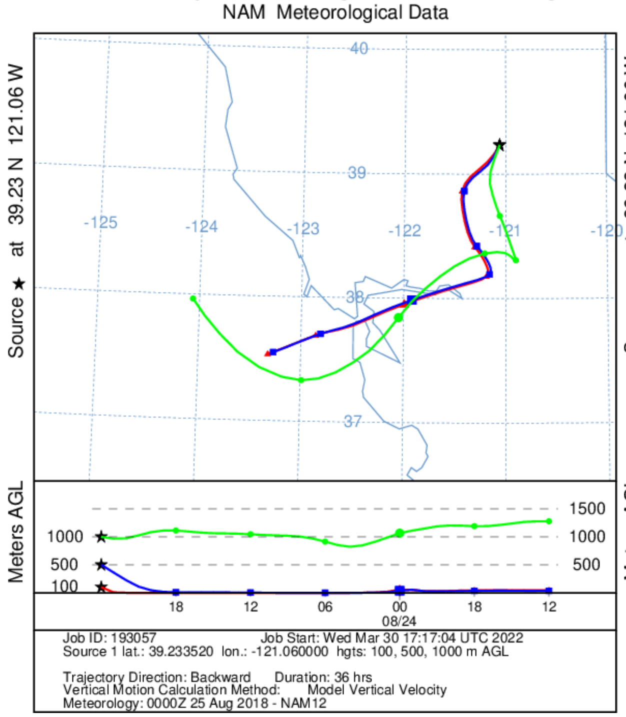
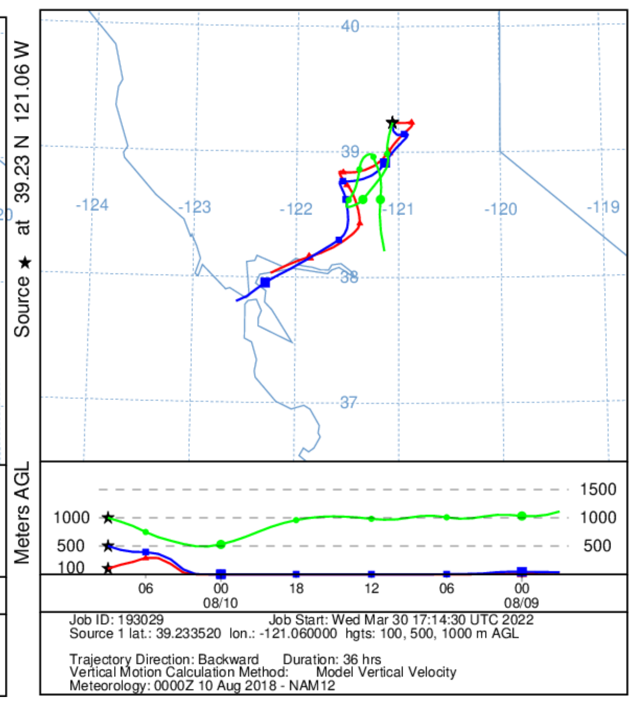
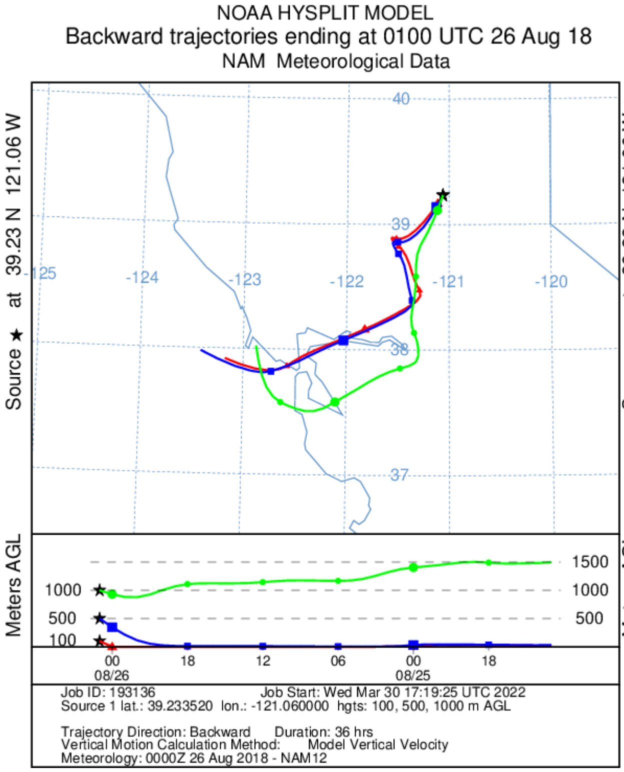
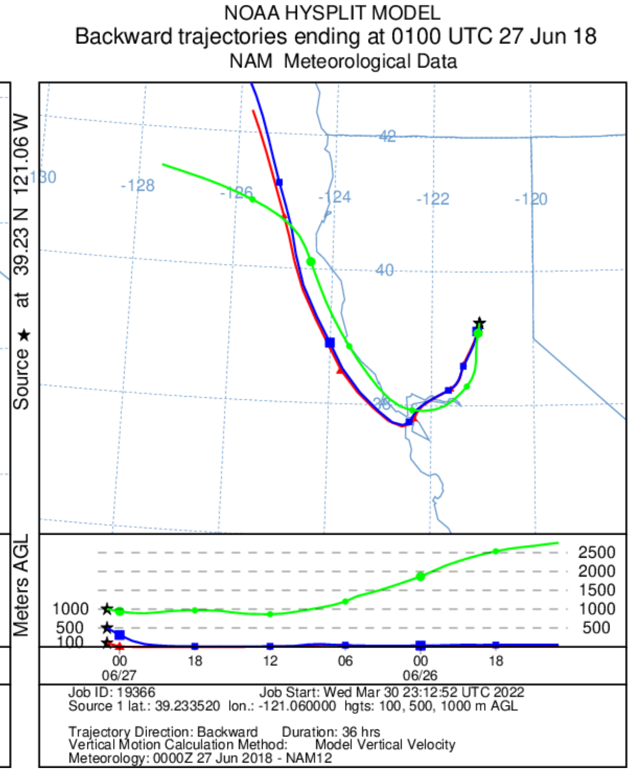
NAM Meteorological Data



NOAA HYSPLIT MODEL
Backward trajectories ending at 0900 UTC 10 Aug 18
NAM Meteorological Data




NOAA HYSPLIT MODEL
Backward trajectories ending at 0100 UTC 26 Aug 18
NAM Meteorological Data
Source ★ at 39.23 N 121.06 W
Meters AGL
Job ID: 193136 Job Start: Wed Mar 30 17:19:25 UTC 2022
Source 1 lat.: 39.233520 lon.: -121.060000 hgts: 100, 500, 1000 m AGL
Trajectory Direction: Backward Duration: 36 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 26 Aug 2018 - NAM12


NOAA HYSPLIT MODEL
Backward trajectories ending at 0100 UTC 27 Jun 18
NAM Meteorological Data
Source ★ at 39.23 N 121.06 W
Meters AGL
Job ID: 19366 Job Start: Wed Mar 30 23:12:52 UTC 2022
Source 1 lat.: 39.233520 lon.: -121.060000 hgts: 100, 500, 1000 m AGL
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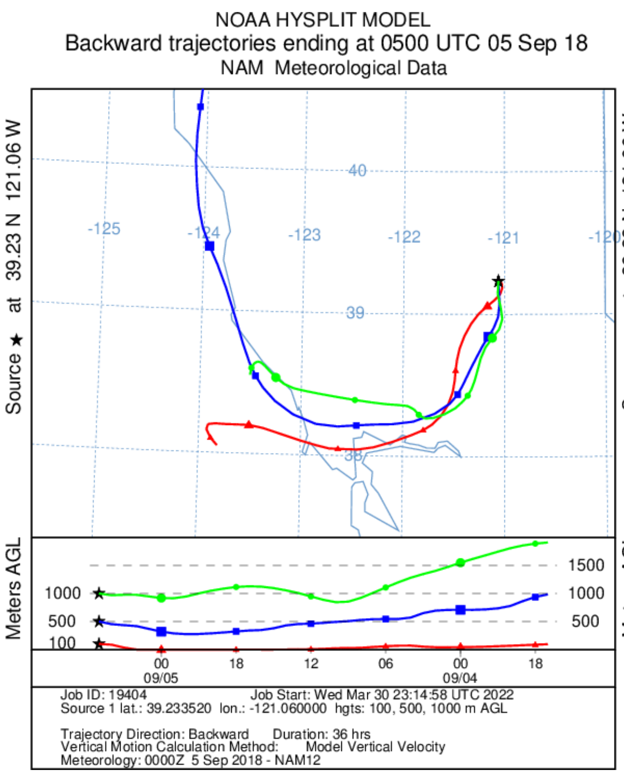
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 27 Jun 2018 - NAM12


NOAA HYSPLIT MODEL
Backward trajectories ending at 0500 UTC 05 Sep 18
NAM Meteorological Data
Source ★ at 39.23 N 121.06 W
Meters AGL
Job ID: 19404 Job Start: Wed Mar 30 23:14:58 UTC 2022
Source 1 lat.: 39.233520 lon.: -121.060000 hgts: 100, 500, 1000 m AGL
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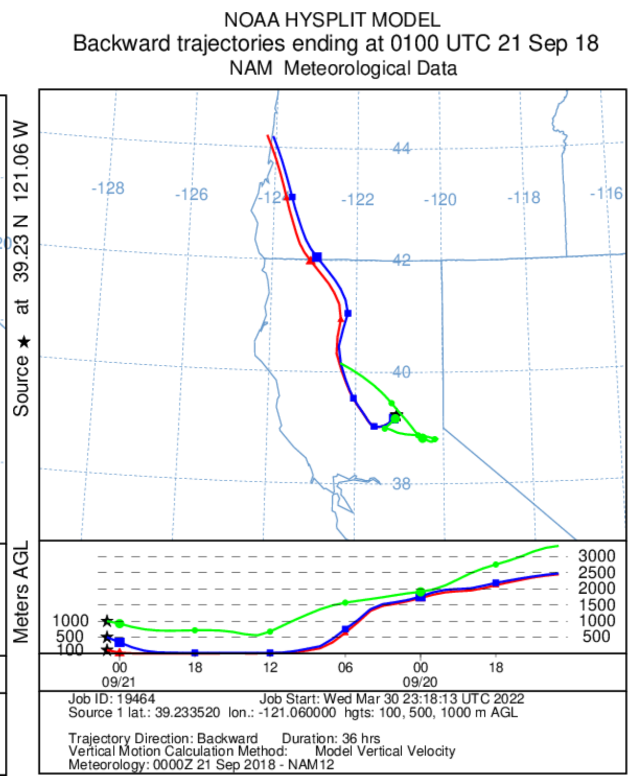
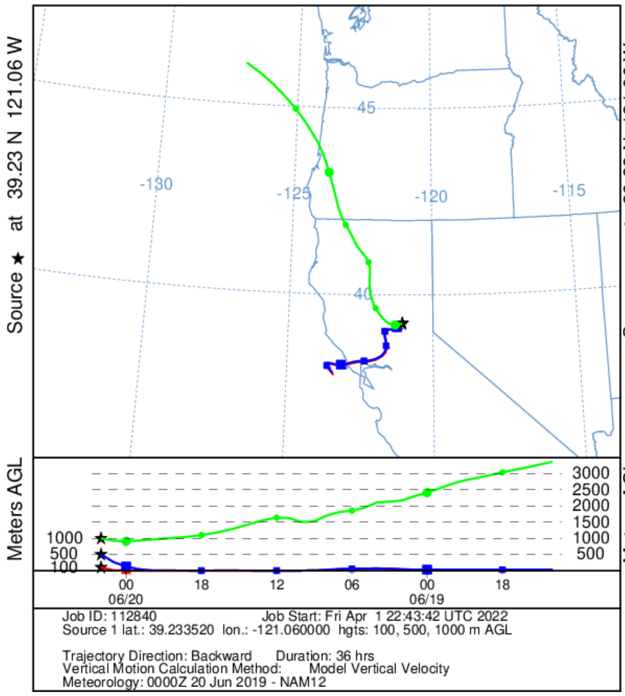
Meteorology: 0000Z 5 Sep 2018 - NAM12

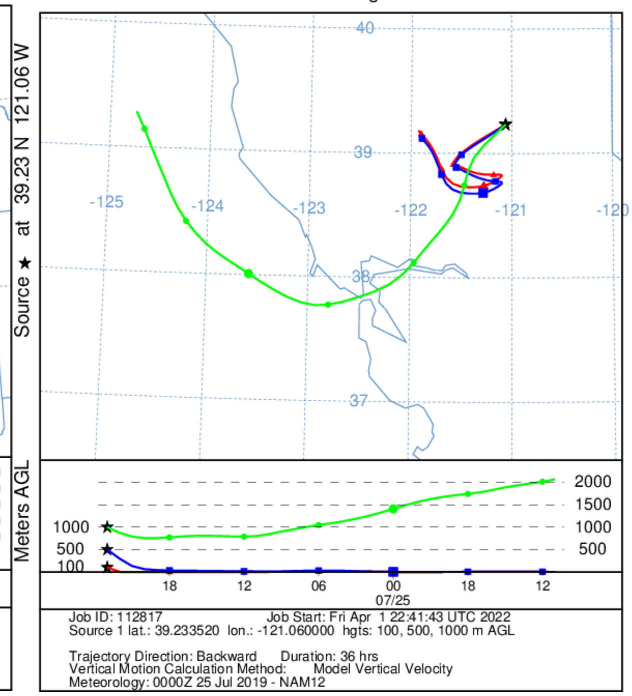

NOAA HYSPLIT MODEL
Backward trajectories ending at 0100 UTC 21 Sep 18
NAM Meteorological Data
Source ★ at 39.23 N 121.06 W
Meters AGL
Job ID: 19464 Job Start: Wed Mar 30 23:18:13 UTC 2022
Source 1 lat.: 39.233520 lon.: -121.060000 hgts: 100, 500, 1000 m AGL
Trajectory Direction: Backward Duration: 36 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 21 Sep 2018 - NAM12

2019

NOAA HYSPLIT MODEL
Backward trajectories ending at 0200 UTC 20 Jun 19
NAM Meteorological Data



NOAA HYSPLIT MODEL
Backward trajectories ending at 2300 UTC 25 Jul 19
NAM Meteorological Data



NOAA HYSPLIT MODEL
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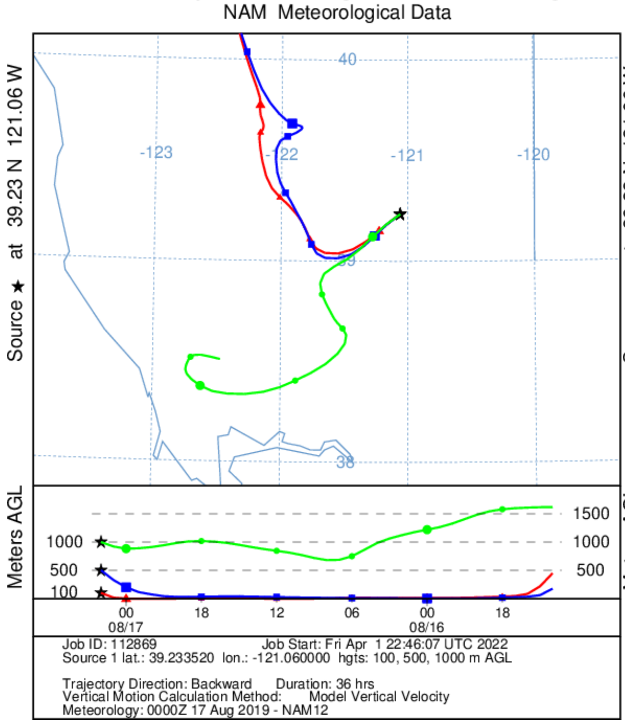
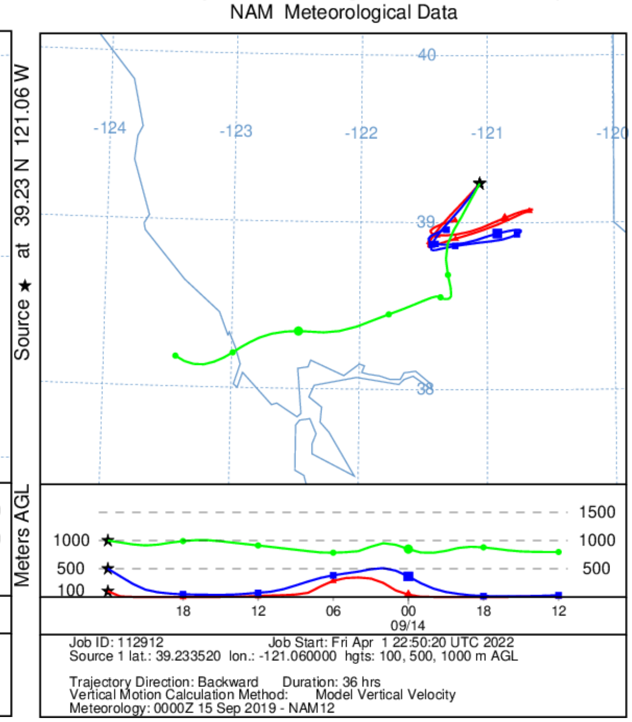
NAM Meteorological Data

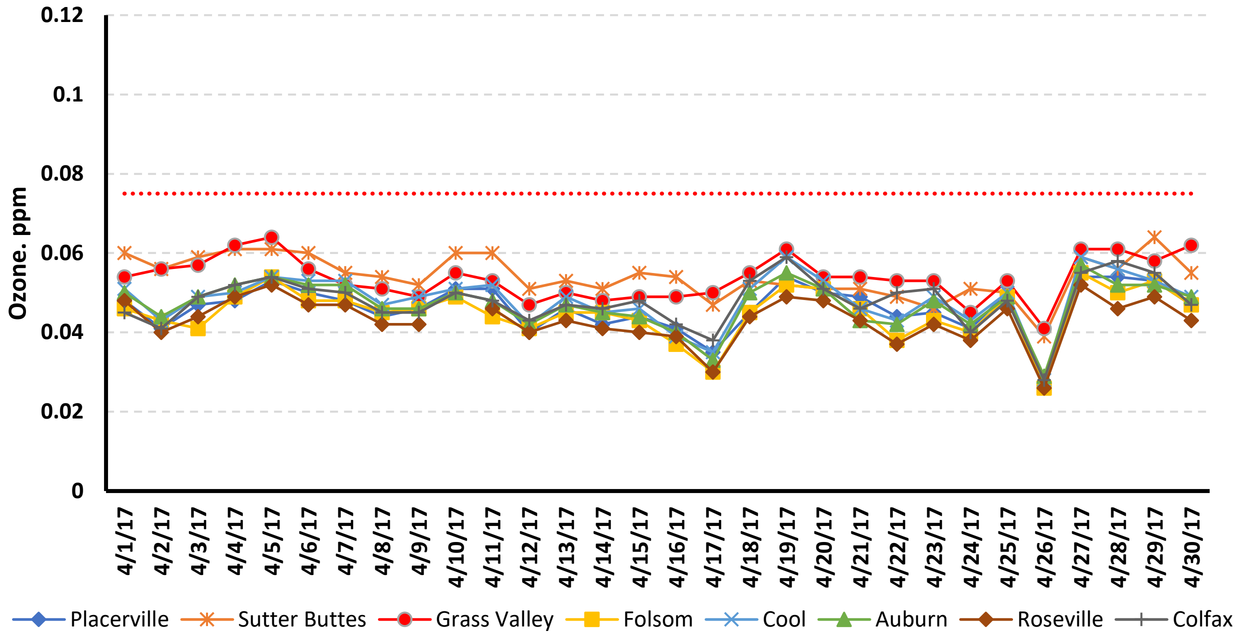


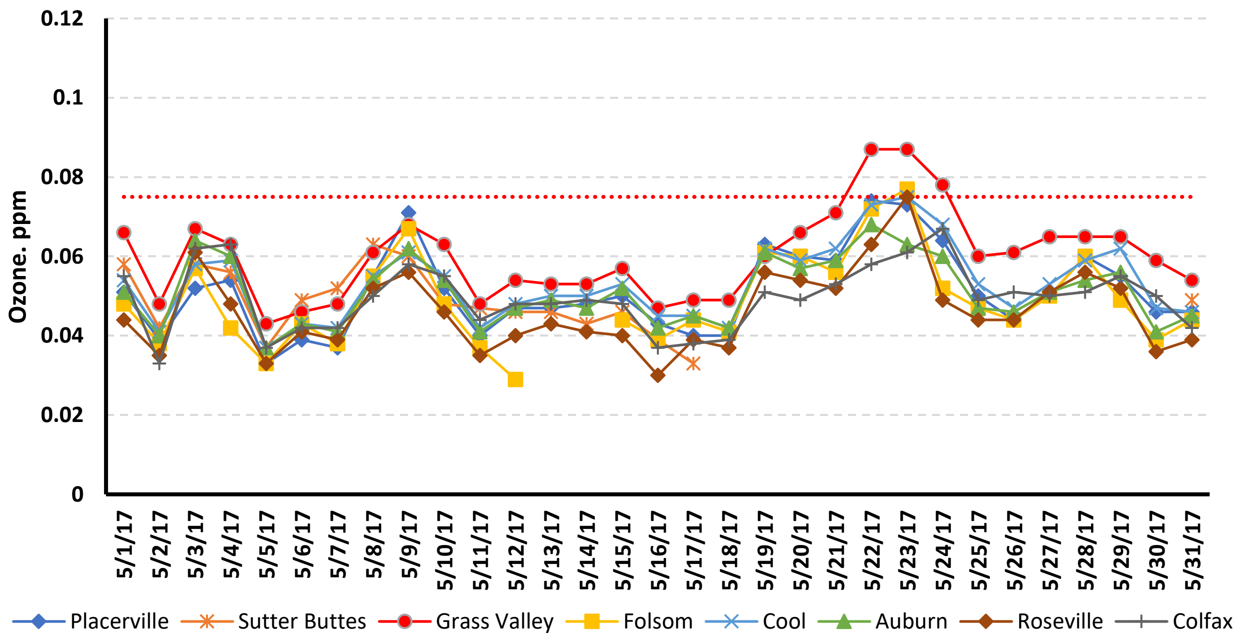
NOAA HYSPLIT MODEL
Backward trajectories ending at 0000 UTC 15 Sep 19
NAM Meteorological Data

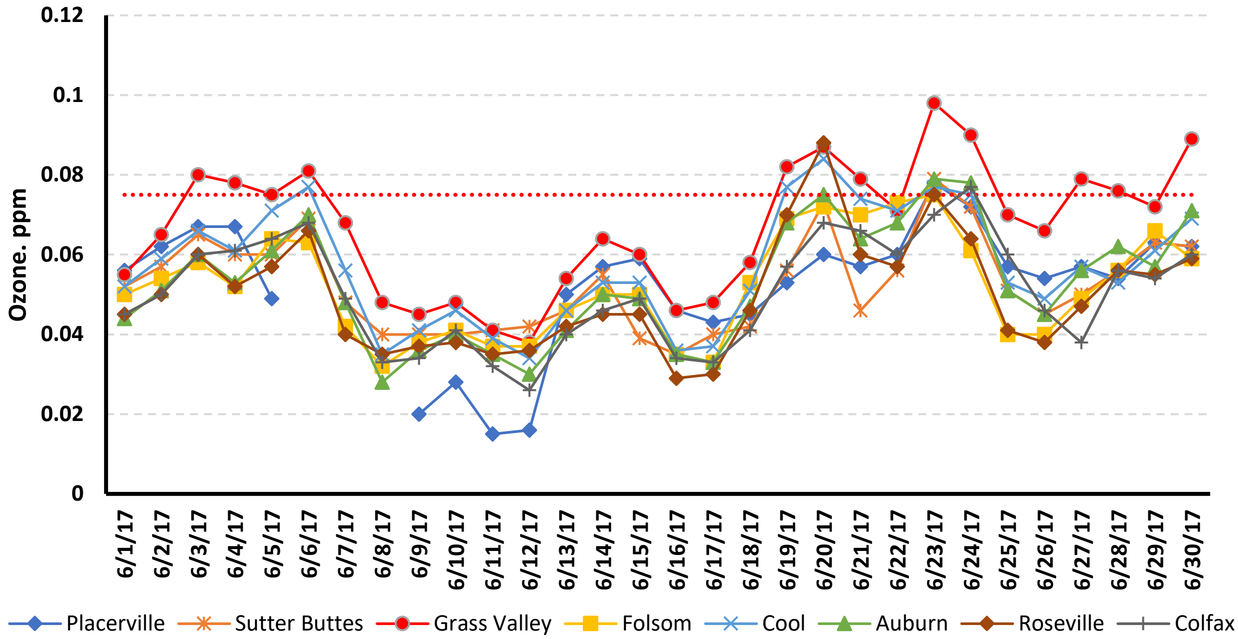


Appendix A4: Regional Ozone Concenrations in 2017

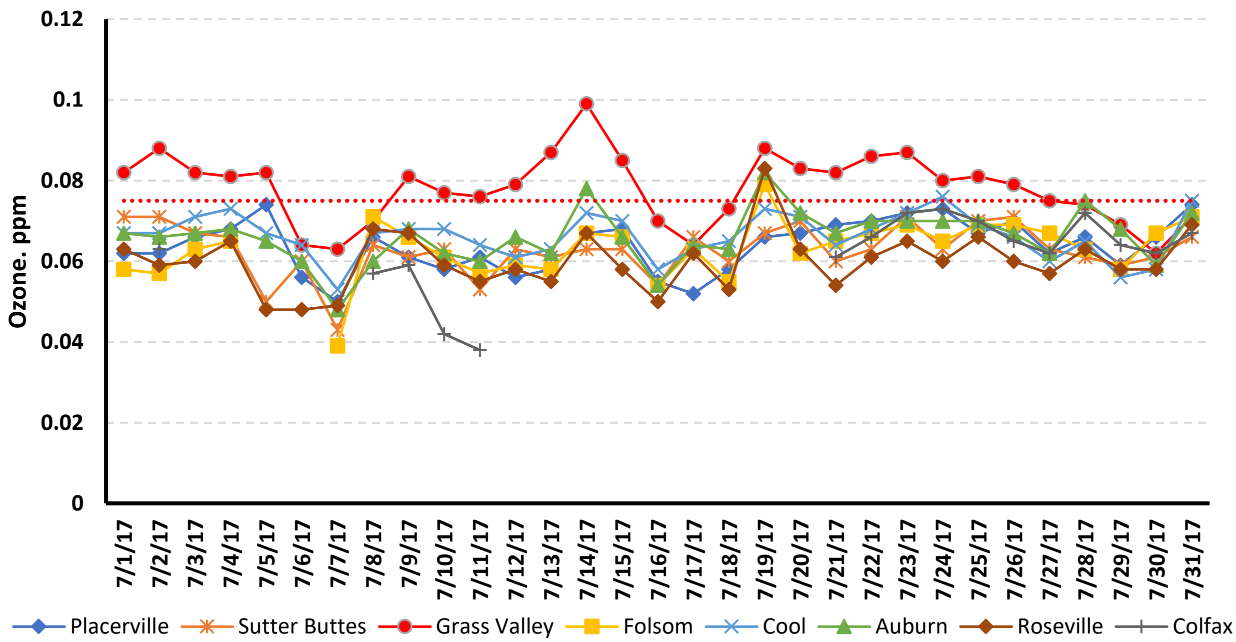
Grass Valley and surrounding regional daily maximum 8-hour ozone concentrations in 2017







0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
6/1/17
6/2/17
6/3/17
6/4/17
6/5/17
6/6/17
6/7/17
6/8/17
6/9/17
6/10/17
6/11/17
6/12/17
6/13/17
6/14/17
6/15/17
6/16/17
6/17/17
6/18/17
6/19/17
6/20/17
6/21/17
6/22/17
6/23/17
6/24/17
6/25/17
6/26/17
6/27/17
6/28/17
6/29/17
6/30/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax



0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
7/1/17
7/2/17
7/3/17
7/4/17
7/5/17
7/6/17
7/7/17
7/8/17
7/9/17
7/10/17
7/11/17
7/12/17
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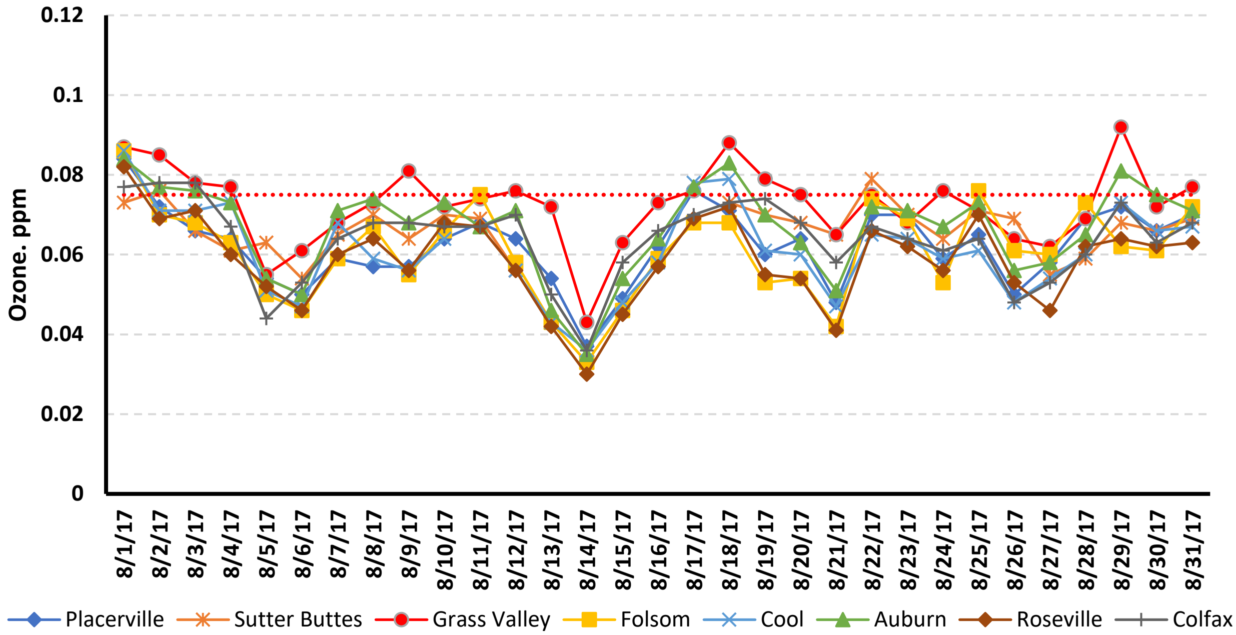
7/20/17
7/21/17
7/22/17
7/23/17
7/24/17
7/25/17
7/26/17
7/27/17
7/28/17
7/29/17
7/30/17
7/31/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax



Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
8/1/17
8/2/17
8/3/17
8/4/17
8/5/17
8/6/17
8/7/17
8/8/17
8/9/17
8/10/17
8/11/17
8/12/17
8/13/17
8/14/17
8/15/17
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8/19/17
8/20/17
8/21/17
8/22/17
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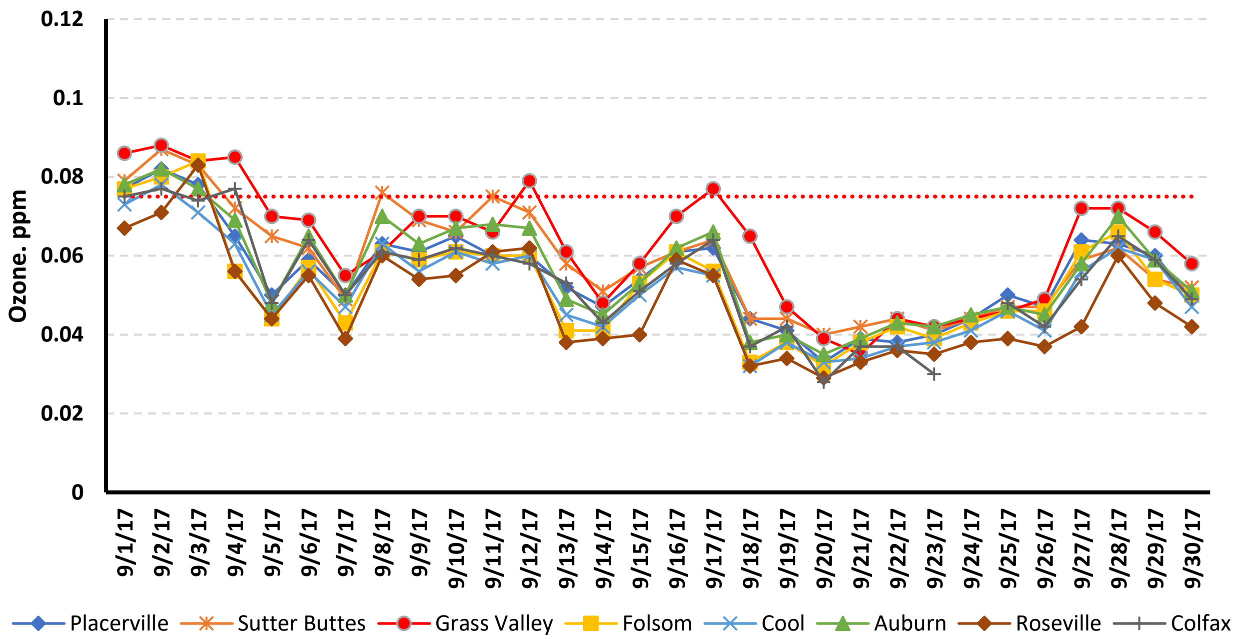
8/26/17
8/27/17
8/28/17
8/29/17
8/30/17
8/31/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax



Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
9/1/17
9/2/17
9/3/17
9/4/17
9/5/17
9/6/17
9/7/17
9/8/17
9/9/17
9/10/17
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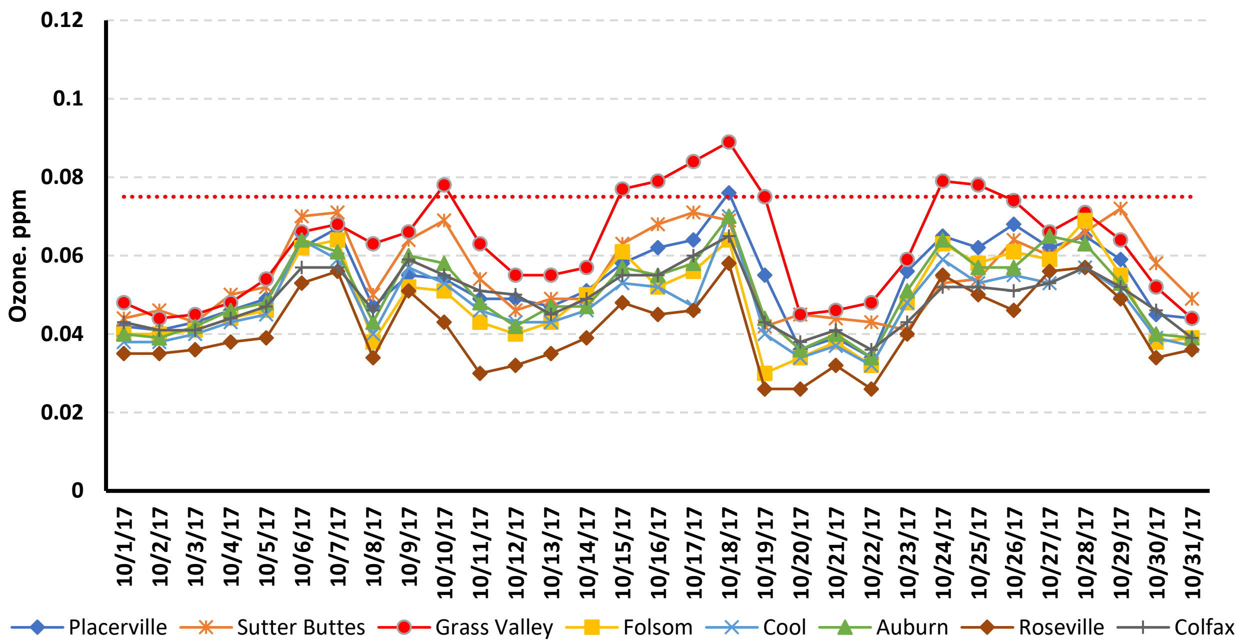
9/22/17
9/23/17
9/24/17
9/25/17
9/26/17
9/27/17
9/28/17
9/29/17
9/30/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax



Ozone, ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
10/1/17
10/2/17
10/3/17
10/4/17
10/5/17
10/6/17
10/7/17
10/8/17
10/9/17
10/10/17
10/11/17
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10/21/17
10/22/17
10/23/17
10/24/17
10/25/17
10/26/17
10/27/17
10/28/17
10/29/17
10/30/17
10/31/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax

Appendix H

NSAQMD Contingency Measure

Architectural Coating

Rule 230

REGULATION II
PROHIBITIONS

RULE 230

ARCHITECTURAL COATINGS

CONTENTS

2.29 Graphic Arts Coating (Sign Paint)
2.30 High-Temperature Coating
2.31 Industrial Maintenance Coating
2.32 Interior Stain
2.33 Intumescent
2.34 Low-Solids Coating
2.35 Magnesite Cement Coating
2.36 Manufacturer's Maximum Thinning Recommendation
2.37 Market
2.38 Mastic Texture Coating
2.39 Medium Density Fiberboard (MDF)
2.40 Metallic Pigmented Coating
2.41 Multi-Color Coating
2.42 Nonflat Coating
2.43 Particleboard
2.44 Pearlescent
2.45 Plywood
2.46 Post-consumer Coating
2.47 Pre-Treatment Wash Primer
2.48 Primer, Sealers and Undercoater
2.49 Reactive Penetrating Sealer
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2.51 Residential
2.52 Roof Coating
2.53 Rust Preventative Coating
2.54 Secondary Industrial Materials
2.55 Semitransparent Coating
2.56 Shellac
2.57 Shop Application
2.58 Solicit
2.59 SCAQMD
2.60 Specialty Primer, Sealer, and Undercoater
2.61 Stain
2.62 Stone Consolidant
2.63 Swimming Pool Coating
2.64 Tile and Stone Sealers
2.65 Tint Base
2.66 Traffic Marking Coating
2.67 Tub and Tile Refinish Coating
2.68 Veneer
2.69 Virgin Materials
2.70 Volatile Organic Compound (VOC)
2.71 VOC Actual

1 GENERAL

1.1 Purpose: To limit the quantity of Volatile Organic Compounds (VOCs) in architectural coatings supplied, sold, offered for sale, applied, solicited for application, or manufactured for use within the Western Nevada County (definition, see Section 2.74).

1.2 Applicability: Except as provided in Section 1.3 below, this Rule is applicable to any person who: (1) supplies, sells, offers for sale, or manufactures any architectural coating for use within the Western Nevada County; (2) manufactures, blends, or repackages any architectural coating for use within Western Nevada County; (3) applies or solicits the application of any architectural coating within the Western Nevada County.

1.2.1 On and after 60 days following the effective date of the U.S. Environmental Protection Agency's (EPA) final determination that the Western Nevada County ozone nonattainment area has failed to meet a Reasonable Further Progress (RFP) milestone for the 2015 8-hour Ozone National Ambient Air Quality Standard or failed to reach attainment by the prescribed attainment date of August 3, 2027, as described in Clean Air Act Sections 172(c)(9) and 182(c)(9), this rule shall be implemented only in the Western Nevada County nonattainment area.

1.3 Exemptions: This Rule does not apply to:

1.3.1 Any architectural coating that is sold or manufactured for use outside of the Western Nevada County or for shipment to other manufacturers for reformulation or repackaging.

1.3.2 Any aerosol coating product.

1.3.3 With the exception of section 5, this rule does not apply to any architectural coating that is sold in a container with a volume of one liter (1.057 quart) or less provided the following requirements are met:

1.3.3.1 The coating container is not bundled together with other containers of the same specific coating category (listed in **Table 1**) to be sold as a unit that exceeds one liter (1.057 quart), excluding containers packed together for shipping to a retail outlet, and

1.3.3.2 The label or any other product literature does not suggest combining multiple containers of the same specific category (listed in **Table 1**) so that the combination exceeds one liter (1.057 quart).

1.3.4 Colorant added at the factory or at the worksite is not subject to the VOC limit in **Table 2**. In addition, containers of colorant sold at the point of sale for use in the field or on a job site are also not subject to the VOC limit in **Table 2**.

2 DEFINITIONS

2.1 **Adhesive:** Any chemical substance that is applied for the purpose of bonding two surfaces together other than by mechanical means.

2.2 **Aerosol Coating Product:** A pressurized coating product containing pigments or resins that dispense product ingredients by means of a propellant and is packaged in a disposable can for hand-held application, or for use in specialized equipment for ground traffic/marking applications.

2.3 **Aluminum Roof Coating:** A coating labeled and formulated exclusively for application to roofs and containing at least 84 grams of elemental aluminum pigment per liter of coating (at least 0.7 pounds per gallon). Pigment content shall be determined in accordance with SCAQMD Method 318-95, incorporated by reference in Section 6.5.4.

2.4 **Appurtenances:** Any accessory to a stationary structure coated at the site of installation, whether installed or detached, including but not limited to: bathroom and kitchen fixtures; cabinets; concrete forms; doors; elevators; fences; hand railings; heating equipment, air conditioning equipment, and other fixed mechanical equipment or stationary tools; lampposts; partitions; pipes and piping systems; rain-gutters and down-spouts; stairways, fixed ladders, catwalks, and fire escapes; and window screens.

2.5 **Architectural Coating:** A coating to be applied to stationary structures and their appurtenances at the site of installation, to portable buildings at the site of installation, to pavements, or to curbs. Coatings applied in shop applications or to non-stationary structures such as airplanes, ships, boats, railcars, and automobiles, and adhesives are not considered architectural coatings for the purpose of this Rule.

2.6 **ASTM:** ASTM International

2.7 **Basement Specialty Coating:** A clear or opaque coating that is labeled and formulated for application to concrete and masonry surfaces to provide a hydrostatic seal for basements and other below-grade surfaces. Basement Specialty Coatings must meet the following criteria:

2.7.1 Coating must be capable of withstanding at least 10 psi of hydrostatic pressure, as determined in accordance with ASTM D7088-17, which is incorporated by reference in Section 6.5.12; and

2.7.2 Coating must be resistant to mold and mildew growth and must achieve a microbial growth rating of 8 or more, as determined in accordance with ASTM D3273-16 and ASTM D3274-09 (2017), incorporated by reference in Section 6.5.19.

2.8 **BAAQMD:** Bay Area Air Quality Management District.

2.9 **Bitumens:** Black or brown materials including, but not limited to, asphalt, tar, pitch, and asphaltite that are soluble in carbon disulfide, consist mainly of hydrocarbons, and are obtained from natural deposits or as residues from the distillation of crude petroleum or coal.

2.10 **Bituminous Roof Coating:** A coating which incorporates bitumens that is labeled and formulated exclusively for roofing.

2.11 **Bituminous Roof Primer:** A primer which incorporates bitumens that is labeled and formulated exclusively for roofing.

2.12 **Bond Breaker:** A coating labeled and formulated for application between layers of concrete to prevent a freshly poured top layer of concrete from bonding to the layer over which it is poured.

2.13 **Building Envelope:** The ensemble of exterior and demising partitions of a building that enclose conditioned space.

2.14 **Building Envelope Coating:** The fluid applied coating applied to the building envelope to provide a continuous barrier to air or vapor leakage through the building envelope that separates conditioned from unconditioned spaces. Building Envelope Coatings are applied to diverse materials including, but not limited to, concrete masonry units (CMU), oriented strand board (OSB), gypsum board, and wood substrates and must meet the following performance criteria:

2.14.1 Air Barriers formulated to have an air permeance not exceeding 0.004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.004 cfm/ft2 @ 1.57 psf), [0.02 liters per square meter per second under a pressure differential of 75 Pa (0.02 L/(s m2) @ 75 Pa)] when tested in accordance with ASTM E2178-13, incorporated by reference in Section 6.5.9; and/or

2.14.2 Water Resistive Barriers formulated to resist liquid water that has penetrated a cladding system from further intruding into the exterior wall assembly and is classified as follows:

2.14.2.1 Passes water resistance testing accordance to ASTM E331-00(2016), incorporated by reference in Section 6.5.24; and

2.14.2.2 Water vapor permeance is classified in accordance with ASTM E96/E96M-16, incorporated by reference in Section 6.5.25.

2.15 **CARB:** California Air Resources Board.

2.16 **Coating:** A material applied onto or impregnated into a substrate for protective, decorative, or functional purposes. Such materials include, but are not limited to, paints, varnishes, sealers, and stains.

2.17 **Colorant:** A concentrated pigment dispersion in water, solvent, and/or binder that is added to an architectural coating after packaging in sale units to produce the desired color.

2.18 **Concrete Curing Compound:** A coating labeled and formulated for application to freshly poured concrete to perform one or more of the following functions:

2.18.1 Retard the evaporation of water; or
2.18.2 Harden or dustproof the surface of freshly poured concrete.

2.19 **Concrete/Masonry Sealer:** A clear or opaque coating that is labeled and formulated primarily for application to concrete and masonry surfaces to perform one or more of the following functions:

2.19.1 Prevent penetration of water;
2.19.2 Provide resistance against abrasion, alkalis, acids, mildew, staining, or ultraviolet light; or
2.19.3 Harden or dustproof the surface of aged or cured concrete.

2.20 **Conversion Varnish:** A clear acid curing coating with an alkyd or other resin blended with amino resins and supplied as a single component or two component products. Conversion varnishes produce a hard, durable, clear finish designed for professional application to wood flooring. The film formation is the result of an acid-catalyzed condensation reaction, affecting a transetherification at the reactive ethers of the amino resins.

2.21 **Driveway Sealer:** A coating labeled and formulated for application to worn asphalt driveway surfaces to perform one or more of the following functions:

2.21.1 Fill cracks; or
2.21.2 Seal the surface to provide protection; or
2.21.3 Restore or preserve the appearance.

2.22 **Dry Fog Coating:** A coating labeled and formulated only for spray application such that overspray droplets dry before subsequent contact with incidental surfaces in the vicinity of the surface coating activity.

2.23 **Exempt Compound:** A compound identified as exempt under the definition of Volatile Organic Compound (VOC), Section 2.69.

2.24 **Faux Finishing Coating:** A coating labeled and formulated to meet one or more of the following criteria:

2.24.1 A glaze or textured coating used to create artistic effects, including, but not limited to: dirt, suede, old age, smoke damage, and simulated marble and wood grain; or

2.24.2 A decorative coating used to create a metallic, iridescent, or pearlescent appearance that contains at least 48 grams of pearlescent mica pigment or other iridescent pigment per liter of coating as applied (at least 0.4 pounds per gallon); or

2.24.3 A decorative coating used to create a metallic appearance that contains less than 48 grams of elemental metallic pigment per liter of coating as applied (less than 0.4 pounds per gallon), when tested in accordance with SCAQMD Method 318-95, incorporated by reference in Section 6.5.4; or

2.24.4 A decorative coating used to create a metallic appearance that contains greater than 48 grams of elemental metallic pigment per liter of coating as applied (greater than 0.4 pounds per gallon) and which requires a clear topcoat to prevent the degradation of the finish under normal use conditions. The metallic pigment content shall be determined in accordance with SCAQMD Method 318-95, incorporated by reference in Section 6.5.4; or

2.24.5 A clear topcoat to seal and protect a Faux Finishing coating that meets the requirements of Section 2.23.1, 2.23.2, 2.23.3, or 2.23.4. These clear topcoats must be sold and used solely as part of a Faux Finishing coating system and must be labeled in accordance with Section 4.4.

2.25 **Fire-Resistive Coating:** An opaque coating labeled and formulated to protect the structural integrity by increasing the fire endurance of interior or exterior steel and other structural materials, that has been fire tested and rated by a testing agency approved by building code officials for use in bringing assemblies of structural materials into compliance with federal, state, and local building code requirements. The fire-resistive coating and the testing agency must be approved by building code officials. The fire-resistive coating shall be tested in accordance with the ASTM Designation E 119-98. The fire-resistive coatings and the testing agency must also be approved by building code officials.

2.26 **Flat Coating:** A coating that is not defined under any other definition in this Rule and that registers gloss less than 15 on an 85-degree meter, or less than 5 on a 60-degree meter in accordance with ASTM D523-14(2018) incorporated by reference in Section 6.5.3.

2.27 **Floor Coating:** An opaque coating that is labeled and formulated for application to flooring, including, but not limited to, decks, porches, steps, and other horizontal surfaces which may be subject to foot traffic.

2.28 **Form-Release Compound:** A coating labeled and formulated for application to a concrete form to prevent the freshly poured concrete from bonding to the form. The form may consist of wood, metal, or some other material other than concrete.

2.29 **Graphic Arts Coating (Sign Paint):** A coating labeled and formulated for hand-application by artists using brush or roller techniques to indoor and outdoor signs (excluding structural components) and murals including lettering enamels, poster colors, copy blockers, and bulletin enamels.

2.30 **High-Temperature Coating:** A high performance coating labeled and formulated for application to substrates exposed continuously or intermittently to temperatures above 204ºC (400ºF).

2.31 **Industrial Maintenance Coating:** A high performance architectural coating, including primers, sealers, undercoats, intermediate coats, and topcoats formulated for application to substrates, including floors, exposed to one or more of the following extreme environmental conditions listed in Sections 2.30.1 through 2.30.5, and labeled as specified in Section 4.5:

2.31.1 Immersion in water, wastewater, or chemical solutions (aqueous and non-aqueous solutions), or chronic exposure of interior surfaces to moisture condensation;
2.31.2 Acute or chronic exposure to corrosive, caustic, or acidic agents, or to chemicals, chemical fumes, or chemical mixtures or solutions;
2.31.3 Repeated exposure to temperatures above 121ºC (250ºF);
2.31.4 Repeated (frequent) heavy abrasion, including mechanical wear and repeated (frequent) scrubbing with industrial solvents, cleansers, or scouring agents; or
2.31.5 Exterior exposure of metal structures and structural components.

2.32 **Interior Stain:** A stain labeled and formulated exclusively for use on interior surfaces.

2.33 **Intumescent:** A material that swells as a result of heat exposure, thus increasing in volume and decreasing in density.

2.34 **Low-Solids Coating:** A coating containing 0.12 kilogram or less of solids per liter (1 pound or less of solids per gallon) of coating material.

2.35 **Magnesite Cement Coating:** A coating labeled and formulated for application to magnesite cement decking to protect the magnesite cement substrate from erosion by water.

2.36 **Manufacturer's Maximum Thinning Recommendation:** The maximum recommendation for thinning that is indicated on the label or lid of the coating container.

2.37 **Market:** To facilitate sales through third party vendors including, but not limited to, catalog or ecommerce sales that bring together buyers and sellers. For the purposes of this rule, market does not mean to generally promote or advertise coatings.

2.38 **Mastic Texture Coating:** A coating labeled and formulated to cover holes and minor cracks and to conceal surface irregularities and is applied in a single coat of at least 10 mils (0.010 inch) dry film thickness.

2.39 **Medium Density Fiberboard (MDF):** A composite wood product, panel, molding, or other building material composed of cellulosic fibers (usually wood) made by dry forming and pressing of a resinated fiber mat.

2.40 **Metallic Pigmented Coating:** A coating containing at least 48 grams of elemental metallic pigment per liter of coating as applied (0.4 pounds per gallon), when tested in accordance with SCAQMD Method 318-95.

2.41 **Multi-Color Coating:** A coating that is packaged in a single container and that exhibits more than one color when applied in a single coat.

2.42 **Nonflat Coating:** A coating that is not defined under any other definition in this rule and that registers a gloss of 15 or greater on an 85-degree meter and 5 or greater on a 60-degree meter according to ASTM D523-14(2018).

2.43 **Particleboard:** A composite wood product panel, molding, or other building material composed of cellulosic material (usually wood) in the form of discrete particles, as distinguished from fibers, flakes, or strands, which are pressed together with resin.

2.44 **Pearlescent:** Exhibiting various colors depending on the angles of illumination and viewing, as observed in mother-of-pearl.

2.45 **Plywood:** A panel product consisting of layers of wood veneers or composite core pressed together with resin. Plywood includes panel products made by either hot or cold pressing (with resin) veneers to a platform.

2.46 **Post-consumer Coating:** Finished coatings generated by a business or consumer that have served their intended end uses, and are recovered from or otherwise diverted from the waste stream for the purpose of recycling.

2.47 **Pre-Treatment Wash Primer:** A primer that contains a minimum of 0.5 percent acid, by weight, and labeled and formulated for application directly to bare metal surfaces to provide corrosion resistance and to promote adhesion of subsequent topcoats. The acidity of a Pretreatment Wash Primer shall be measured by ASTM D1613-17.

2.48 **Primer, Sealers and Undercoater:** Coatings labeled, formulated, and applied to substrates to:

2.48.1 Provide a firm bond between the substrate and subsequent coats; or
2.48.2 Prevent subsequent coatings from being absorbed by the substrate; or
2.48.3 Prevent harm to subsequent coatings by materials in the substrate; or
2.48.4 Provide a smooth surface for the substrate application of coatings; or
2.48.5 Provide a clear finish coat to seal the substrate; or
2.48.6 Block materials from penetrating into or leaching out of a substrate.

2.49 Reactive Penetrating Sealer: A clear or pigmented coating that is labeled and formulated for application to above-grade concrete and masonry substrates to provide protection from water and waterborne contaminants, including, but not limited to, alkalis, acids, and salts. Reactive Penetrating Sealers must penetrate into concrete and masonry substrates and chemically react to form covalent bonds with naturally occurring minerals in the substrate. Reactive Penetrating Sealers line the pores of concrete and masonry substrates with a hydrophobic coating, but do not form a surface film. Reactive Penetrating Sealers must meet all of the following criteria:

7.1.1 The Reactive Penetrating Sealer must improve water repellency at least 80 percent after application on a concrete or masonry substrate. This performance must be verified on standardized test specimens, in accordance with one or more of the following standards, incorporated by reference in Section 6.5.19: ASTM C67/C67M-18, or ASTM C97/97M-18, or ASTM C140/C140M-18a; and

7.1.2 The Reactive Penetrating Sealer must provide a breathable waterproof barrier for concrete or masonry surfaces that does not prevent or substantially retard water vapor transmission. This performance must be verified on standardized test specimens, in accordance with ASTM E96/96M-16 or ASTM D6490-99 (2014), incorporated by reference in Section 6.5.20; and

7.1.3 Products labeled and formulated for vehicular traffic surface chloride screening applications must meet the performance criteria listed in the National Cooperative Highway Research Report 244 (1981), incorporated by reference in Section 6.5.21.

Reactive Penetrating Sealers must be labeled in accordance with Section 4.6.

2.50 Recycled Coating: An architectural coating formulated such that it contains a minimum of 50% by volume post-consumer coating, with a maximum of 50% by volume secondary industrial materials or virgin materials.

2.51 Residential: Areas where people reside or lodge, including, but not limited to, single and multiple family dwellings, condominiums, mobile homes, apartment complexes, motels, and hotels.

2.52 Roof Coating: A non-bituminous coating labeled and formulated for application to roofs for the primary purpose of preventing water penetration, reflecting ultraviolet light, or reflecting solar radiation.

2.53 Rust Preventative Coating: A coating formulated to prevent the corrosion of metal surfaces for one or more of the following applications:

2.53.1 Direct-to-metal coating; or

2.53.2 Coating intended for application over rusty, previously coated surfaces.

The Rust Preventative category does not include the following:

2.53.3 Coatings that are required to be applied as a topcoat over a primer; or
2.53.4 Coatings that are intended for use on wood or any other nonmetallic surface.

Rust Preventative coatings are for metal substrates only and must be labeled as such, in accordance with the labeling requirements in Section 4.7.

2.54 **Secondary Industrial Materials:** Products or by-products of the paint manufacturing process that are of known composition and have economic value but can no longer be used for their intended purpose.

2.55 **Semitransparent Coating:** A coating that contains binders and colored pigments and is formulated to change the color of the surface but not conceal its grain patterns or texture.

2.56 **Shellac:** A clear or opaque coating formulated solely with the resinous secretions of the lac beetle (Laccifer lacca), thinned with alcohol, and formulated to dry by evaporation without a chemical reaction.

2.57 **Shop Application:** Application of a coating to a product or a component of a product in or on the premises of a factory or a shop as part of a manufacturing, production, or repairing process (e.g., original equipment manufacturing coatings).

2.58 **Solicit:** To require for use or to specify, by written or oral contract.

2.59 **SCAQMD:** South Coast Air Quality Management District.

2.60 **Specialty Primer, Sealer, and Undercoater:** Coatings formulated for application to a substrate to block water-soluble stains resulting from: fire damage, smoke damage; or water damage.

Specialty Primers, Sealers, and Undercoaters must be labeled in accordance with Section 4.8.

2.61 **Stain:** A clear, semitransparent, or opaque coating labeled and formulated to change the color of a surface but not conceal the grain pattern or texture.

2.62 **Stone Consolidant:** A coating that is labeled and formulated for application to stone substrates to repair historical structures that have been damaged by weathering or other decay mechanisms. Stone Consolidants must penetrate into stone substrates to create bonds between particles and consolidate deteriorated material. Stone Consolidants must be specified and used in accordance with ASTM E2167-01 (2008), incorporated by reference in Section 6.5.22.

Stone Consolidants are for professional use only and must be labeled as such, in accordance with the labeling requirements in Section 4.9.

2.63 **Swimming Pool Coating:** A coating labeled and formulated to coat the interior of swimming pools and to resist swimming pool chemicals. Swimming pool coatings include coatings used for swimming pool repair and maintenance**.**

2.64 **Tile and Stone Sealers:** A clear or pigmented sealer that is used for sealing tile, stone or grout to provide resistance against water, alkalis, acids, ultraviolet light or straining and which meet one of the following subcategories:

2.64.1 Penetrating sealers are polymer solutions that cross-link in the substrate and must meet the following criteria:

2.64.1.1 A fine particle structure to penetrate dense tile such as porcelain with absorption as low as 0.10 percent per ASTM C373-18, ASTM C97/C97M-18, or ASTM C642-13, incorporated by reference in Section 6.5.26;

2.64.1.2 Retain or increase static coefficient of friction per ANSI A137.1 (2019), incorporated by reference in Section 6.5.27.;

2.64.1.3 Not create a topical surface film on the tile or stone; and

2.64.1.4 Allow vapor transmission per ASTM E96/E96M-16, incorporated by reference in Section 6.5.28.

2.64.2 Film forming sealers which leave a protective film on the surface.

2.65 **Tint Base:** An architectural coating to which colorant is added after packaging in sale units to produce a desired color.

2.66 **Traffic Marking Coating:** A coating labeled and formulated for marking and striping streets, highways, or other traffic surfaces, including, but not limited to, curbs, berms, driveways, parking lots, sidewalks, and airport runways. This coating category also includes Methacrylate Multicomponent Coatings used as traffic marking coatings. The VOC content of Methacrylate Multicomponent Coatings used as traffic marking coatings shall be analyzed by the procedures in 40 CFR Part 59, Subpart D, Appendix A, incorporated by reference in Section 6.5.11.

2.67 **Tub and Tile Refinish Coating:** A clear or opaque coating that is labeled and formulated exclusively for refinishing the surface of a bathtub, shower, sink, or countertop. Tub and Tile Refinish coatings must meet all of the following criteria:

2.67.1 The coating must have a scratch hardness of 3H or harder and a gouge hardness of 4H or harder. This must be determined on bonderite 1000, in accordance with ASTM D3363-05 (2011)e2, incorporated by reference in Section 6.5.14; and

2.67.2 The coating must have a weight loss of 20 milligrams or less after 1000 cycles. This must be determined with CS-17 wheels on bonderite 1000, in accordance with ASTM D4060-14, incorporated by reference in Section 6.5.15; and

2.67.3 The coating must withstand 1000 hours or more of exposure with few or no #8 blisters. This must be determined on unscribed bonderite, in accordance with ASTM D4585-99, and 2020 CARB SCM for Architectural Coatings California Air Resources Board 12 May 2020 ASTM D714-02 (2017), incorporated by reference in Section 6.5.16; and

2.67.4 The coating must have an adhesion rating of 4B or better after 24 hours of recovery. This must be determined on unscribed bonderite, in accordance with ASTM D4585-/D4585M-18 and ASTM D3359-17, incorporated by reference in Section 6.5.13.

2.68 **Veneer:** Thin sheets of wood peeled or sliced from logs for use in the manufacture of wood products such as plywood, laminated veneer lumber, or other products.

2.69 **Virgin Materials:** Materials that contain no post-consumer coatings or secondary industrial materials.

2.70 **Volatile Organic Compound (VOC):** Any volatile compound containing at least one atom of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and excluding the following:

2.70.1 methane;
methylene chloride (dichloromethane);
1,1,1-trichloroethane (methyl chloroform);
trichlorofluoromethane (CFC-11);
dichlorodifluoromethane (CFC-12);
1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113);
1,2-dichloro-1,1,2,2-tetrafluoroethane (CFC-114);
chloropentafluoroethane (CFC-115);
chlorodifluoromethane (HCFC-22);
1,1,1-trifluoro-2,2-dichloroethane (HCFC-123);
2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124);
1,1-dichloro-1-fluoroethane (HCFC-141b);
1-chloro-1,1-difluoroethane (HCFC-142b);
trifluoromethane (HFC-23);
pentafluoroethane (HFC-125);
1,1,2,2-tetrafluoroethane (HFC-134);
1,1,1,2-tetrafluoroethane (HFC-134a);
1,1,1-trifluoroethane (HFC-143a);
1,1-difluoroethane (HFC-152a);
cyclic, branched, or linear completely methylated siloxanes; the following classes of perfluorocarbons:
cyclic, branched, or linear, completely fluorinated alkanes;
cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;

cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and
sulfur-containing perfluorocarbons with no unsaturations and with the sulfur bonds only to carbon and fluorine; and

2.70.2 the following low-reactive organic compounds which have been exempted by the U.S. EPA:
acetone;
ethane;
parachlorobenzotrifluoride (1-chloro-4-trifluoromethyl benzene);perchloroethylene; and
methyl acetate

2.71 **VOC Actual:** VOC Actual is the weight of VOC per volume of coating or colorant and it is calculated with the following equation:

$$\textbf{VOC Actual} = \frac{(Ws - Ww - Wec)}{(Vm)}$$

Where:
VOC Actual = the grams of VOC per liter of coating (also known as "Material VOC").
Ws = weight of volatiles, in grams.
Ww = weight of water, in grams.
Wec = weight of exempt compounds, in grams.
Vm = volume of coating, in liters.

2.72 **VOC Content:** The weight of VOC per volume of coating or colorant. VOC Content is VOC Regulatory, as defined in Section 2.72, for all coatings or colorants except those in the Low Solids category. For coatings or colorants in the Low Solids category, the VOC Content is VOC Actual, as defined in Section 2.70. If the coating is a multi-component product, the VOC content is VOC Regulatory as mixed or catalyzed. If the coating contains silanes, siloxanes, or other ingredients that generate ethanol or other VOCs during the curing process, the VOC content must include the VOCs emitted during curing.

2.73 **VOC Regulatory:** VOC Regulatory is the weight of VOC per volume of coating or colorant, less the volume of water and exempt compounds. It is calculated with the following equation:

$$\textbf{VOC Regulatory} = \frac{(Ws - Ww - Wec)}{(Vm - Vw - Vec)}$$

Where:
VOC Regulatory = the grams of VOC per liter of coating, less water and exempt compounds (also known as "Coating VOC").
Ws = weight of volatiles, in grams.
Ww = weight of water, in grams.
Wec = weight of exempt compounds, in grams.
Vm = volume of coating, in liters.
Vw = volume of water, in liters.
Vec = volume of exempt compounds, in liters.

2.74 **Waterproofing Membrane:** A clear or opaque coating labeled and formulated for application to concrete and masonry surfaces to provide a seamless waterproofing membrane that prevents penetration of water into the substrate. Waterproofing Membranes are intended for the following waterproofing applications: below-grade surfaces, between concrete slabs, inside tunnels, inside concrete planters, and under flooring materials. The Waterproofing Membrane category does not include topcoats that are included in the Concrete/Masonry Sealer category (e.g., parking deck topcoats, pedestrian deck topcoats, etc.). Waterproofing Membranes must meet the following criteria:

2.74.1 Coating must be applied in a single coat of at least 25 mils (at least 0.025 inch) dry film thickness; and

2.74.2 Coatings must meet or exceed the requirements contained in ASTM C836/C836M-18 incorporated by reference in Section 6.5.17.

The Waterproofing Membrane category does not include topcoats that are included in the Concrete/Masonry Sealer category (e.g., parking deck topcoats, pedestrian deck topcoats, etc.).

2.75 **Western Nevada County:** Is based on a divide line that runs north/south near the Sierra crest, less than a mile east of the town of Soda Springs; the western portion of Nevada County, which lies west of a line, described as follows: Beginning at the Nevada-Placer County boundary and running north along the western boundaries of Sections 24, 13, 12, 1, Township 17 North, Range 14 East, Mount Diablo Base and Meridian, and Sections 36, 25, 24, 13, 12, Township 18 North, Range 14 East to the Nevada-Sierra County boundary.

2.76 **Wood Coating:** Coatings labeled and formulated for application to wood substrates only. The Wood Coatings category includes the following clear and semitransparent coatings: lacquers; varnishes; sanding sealers; penetrating oils; clear stains; wood conditioners used as undercoats; and wood sealers used as topcoats. The Wood Coatings category also includes the following opaque wood coatings: opaque lacquers; opaque sanding sealers; and opaque lacquer undercoaters. The Wood Coatings category does not include the following: clear sealers that are labeled and formulated for use on concrete/masonry surfaces; or coatings intended for substrates other than wood. Wood Coatings must be labeled "For Wood Substrates Only", in accordance with Section 4.10.

2.77 **Wood Preservative:** A coating labeled and formulated to protect exposed wood from decay or insect attack, that is registered with both the EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (7 United States Code (U.S.C.) Section 136, *et seq.*) and with the California Department of Pesticide Regulation.)

2.78 **Wood Substrate:** A substrate made of wood, particleboard, plywood, medium density fiberboard, rattan, wicker, bamboo, or composite products with exposed wood grain. Wood Products do not include items comprised of simulated wood.

2.79 Zinc-Rich Primer: A coating that meets all of the following specifications:

2.79.1 Contains at least 65 percent metallic zinc powder or zinc dust by weight of total solids; and

2.79.2 Is formulated for application to metal substrates to provide a firm bond between the substrate and subsequent applications of coatings; and

2.79.3 Is intended for professional use only and is labeled as such, in accordance with the labeling requirements in Section 4.11.

3 STANDARDS

3.1 VOC CONTENT LIMITS: Except as provided in and 3.3 and 3.4 no person shall:

a. manufacture, blend, or repackage for use within Western Nevada County;

b. supply, sell, market, or offer for sale within Western Nevada County; or

c. solicit for application or apply within the Western Nevada County, any architectural coating with a VOC content in excess of the corresponding limit specified in **Table 1**, after the specified effective date in **Table 1**. Limits are expressed as VOC Regulatory, thinned to the manufacturer's maximum thinning recommendation, excluding any colorant added to tint bases.

TABLE 1: VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS

Coating Category	Effective 1/1/2022)
Flat Coatings	50
Nonflat Coatings	100
Nonflat-High Gloss	150
Specialty Coatings:	
Aluminum Roof Coating	100
Basement Specialty Coating	400
Bituminous Roof Coating	50
Bituminous Roof Primers	350
Bond Breakers	350
Building Envelope Coatings	50
Concrete Curing Compounds	350
Concrete/Masonry Sealers	100
Conversion Varnish	550
Driveway Sealers	50
Dry Fog Coating	50
Faux Finishing Coating	350
Fire Resistant Coating	150
Floor Coatings	50

Form-Release Compounds	100
Graphic Arts Coating (Sign Paints)	500
High Temperature Coating	420
Industrial Maintenance Coatings	250
Low Solids Coatings	120
Magnesite Cement Coatings	450
Mastic Texture Coatings	100
Metallic Pigmented Coatings	500
Multi-Color Coatings	250
Pre-Treatment Wash Primers	420
Primers, Sealers, and Undercoaters	100
Reactive Penetrating Sealers	350
Recycled Coatings	250
Roof Coatings	50
Rust Preventative Coatings	250
Shellacs: • Clear • Opaque	 730 550
Specialty Primers, Sealers, and Undercoaters	100
Stains (Exterior/Dual, Interior)	100
Stone Consolidants	450
Swimming Pool Coatings	340
Tile and Stone Sealers	100
Traffic Marking Coatings	100
Tube and Tile Refinish Coatings	420
Waterproofing Membrane	100
Wood Coating	275
Wood Preservatives	350
Zinc-Rich Primers	340

3.2 Coating Not Listed in Table 1. VOC Content of Coatings : For any coating that does not conform with any of the definitions for the specialty coating categories listed in **Table 1**, the VOC content limit shall be determined by classifying the coating as a Flat or Nonflat coating, based on its gloss, as defined in Sections 2.25 and 2.41 and the corresponding Flat or Nonflat VOC limit in **Table 1** shall apply.

3.3 Most Restrictive VOC Content Limits: If a coating meets the definition in Section 2 for one or more specialty coating categories that are listed in **Table 1**, then that coating is not required to meet the VOC limits for Flat or Nonflat, but is required to meet the VOC limit for the applicable specialty coating listed in **Table 1**.

With the exception of the specialty coating categories specified in Sections 3.3.1 through 3.3.12, if a coating is recommended for use in more than one of the specialty coating categories listed in **Table 1**, the most restrictive (or lowest) VOC content limit shall apply. This requirement applies to: usage recommendations that appear anywhere on the coating container, anywhere on any label or sticker affixed to the container, or in any sales, advertising, or technical literature supplied by a manufacturer or anyone acting on their behalf This provision does not apply to the specialty coating categories specified below:

3.3.1 Metallic pigmented coatings.
3.3.2 Shellacs.
3.3.3 Pretreatment wash primers.
3.3.4 Industrial maintenance coatings.
3.3.5 Low-solids coatings.
3.3.6 Wood preservatives.
3.3.7 High temperature coatings.
3.3.8 Bituminous roof primers.
3.3.9 Specialty primers, sealers, and undercoaters.
3.3.10 Aluminum roof coatings.
3.3.11 Zinc-rich primers.
3.3.12 Wood Coatings

3.4 **Sell-through Provisions:** Coatings or colorants manufactured prior to January 1, 2022, shall comply with the following requirements:

3.4.1 A coating manufactured prior to January 1, 2022, may be sold, supplied, or offered for sale for up to three years after January 1, 2022. In addition, a coating manufactured before January 1, 2022, may be applied at any time, both before and after January 1, 2022, so long as the coating complied with all applicable provisions of this rule. This provision does not apply to any coating that does not display the date or date-code required by Section 4.1.

3.4.2 A colorant manufactured prior to January 1, 2022, may be sold, supplied, or offered for sale for up to three years after January 1, 2022. In addition, a colorant manufactured before January 1, 2022, may be applied at any time, both before and after January 1, 2022, so long as the colorant complied with all applicable provisions of this rule. This provision does not apply to any colorant that does not display the date or date-code required by Section 4.12.1.

3.5 **Thinning:** No person who applies or solicits the application of any architectural coating shall apply or specify the application of a coating that is thinned to exceed the applicable VOC limit specified in **Table 1**.

3.6 **Painting Practices:** All architectural coating containers used to apply the contents therein to a surface directly from the container by pouring, siphoning, brushing, rolling, padding, ragging or other means, shall be closed when not in use. These architectural coating containers include, but are not limited to, drums, buckets, cans, pails, trays or other application containers. Containers of any VOC-containing materials used for thinning and cleanup shall also be closed when not in use.

3.7 **Colorants:** No person within Western Nevada County shall, at the point of sale of any architectural coating subject to Section 3.1, add to such coating any colorant that contains VOC in excess of the corresponding applicable VOC limit specified in **Table 2.** VOC Content of Colorants. The point of sale includes retail outlets that add colorant to a coating container to obtain a specific color.

Table 2. VOC Content of Colorants

Colorant Added To	**VOC**
Coating Categories	**Grams/liter**
Architectural Coatings, excluding Industrial Maintenance Coatings	50
Solvent-Based Industrial Maintenance Coatings	600
Waterborne Industrial Maintenance Coatings	50
Wood Coatings	600

4 CONTAINER LABELING REQUIREMENTS

4.1 **Date Code:** The date the coating was manufactured, or a date code representing the date, shall be indicated on the label, lid, or bottom of the container. If the manufacturer uses a date code for any coating, the manufacturer shall file an explanation of each code with the Executive Officer of the Air Resources Board (ARB).

4.2 **Thinning Recommendations:** The manufacturer's thinning recommendations shall be indicated on the label or lid of the container. This requirement does not apply to the thinning of architectural coatings with water. If thinning of the coating prior to use is not necessary, the recommendation must specify that the coating is to be applied without thinning.

4.3 **VOC Content:** Each container of any coating subject to this rule shall display one of the following values in grams of VOC per liter of coating:

4.3.1 Maximum VOC Content as determined from all potential product formulations; or
4.3.2 VOC Content as determined from actual formulation data; or
4.3.3 VOC Content as determined using the test methods in Section 6.2.

If the manufacturer does not recommend thinning, the container must display the VOC Content, as supplied. If the manufacturer recommends thinning, the container must display the VOC Content, including the maximum amount of thinning solvent recommended by the manufacturer. If the coating is a multi-component product, the container must display the

VOC content as mixed or catalyzed. If the coating contains silanes, siloxanes, or other ingredients that generate ethanol or other VOCs during the curing process, the VOC content must include the VOCs emitted during curing. VOC Content shall be determined as defined in Sections 2.70, 2.71, and 2.72.

4.4 **Faux Finishing Coatings:** The labels of all clear topcoat faux finishing coatings shall prominently display the following statement: "This product can only be sold or used as a part of a Faux Finishing coating system".

4.5 **Industrial Maintenance Coatings:** The labels of all Industrial Maintenance coatings shall prominently display the statement "For industrial use only" or "For professional use only".

4.6 **Reactive Penetrating Sealers:** The labels of reactive penetrating sealers shall prominently display the statement "Reactive Penetrating Sealer".

4.7 **Rust Preventative Coatings:** The labels of all rust preventative coatings shall prominently display the statement "For Metal Substrates Only".

4.8 **Specialty Primers, Sealers, and Undercoaters:** The labels of all specialty primers, sealers, and undercoaters shall prominently display the statement "Specialty Primer, Sealer, Undercoater".

4.9 **Stone Consolidants:** The labels of Stone Consolidants shall prominently display the statement "Stone Consolidant – For Professional Use Only".

4.10 **Wood Coating:** The labels of Wood Coatings shall prominently display the statement "For Wood Substrates Only".

4.11 **Zinc Rich Primers:** The labels of Zinc-Rich Primers shall prominently display the statement "For professional use only".

4.12 Effective January 1, 2022, each manufacturer of any colorant subject to this rule shall display the information listed in Sections 4.12.1 and 4.12.2 on the container (or its label) in which the colorant is sold or distributed.

4.12.1 **Date Code:** The date the colorant was manufactured, or a date code representing the date, shall be indicated on the label, lid, or bottom of the container. If the manufacturer uses a date code for any colorant, the manufacturer shall file an explanation of each code with the Executive Officer.

4.12.2 **VOC Content:** Each container of any colorant subject to this rule shall display one of the following values in grams of VOC per liter of colorant:

4.12.2.1 Maximum VOC Content as determined from all potential product formulations; or

4.12.2.2 VOC Content as determined from actual formulation data; or

4.12.2.3 VOC Content as determined using the test methods in Section 6.2.

If the colorant contains silanes, siloxanes, or other ingredients that generate ethanol or other VOCs during the curing process, the VOC content must include the VOCs emitted during curing. VOC Content shall be determined as defined in Sections 2.69, 2.70, and 2.71.

5 REPORTING REQUIREMENTS

5.1 **Sales Data:** A responsible official from each manufacturer shall upon request of the Executive Officer of the CARB, or his or her delegate, provide data concerning the distribution and sales of architectural coatings. The responsible official shall within 180 days provide information, including, but not limited to:

5.1.1 the name and mailing address of the manufacturer;

5.1.2 the name, address, and telephone number of a contact person;

5.1.3 the name of the coating product as it appears on the label and the applicable coating category;

5.1.4 whether the product is marketed for interior or exterior use or both;

5.1.5 the number of gallons sold in California in containers greater than one liter (1.057 quart) and equal to or less than one liter (1.057 quart);

5.1.6 the VOC Actual content and VOC Regulatory content in grams per liter. If thinning is recommended, list the VOC Actual content and VOC Regulatory content after maximum recommended thinning. If containers less than one liter have a different VOC content than containers greater than one liter, list separately. If the coating is a multi-component product, provide the VOC content as mixed or catalyzed;

5.1.7 the names and CAS numbers of the VOC constituents in the product;

5.1.8 the names and CAS numbers of any compounds in the product specifically exempted from the VOC definition, as listed in Section 2.69.1 or 2.69.2;

5.1.9 whether the product is marketed as solventborne, waterborne, or 100% solids;

5.1.10 description of resin or binder in the product;

5.1.11 whether the coating is a single-component or multi-component product;

5.1.12 the density of the product in pounds per gallon;

5.1.13 the percent by weight of: solids, all volatile materials, water, and any compounds in the product specifically exempted from the VOC definition, as listed in Section 2.69.1 or 2.69.2; and

5.1.14 the percent by volume of: solids, water, and any compounds in the product specifically exempted from the VOC definition, as listed in Section 2.69.1 or 2.69.2.

All sales data listed in Sections 5.1.1 to 5.1.14 shall be maintained by the responsible official for a minimum of three years. Sales data submitted by the responsible official to the Executive Officer of the ARB may be claimed as confidential, and such information shall be handled in accordance with the procedures specified in Title 17, California Code of Regulations Sections 91000-91022.

6 COMPLIANCE PROVISIONS AND TESTING REQUIREMENTS

6.1 Calculations of VOC Content: For the purpose of determining compliance with the VOC content limits in **Table 1** or **Table 2**, the VOC content of a coating or colorant shall be determined as defined in Section 2.70, 2.71, or 2.72. The VOC content of a tint base shall be determined without colorant that is added after the tint base is manufactured. If the manufacturer does not recommend thinning, the VOC Content must be calculated for the product as supplied. If the manufacturer recommends thinning, the VOC Content must be calculated including the maximum amount of thinning solvent recommended by the manufacturer. If the coating is a multi-component product, the VOC content must be calculated as mixed or catalyzed. If the coating contains silanes, siloxanes, or other ingredients that generate ethanol or other VOCs during the curing process, the VOC content must include the VOCs emitted during curing.

6.2 VOC Content of Coatings: The VOC content of coatings or colorants shall be determined by the following:

6.2.1 To determine the physical properties of a coating or colorant in order to perform the calculations in Section 2.70 or 2.72, the reference method for VOC content is U.S. EPA Method 24, incorporated by reference in Section 6.5.9, except as provided in Sections 6.3 and 6.4.

6.2.2 An alternative method to determine the VOC content of coatings or colorants is SCAQMD Method 304-91 (Revised 1996), incorporated by reference in Section 6.5.9.

6.2.3 The exempt compounds content shall be determined by SCAQMD Method 303-91 (Revised 1996), BAAQMD Method 43 (Revised 2005), or BAAQMD Method 41 (Revised 2005), as applicable, incorporated by reference in Sections 6.5.8, 6.5.6, and 6.5.7, respectively.

6.2.4 To determine the VOC content of a coating or colorant, the manufacturer may use U.S. EPA Method 24, or an alternative method as provided in Section 6.3, formulation data, or any other reasonable means for predicting that the coating or colorant has been formulated as intended (e.g., quality assurance checks, record keeping). However, if there are any inconsistencies between the results of a Method 24 test and any other means for determining VOC content, the Method 24 test results will govern, except when an alternative method is approved as specified in Section 6.3.

6.2.5 To determine the VOC content of a coating or colorant with a VOC content of 150 g/l or less, the manufacturer may use SCAQMD Method 313, incorporated by reference in Section 6.5.29, ASTM D6886-18, incorporated by reference in Section 6.5.30, or any other reasonable means for predicting that the coating or colorant has been formulated as intended (e.g., quality assurance checks, record keeping).

6.2.6 The Western Nevada County Air Pollution Control Officer (APCO) may require the manufacturer to conduct a Method 24 analysis.

6.3 **Alternative Test Method:** Alternatively, the VOC content of coatings or colorants may be determined by SCAQMD Method 304-91 (1996), "Determination of Volatile Organic Compounds (VOC) in Various Materials", SCAQMD "Laboratory Methods of Analysis for Enforcement Samples".

6.4 **Methacrylate Traffic Marking Coatings:** Analysis of methacrylate multicomponent coatings used as traffic marking coatings shall be conducted according to a modification of U.S. EPA Method 24 (40 CFR 59, subpart D, Appendix A), incorporated by reference in Section 6.5.11. This method has not been approved for methacrylate multicomponent coatings used for other purposes than as traffic marking coatings or for other classes of multicomponent coatings.

6.5 **Test Methods:** The following test methods are incorporated by reference herein, and shall be used to test coatings subject to the provisions of this rule:

6.5.1 **Flame Spread Index:** The flame spread index of a fire-retardant coating shall be determined by ASTM E84-18b, "Standard Test Method for Surface Burning Characteristics of Building Materials" (see section 2, Fire-Retardant Coating).

6.5.2 **Fire Resistance Rating:** The fire resistance rating of fire-resistive coatings shall be determined by ASTM E119-20, "Standard Test Methods for Fire Tests of Building Construction and Materials" (see section 2, Fire-Resistive Coating).

6.5.3 **Glass Determination:** The gloss of flat and nonflat coatings shall be determined by ASTM D523- 14(2018), "Standard Test Method for Specular Gloss" (see section 2, Flat Coating and Nonflat Coating).

6.5.4 **Metal Content of Coatings:** SCAQMD Method 318-95, "Determination of Weight Percent Elemental Metal in Coatings by X-Ray Diffraction," SCAQMD Laboratory Methods of Analysis for Enforcement Samples (see section 2, Aluminum Roof, Faux Finishing, and Metallic Pigmented Coating).

6.5.5 **Acid Content of Coatings:** The acid content of Pretreatment Wash Primer shall be determined by ASTM D1613-17, "Standard Test Method for Acidity in Volatile Solvents and Chemical Intermediates

Used in Paint, Varnish, Lacquer, and Related Products" (see section 2, Pre-treatment Wash Primer).

6.5.6 Exempt Compounds – Siloxanes: Cyclic, branched, or linear completely methylated siloxanes shall be analyzed by BAAQMD Test Method 43, "Determination of Volatile Methylsiloxanes in Solvent Based Coatings, Inks, and Related Materials", BAAQMD Manual of Procedures, Volume III, adopted 05/18/2005 (see section 2, Volatile Organic Compound, and Section 6.2).

6.5.7 Exempt Compounds – Parachlorobenzotrifluoride (PCBTF): PCBTF shall be analyzed by BAAQMD Test Method 41, "Determination of Volatile Organic Compounds in Solvent Based Coatings and Related Materials Containing Parachlorobenzotrifluoride", BAAQMD Manual of Procedures, Volume III, adopted 05/18/2005 (see section 2, Volatile Organic Compound, and Section 6.2).

6.5.8 Exempt Compounds: The content of compounds exempt under EPA Test Method 24 shall be analyzed by SCAQMD Method 303-91 (1993), "Determination of Exempt Compounds", SCAQMD "Laboratory Methods of Analysis for Enforcement Samples" (see section 4, Volatile Organic Compound, and Section 6.2).

6.5.9 VOC Content of Coatings: The VOC content of a coating shall be determined by U.S. EPA Method 24 as it exists in appendix A of 40 Code of Federal Regulations (CFR) part 60, "Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings" (see Section 6.2).

6.5.10 Alternative VOC Content of Coatings: The VOC content of coatings may be analyzed either by U.S. EPA Method 24 or SCAQMD Method 304-91 (Revised 1996), "Determination of Volatile Organic Compounds (VOC) in Various Materials," SCAQMD Laboratory Methods of Analysis for Enforcement Samples (see Section 6.2).

6.5.11 Methacrylate Traffic Marking Coatings: The VOC content of methacrylate multicomponent coatings used as traffic marking coatings shall be analyzed by the procedures in 40 CFR part 59, subpart D, appendix A, "Determination of Volatile Matter Content of Methacrylate Multicomponent Coatings Used as Traffic Marking Coatings" (see Section 6.4).

6.5.12 Hydrostatic Pressure for Basement Specialty Coatings: ASTM D7088-17, "Standard Practice for Resistance to Hydrostatic Pressure for Coatings Used in Below Grade Applications Applied to Masonry" (see section 2, Basement Specialty Coating).

6.5.13 Tub and Tile Refinish Coating Adhesion: ASTM D4585/4585M-18, "Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation" and ASTM D3359-17, "Standard Test Methods for Measuring Adhesion by Tape Test" (see section 2, Tub and Tile Refinish Coating).

6.5.14 Tub and Tile Refinish Coating Hardness: ASTM D3363-05 (2011)e2, "Standard Test Method for Film Hardness by Pencil Test" (see section 2, Tub and Tile Refinish Coating).

6.5.15 Tub and Tile Refinish Coating Abrasion Resistance: ASTM D4060-14, "Standard Test Methods for Abrasion Resistance of Organic Coatings by the Taber Abraser" (see section 2, Tub and Tile Refinish Coating).

6.5.16 Tub and Tile Refinish Coating Water Resistance: ASTM D4585/4585M-18, "Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation" and ASTM D714-02 (2017), "Standard Test Method for Evaluating Degree of Blistering of Paints" (see section 2, Tub and Tile Refinish Coating).

6.5.17 Waterproof Membrane: ASTM C836/836M-18, "Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course" (see section 2, Waterproofing Membrane).

6.5.18 Mold and Mildew Growth for Basement Specialty Coatings: ASTM D3273-16, "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber" and ASTM D3274-09 (2017), "Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth or Soil and Dirt Accumulation" (see section 2, Basement Specialty Coating).

6.5.19 Reactive Penetrating Sealer Water Repellency: ASTM C67/C67M-18, "Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile"; or ASTM C97/97M-18, "Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone"; or ASTM C140/140M-18a, "Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units" (see section 2, Reactive Penetrating Sealer).

6.5.20 Reactive Penetrating Sealer Water Vapor Transmission: ASTM E96/E96M-16, "Standard Test Method for Water Vapor Transmission of Materials"; or ASTM D6490-99 (2014), "Standard Test Method for Water Vapor Transmission of Nonfilm Forming Treatments Used on Cementitious Panels" (see section 2, Reactive Penetrating Sealer).

6.5.21 Reactive Penetrating Sealer- Chloride Screening Applications: National Cooperative Highway Research Report 244 (1981), "Concrete Sealers for the Protection of Bridge Structures" (see section 2, Reactive Penetrating Sealer).

6.5.22 Stone Consolidants: ASTM E2167-01 (2008), "Standard Guide for Selection and Use of Stone Consolidants" (see section 2, Stone Consolidant).

6.5.23 Building Envelope Coating Air Permeance of Building Materials: ASTM E2178-13, "Standard Test Method for Air Permeance of Building Materials" (see section 2, Building Envelope Coating).

6.5.24 Building Envelope Coating Water Penetrating Testing: ASTM E331-00 (2016), "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference" (see section 2, Building Envelope Coating).

6.5.25 Building Envelope Coating Water Vapor Transmission: ASTM E96/96M-16, "Standard Test Methods for Water Vapor Transmission of Materials" (see section 2, Building Envelope Coating).

6.5.26 Tile and Stone Sealers Absorption: ASTM C373-18, "Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tile and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products"; or ASTM C97/97M-18, "Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone"; or ASTM C642-13, "Standard Test Method for Density, Absorption, and Voids in Hardened Concrete" (see section 2, Tile and Stone Sealers).

6.5.27 Tile and Stone Sealers – Static Coefficient of Friction: ANSI A137.1 (2012), "American National Standard of Specifications for Ceramic Tile" (see section 2, Tile and Stone Sealers).

6.5.28 Tile and Stone Sealers Water Vapor Transmission: ASTM E96/96M-16, "Standard Test Methods for Water Vapor Transmission of Materials" (see section 2, Tile and Stone Sealers).

6.5.29 VOC Content of Coatings: SCAQMD Method 313, "Determination of Volatile Organic Compounds (VOC) by Gas Chromatography/Mass Spectrometry/Flame Ionization Detection (GS/MS/FID)" (see section 6.2, VOC Content of Coatings).

6.5.30 VOC Content of Coatings: ASTM D6886-18, "Standard Test Method for Determination of the Weight Percent Individual Volatile Organic

Compounds in Waterborne Air-Dry Coatings by Gas Chromatography" (see section 6.2, VOC Content of Coatings).

7 VIOLATIONS

Failure to comply with any provision of this rule shall constitute a violation of this rule. The exceedance of the allowable emissions for any compliance period shall constitute a separate violation for each day of the compliance period. However, any violation of the requirements of the Averaging Provision of this Rule, which the violator can demonstrate, to the Executive Officer, did not cause or allow the emission of an air contaminant and was not the result of negligent or knowing activity may be considered a minor violation.