AIR POLLUTION CONTROL DISTRICT

IMPERIAL COUNTY
2017 STATE IMPLEMENTATION PLAN FOR THE 2008 8-HOUR OZONE STANDARD

September 2017

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Abbreviations and Acronyms

AERR	Air Emissions Reporting Requirements
AQMP	Air Quality Management Plan
AQI	Air Quality Index
AQIP	Air Quality Improvement Program
AQTF	Air Quality Task Force
ACT	Alternative Control Technique
BACM	Best Available Control Measure
BACT	Best Available Control Technology
BECC	Boarder Environment Cooperative Commission
CAA	Federal Clean Air Act
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CaRFG	California's Reformulated Gasoline program
CCAA	California Clean Air Act
CEC	California Energy Commission
CEIDARS	California Emission Inventory Development and Reporting System
CEPAM	California Emission Projection Analysis Model
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CHE	cargo handling equipment
CMAQ	Community Multiscale Air Quality
CO	carbon monoxide
CTG	Control Technique Guideline
DMV	Department of Motor Vehicles
DPR	Department of Pesticide Regulation
DV	design value
EMFAC	EMission FACtor model
ERC	emission reduction credit
FTIP	Federal Transportation Improvement Plan
GDF	gasoline dispensing facility
GVR	gasoline vapor recovery
hp	horsepower
ICAPCD	Imperial County Air Pollution Control District
IFNA	Imperial County Federal Nonattainment Area
IRP	International Registration Plan
LCAF	Large Confined Animal Facilities
LEV	low-emission vehicle
MACT	Maximum Achievable Control Technology
MDA8	Maximum daily average 8-hour
mph	miles per hour
MPO	Metropolitan Planning Organization
NAAQS	National Ambient Air Quality Standards
NOX	oxides of nitrogen
NO2	nitrogen dioxide

NSR	New Source Review
O3	ozone
ORVR	onboard refueling vapor recovery
Pb	lead
Perc	perchloroethylene
PM	particulate matter
PM2.5	particulate matter less than 2.5 microns in aerodynamic diameter
PM10	particulate matter less than 10 microns in aerodynamic diameter
POE	port of entry
Ppb	parts per billion
ppm	parts per million
RACM	Reasonably Available Control Measure
RACT	Reasonably Available Control Technology
REMI	Regional Economic Models, Inc.
RFP	reasonable further progress
ROG	reactive organic gases
RTP	Regional Transportation Plan
RTIP	Regional Transportation Improvement Plan
SCAG	Southern California Association of Governments
SCG	SoCAL Gas Company
SCS	Sustainable Communities Strategy
SIP	state implementation plan
SO2	sulfur dioxide
TCM	transportation control measure
TLEV	transitional low-emission vehicle
tpd	tons per day
TRU	transport refrigeration unit
ULEV	ultra-low-emission vehicle
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
VMT	vehicle miles traveled
VOC	volatile organic compound
WRF	Weather Research and Forecasting
ZEV	zero-emission vehicle

1 Introduction

1.1 Introduction

On March 12, 2008, the United States Environmental Protection Agency (USEPA) announced revisions to the primary and secondary National Ambient Air Quality Standard (NAAQS) for 8-hour ozone that included a new standard level of 0.075 parts per million (ppm).[1] This update to the previously established 1997 standard of 0.08 ppm, was deemed necessary in order to provide increased protection of human health and welfare. In accordance with the Clean Air Act (CAA), the USEPA is required to designate areas with their attainment status whenever a new NAAQS is promulgated. Thus, on May 21, 2012, the USEPA designated Imperial County as Marginal nonattainment for the 2008 8-hour ozone NAAQS.[2]

On May 4, 2016, the USEPA issued a final rule declaring that 11 areas previously classified as Marginal nonattainment had failed to attain the 2008 ozone NAAQS by the applicable attainment date of July 20, 2015, and thus were reclassified as Moderate nonattainment areas.[3] Imperial County was identified as one of these areas since the fourth highest daily maximum 8-hour average ozone concentration for at least one of its ambient air quality monitors was greater than 0.075 ppm for the 2012-2014 monitoring period. With the assignment of a Moderate nonattainment classification to an area, the state containing this area must submit a revised State Implementation Plan (SIP) that addresses the issues related to nonattainment, their underlying causes, and the steps necessary to reduce pollutant emissions and bring the region back into attainment of the standard. Per the May 4, 2016 rule, these SIP revisions must be submitted by January 1, 2017 and must meet the statutory and regulatory requirements that specifically apply to 2008 8-hour ozone nonattainment areas classified as Moderate. Additionally, the area must show attainment of the standard as expeditiously as practicable, but no later than July 20, 2018.

This 2017 SIP for the 2008 8-hour ozone standard, henceforth referred to as the “2017 Ozone SIP”, is a legal document that fulfills the stipulations contained under Title 40 of the Code of Federal Regulations (CFR) pertaining to the preparation, adoption, and submittal of State Implementation Plans. At a minimum, the 2017 Ozone SIP must address the following Moderate area requirements:[4]

- A comprehensive emission inventory;
- A demonstration of reasonable further progress (RFP) towards attainment;

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1 Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.

2 United States Environmental Protection Agency. 2012. *Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards; Final rule*. Federal Register. Vol. 77. No. 98. May 21, 2012. p. 30088.

3 United States Environmental Protection Agency. 2016*. Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Several Areas for the 2008 Ozone National Ambient Air Quality Standards; Final rule*. Federal Register. Vol. 81. No. 86. May 4, 2016. p. 26697.

4 Per CAA Sec. 182, State Implementation Plans for ozone nonattainment areas must also address Vehicle Inspection and Maintenance (I/M) programs as well as Stage 2 Gasoline Vapor Recovery (GVR) requirements. The Vehicle I/M program requirement does not apply to Imperial County since its population is below 200,000 people (40 CFR 51.350(a)(8)). The Stage 2 GVR requirements no longer apply to Moderate ozone nonattainment areas following the promulgation of the Onboard Refueling Vapor Recovery Rule (CAA Sec. 202(a)(6); 59 FR 16262, April 6, 1994).

- A discussion on the implementation of reasonably available control measures (RACM) and reasonably available control technology (RACT);
- Commitments to a new source review (NSR) permitting program, emission offsets at a ratio of 1.15 to 1, and an emissions statement rule;
- An attainment demonstration; and
- Contingency measures in the event that the area fails to meet RFP or attainment milestones.

One of Imperial County's unique features is also its greatest challenge in its mission to improve air quality. It serves as one of California's international gateways, sharing a border with Mexicali, Mexico, whose metropolitan area has more than five times the population of the entire County. As demonstrated in this SIP, a part of the reason why Imperial County has elevated ozone concentrations is because of transport of emissions from Mexico. Therefore, this 2017 Ozone SIP relies on the provisions in CAA Section 179B to demonstrate that Imperial County is in attainment of the 2008 8-hour ozone standard but for emissions emanating across the international border. A weight-of-evidence analysis has been included to show that Imperial County will maintain this status of attainment through the July 2018 attainment date. For a complete list of SIP requirements, please review the checklist provided in Chapter 11.

1.2 Purpose

Clean air is a valuable and essential resource that is vital to the health and welfare of the citizens of Imperial County and the local agricultural economy. Because the capacity of the air to absorb environmental contaminants is limited, wise management must be practiced in order to avoid significant deterioration of the resource. At its core, the CAA adopted the NAAQS to protect public health, vegetation, and materials, as well as to improve visibility. Continued compliance with the NAAQS can only be accomplished by developing, adopting, and implementing a SIP that specifically addresses those issues related to maintaining air quality in a sound, reasonable, and effective manner.

1.3 Background

Since the 1977 amendments to the CAA, areas of the country that violated the NAAQS for a particular pollutant were formally designated as nonattainment for that pollutant. With the 1990 amendments to the CAA, areas designated as nonattainment for the 1-hour ozone NAAQS were classified as to the degree of nonattainment status, effectively adding a greater degree of accountability upon states. Five classification categories were created (CAA Section 181). In increasing severity, these were Marginal, Moderate, Serious, Severe, and Extreme. Each classification retained a different attainment date which would guarantee further protection to public health and welfare. The classification of nonattainment areas is accomplished by the determination of a design value.

On July 18, 1997, the USEPA promulgated an 8-hour ozone NAAQS of 0.08 ppm in order to promote greater protection of public health by strengthening the already existing 1-hour ozone standard.[5] The new standard, henceforth referred to as the 1997 8-hour ozone NAAQS, was

[5] United States Environmental Protection Agency. 1997. *National Ambient Air Quality Standards for Ozone; Final rule.* Federal Register. Vol. 62. No. 138. July 18, 1997. p. 38856.

much more stringent than the previous 1-hour ozone standard. With the promulgation of the 1997 8-hour ozone NAAQS, the USEPA classified Imperial County as a Marginal nonattainment area on April 30, 2004.[6] Subsequently, on February 13, 2008 the USEPA found that Imperial County failed to meet attainment for the 1997 8-hour ozone NAAQS by the Marginal area deadline of June 15, 2007.[7] As a result, Imperial County was reclassified as a Moderate nonattainment area for the 1997 8-hour ozone NAAQS. Those areas originally classified as Moderate for the 1997 8-hour ozone NAAQS were required to attain the standard "as expeditiously as practicable," but no later than 6 years after designation (i.e., by June 15, 2010).

On December 3, 2009, the USEPA issued a final ruling determining that Imperial County had attained the 1997 8-hour ozone NAAQS. This determination was based upon complete, quality-assured, and certified ambient air monitoring data for the years 2006 through 2008. This determination effectively suspended the requirement for the state to submit an attainment demonstration, an RFP plan, contingency measures, and other planning requirements for so long as Imperial County continued to attain the 1997 8- hour ozone NAAQS. However, this determination did not constitute a redesignation to attainment under CAA Section 107(d)(3). Therefore, the classification and designation status for Imperial County remained as a Moderate nonattainment area for the 1997 8-hour ozone NAAQS. As such, Imperial County was required to submit for USEPA approval an 8-hour ozone "modified" Air Quality Management Plan (AQMP). This plan was drafted and completed as the *2009 1997 8-Hour Ozone Modified Air Quality Management Plan* ("2009 Ozone AQMP").[8] On July 30, 2010, it was adopted by the Imperial County Air Pollution Control District (ICAPCD or "District") along with the *2009 Reasonably Available Control Technology State Implementation Plan* ("2009 RACT SIP").[9] Both plans were approved by the California Air Resources Board (CARB) on November 18, 2010 and sent on to the USEPA as revisions to the state of California's SIP.[10] Together, these plans addressed the CAA requirements for areas of Moderate nonattainment for the 1997 8-hour ozone NAAQS.

The 8-hour ozone standard was revised in March 2008 to a more stringent level of 0.075 ppm. The subsequent implementation rule that was promulgated on March 6, 2015 ("2015 Ozone Implementation Rule") provided details regarding the revocation of the 1997 8-hour ozone

[6] United States Environmental Protection Agency. 2004. *Air Quality Designations and Classifications for the 8-Hour Ozone National Ambient Air Quality Standards; Early Action Compact Areas with Deferred Effective Dates; Final rule*. Federal Register. Vol. 69. No. 84. April 30, 2004. p. 23858.

[7] United States Environmental Protection Agency. 2008. *Determination of Nonattainment and Reclassification of the Imperial County, 8-Hour Ozone Nonattainment Area; Final rule.* Federal Register. Vol. 73. No. 30. February 13, 2008. p. 8209.

[8] Imperial County Air Pollution Control District. 2010. Final 2009 1997 8-Hour Ozone Modified Air Quality Management Plan. July 13. Available at: http://www.co.imperial.ca.us/AirPollution/PlanningDocs/StatePlans/8_HR_OZONE_AQMP.pdf. Accessed: October 2016.

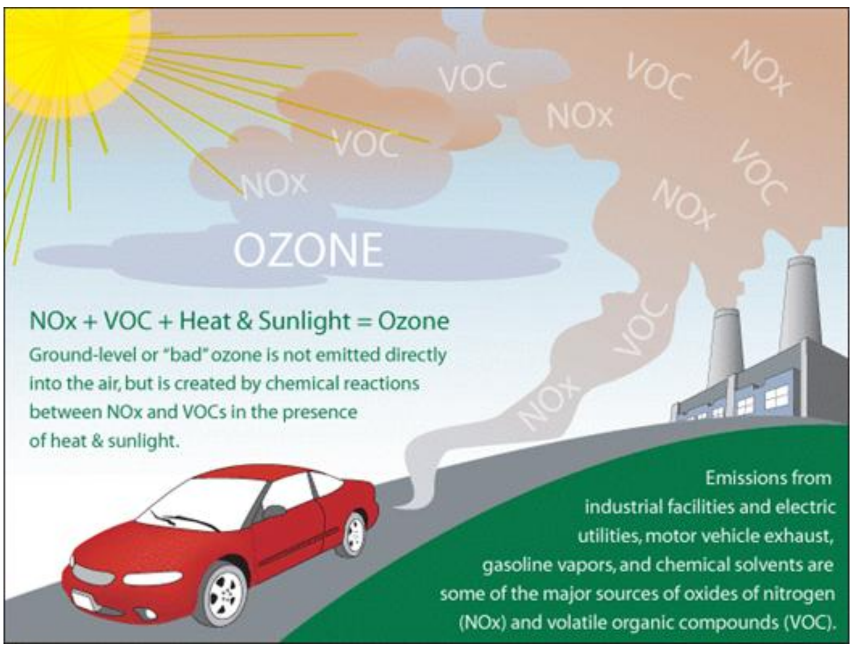
[9] Imperial County Air Pollution Control District. 2010. Final 2009 Reasonably Available Control Technology State Implementation Plan. July 13. Available at: http://www.co.imperial.ca.us/AirPollution/PlanningDocs/StatePlans/FINAL_RACTANALYSIS.pdf. Accessed: October 2016.

[10] California Air Resources Board. 2010. Letter from James Goldstene, CARB Executive Officer, to Jared Blumenfeld, Regional Administrator of USEPA Region 9. December 21. Available at: http://www.arb.ca.gov/planning/sip/planarea/imperial/arb_subltr.pdf. Accessed: August 2016.

NAAQS and the anti-backsliding requirements that would apply once the 1997 8-hour ozone NAAQS was revoked.[11] Revocation of the 1997 8-hour ozone NAAQS became effective on April 6, 2015.[12]

1.4 Ozone Production and Health Effects

Ozone exists in two layers of the atmosphere. Ozone in the troposphere, which is the atmospheric layer closest to Earth's surface, is known as ground-level ozone. Ground-level or "bad" ozone is not emitted directly into the air, but rather is formed by a complex series of chemical reactions involving oxides of nitrogen (NO_X), the result of combustion processes, and reactive organic gases (ROG) in the presence of sunlight. Organic gases are also known as volatile organic compounds (VOCs) and include many industrial solvents, toluene, xylene, and hexane, as well as the various hydrocarbons that are evaporated from gasoline used by motor vehicles or emitted through the tailpipe following combustion. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NO_X and VOCs.



Bad Ozone. Ground-level or "bad" ozone is an air pollutant that is harmful to the human respiratory function and is known to damage crops, trees, and other vegetation. It is the main component of urban smog. At ground level, ozone is of greatest concern during the summer months because strong sunlight and hot weather result in harmful ozone concentrations in the ambient air. This is because ozone's formation is promoted by strong sunlight, warm

[11] United States Environmental Protection Agency. 2015. *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; Final rule.* Federal Register. Vol. 80. No. 44. March 6, 2015. p. 12264.

[12] The USEPA promulgated a new 8-hour ozone standard in 2015 with a level of 0.070 ppm. Area designations are still pending. For this reason, this standard is not addressed in the 2017 Ozone SIP.

temperatures, and winds. High concentrations of ground-level ozone tend to be a problem in Imperial County only during the hot summer months when these conditions frequently occur.

Good Ozone. Ozone occurs naturally in the Earth's upper atmosphere, 6 to 30 miles above the Earth's surface, where it forms a protective layer that shields the Earth from the sun's harmful ultraviolet rays. Manmade chemicals are known to destroy this beneficial ozone. Areas where the protective "ozone layer" has been significantly depleted, such as over the North and South Poles, are sometimes called "ozone holes". The United States, along with over 180 other countries, recognized the threats posed by ozone depletion and in 1987 adopted a treaty called the Montreal Protocol to phase out the production and use of ozone-depleting substances. As part of this treaty, the USEPA has established regulations to phase out ozone-depleting chemicals in the United States.

Health Effects. Repeated exposure to ozone pollution may cause permanent damage to the lungs. Even when ozone is present in low levels, inhaling it triggers a variety of health problems. Although breathing impairment is the primary and most noticeable health effect, ozone can cause chest pains, coughing, throat irritation, and congestion.[13] It can also worsen bronchitis, heart disease, emphysema, and asthma, and reduce lung capacity. Asthma is a significant and growing threat to children and adults. Ozone can aggravate asthma, causing more asthma attacks, increased use of medication, more need for medical treatment, and more frequent visits to hospital emergency clinics.[14] If exposure to higher concentrations is of limited duration, most people can recover to their previous functioning level. However, studies have shown that routine exposure to lower concentrations of ozone can cause chronic lung damage in children, with permanent reductions in lung capacity of up to 50 percent measured.[15]

Healthy people also experience difficulty breathing when exposed to ozone pollution. Because ozone pollution usually forms in hot weather, anyone who spends time outdoors in the summer may be affected, particularly children, the elderly, outdoor workers, and people exercising outdoors. Children are most at risk from exposure to ozone because they are frequently active outside, playing and exercising, during the summertime when ozone levels are at their highest. Table 1-1 presents Imperial County's population at risk from ozone exposure as of 2016.

Table 1-1. Imperial County's Population at Risk from Ozone Exposure

Groups at Risk	Population
Pediatric Asthma:	4,527 (2.5%)

[13] United States Environmental Protection Agency. 2003. Ozone: Good up High, Bad Nearby. Office of Air and Radiation. June. EPA-451/K-03-001. Available at: https://www.epa.gov/ozone-pollution/health-effects-ozone-pollution. Accessed August 2016.

[14] United States Environmental Protection Agency. 1999. Smog – Who Does It Hurt? What You Need to Know About Ozone and Your Health. Office of Air and Radiation. July. EPA-452/K-99-001. Available at: https://www.epa.gov/sites/production/files/2015-06/documents/smog.pdf. Accessed: August 2016.

[15] San Luis Obispo County Air Pollution Control District Board. 2001. Clean Air Plan San Luis Obispo County. December. Available at: http://www.slocleanair.org/images/cms/upload/files/business/pdf/CAP.pdf. Accessed August 2016.

Table 1-1. Imperial County's Population at Risk from Ozone Exposure

Groups at Risk	Population
Adult Asthma:	9,863 (5.5%)
Chronic Obstructive Pulmonary Disease:	6,045 (3.4%)
Cardiovascular Disease:	8,897 (5.0%)
Diabetes:	12,790 (7.1%)
Total Population:	179,091
Population Under 18:	51,111 (28.5%)
Population 65 & Over:	21,523 (12.0%)

Source: American Lung Association. 2016. State of the Air: 2016. California: Imperial. Available at: http://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/states/california/imperial.html. Accessed: August 2016.

Environmental Effects. Ground-level ozone damages plant life and is responsible for an estimated 500 million dollars in reduced crop production in the United States each year. Ozone interferes with the ability of plants to produce and store food, making them more susceptible to disease, insects, other pollutants, and harsh weather. It damages the foliage of trees and other plants, ruining the landscapes of cities, parks, forests, and recreation areas.

Ozone is also considered a serious threat to California agriculture and native vegetation due to its pervasive nature. Many sensitive plant species are known to suffer damage at concentrations below human health standards. Ozone interferes with photosynthesis by attacking leaves, causing them to yellow, develop dead areas, and fall off early. Ozone stunts growth in many crop varieties, reduces yields, and can cause aesthetic damage which lowers market value. Many of the crops grown within this County are particularly sensitive to ozone injury, including orchard crops, lettuce, and several other varieties of vegetation.

1.5 Responsibilities of Agencies

Agencies with direct and indirect interest in air quality which participate in the planning process as it pertains to the CAA are discussed below.

United States Environmental Protection Agency (USEPA)

The USEPA administers the CAA and other air quality related legislation. As a regulatory agency, USEPA's responsibilities include establishing national emission limits for major sources of air pollution, inspecting and monitoring emission sources, enforcing federal air quality laws, promulgating new regulations, providing financial and technical support for air quality research and development programs, establishing the NAAQS, and preparing guidance for and taking action on air quality plans to meet and/or maintain those NAAQS. Ultimately, the USEPA is required to take action on the California SIP. The California SIP is comprised of air quality plans developed at the regional or local level. Each of these plans is individually reviewed and approved by the USEPA prior to incorporation into the SIP. The USEPA has the power to impose sanctions for failure to submit a plan or carry out commitments in a plan. Sanctions could include offset sanctions and the withholding of federal highway funds.

California Air Resources Board (CARB)

CARB is the state agency responsible for the coordination and administration of both state and federal air pollution control programs in California. CARB undertakes research, sets state ambient air quality standards (CAAQS), provides technical assistance to local air pollution control districts, compiles emission inventories, develops suggested control measures, and provides oversight of air pollution control district control programs.

A key function of CARB is to coordinate and guide regional and local air quality planning efforts required by the California Clean Air Act (CCAA), and to prepare and submit required SIPs to the USEPA. CARB also establishes emission standards for motor vehicles. The CAA allows California to adopt more stringent vehicle emission standards than the rest of the nation due to California's severe air pollution problem.

Imperial County Air Pollution Control District (ICAPCD)

ICAPCD shares responsibility with CARB for ensuring that all state and federal ambient air quality standards are achieved and maintained within the County. State law assigns to local air pollution control districts the primary responsibility for control of air pollution from stationary sources, while reserving an oversight role for CARB. Generally, the air pollution control districts must meet minimum state and USEPA program requirements. The air pollution control district is also responsible for the inspection of stationary sources, monitoring of ambient air quality, and planning activities such as modeling and maintenance of the emissions inventory.

2 Planning Area

2.1 Physical Description of the Planning Area

Imperial County extends over 4,284 square miles[16] in the southeastern corner of California. It is bordered on the south by Mexico, on the east by Arizona, on the west by the Coyote and Fish Creek Mountains (which are in San Diego County), and on the north by Riverside County. The Salton Trough runs approximately northwest to southeast through the center of the County and extends into Mexico. The elevation in Imperial County ranges from about 230 feet below sea level at the Salton Sea in the north to more than 2,800 feet on the mountain summits to the east.

2.2 Climate

Climatic conditions in Imperial County are governed by the large-scale sinking and warming of air in the semi-permanent tropical high pressure center of the Pacific Ocean. The high pressure ridge blocks out most mid-latitude storms except in winter when it is weakest and farthest south. The coastal mountains prevent the intrusion of any cool, damp air found in California coastal environs. Because of the barrier and weakened storms, Imperial County experiences clear skies, extremely hot summers, mild winters, and little rainfall. The sun shines, on the average, more in Imperial County than anywhere else in the United States.

Winters are mild and dry with daily average temperatures ranging between 65 and 75ºF (18-24ºC). During winter months it is not uncommon to record maximum temperatures of up to 80ºF. Summers are extremely hot with daily average temperatures ranging between 104 and 115ºF (40-46ºC). It is not uncommon to record maximum temperatures of 120ºF during summer months.

The flat terrain of the valley and the strong temperature differentials created by intense solar heating, produce moderate winds and deep thermal convection. The combination of subsiding air, protective mountains, and distance from the ocean all combine to severely limit precipitation. Rainfall is highly variable with precipitation from a single heavy storm able to exceed the entire annual total during a later drought condition. The average annual rainfall is just over three inches (7.5 centimeters) with most of it occurring in late summer or mid-winter.

Humidity is low throughout the year, ranging from an average of 28 percent in summer to 52 percent in winter. The large daily oscillation of temperature produces a corresponding large variation in the relative humidity. Nocturnal humidity rises to 50 to 60 percent, but drops to about 10 percent during the day.

The wind in Imperial County follows two general patterns. Wind statistics indicate prevailing winds are from the west-northwest through southwest; a secondary flow maximum from the southeast is also evident. The prevailing winds from the west and northwest occur seasonally from fall through spring and are known to be from the Los Angeles area. Occasionally, Imperial County experiences periods of extremely high wind speeds. Wind speeds can exceed 31 miles per hour (mph) and this occurs most frequently during the months of April and May. However,

[16] Official website of Imperial County, http://www.co.imperial.ca.us/.

speeds of less than 6.8 mph account for more than one-half of the observed wind measurements.

2.3 Atmospheric Stability and Dispersion

Air pollutant concentrations are primarily determined by the amount of pollutant emissions in an area and the degree to which these pollutants are dispersed in the atmosphere. The stability of the atmosphere is one of the key factors affecting pollutant dispersion. Atmospheric stability regulates the amount of vertical and horizontal air exchange, or mixing, that can occur within a given air basin. Restricted mixing and low wind speeds are generally associated with a high degree of stability in the atmosphere. These conditions are characteristic of temperature inversions.

In the atmosphere, air temperatures normally decrease as altitude increases. At varying distances above the Earth's surface, however, a reversal of this gradient can occur. This condition, termed an “inversion”, is simply a warm layer of air above a layer of cooler air, and it has the effect of limiting the vertical dispersion of pollutants. The height of the inversion determines the size of the mixing volume trapped below. Inversion strength or intensity is measured by the thickness of the layer and the difference in temperature between the base and the top of the inversion. The strength of the inversion determines how easily it can be broken by winds or solar heating.

Imperial County experiences surface inversions almost every day of the year. Due to strong surface heating, these inversions are usually broken allowing pollutants to be more easily dispersed. Weak surface inversions are caused by radiative cooling of air in contact with the cold surface of the Earth at night. In valleys and low lying areas, this condition is intensified by the addition of cold air flowing down slope from the hills and pooling on the valley floor.

However, in some circumstances the presence of the Pacific high pressure cell can cause the air to warm to a temperature higher than the air below. This highly stable atmospheric condition, termed a subsidence inversion can act as a nearly impenetrable lid to the vertical mixing of pollutants. The strength of these inversions makes them difficult to disrupt. Consequently, they can persist for one or more days, causing air stagnation and the build-up of pollutants. Highest and worst-case ozone levels are often associated with the presence of this type of inversion.

2.4 Land Use

Imperial County’s agricultural industry was valued at $1.86 billion in 2014. Vegetable and melon crops led the County tally, grossing more than $720 million, followed by field crops (e.g., hay) which grossed $531 million. More than 100 types of crops and commodities are grown in Imperial County, and in 2013, it ranked ninth out of all 58 counties in California for gross value of agricultural production.[17] Approximately half a million acres of land were harvested in Imperial County in 2014 and this amount has remained fairly constant over the past decade. During the high season, approximately 25 percent of Imperial County’s labor force works in the Agricultural

[17] Imperial County. 2014 Imperial County Agricultural Crop and Livestock Report. Imperial County Agricultural Commissioner’s Office. Available at: http://www.co.imperial.ca.us/ag/docs/spc/crop_reports/2014_Imperial_County_Crop_and_Livestock_Report.pdf. Accessed: August 2016.

Sector. Additionally, Imperial County has more acreage and production of alfalfa than any other county in the United States. It is also a major producer of lettuce, feedlot beef, melons, carrots, Sudan grass hay, onions, and numerous other commodities.

2.5 Population

Growth has been a central part of local discussion for the past few years in the Imperial County. Table 2-1 below shows the population estimates for the larger incorporated areas in Imperial County. In addition, the category “Balance of County” identifies the population estimates for the cities of Bombay Beach, Desert Shores, Heber, Niland, Ocotillo, Palo Verde, Salton City, Salton Sea Beach, Seeley, and Winterhaven. The increase in population is evident when comparing the populations for 1990 and 2015. Between 1990 and 2015, Imperial County increased its population by 75,200 new residents or approximately 70 percent.

Table 2-1. Incorporated Cities in Imperial County

City/Area	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015
Brawley	18,923	21,186	21,912	22,381	24,937	25,321	25,670	25,867	26,018	26,327
Calexico	18,633	23,679	26,988	35,056	38,506	39,049	39,497	39,597	39,809	40,092
Calipatria	2,690	7,071	7,291	7,621	7,797	7,671	7,976	7,050	7,447	7,367
El Centro	31,405	36,869	37,871	39,147	42,544	43,169	43,713	44,201	44,443	44,946
Holtville	4,820	5,497	5,600	5,336	5,944	6,011	6,031	5,986	6,007	6,052
Imperial	4,113	6,125	7,496	10,093	14,667	15,102	15,492	16,160	16,829	17,517
Westmorland	1,380	1,785	2,112	2,319	2,228	2,252	2,261	2,240	2,238	2,251
Balance of County	27,339	32,636	32,578	33,840	37,621	37,795	38,333	39,120	39,151	39,948
County Total	**109,303**	**134,848**	**141,848**	**155,793**	**174,244**	**176,370**	**178,973**	**180,221**	**181,942**	**184,500**

Source: State of California Department of Finance. Population Estimates. Available at: http://www.dof.ca.gov/Forecasting/Demographics/Estimates/. Accessed: August 2016.

3 Existing Air Quality

3.1 Air Quality Standards

In 1970, Congress simultaneously created the USEPA and passed the CAA in a national campaign to maintain healthy air quality by way of establishing standards for the control of air pollution. The CAA was subsequently amended in 1990, which intensified the national air quality control efforts. The provisions within the 1990 amendments included NAAQS for six common air pollutants, state attainment plans, vehicle emission standards, stationary source emission standards, permitting programs, and enforcement provisions.

The USEPA established the NAAQS based on identified impacts to humans and the environment. Primary NAAQS standards are designated to protect human health, while secondary NAAQS standards are designated to protect public welfare and the environment. The CAA requires not only that the USEPA establish the NAAQS, but also that it periodically review and amend those standards as needed.

Over the past several decades, the federal government has set and periodically revised the NAAQS for pollutants that are of the greatest public health concern. These standards encompass the most common varieties of airborne materials which can pose a health hazard. The NAAQS is expressed as a measure of the amount of pollutant per unit of air. Because these pollutants are found all over the United States, tribal, state, and local governments must comply with the CAA by meeting the NAAQS. As a consequence, pollutants with these ambient standards remain the chief focus of air quality management activities around the nation.

At the state and national level, the process of setting standards involves careful review of scientific studies which relate pollutant concentrations to public health and welfare. These studies are used to establish the criteria on which the standards are based. Air quality standards are typically set at levels which provide a reasonable margin of safety and protect the health of the most sensitive individuals in the population. Pollutants for which ambient standards have been established based on the criteria studies mentioned above are known as "criteria pollutants". Criteria pollutants include ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). Different standards for these and other pollutants have been set by the federal and California governments. California standards tend to be more restrictive than national standards.

The CCAA requires air pollution control districts to use the more restrictive state standards when setting up New Source Review (NSR) limits in order to achieve no net increase in emissions. In addition, state law requires all districts that cannot demonstrate attainment of the state ozone standard to adopt all feasible measures to reduce ROG and NO_X, the precursors to ozone. Beyond the tighter standards for the criteria pollutants listed above, California has also set standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. The ambient air quality standards for each of these pollutants are shown in Table 3-1.

Table 3-1. Ambient Air Quality Standards

Ambient Air Quality Standards						
Pollutant	Averaging Time	California Standards [1]		National Standards [2]		
		Concentration [3]	Method [4]	Primary [3,5]	Secondary [3,6]	Method [7]
Ozone (O_3)[8]	1 Hour	0.09 ppm (180 µg/m^3)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 µg/m^3)		0.070 ppm (137 µg/m^3)		
Respirable Particulate Matter (PM10)[9]	24 Hour	50 µg/m^3	Gravimetric or Beta Attenuation	150 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m^3		—		
Fine Particulate Matter (PM2.5)[9]	24 Hour	—	—	35 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m^3	Gravimetric or Beta Attenuation	12.0 µg/m^3	15 µg/m^3	
Carbon Monoxide (CO)	1 Hour	20 ppm (23 mg/m^3)	Non-Dispersive Infrared Photometry (NDIR)	35 ppm (40 mg/m^3)	—	Non-Dispersive Infrared Photometry (NDIR)
	8 Hour	9.0 ppm (10 mg/m^3)		9 ppm (10 mg/m^3)	—	
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)		—	—	
Nitrogen Dioxide (NO_2)[10]	1 Hour	0.18 ppm (339 µg/m^3)	Gas Phase Chemiluminescence	100 ppb (188 µg/m^3)	—	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 µg/m^3)		0.053 ppm (100 µg/m^3)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[11]	1 Hour	0.25 ppm (655 µg/m^3)	Ultraviolet Fluorescence	75 ppb (196 µg/m^3)	—	Ultraviolet Flourescence; Spectrophotometry (Pararosaniline Method)
	3 Hour	—		—	0.5 ppm (1300 µg/m^3)	
	24 Hour	0.04 ppm (105 µg/m^3)		0.14 ppm (for certain areas)[11]	—	
	Annual Arithmetic Mean	—		0.030 ppm (for certain areas)[11]	—	
Lead[12,13]	30 Day Average	1.5 µg/m^3	Atomic Absorption	—	—	High Volume Sampler and Atomic Absorption
	Calendar Quarter	—		1.5 µg/m^3 (for certain areas)[12]	Same as Primary Standard	
	Rolling 3-Month Average	—		0.15 µg/m^3		
Visibility Reducing Particles[14]	8 Hour	See footnote 14	Beta Attenuation and Transmittance through Filter Tape	No National Standards		
Sulfates	24 Hour	25 µg/m^3	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m^3)	Ultraviolet Fluorescence			
Vinyl Chloride[12]	24 Hour	0.01 ppm (26 µg/m^3)	Gas Chromatography			

Table 3-1 (continued). Ambient Air Quality Standards

1. California standards for ozone, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, and particulate matter (PM10, PM2.5, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

2. National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24 hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For PM2.5, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current national policies.

3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4. Any equivalent measurement method which can be shown to the satisfaction of the ARB to give equivalent results at or near the level of the air quality standard may be used.

5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

7. Reference method as described by the U.S. EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the U.S. EPA.

8. On October 1, 2015, the national 8-hour ozone primary and secondary standards were lowered from 0.075 to 0.070 ppm.

9. On December 14, 2012, the national annual PM2.5 primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24-hour PM2.5 standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was the annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM10 standards (primary and secondary) of 150 $\mu g/m^3$ also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.

10. To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.

11. On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

    Note that the 1-hour national standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the 1-hour national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

12. The ARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

13. The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

14. In 1989, the ARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.

For more information please call ARB-PIO at (916) 322-2990 **California Air Resources Board (5/4/16)**

3.2 Ambient Air Quality Monitoring

Imperial County began its ambient air quality monitoring program in 1976. However, monitoring of ozone didn't begin until 1986 with monitoring at the El Centro station. Currently, ground-level ozone concentrations in Imperial County are measured at four monitoring stations: Calexico-Ethel, El Centro, Westmorland, and Niland. These stations form a monitoring network oriented south to north from the United States-Mexico border. Figure 3-1 shows the location of these monitoring stations plus Imperial County's fifth monitoring station, Brawley, which does not measure ozone. In addition to the Imperial County monitoring stations, ozone monitoring stations have been established across the border in Mexicali, Mexico. These stations were originally founded to help identify cross-border transport of pollutants and associated pollutant precursors but data collection from these monitors has been historically discontinuous.

Air quality monitoring is typically performed in locations representative of where people live and/or work and is used to meet multiple objectives. These include determining compliance with air quality standards, identifying areas with the highest pollutant concentrations, evaluating pollutant transport, and reporting on air quality levels to the public.

For most pollutants, continuous monitoring occurs 24 hours a day, usually for periods of many years at one location. After many years of continual monitoring, a baseline level can be established and used to identify trends and progress towards air quality goals. Air quality monitoring demands close attention by experienced technicians. In Imperial County, stringent quality assurance procedures for instrument operation and data validation are followed before monitoring data is included into the County's air quality record. These measurements are then stored in a comprehensive air quality database maintained by the USEPA.[18] CARB also maintains an air quality database that can be accessed through its webpage.[19]

[18] United States Environmental Protection Agency. AQS Data Mart. Available at: https://aqs.epa.gov/aqsweb/documents/data_mart_welcome.html. Accessed: October 2016.

[19] California Air Resources Board. iADAM: Air Quality Data Statistics. Available at: https://www.arb.ca.gov/adam/. Accessed: October 2016.

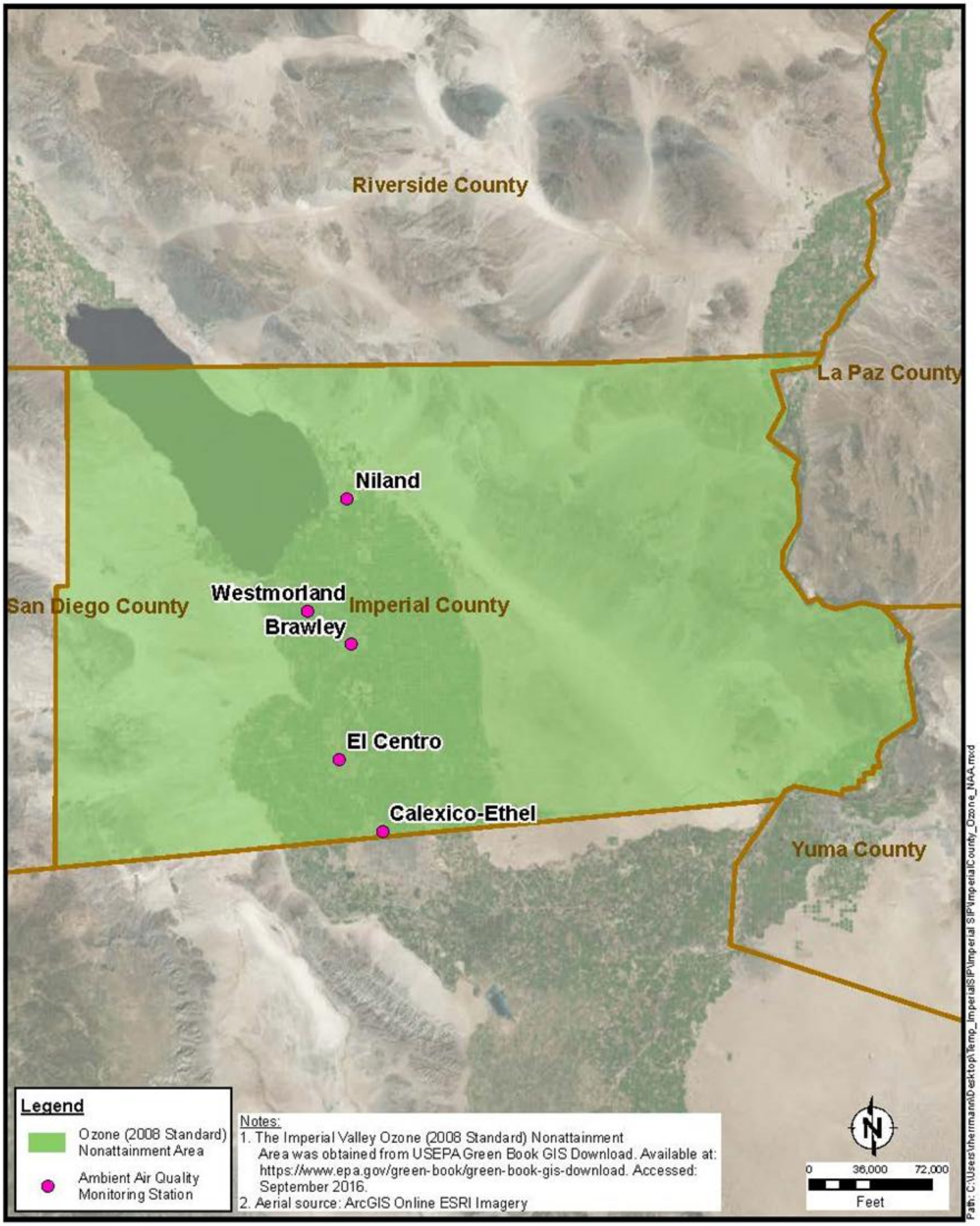


Figure 3-1. Locations of Imperial County Monitoring Stations

Calexico-Ethel – The Calexico-Ethel monitoring station was installed in 1994 and is operated and maintained by CARB. Located above sea level, it has an absolute location of latitude 32° 40' 34" and longitude 115° 28' 59". Its relative location is 1029 Belcher Street within the property boundary on the southeast corner of the Calexico High School football field parking lot. To the north is located an athletic sports field used for football, baseball, and track. The monitoring station is surrounded by a suburban neighborhood directly to the south, southeast, and southwest and is approximately 0.75 miles (1.2 kilometers) directly north of the international border crossing. The site currently records measurements for ozone (O_3), CO, NO_2, SO_2, $PM_{2.5}$, PM_{10}, Pb, and toxics.

El Centro - The El Centro monitoring station was installed in 1986. Located above sea level, its absolute location is latitude 32° 47' 32" and longitude 115°33' 47". Its relative location is 150 South 9th Street on the roof of the ICAPCD building. The monitoring station is surrounded by government and commercial buildings. It is the first monitoring site north of the City of Calexico, continuing the south to north monitoring network for Imperial County. The El Centro monitoring station is classified as urban with large agricultural areas to the east and west of the city's boundaries. This site records measurements for O_3, CO, NO_2, $PM_{2.5}$, and PM_{10}.

Brawley - The current Brawley monitoring station, which was installed in 2003 as a new station, replaced the old one which was installed in 1982. It is located below sea level and has an absolute location of latitude 32° 58' 42" and longitude 115° 32' 21". Its relative location is 220 Main Street atop the Imperial County courthouse in the middle of the city of Brawley, surrounded by commercial buildings. Like other cities within Imperial County, Brawley is surrounded by agricultural lands to the east, north, and west. The Brawley station is the third northernmost station within the Imperial County monitoring network. This site records measurements for $PM_{2.5}$ and PM_{10}.

Westmorland - The Westmorland monitoring station was installed in 1994 and commenced measuring ozone in 1998. Located below sea level, its absolute location is latitude 33° 1' 57" and longitude 115° 37' 25". Its relative location is 570 Cook Street in Westmorland. The site is the second northernmost station within the Imperial County monitoring network. It lies west of the Brawley monitor, but southwest of the Niland monitor. Residential and agricultural areas lie within 10 meters and 400 meters of the site, respectively. The site originally monitored both O_3 and PM_{10} concentrations, but in November 2012, the station experienced an electrical fire and the O_3 monitor was placed out of commission.

Niland - The Niland monitoring station was installed in 1996 and commenced measuring ozone in 1997. Located below sea level, its absolute location is latitude 33° 12' 49" and longitude 115° 32' 43". Its relative location is 7711 English Road. It is adjacent to English Road, which is an unpaved and lightly travelled road (approximately 100 vehicles per day). The monitoring site is surrounded by agricultural land to the south, southwest, and southeast. A single residence exists to the west of the station, across English Road. The monitoring station is southeast of Riverside County and the Salton Sea and is the most northerly site within the Imperial County monitoring network. The site records measurements for O_3 and PM_{10}.

3.3 Local Ozone Measurements

Typically, pollutant levels at any one location vary widely over time. As a result, air monitoring produces highly diverse data sets which are difficult to characterize with a few simple numbers. Statistical descriptors of air quality data can range from simple averages and maximum values to more involved indicators. The simplest measure, cited in the narrative below, is to note the highest levels observed at different locations each year. Maximum and average values are useful for evaluating compliance with established air quality standards and for defining the time periods when the highest pollutant concentrations are most likely to occur. As such, they characterize only the most adverse air quality conditions measured during the year and are not representative of more commonly occurring pollutant levels.

Air quality trend analysis is important in assessing pollutant levels, and is particularly useful for planning purposes. Trends are evaluated in this analysis on a per station basis, using two indicators of local ozone levels: the 4th highest 8-hour average concentration measured each year and the design value for each year.

According to 40 CFR Part 50, the primary and secondary 2008 8-hour ozone standard is met when a given three-year average of the annual fourth highest daily maximum 8-hour average ambient air ozone concentration is less than or equal to 0.075 ppm. Simply put, ozone is measured hourly at each monitoring site. From the hourly measurements, 8-hour running averages are calculated for each hour of the day, at each monitoring site. From these values, the highest daily 8-hour average is identified for each day and monitoring site. ***Compliance with the standard is determined by taking the annual fourth highest daily maximum 8-hour ozone concentration and averaging it over three years for each site. This three-year average is referred to as the design value.*** When the design value is less than or equal to 0.075 ppm at each monitor within the area, then the area is meeting the NAAQS. Figure 3-2 and Table 3-2 present the 8-hour ozone design values for Imperial County for 2008 through 2015. When determining compliance with the 2008 8-hour ozone standard, ambient air quality monitoring data for the three-year period must meet a data completeness requirement. This requirement is met when the average percent of days with valid ambient monitoring data is greater than 90 percent, and no single year has less than 75 percent of data completeness as determined in Appendix I of 40 CFR Part 50.

Figure 3-2. Annual Design Values for the 2008 8-hour Ozone NAAQS, Imperial County Monitoring Stations, 2008 through 2015

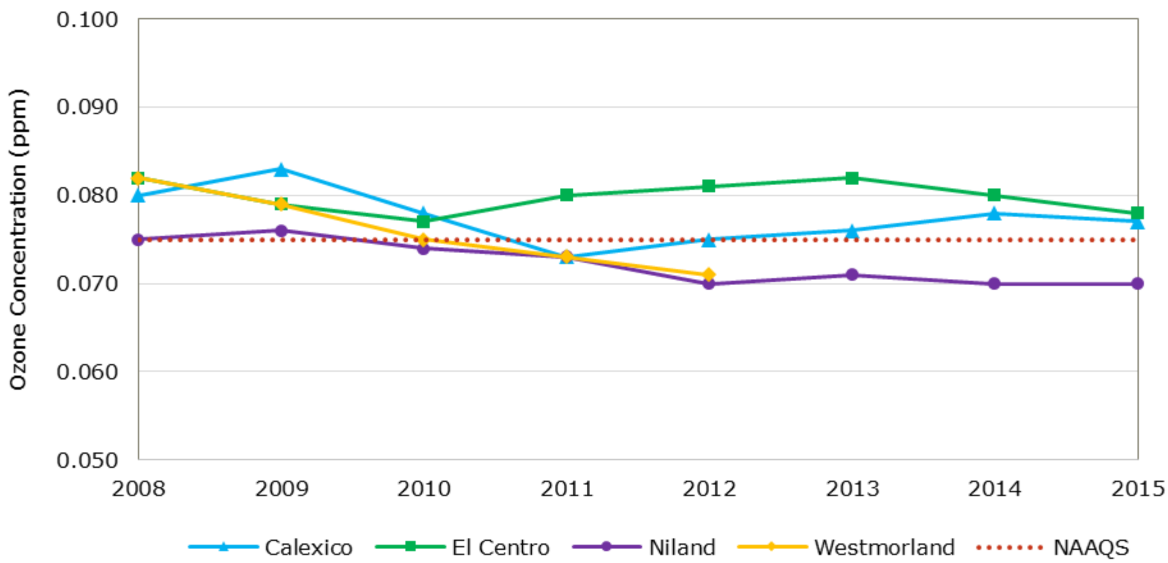


Table 3-2. Design Values for the 2008 8-hour Ozone NAAQS (ppm)

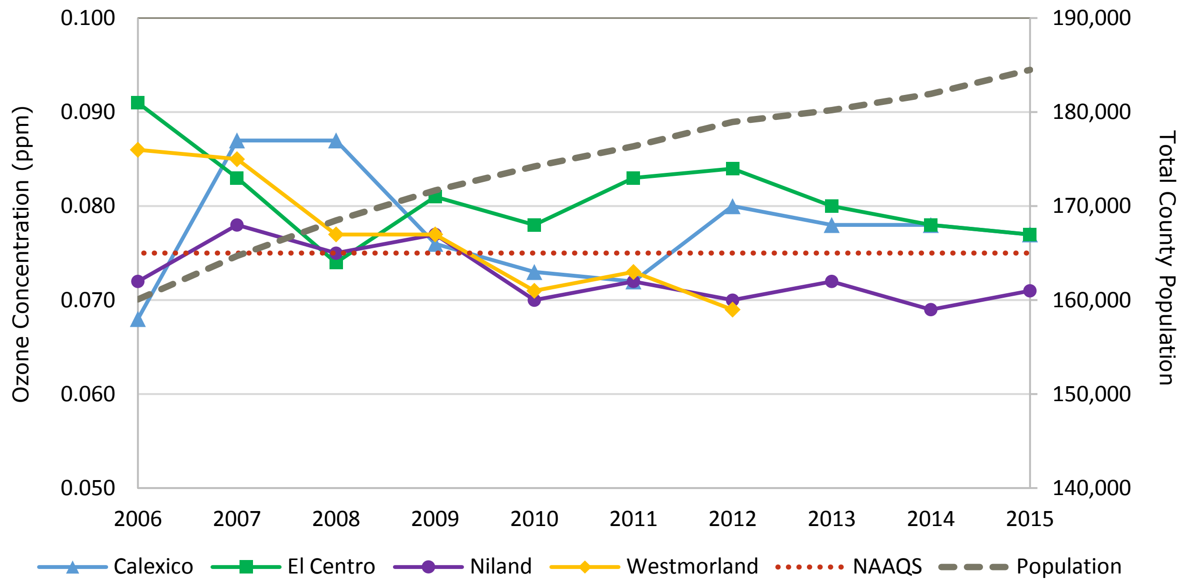
Year	Imperial County Air Quality Monitoring Stations			
	Calexico	El Centro	Niland	Westmorland
2008	0.080	0.082	0.075	0.082
2009	0.083	0.079	0.076	0.079
2010	0.078	0.077	0.074	0.075
2011	0.073	0.080	0.073	0.073
2012	0.075	0.081	0.070	0.071
2013	0.076	0.082	0.071	--
2014	0.078	0.080	0.070	--
2015	0.077	0.078	0.070	--

Note: ”--“ indicates that the monitor was out of commission.

Despite an approximate population growth of 18.4 percent in Imperial County from 2005 to 2015 and a 70 percent growth between 1990 and 2015, air quality as it pertains to ozone has improved greatly in this region. To illustrate the downward trend in ozone concentrations, Figure 3-3 shows the fourth highest 8-hour average ozone concentrations by Imperial County monitoring station for the years 2006 through 2015.

Despite these improvements, ambient air concentrations remain above the NAAQS at the two monitoring stations closest to the United States-Mexico border. The impact of the transport of emissions from Mexico is addressed in the attainment demonstration presented in Chapter 8.

Figure 3-3. Annual Fourth Highest 8-hour Ozone Concentrations, Imperial County Monitoring Stations, 2006 through 2015



4 Emission Inventory

[Sections 4.1 through 4.14 were provided by the California Air Resources Board]

Emissions inventories are one of the fundamental building blocks in the development of a State Implementation Plan (SIP or Plan). In simple terms, an emissions inventory is a systematic listing of the sources of air pollution along with the amount of pollution emitted from each source or category over a given time period. This document describes the emissions inventory included in the 8-hour Ozone Plan for the Imperial County Nonattainment Area, which covers the entirety of Imperial County. It also summarizes the revisions and improvements made to the inventory as part of this Plan.

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

CARB also reviewed the growth profiles for point and areawide source categories and updated them as necessary to ensure that the emission projections are based on data that reflect historical trends, current conditions, and recent economic and demographic forecasts. Growth forecasts for most point and areawide sources were developed either by CARB or by the Southern California Association of Governments (SCAG) and provided to CARB through the South Coast Air Quality Management District. SCAG is the metropolitan planning organization representing Imperial County, along with five other counties in Southern California.

4.1 Emissions Inventory Overview

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

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

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

4.2 Agency Responsibilities

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

4.3 Inventory Base Year

The base year inventory forms the basis for all future year projections and also establishes the emission levels against which progress in emission reductions will be measured. USEPA regulations establish that the base year inventory should be preferably consistent with the triennial reporting schedule required under the Air Emissions Reporting Requirements (AERR) rule. However, USEPA allows a different year to be selected if justified by the state. CARB worked with the local air districts to determine the base year that should be used across the State. Since the South Coast Air Quality Management District typically aligns their base year inventory with the data collection period for their Multiple Air Toxics Exposure Study, which was last conducted in 2012, CARB selected 2012 as the base year to maintain consistency across the various plans being developed in the State.

4.4 Forecasted and Backcasted Inventories

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

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

Projections for mobile source emissions are generated by models that predict activity rates and vehicle fleet turnover by vehicle model year. As with stationary sources, the mobile source models include control algorithms that account for all adopted regulatory actions.

Point-source emissions in the backcast years are the figures reported by Imperial County APCD for those years. Stationary aggregated and areawide emissions for the backcast years are estimated in the same way as the forecast, by applying growth parameters and control profiles to 2012 emissions. All of ARB’s growth parameters and control profiles run back to 2000. Mobile source emissions are estimated with the same models that were used for the forecast years.

4.5 Temporal Resolution

Planning inventories typically include annual as well as seasonal (summer and winter) emission estimates. Annual emission inventories represent the total emissions over an entire year (tons per year), or the daily emissions produced on an average day (tons per day). Seasonal inventories account for temporal activity variations throughout the year, as determined by category-specific temporal profiles. Since ozone concentrations tend to be highest during the summer months, the emission inventory used in the Plan is based on the summer season (May through October).

4.6 Geographical Scope

The inventories presented in this Plan consist of emissions for the Imperial Ozone Nonattainment Area, which consists of the entirety of Imperial County.

4.7 Quality Assurance and Quality Control

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

Future year emissions are estimated using the California Emission Projection Analysis Model (CEPAM), 2016 SIP Baseline Emission Projections, Version 1.04. Growth and control factors are reviewed for each category and year along with the resulting emission projections. Year to year trends are compared to similar and past datasets to ensure general consistency. Emissions for specific categories are checked to confirm they reflect the anticipated effects of applicable control measures. Mobile categories are verified with mobile source staff for consistency with the on-road and off-road emission models.

A summary of the information supporting the Imperial 8-hour Ozone SIP emissions inventory is presented in the sections below.

4.8 Point Sources

The inventory reflects actual emissions from industrial point sources reported to the District by the facility operators through calendar year 2012, in accordance with the requirements set forth in USEPA's AERR rule. The data elements in the 2012 baseline inventory are consistent with the data elements required by the AERR rule. Estimation methods include source testing, direct measurement by continuous emissions monitoring systems, or engineering calculations.

Table 4-1 lists the point source categories that occur in the ozone nonattainment area.

Table 4-1. Point Source Categories

Source Category	Subcategory
Fuel Combustion	Electrical Utilities
	Cogeneration
	Manufacturing and Industrial
	Food and Agricultural Processing
Fuel Combustion (continued)	Service and Commercial
	Other (I.C. Reciprocating Engines)
Cleaning and Surface Coatings	Laundering
	Degreasing
	Coatings and Thinners
	Adhesives and Sealants
Petroleum Production and Marketing	Petroleum Refining
	Petroleum Marketing
	Other (Petroleum Production & Marketing)
Industrial Processes	Food and Agriculture
	Mineral Processes
	Other (Industrial Processes)

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

4.8.1 Agricultural Diesel Irrigation Pumps

This category includes emissions from the operation of diesel-fueled stationary and mobile agricultural irrigation pumps. The emission estimates are based on a 2003 CARB methodology using statewide population and include replacements due to the Carl Moyer Program. Emissions are grown based on projected acreage for irrigated farmland. Additional information on this category is available at: https://www.arb.ca.gov/ei/areasrc/arbfuelcombagric.htm.

4.8.2 Stationary Nonagricultural Diesel Engines

This category includes emissions from backup and prime generators and pumps, air compressors, and other miscellaneous stationary diesel engines that are widely used throughout the industrial, service, institutional, and commercial sectors. The emission estimates, including emission forecasts, are based on a 2003 CARB methodology derived from the OFFROAD model. Additional information on this methodology is available at: https://www.arb.ca.gov/ei/areasrc/FULLPDF/FULL1-2.pdf.

4.8.3 Laundering

This category includes emissions from perchloroethylene (perc) dry cleaning establishments. The emission estimates are based on a 2002 CARB methodology that used nationwide perc consumption rates allocated to the county level based on population and an emission factor of 10.125 pounds per gallon used. Emissions were grown from the original estimates to 2012 using human population growth trends from SCAG. Additional information on this methodology is available at: https://www.arb.ca.gov/ei/areasrc/onehtm/one3-1.htm.

4.8.4 Degreasing

This category includes emissions from solvents in degreasing operations in the manufacturing and maintenance industries. The emissions estimates are based on a 2000 CARB methodology using survey and industry data, activity factors, emission factors and a user's fraction. Growth for this category is based on CARB/REMI industry-specific economic output. Additional information on this methodology is available at: https://www.arb.ca.gov/ei/areasrc/arbcleandegreas.htm.

4.8.5 Coatings and Thinners

This category includes emissions from coatings and related process solvents. Auto refinishing emissions estimates are based on a 1990 CARB methodology using production data and a composite emission factor derived from surveys. Growth is based on projected vehicle miles travelled (VMT) provided by SCAG. Estimates for industrial coatings emissions are based on a 1990 ARB methodology using production and survey data, and emission factors derived from surveys. Estimates for thinning and cleaning solvents are based on a 1991 CARB methodology, census data and a default emission factor developed by CARB. Growth for these categories is projected using CARB/REMI industry-specific economic output and employment. Additional information on these methodologies is available at: https://www.arb.ca.gov/ei/areasrc/arbcleancoatreproc.htm.

4.8.6 Adhesives and Sealants

This category includes emissions from solvent-based and water-based solvents contained in adhesives and sealants. Emissions are estimated based on a 1990 CARB methodology using production data and default emission factors. Growth for this category is based on CARB/REMI industry-specific economic output. Additional information on this methodology is available at: https://www.arb.ca.gov/ei/areasrc/arbcleanadhseal.htm.

4.8.7 Gasoline Dispensing Facilities

CARB staff developed an updated 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 CARB's on-road mobile sources model (EMFAC). Additional information on this category is available at: https://www.arb.ca.gov/ei/areasrc/arbpetprodmarkpm.htm.

4.9 Areawide Sources

Areawide sources are categories such as consumer products, fireplaces, and agricultural burning (see Table 4-2) for which emissions occur over a wide geographic area. Emissions for these categories are estimated by both CARB and the local air districts using various models and methodologies.

Table 4-2. Areawide Sources

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

A summary of the areawide methodologies is presented below:

4.9.1 Consumer Products

The consumer products category reflects the four most recent surveys conducted by CARB staff for the years 2003, 2006, 2008, and 2010. Together these surveys collected updated product information and ingredient information for approximately 350 product categories. Based on the survey data, CARB staff determined the total product sales and total VOC emissions for the various product categories. The growth trend for most consumer product subcategories is based on the latest SCAG human population growth projections, except for aerosol coatings. Staff determined that a no-growth profile would be more appropriate for aerosol coatings based on survey data that show relatively flat sales of these products over the last decade. Additional information on CARB's consumer products surveys is available at: https://www.arb.ca.gov/consprod/survey/survey.htm.

4.9.2 Architectural Coatings

The architectural coatings category reflects emission estimates based on a comprehensive CARB survey for the 2004 calendar year. The emission estimates include benefits of the 2000 and 2007 CARB Suggested Control Measures. These emissions are grown based on SCAG projections for number of households. Additional information about CARB's architectural coatings program is available at: https://www.arb.ca.gov/coatings/arch/arch.htm.

4.9.3 Pesticides

DPR develops month-specific emission estimates for agricultural and structural pesticides. Each calendar year, DPR updates the inventory based on the Pesticides Use Report, which provides updated information from 1990 to the most current data year available. The inventory includes estimates through the 2014 calendar year. Emission forecasts for years 2015 and beyond are based on the average of the most recent five years. Growth for agricultural pesticides is based on CARB projections of harvested acreage provided by the U.S. Department of Agriculture (USDA). Growth for structural pesticides is based on CARB projections of housing expenditures.

4.9.4 Asphalt Paving/Roofing

Asphalt paving emissions for 2012 were estimated using a District methodology, and asphalt roofing emissions were grown from a 2005 estimate. Emissions are estimated based on tons of asphalt applied and a default emission factor for each type of asphalt operation. The growth profile for both categories is based on construction employment from the CARB/REMI forecasting model. Additional information on the District's methodology is available at: https://www.arb.ca.gov/ei/areasrc/distsolevapasphpav.htm.

4.9.5 Residential Wood Combustion

CARB staff updated the methodology to reflect 2005 fuel use, and more recent emission factors and calculation approaches. The emission estimates reflect emission factors from USEPA's National Emission Inventory. No growth is assumed for future years. Additional information on this methodology is available at: https://www.arb.ca.gov/ei/areasrc/arbmiscprocresfuelcom.htm

4.9.6 Farming Operations

CARB staff updated the Livestock Husbandry methodology to reflect livestock population data based on the USDA's 2007 Census of Agriculture, and ammonia emission factors for dairy support cattle. A seasonal adjustment was added to account for the suppression of dust emissions in months in which rainfall occurs. Animal populations and emission factors for feedlots and dairies were updated for 2012 based on District data and California specific testing. CARB projects growth for feedlot cattle based on county livestock report data. Based on an analysis of livestock population trends, no growth is assumed for other livestock categories. In addition, the inventory reflects emission reductions from District Rules 420 and 217. Additional information on CARB's methodology is available at: https://www.arb.ca.gov/ei/areasrc/arbmiscproclivestock.htm.

Additional information on the District's update is available here: https://www.arb.ca.gov/ei/areasrc/districtmeth/imperial/2016mar16_dairyfeedlotops.pdf.

4.9.7 Fires

Emissions from structural and automobile fires were estimated based on a 1999 CARB methodology using the number of fires and the associated emission factors. Estimates for structural fires are calculated using the amount of the structure that is burned, the amount and content of the material burned, and emission factors derived from test data. Estimates for automobile fires are calculated using the weight of the car and components and composite emission factors derived from AP-42 emission factors. No growth is assumed for this category. Additional information on this methodology is available at: https://www.arb.ca.gov/ei/areasrc/arbmiscprocfires.htm.

4.9.8 Managed Burning & Disposal

CARB updated the emissions inventory to reflect burn data reported by District staff for 2012. Emissions are calculated using crop specific emission factors and fuel loadings. Temporal profiles reflect monthly burn activity. Growth for agricultural burning is based on projected harvested acreage. No growth is assumed for burning associated with weed abatement. CARB's methodology for managed burning is available at: https://www.arb.ca.gov/ei/areasrc/distmiscprocwstburndis.htm.

Additional background information is available here: https://www.arb.ca.gov/ei/see/see.htm.

4.9.9 Commercial Cooking

The commercial cooking emissions were grown from a 2005 estimate. The emissions estimates were developed from the number of restaurants, the number and types of cooking equipment, the food type, and default emission factors. The growth profile reflects the latest population projections provided by SCAG.

4.10 Point and Areawide Source Emissions Forecasting

Emission forecasts (2013 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 4-3.

Table 4-3. Growth Surrogates for Point and Areawide Sources

Source Category	Subcategory	Growth Surrogate
Fuel Combustion	Electric Utilities	SoCAL Gas Company (SCG) 2014 report
	Cogeneration	CARB/REMI industry-specific economic output
	Manufacturing and Industrial Area Source/Natural Gas	SCG 2014 report
	Manufacturing and Industrial Others	CARB/REMI industry-specific economic output
	Food and Agricultural Processing Ag Irrigation I. C. Engines	Irrigated farmland
	Food and Agricultural Processing Point Sources	CARB/REMI industry-specific economic output
	Service and Commercial Natural Gas	SCG 2014 Report
	Service and Commercial Other Fuels	CARB/REMI industry-specific employment
	Diesel	CARB EMFAC model for fuel consumption
	Other Fuels	CARB/REMI industry specific economic output/employment

Table 4-3. Growth Surrogates for Point and Areawide Sources

Source Category	Subcategory	Growth Surrogate
Laundering	Dry Cleaning	SCAG population
Degreasing	All	CARB/REMI industry-specific economic output
Coatings & Thinners	Auto Refinishing	SCAG Vehicle Miles Traveled (VMT)
	Others	CARB/REMI industry specific economic output/employment
Adhesives & Sealants	All	CARB/REMI industry-specific economic output
Petroleum Refining	All	CARB EMFAC model fuel consumption
Petroleum Marketing	All	CARB EMFAC model fuel consumption
Petroleum Production & Marketing	All	CARB/REMI industry-specific economic output
Food and Agriculture	All	CARB/REMI industry-specific economic output
Mineral Processes	All	CARB/REMI industry-specific economic output/employment
Other Industrial Processes	Electrical Power Generation	SCG 2014 report
	Others	CARB/REMI industry-specific economic output
Consumer Products	Consumer Products	SCAG population
	Aerosol Coatings	No growth
Architectural Coatings and Related Process Solvents	All	SCAG households
Pesticides/Fertilizers	Agricultural Pesticides	Harvested acreage
	Structural Pesticides	CARB housing expenditure
Asphalt Paving / Roofing	All	CARB/REMI industry-specific employment
Residential Fuel Combustion	Natural Gas	SCG 2014 report
	Woodstoves & Fireplaces - Wood	No growth
	Other Fuels	SCAG households
Farming Operations	Livestock / Feedlot Cattle	County livestock report data/CARB
	Livestock / Others	No growth
Fires	All	No growth

Table 4-3. Growth Surrogates for Point and Areawide Sources

Source Category	Subcategory	Growth Surrogate
Managed Burning and Disposal	Agricultural Burning, Prunings & Field Crops	Harvested acreage
	Weed Abatement	No growth
Cooking	All	SCAG population

4.11 Stationary Source Control Profiles

The emissions inventory reflects emission reductions from point and areawide sources subject to District rules and CARB regulations. The rules and regulations reflected in the inventory are listed below in Table 4-4.

Table 4-4. District and ARB Stationary Source Control Rules and Regulations Included in the Inventory

Agency	Rule/Reg No.	Rule Title	Source Categories Impacted
District	217	Large Confined Animal Facilities (LCAF) Permits Required	Livestock Husbandry
CARB	AC_SCM2007	Architectural Coatings 2007 SCM	Architectural coatings
CARB	ARCH_SCM	Architectural Coatings 2000 SCM	Architectural coatings
CARB	ARB_R003	Consumer Product Regulations & Amendments	Consumer products
CARB	ARB_R003_A	Consumer Product Regulations & Amendments	Consumer products
CARB	ARB_R007	Aerosol Coating Regulation	Consumer products / Aerosol coatings
CARB	GDF_HOSREG	Gasoline Dispensing Facilities - Hose Permeation	Petroleum marketing
CARB	ORVR	Fueling emissions from ORVR vehicles	Petroleum marketing

4.12 On-Road Mobile Sources

Emissions from on-road mobile sources, which include passenger vehicles, buses, and trucks, were estimated using outputs from CARB's EMFAC2014 model. The on-road emissions were calculated by applying EMFAC2014 emission factors to the transportation activity data provided by SCAG from their 2016 adopted Regional Transportation Plan/Sustainable Communities Strategy (2016 RTP/SCS).

EMFAC2014 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 2012 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.

EMFAC2014 utilizes a socio-econometric regression modeling approach to forecast new vehicle sales and to estimate future fleet mix. Light-duty passenger vehicle population includes 2012 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 EMFAC2014 model is available at: https://www.arb.ca.gov/msei/categories.htm#emfac2014.

4.13 Off-Road Mobile Sources

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

4.13.1 Cargo Handling Equipment (CHE)

The emissions inventory for the Cargo Handling Equipment category has been updated to reflect new information on equipment population, activity, recessionary impacts on growth, and engine load. The new information includes regulatory reporting data which provide an accounting of all the cargo handling equipment in the State including their model year, horsepower and activity. Background and supporting documents for the Cargo Handling Equipment Regulation are available here: https://www.arb.ca.gov/ports/cargo/cheamd2011.htm.

4.13.2 Pleasure Craft and Recreational Vehicles

A new model was developed in 2011 to estimate emissions from pleasure craft and recreational vehicles. In both cases, population, activity, and emission factors were re-assessed using new surveys, registration information, and emissions testing. Additional information is available at: https://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles.

4.13.3 In-Use Off-Road Equipment

CARB developed this model in 2010 to support the analysis for amendments to the In-Use Off-Road Diesel Fueled Fleets Regulation. Staff updated the underlying activity forecast to reflect more recent economic forecast data, which suggests a slower rate of recovery through 2024 than previously anticipated. Additional information is available at: https://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles.

4.13.4 Locomotives

In 2014, CARB developed a revised inventory for line-haul locomotive activity in California. The new model is based primarily on activity data reported to CARB by the major rail lines for calendar year 2011. To estimate emissions, CARB used duty cycle, fuel consumption and activity data reported by the rail lines. Activity is forecasted for individual train types and is consistent with CARB's ocean-going vessel and truck growth rates. Fuel efficiency improvements are projected to follow Federal Railroad Association projections and turnover assumptions are consistent with USEPA projections. Additional information is available at: https://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles.

4.13.5 Transport Refrigeration Units (TRU)

This model reflects updates to activity, population, growth and turn-over data, and emission factors developed to support the 2011 amendments to the Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units. Additional information is available at: https://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles.

4.13.6 Fuel Storage and Handling

Emissions for fuel storage and handling were estimated using the OFFROAD2007 model. Additional information is available at: https://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles.

4.13.7 Diesel Agricultural Equipment

The inventory for agricultural diesel equipment (such as tractors, harvesters, combines, sprayers and others) was revised based on a 2008 survey of thousands of farmers, custom operators, and first processors. The survey data, along with information from the 2007 USDA Farm Census, was used to revise almost every aspect of the agricultural inventory, including population, activity, age distribution, fuel use, and allocation. This updated inventory replaces general information on farm equipment in the United States with one specific to California farms and practices. The updated inventory was compared against other available data sources such as Board of Equalization fuel reports, USDA tractor populations and age, and Eastern Research Group tractor ages and activity, to ensure the results were reasonable and compared well against outside data sources. Agricultural growth rates through 2050 were developed through a contract with URS Corp and the University of California, Davis (UC Davis). Additional information is available at: https://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles.

4.14 Mobile Source Forecasting

Table 4-5 below summarizes the data and methods used to forecast future-year mobile source emissions by broad source category groupings.

Table 4-5. Growth Surrogates for Mobile Sources

Category	Growth Methodology
On-Road Sources	
All	Match total VMT projections provided by SCAG
Off-Road Gasoline Fueled Equipment	
Lawn & Garden	Household growth projection
Off-Road Equipment	Employment growth projection
Recreational Boats	Housing starts (short-term) and human population growth (long-term)
Recreational Vehicles	Housing starts (short-term) and human population growth (long-term)

Table 4-5. Growth Surrogates for Mobile Sources	
Category	**Growth Methodology**
Off-Road Diesel-Fueled Equipment	
Construction and Mining	California construction employment data from U.S. Bureau of Labor Statistics
Farm Equipment	2011 study of forecasted growth by URS Corp
Industrial Equipment	California construction employment data from Bureau of Labor Statistics
Trains (line haul)4-12	International/premium train growth tied to OGV forecast; Domestic train growth tied truck growth
Transport Refrigeration Units	Projection of historical Truck/Trailer TRU sales from ACT Research, adjusted for recession.

4.15 Emission Inventories

Tables 4-6 through 4-9 present the 2008, 2012, 2014, and 2017 ozone precursor summer planning emissions inventories[20], respectively, for Imperial County by major source category. These inventories were queried from CARB's CEPAM, Version 1.04, which utilizes the data and methodologies outlined in Sections 4.1 through 4.14. More detailed inventories are provided in Appendix A.

Table 4-6. Ozone Precursor Emissions by Major Source Category in Imperial County, 2008

Source Category	ROG (tons/day)	% Total	NO_x (tons/day)	% Total
Stationary Sources				
Fuel Combustion	0.16	0.76%	3.85	12.88%
Waste Disposal	0.02	0.08%	0	0.00%
Cleaning and Surface Coatings	0.60	2.81%	0.00	0.00%
Petroleum Production and Marketing	0.74	3.45%	0.00	0.00%
Industrial Processes	0.01	0.05%	0.01	0.04%
Total Stationary Sources	**1.53**	**7.14%**	**3.86**	**12.92%**
Areawide Sources				
Solvent Evaporation	4.86	22.76%	0.00	0.00%
Miscellaneous Processes	4.24	19.84%	0.81	2.71%
Total Areawide Sources	**9.11**	**42.60%**	**0.81**	**2.71%**

[20] Each inventory table does not include emission reduction credits (ERCs).

Table 4-6. Ozone Precursor Emissions by Major Source Category in Imperial County, 2008

Source Category	ROG (tons/day)	% Total	NO_x (tons/day)	% Total
Mobile Sources				
On-Road Vehicles	5.03	23.52%	13.99	46.84%
Off-Road Vehicles	5.72	26.74%	11.21	37.53%
Total Mobile Sources	**10.74**	**50.25%**	**25.20**	**84.37%**
Total for Imperial County	**21.38**	**100.00%**	**29.87**	**100.00%**

Table 4-7. Ozone Precursor Emissions by Major Source Category in Imperial County, 2012

Source Category	ROG (tons/day)	% Total	NO_x (tons/day)	% Total
Stationary Sources				
Fuel Combustion	0.11	0.58%	1.66	7.61%
Waste Disposal	0.00	0	0.00	0
Cleaning and Surface Coatings	0.50	2.60%	0.00	0.00%
Petroleum Production and Marketing	0.72	3.74%	0.00	0.00%
Industrial Processes	0.00	0.02%	0.07	0.30%
Total Stationary Sources	**1.33**	**6.95%**	**1.73**	**7.91%**
Areawide Sources				
Solvent Evaporation	4.70	24.47%	0.00	0.00%
Miscellaneous Processes	3.81	19.86%	0.67	3.07%
Total Areawide Sources	**8.51**	**44.33%**	**0.67**	**3.07%**
Mobile Sources				
On-Road Vehicles	4.25	22.16%	10.01	45.84%
Off-Road Vehicles	5.10	26.56%	9.43	43.18%
Total Mobile Sources	**9.35**	**48.72%**	**19.44**	**89.02%**
Total for Imperial County	**19.20**	**100.00%**	**21.83**	**100.00%**

Table 4-8. Ozone Precursor Emissions by Major Source Category in Imperial County, 2014

Source Category	ROG (tons/day)	% Total	NO_x (tons/day)	% Total

Table 4-8. Ozone Precursor Emissions by Major Source Category in Imperial County, 2014				
Source Category	**ROG (tons/day)**	**% Total**	**NO_x (tons/day)**	**% Total**
Stationary Sources				
Fuel Combustion	0.11	0.67%	1.61	8.18%
Waste Disposal	0.00	0.00%	0.00	0.00%
Cleaning and Surface Coatings	0.56	3.50%	0.00	0.00%
Petroleum Production and Marketing	0.69	4.30%	0.00	0.00%
Industrial Processes	0.01	0.03%	0.07	0.36%
Total Stationary Sources	**1.37**	**8.50%**	**1.68**	**8.54%**
Areawide Sources				
Solvent Evaporation	3.32	20.61%	0.00	0.00%
Miscellaneous Processes	2.82	17.48%	0.26	1.31%
Total Areawide Sources	**6.14**	**38.10%**	**0.26**	**1.31%**
Mobile Sources				
On-Road Vehicles	3.73	23.12%	8.04	40.96%
Off-Road Vehicles	4.88	30.28%	9.66	49.19%
Total Mobile Sources	**8.61**	**53.40%**	**17.70**	**90.15%**
Total for Imperial County	**16.12**	**100.00%**	**19.63**	**100.00%**

Table 4-9. Ozone Precursor Emissions by Major Source Category in Imperial County, 2017				
Source Category	**ROG (tons/day)**	**% Total**	**NO_x (tons/day)**	**% Total**
Stationary Sources				
Fuel Combustion	0.09	0.55%	1.44	7.98%
Waste Disposal	0	0	0	0
Cleaning and Surface Coatings	0.59	3.51%	0.00	0.00%
Petroleum Production and Marketing	0.66	3.94%	0.00	0.00%
Industrial Processes	0.01	0.04%	0.08	0.44%
Total Stationary Sources	**1.36**	**8.04%**	**1.52**	**8.42%**
Areawide Sources				
Solvent Evaporation	4.07	24.17%	0.00	0.00%
Miscellaneous Processes	3.66	21.69%	0.59	3.28%
Total Areawide Sources	**7.73**	**45.86%**	**0.59**	**3.28%**

Table 4-9. Ozone Precursor Emissions by Major Source Category in Imperial County, 2017

Source Category	ROG (tons/day)	% Total	NO_x (tons/day)	% Total
Mobile Sources				
On-Road Vehicles	3.14	18.60%	6.52	36.17%
Off-Road Vehicles	4.63	27.50%	9.40	52.13%
Total Mobile Sources	**7.77**	**46.10%**	**15.93**	**88.29%**
Total for Imperial County	**16.85**	**100.00%**	**18.04**	**100.00%**

4.16 Emission Reduction Credits (ERCs)

Currently, Imperial County is designated nonattainment for the NAAQS for ozone, PM_{10}, and $PM_{2.5}$. A key tool for enabling nonattainment areas to reach attainment and/or to maintain the NAAQS is the implementation of NSR. The ICAPCD NSR program (described in Chapter 6) ensures that air quality is not significantly degraded from the addition of new and modified stationary sources. Rule 207, New and Modified Stationary Source Review, is the implementing regulation within the ICAPCD that assures the public that any large new or modified industrial source will be as clean as possible.

Rule 207 requires new or modified industrial stationary sources that increase their air emissions above certain thresholds to apply Best Available Control Technology (BACT) and to provide offsets for a portion or all of the emissions increase. The purpose of the emission offset requirement is to provide mitigation, on a nonattainment pollutant-specific basis, for the regional impacts that might otherwise result from the increased emissions of that nonattainment pollutant.

Offsets occur as a result of equipment shutdowns or the voluntary reduction of emissions at a stationary source. These offsets can be registered or banked with an air district as Emission Reduction Credits (ERCs) which can be later used as an offset to compensate for emission increases at the same stationary source or at other stationary sources. USEPA must approve offsets which are required for major stationary sources prior to use.

In order to use ERCs banked before the base year emission inventory, 40 CFR 51.165(a)(3)(ii)(C)(1)(ii) requires the inclusion of the available pre-base year banked ERCs in the base and forecasted years of an attainment demonstration's planning emissions inventory. The unused banked ERCs for this Ozone SIP which occurred prior to the 2012 baseline year are 137.92 tons of NO_x and 13.65 tons of VOCs. The banked ERCs for 2014 are 204.9 tons of NO_x and 12.36 tons of VOCs. The ERCs in ICAPCD's bank for 2012 and 2014 are found in Table 4-10, where the NO_x and VOC emission inventory totals for the years 2012 and 2014 have been updated accordingly. Future year projections for 2017 have been included in Table 4-10 assuming a constant ERC balance post 2014. These same projections are used in the RFP analysis in Section 5.

Table 4-10. Emission Reduction Credits Added to the Summer Planning Emission Inventories for Imperial County (tons/day)

	2012	2014	2017
NO_x Emission Reduction Credits	0.38	0.56	0.56
NO_x Emission Inventory	21.83	19.63	18.04
NO_x Total	22.21	20.19	18.60
VOC Emission Reduction Credits	0.03	0.03	0.03
VOC Emission Inventory	19.20	16.12	16.85
VOC Total	19.23	16.15	16.88

5 Reasonable Further Progress

[Section 5 was provided by the California Air Resources Board]

Clean Air Act (CAA) Sections 172(c)(2) and 182(b)(1) require attainment plans to provide for reasonable further progress (RFP). RFP is defined in CAA section 171(1) as annual incremental reductions for the purpose of ensuring attainment by the attainment year. This requirement to show steady progress in emission reductions between the baseline year and attainment date ensures that areas will not delay implementation of emission control programs until immediately before the attainment deadline.

There are two separate requirements for nonattainment areas depending upon their classification. The first is a one-time requirement for a 15 percent reduction in ROG emissions between the years of 1990 and 1996 for nonattainment areas classified as Moderate or above (Section 182(b)(1)). The second is an additional three percent per year reduction of ozone precursor emissions until attainment for ozone nonattainment areas classified as Serious or higher (Section 182(c)(2)(B)).

In addition to the RFP requirements, CAA Section 172(c)(9) requires that plans provide for contingency measures in case the area fails to make RFP. USEPA has interpreted this requirement to represent one year's worth of emission reduction progress, amounting to three percent reductions, from measures that are already in place or that would take effect without further rulemaking action.

<u>Fifteen Percent ROG-only Rate of Progress Requirement</u>

The March 2015 USEPA implementation rule (Rule) for the 2008 8-hour ozone standard interprets the CAA RFP requirements, establishing requirements for RFP that depend on the area's classification and whether the area has an approved 15 percent ROG-only reduction plan for a previous ozone standard that covers all of the 2008 8-hour ozone nonattainment area (80 FR 12264).

Imperial County APCD is required to submit a ROG-only rate of progress plan that demonstrates a 15 percent reduction in ROG emissions for the first six years of the RFP period for the 2008 8-hour ozone standard (80 FR 12264). Because of large reductions in emissions from programs implemented in the years immediately following the promulgation of the 2008 standard, Imperial County is demonstrating RFP from a baseline year of 2008 as permitted in the Rule. In doing so, the District must show 15 percent ROG emission reductions in the initial six-year period, followed by an average of three percent ozone precursor emissions reductions each year until the attainment year.

As detailed in CAA Section 182(b)(1)(C), emission reductions must be achieved through existing programs. The Imperial County RFP demonstration is achieved by forecasted emission reductions from existing control regulations as shown in the planning inventory. As required, ROG emission reductions alone are used to meet the RFP reduction target for the initial six-year period.

The table below demonstrates that Imperial County meets the RFP target in the milestone years of 2014 and 2017, with a three percent contingency set aside in 2014 and carried through to 2017 per the requirements of the Rule.

Table 5-1. Imperial County 2008 8-hour Ozone NAAQS Reasonable Further Progress (Summer Planning Inventory, Tons Per Day)

Year	2008	2014	2017
ROG (with existing measures)*	21.4	16.1	16.9
Required % change since previous milestone year (ROG or NOx)		15%	9%
Required % change since 2008 (ROG or NOx)		15%	24%
Target ROG levels		18.2	16.5
Shortfall (-)/ Surplus (+) in ROG reductions needed to meet target		2.0	-0.3
Shortfall (-)/ Surplus (+) in ROG reductions needed to meet target, %		9.6%	-1.6%
ROG reductions since 2008 used for contingency in this milestone year, %		0.0%	0.0%
ROG reductions shortfall previously provided by NOx substitution, %		0.0%	0.0%
Actual ROG reductions Shortfall (-)/ Surplus (+), %		9.6%	-1.6%
Year	**2008**	**2014**	**2017**
NOx (with existing measures)*	29.9	19.6	18.6
Change in NOx since 2008		10.2	11.3
Change in NOx since 2008, %		34.3%	37.7%
NOx reductions since 2008 already used for ROG substitution & contingency through last milestone year, %		0.0%	3.0%
NOx reductions since 2008 available for ROG substitution & contingency in this milestone year, %		34.3%	34.7%
NOx reductions since 2008 used for ROG substitution in this milestone year, %		0.0%	1.6%
NOx reductions since 2008 used for contingency in this milestone year, %		3.0%	0.0%
NOx reductions since 2008 surplus after meeting ROG substitution & contingency needs in this milestone year, %		31.3%	33.1%
RFP shortfall (-) in reductions needed to meet target, if any, %		0.0%	0.0%
Total shortfall (-) for RFP and Contingency, if any, %		0.0%	0.0%
RFP Met?		YES	YES
Contingency Met?		YES	YES

* Future year (2017) projections include addition of ERC balance as of January 1, 2015.

6 Reasonably Available Control Measure Assessment

6.1 Overview and Criteria

Section 172(c)(1) of the CAA requires nonattainment plans to demonstrate that the state has implemented all reasonably available control measures (RACM) as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of RACT) and has provided for attainment of the standard. In general, RACM are non-technological measures which have been found to be cost-effective at reducing emissions, while RACT are measures established by the USEPA that consist of scientifically proven techniques and/or equipment add-ons that can be applied to certain stationary sources to reduce emissions. RACT measures are found within Control Technique Guidelines (CTG) and Alternative Control Technique (ACT) documents published by the USEPA.[21]

USEPA guidance[22] has interpreted the provision in Section 172(c)(1) to mean that the state must implement all RACM (and RACT) to meet RFP requirements and to demonstrate attainment as expeditiously as practicable, thus leaving no additional measures reasonably available that could advance the attainment date or contribute to RFP. As demonstrated in Chapter 5, the existing control strategy in Imperial County was adequate to satisfy RFP requirements in the six year period following the baseline year (i.e. 2008 through 2014). Furthermore, as Chapter 8 demonstrates, these reductions have been sufficient in bringing Imperial County into attainment of the 2008 ozone standard but for the ongoing contribution of emissions from Mexico. As a result, the implementation of new or strengthened RACM would have no effect on RFP or attainment of the standard. ICAPCD also considered adoption of additional reasonable measures to improve air quality, but determined it was not feasible to implement those measures prior to the attainment year, given the short time between final reclassification and the attainment year. Therefore, this Chapter focuses predominantly on the existing control measures that make up the control strategy for the Imperial County 8-hour Ozone Nonattainment Area. This discussion focuses on stationary source control measures, non-point or area source control measures, transportation control measures, and measures governed at the state level.

ICAPCD has the primary responsibility, under legislative authority, for regulating emissions from stationary sources as well as from some area sources found within the County.[23] At the state level, CARB is responsible for regulating on-road motor vehicles, some off-road mobile sources, consumer products, as well as setting motor vehicle fuel specifications in California. At the federal level, the USEPA traditionally regulates emission sources related to interstate commerce such as locomotives, aircraft, heavy-duty trucks, and some off-road engines which are either exempt from state authority or are best regulated at the national level. The local measures combined with the efforts driven at the state and federal levels, together address the majority of

[21] CTG and ACT documents for ozone precursors can be found at: https://www.epa.gov/ozone-pollution/control-techniques-guidelines-and-alternative-control-techniques-documents-reducing. Accessed: October 2016.

[22] United States Environmental Protection Agency. 2015. *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; Final rule.* Federal Register. Vol. 80. No. 44. March 6, 2015. p. 12282.

[23] Currently, state and federal regulation prohibit the implementation of mobile source regulation by local air districts.

the sources impacting air quality in Imperial County, with the exception of internationally sourced emissions. Ultimately, ICAPCD is committed to continued implementation of its control measures; however, it recognizes that any maintenance of the NAAQS will depend largely on the current and proposed mobile source strategies under state and federal jurisdictions.

6.2 Stationary Source Control Measures

Since the late 1970s and early 1980s, ICAPCD has been committed to bringing area sources and major and non-major stationary sources under regulation for the effective control of ozone precursor emissions. The District's current control strategy is represented by its adopted rule book and the ROG and NO_x control measures committed in the previous 1991 Air Quality Attainment Plan, 2009 Ozone AQMP, and 2009 RACT SIP. For stationary sources, RACM can be achieved through the adoption of RACT. With the issuance of the 2009 RACT SIP, the ICAPCD made the determination that all CTG sources and major non-CTG sources under ICAPCD jurisdiction were controlled to RACT or better. The ICAPCD also determined that all ozone precursor rules fulfilled RACT requirements for the 1997 8-hour ozone standard. The District updated this analysis with the issuance of the 2017 RACT analysis (Appendix B). Chapter 7 provides additional information on the 2009 and 2017 RACT SIPs and defines their role in meeting the RACT requirements for the 2008 8-hour ozone standard.

<u>New Source Review</u>

Stationary sources in Imperial County are also regulated through New Source Review (NSR). NSR is a permitting process required by the CAA to help ensure that any new or modified equipment and facilities (i.e. boilers, turbines, crude oil storage tanks, power plants and factories) do not significantly degrade air quality or slow progress towards clean air. The ICAPCD rule which dictates the NSR requirements is Rule 207. There are two primary components of NSR, the application of BACT and emission offsets. BACT plays a very important role in helping the ICAPCD to meet the no net increase in emissions required by the CAA by acting as an emissions limitation on pollutants emitted from or resulting from any new or modified stationary source. Sources that reduce their emissions in excess of what is required by law can generate ERCs. These emission reductions are banked and made available for offsetting emission growth from new or modified emission units.

Under Rule 207, BACT is currently required for all new or modified emission units which have a potential to emit of 25 pounds per day or more of any nonattainment pollutant or its precursors. New or modified sources with potentials to emit of 137 pounds per day of ROG or NO_x are required to offset those emissions through the use of ERCs. These reductions must be permanent, real, enforceable, quantifiable and surplus. There are two versions of NSR rule that are enforced by ICAPCD. A current version adopted as an amendment by the ICAPCD on October 10, 2006 and a SIP-approved version of Rule 207, Standards for Permit to Construct, approved on November 10, 1980. Both versions of Rule 207 fulfill the requirements of CAA sections 172(c)(4) and (5), 182(a)(2)(C) and the 1.15 to 1 offset ratio required by sections 182(a)(4) and 182(b)(5).

6.3 Area Source Control Measures

The District evaluated the adequacy of its control measures on area (i.e., non-point) sources of NO_x and VOCs by reviewing the USEPA Office of Air Quality Planning and Standards' Menu of

Control Measures (MCM),[24] a list that provides a broad set of emission reduction measures for different pollutants and source types. A summary of this evaluation is presented in Appendix C, which features of a table that specifically lists each control measure in the MCM that pertains to area sources of NO_X and VOCs. Each control measure was then evaluated against existing ICAPCD rules that address the same source(s). If a source type did not exist in Imperial County, it was noted in the table. For the few instances in which a MCM measure exists for a source type in Imperial County, but for which ICAPCD has no current rule, it was ultimately determined that implementing the measure was not necessary for demonstrating attainment or for meeting reasonable further progress requirements and would not advance the attainment date for Imperial County. As noted previously, ICAPCD considered the adoption of additional reasonable measures to improve air quality but determined it was not feasible to adopt and implement such measures prior to the attainment year, given the limited time between final reclassification and the attainment year.

6.4 Transportation Control Measures

As demonstrated in Chapter 4, the largest sources of ROG and NO_x emissions in Imperial County are mobile sources, which emitted approximately 50 to 46 percent of the total ROG and 84 to 88 percent of the total NO_x from 2008 to 2017. Ongoing reductions in emissions from mobile sources occur due to control measures implemented under various jurisdictions. This section discusses those measures implemented by regional and local bodies, whereas Section 6.5.2 discusses the state's mobile source control program.

6.4.1 Regional Measures

The Southern California Association of Governments (SCAG) functions as the Metropolitan Planning Organization (MPO) for six counties: Los Angeles, Orange, San Bernardino, Riverside, Ventura, and Imperial. As the designated MPO, SCAG is mandated by the federal government to research and plan for transportation, growth management, hazardous waste management, and air quality. The byproduct of this research are quadrennial regional transportation plans, the most recent of which is the 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy (2016 RTP/SCS).[25]

The 2016 RTP/SCS is SCAG's multi-modal plan for a better regional transportation system, integrated with the best possible growth pattern for the region out to 2040. The plan provides the basic policy and program framework for long-term investment in the region's vast transportation system in a coordinated, cooperative, and continuous manner. Transportation investments in the SCAG region that receive state or federal transportation funds must be consistent with the RTP/SCS and must be included in the RTP/SCS when ready for funding.

As part of its many functions, SCAG is required by law to ensure that transportation activities "conform" to and are supportive of, the regional and state air quality plans to attain the NAAQS. That is, SCAG has the responsibility under the CAA to determine conformity by comparing each

[24] USEPA. 2012. Menu of Control Measures for NAAQS Implementation. April 12. Available at: https://www.epa.gov/criteria-air-pollutants/menu-control-measures-naaqs-implementation. Accessed: March 2017.

[25] Southern California Association of Governments. 2016. 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy. Available at: http://scagrtpscs.net/Pages/FINAL2016RTPSCS.aspx. Accessed: October 2016.

relevant air quality plan against projects, plans, and programs, including the Transportation Conformity Rule. These long-term planning requirements are accomplished with the RTP/SCS. The short term implementation requirements of the Transportation Conformity Rule are met by SCAG's biennial Federal Transportation Improvement Plan (FTIP).

As part of its conformity obligations, SCAG must demonstrate the timely implementation of transportation control measures (TCMs). TCMs are projects or programs that are designed to reduce emissions or concentrations of emissions from transportation sources.

USEPA and related court decisions have maintained that in order to be considered RACM, TCMs must be measures that both 1) advance the attainment date and 2) are technologically and economically feasible. CAA section 108(f)(1)(A) provides a list of TCMs that could potentially qualify as RACM, depending on environmental and economic factors of the region in which they are to be implemented. TCMs must be evaluated on an area-by-area basis to determine which are "reasonably" available. Among suggestions on the list are programs for improved use of public transit, traffic flow improvement programs, programs to control extended idling of vehicles, and programs for new construction of paths, tracks, or areas solely for use by pedestrian or other non-motorized means of transportation, among many others. Currently, there are no ongoing TCM projects in Imperial County. Given the short amount of time to the attainment date and the fact that Imperial County exhibits attainment of the 2008 8-hour ozone standard but for emissions from Mexico, no new TCMs are being proposed in this SIP.

6.4.2 Local Measures

At the local level, ICAPCD relies on the reductions of VMT associated with the implementation of the Imperial County CEQA Air Quality Handbook[26] (CEQA Handbook), a guidance document approved by the ICAPCD Board of Directors in November 2007. The CEQA Handbook provides guidance to interested parties on how to determine the significance of impacts, including air emissions, related to the development of residential, commercial, and industrial projects. If impacts are determined to be significant, the CEQA Handbook provides a list of feasible measures to mitigate such impacts. Frequently, mobile source emissions make up a large portion of the operational air emissions of a development project, a result of increases in VMT. Therefore, the CEQA Handbook provides guidance on a number of ways that projects can reduce or eliminate project-related VMTs. These transportation-related CEQA measures are presented in Tables 6-1 and 6-2.

Table 6-1. Imperial County CEQA Air Quality Handbook Transportation Control Measures for Residential and Commercial Projects

Residential Projects	Commercial Projects
Standard Site Design Measures	

[26] Imperial County Air Pollution Control District. 2007. CEQA Air Quality Handbook. Guidelines for the Implementation of the California Environmental Quality Act of 1970, as amended. November. Available at: http://www.co.imperial.ca.us/AirPollution/PlanningDocs/CEQAHandbk.pdf. Accessed: October 2016.

Table 6-1. Imperial County CEQA Air Quality Handbook Transportation Control Measures for Residential and Commercial Projects

Residential Projects	Commercial Projects
Link cul-de-sacs and dead-end streets to encourage pedestrian and bicycle travel.	Provide on-site bicycle lockers and/or racks.
Allocate easements or land dedications for bikeways and pedestrian walkways.	Provide on-site eating, refrigeration, and food vending facilities to reduce lunchtime trips.
Provide continuous sidewalks separated from the roadway and adequate lighting.	Provide shower and locker facilities to encourage employees to bike and/or walk to work.
Provide bicycle storage at apartment complex or condos without garages.	
Discretionary Site Design Measures	
If project is near transit route, improve accessibility.	If project is near transit route, improve accessibility.
Increase street tree planting.	Increase street tree planting.
Increase the number of bicycle routes/lanes.	Increase the number of bicycle routes/lanes.
Provide pedestrian signalization to improve pedestrian safety.	Provide pedestrian signalization to improve pedestrian safety.
Synchronize traffic lights on street impacted by development.	Synchronize traffic lights on street impacted by development.
Use Energy Efficiency Design Measures.	Use Energy Efficiency Design Measures.
Provide outdoor electrical outlets to encourage use of electric appliances and tools.	Improve on-site circulation design elements in parking lots to reduce vehicles queuing.
Provide bikeways lanes and/or link new bikeways lanes to existing.	

Table 6-2. Imperial County CEQA Air Quality Handbook Transportation Control Measures for Industrial Projects

Standard Site Design Measures for Industrial Projects
Implement carpool/vanpool programs and incentives (i.e. carpool ride matching for employees, assistance with vanpool formation, provision of vanpool vehicles, etc.).
Provide for shuttle/mini bus service such as to establish a shuttle service from residential care areas to the worksite.
Provide preferential carpool and vanpool parking.
Construct transit facilities such as bus turnouts/bus bulbs, benches, shelters, etc. if the project is located on an established transit route.
Design and locate buildings to facilitate transit access (i.e., locate building entrances near transit stops, eliminate building setbacks, etc.).
Provide incentives to employees to take public transportation, walk, bike, etc.

Table 6-2. Imperial County CEQA Air Quality Handbook Transportation Control Measures for Industrial Projects

Standard Site Design Measures for Industrial Projects
Provide pedestrian signalization and signage to improve pedestrian safety.
Implement on-site circulation design elements in parking lots to reduce vehicle queuing and improve the pedestrian environment.
Provide on-site bicycle and motorcycle parking, such as providing weather-protected bicycle parking for employees.
Provide safe, direct access for bicyclists to adjacent bicycle routes.
Provide shower and locker facilities to encourage employees to bike and/or walk to work – typically, one shower and three lockers for every 25 employees.
Provide on-site eating, refrigeration and food vending facilities to reduce lunchtime trips.
Increase street tree planting.
Use low emission fleet vehicles such as transitional low-emission vehicles (TLEVs), ultra-low-emission vehicles (ULEV), low-emission vehicles (LEVs), and zero-emission vehicles (ZEVs).
Install an electrical vehicle charging station with both conductive and inductive charging capabilities.
Use built-in energy efficient appliances, where applicable.

6.5 State Measures

[Section 6.5 was provided by the California Air Resources Board]

To fulfill the CAA control measure requirements for ozone nonattainment areas, an assessment of control measures in the SIP must be performed. For ozone nonattainment areas, the control measures must be shown to be RACM. Since CARB is responsible for measures to reduce emissions from mobile sources needed to attain the national ambient air quality standards (standards), this Section will discuss how California's mobile source measures meet RACM. Appendix D provides additional detail regarding CARB's mobile source strategy.

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 program meets RACM requirements in the context of ozone nonattainment.

6.5.1 RACM Requirements

Subpart 1, Section 172(c)(1) of the CAA requires SIPs to provide for the implementation of RACM as expeditiously as practicable. USEPA 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. Additionally, in 179B areas where by definition the area will not attain due to international emissions, states should adopt reasonable measures that can be implemented prior to the attainment year to ensure air quality is improved to the extent reasonably feasible.

CARB developed its State SIP Strategy through a multi-step measure development process, including extensive public consultation, to develop and evaluate potential strategies for mobile source categories under CARB's regulatory authority that could contribute to expeditious attainment of the standard. First, CARB developed a series of technology assessments for heavy-duty mobile source applications and the fuels necessary to power them[27] along with ongoing review of advanced vehicle technologies for the light-duty sector in collaboration with USEPA and the National Highway Traffic Safety Administration. CARB staff then used a scenario planning tool to examine the magnitude of technology penetration necessary, as well as how quickly technologies need to be introduced to meet attainment of the standard.

CARB staff released a discussion draft Mobile Source Strategy[28] for public comment in October 2015. This strategy specifically outlined a coordinated suite of proposed actions to not only meet federal air quality standards, but also achieve greenhouse gas emission reduction targets, reduce petroleum consumption, and decrease health risk from transportation emissions over the next 15 years. CARB staff held a public workshop on October 16, 2015 in Sacramento, and on October 22, 2015, CARB held a public Board meeting to update the Board and solicit public comment on the Mobile Source Strategy in Diamond Bar.

Staff continued to work with stakeholders to refine the measure concepts for incorporation into related planning efforts including the 75 ppb 8-hour ozone SIPs. On May 16, 2016, CARB released an updated Mobile Source Strategy and on May 17, 2016 CARB released the proposed State SIP strategy for a 45-day public comment period.

The current mobile source program and proposed measures included in the State SIP Strategy provide attainment of the ozone standard as expeditiously as practicable and meet RFP requirements.

6.5.2 Mobile Sources

6.5.2.1 Waiver Approvals

While the CAA preempts most states from adopting emission standards and other emission-related requirements for new motor vehicles and engines, it allows California to seek a waiver or authorization from the federal preemption to enact emission standards and other emission-related requirements for new motor vehicles and engines and new and in-use off-road vehicles and engines that are at least as protective as applicable federal standards, except for locomotives and engines used in farm and construction equipment which are less than 175 horsepower (hp).

Over the years, California has received waivers and authorizations for over 100 regulations. The most recent California standards and regulations that have received waivers and authorizations are Advanced Clean Cars (including ZEV and LEV III) for Light-Duty vehicles, and On-Board Diagnostics, Heavy-Duty Idling, Malfunction and Diagnostics System, In-Use Off-Road Diesel

[27] Technology and Fuel assessments. Available at: http://www.arb.ca.gov/msprog/tech/tech.htm. Accessed: November 2016.

[28] 2016 Mobile Source Strategy. Available at: http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm. Accessed: November 2016.

Fleets, Large Spark Ignition Fleet, Mobile Cargo Handling Equipment for Heavy-Duty engines. Other Authorizations include Off-Highway Recreational Vehicles and the Portable Equipment Registration Program.

Finally, CARB obtained an authorization from USEPA to enforce adopted emission standards for off-road engines used in yard trucks and two-engine sweepers. CARB adopted the off-road emission standards as part of its “Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles,” (Truck and Bus Regulation). The bulk of the regulation applies to in-use heavy-duty diesel on-road motor vehicles with a gross vehicle weight rating in excess of 14,000 pounds, which are not subject to preemption under Section 209(a) of the CAA and do not require a waiver under Section 209(b).

6.5.2.2 Light- and Medium-Duty Vehicles

Light- and medium-duty vehicles are currently regulated under California’s Advanced Clean Cars program including the Low-Emission Vehicle III (LEV III) and Zero-Emission Vehicle (ZEV) programs. Other California programs such as the 2012 Governor Brown Executive Order to put 1.5 million zero-emission vehicles on the road by 2025, and California’s Reformulated Gasoline program (CaRFG) will produce substantial and cost-effective emission reductions from gasoline-powered vehicles.

CARB is also active in implementing programs for owners of older dirtier vehicles to retire them early in favor of cleaner vehicles. The Air Quality Improvement Program (AQIP) is a voluntary incentive program to fund clean vehicles. The Clean Vehicle Rebate Project, a project under AQIP, provides monetary incentives for the purchase of zero-emission and plug-in hybrid electric vehicles.

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.

6.5.2.3 Heavy-Duty Vehicles

California’s heavy-duty vehicle emissions control program includes requirements for increasingly tighter new engine standards and address vehicle idling, certification procedures, on-board diagnostics, emissions control device verification, and in-use vehicles. This program is designed to achieve an on-road heavy-duty diesel fleet with 2010 engines emitting 98 percent less NO_X and $PM_{2.5}$ than trucks sold in 1986.

Most recently in the ongoing efforts to go beyond federal standards and achieve further reductions, CARB adopted the Optional Reduced Emissions Standards for Heavy-Duty Engines regulation in 2014 that establishes the new generation of optional NO_x emission standards for heavy-duty engines.

The recent in-use control measures include On-Road Heavy-Duty Diesel Vehicle (In-Use) Regulation, Drayage (Port or Rail Yard) Regulation, Public Agency and Utilities Regulation, Solid Waste Collection Vehicle Regulation, Heavy-Duty (Tractor-Trailer) Greenhouse Gas Regulation, ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling, Heavy-Duty Diesel Vehicle Inspection Program, Periodic Smoke Inspection Program, Fleet Rule for Transit

Agencies, Lower-Emission School Bus Program, and Heavy-Duty Truck Idling Requirements. In addition, CARB's significant investment in incentive programs provides an additional mechanism to achieve maximum emission reductions from this source sector.

Taken together, California's emission standards, fuel specifications, and incentive programs for heavy-duty vehicles represent all measures that are technologically and economically feasible within California.

6.5.2.4 Off-Road Vehicles and Engines

California regulations for off-road equipment include not only increasingly stringent standards for new off-road diesel engines, but also in-use requirements and idling restrictions.

The Off-Road Regulation is an extensive program designed to accelerate the penetration of the cleanest equipment into California's fleets, and impose idling limits on off-road diesel vehicles. The program goes beyond emission standards for new engines through comprehensive in-use requirements for legacy fleets.

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

Taken together, California's comprehensive suite of emission standards, fuel specifications, and incentive programs for off-road vehicles and engines represent all measures that are technologically and economically feasible within California and when considered in aggregate, would advance the attainment date by at least one year.

6.5.2.5 Other Sources and Fuels

The emission limits established for other mobile source categories, coupled with USEPA waivers and authorization of preemption establish that California's programs for motorcycles, recreational boats, off-road recreational vehicles, cargo handling equipment, and commercial harbor craft sources meet the requirements for RACM and BACM.

Cleaner burning fuels also play an important role in reducing emissions from motor vehicles and engines as CARB has adopted a number of more stringent standards for fuels sold in California, including the Reformulated Gasoline program, low sulfur diesel requirements, and the Low Carbon Fuel Standard. These fuel standards, in combination with engine technology requirements, ensure that California's transportation system achieves the most effective emission reductions possible.

Taken together, California's emission standards, fuel specifications, and incentive programs for other mobile sources and fuels represent all measures that are technologically and economically feasible within California.

6.5.2.6 Mobile Source Summary

California's long history of comprehensive and innovative emissions control has resulted in the most stringent mobile source control program in the nation. USEPA has previously acknowledged the strength of the program in their approval of CARB's regulations and through the waiver process.

In addition, USEPA has provided past determinations that CARB's mobile source control programs meet BACM requirements, which are more stringent than RACM, as part of their 2004 approval of the San Joaquin Valley's 2003 PM_{10} Plan:

"We believe that the State's control programs constitute BACM at this time for the mobile source and fuels categories, since the State's measures reflect the most stringent emission control programs currently available, taking into account economic and technological feasibility."

Since then, CARB has continued to substantially enhance and accelerate reductions from our mobile source control programs through the implementation of more stringent engine emissions standards, in-use requirements, incentive funding, and other policies and initiatives as described in the preceding sections.

CARB finds that with the current mobile source control program; there are no additional reasonable available control measures that would advance attainment of the 75 ppb 8-hour ozone standard in Imperial County. There are no reasonable regulatory control measures excluded from use in this plan; therefore, there are no emissions reductions associated with unused regulatory control measures. As a result, California's mobile source control programs fully meet the requirements for RACM.

6.5.3 Consumer Products

Consumer products are defined as chemically formulated products used by household and institutional consumers. For more than twenty five 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 2013.

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

6.5.4 Pesticides

The Department of Pesticide Regulation (DPR) is the State agency responsible for regulating the application of pesticides, which are a source of VOCs in Imperial County. DPR has adopted and implemented regulations to limit VOC emissions from use of agricultural pesticides in areas of California classified as serious and above and for which VOC reductions were needed for previous ozone attainment plans. DPR is also required to annually prepare and make available to the public a pesticide emission inventory to track VOCs and determine compliance in the applicable areas.

In the case of Imperial County, timing did not allow for the implementation of regulations to limit VOC emissions from agricultural pesticides as RACM in the context of the 2017 Ozone SIP. Imperial County was originally classified as Marginal with an attainment date of July 20, 2015. Because they did not attain by the Marginal deadline, Imperial County was classified as a Moderate ozone nonattainment area effective June 3, 2016, with an attainment date of July 20, 2018. Effectively, the Moderate areas need to show attainment of the standard in the 2017 calendar year. In order for control measures to be required as RACM, they need to be economically and technologically feasible and advance the attainment date or be necessary to meet Reasonable Further Progress. As such, a measure would need to be fully implemented and achieving reductions by January 1, 2017 to be considered RACM. Due to the timing of the Moderate area reclassification and the date by which RACM would need to be implemented, it was not possible for the State to implement regulations to limit VOC emissions from agricultural pesticides in Imperial County.

6.6 RACM Determination

As demonstrated in Chapter 5, the existing control strategy in Imperial County was adequate to satisfy RFP requirements in the six year period following the baseline year (i.e. 2008 through 2014). Furthermore, as Chapter 8 demonstrates, these reductions have been sufficient in bringing Imperial County into attainment of the 2008 ozone standard but for the ongoing contribution of emissions from Mexico. This Chapter reviewed the existing state and local measures that make up the control strategy for the Imperial County Nonattainment Area. Ultimately, no new or strengthen measures were deemed necessary to demonstrate attainment or meet reasonable further progress requirements. Appendix E contains a list of the CARB regulations contributing to attainment of the standard.

7 Reasonably Available Control Technology Assessment

7.1 Overview and Criteria

According to the CAA, Moderate nonattainment areas for the 8-hour ozone NAAQS are required to implement RACT to control certain emission sources of ozone precursors. This requirement, specified by sections 182(b)(2) and 182(f) of the CAA, applies to sources which are subject to Control Technique Guidance (CTG), documents issued by the USEPA that define RACT for existing sources of air pollution. In addition, the CAA requires major stationary sources of ozone precursors without applicable CTGs to be controlled via RACT. Compared with Best Available Control Technology (BACT) and Maximum Achievable Control Technology (MACT), RACT requirements are less stringent. They represent the necessary methods to achieve the lowest emissions limitation that a particular source is capable of meeting via the application of control technology that is reasonably available considering technological and economic feasibility.[29] While the aim of RACT is not to eliminate or completely control ozone precursor emissions, the implementation of RACT ensures that all major sources are at least controlled to a "reasonable" extent.

In 2010, in conjunction with the release and adoption of the 2009 Ozone AQMP,[30] ICAPCD adopted the 2009 RACT SIP.[31] This plan summarized each of the ozone-specific CTGs established by the USEPA to date and either addressed the ICAPCD rule which implements the CTG or made a negative declaration for the CTG if there were no sources subject to it within the District. The plan also identified the major sources of VOCs and NO_x emissions (ozone precursors) in the District and evaluated the rules applicable to those sources for RACT. Since the CTGs and most of the District's rules and major pollutant sources have not changed since 2009, this 2017 RACT analysis, which is fully documented in Appendix B, builds upon the analysis and conclusions in the 2009 RACT SIP to demonstrate that the District's rules meet RACT stringency for the 2008 8-hour ozone standard.

7.2 2009 RACT State Implementation Plan

Within the 2009 RACT SIP, the District performed a three-part evaluation of the area's main sources of ozone precursors. First, ICAPCD identified the sources of ozone precursors under its jurisdiction subject to a CTG category. The District then compared the rules pertaining to these sources with those of other air districts and concluded that the District's rules met RACT stringency levels. For the second part of ICAPCD's evaluation, the District determined which CTGs were not applicable to any sources under its jurisdiction and made negative declarations

[29] United States Environmental Protection Agency. 1979. *State Implementation Plans; General Preamble for Proposed Rulemaking on Approval of Plan Revisions for Nonattainment Areas – Supplement (on Control Technique Guidelines); General preamble for proposed rulemaking – Supplement*. Federal Register. Vol. 44. No. 181. September 17, 1979. p. 53761.

[30] Imperial County Air Pollution Control District. 2010. Final 2009 1997 8-Hour Ozone Modified Air Quality Management Plan. July 13. Available at: http://www.co.imperial.ca.us/AirPollution/PlanningDocs/StatePlans/8_HR_OZONE_AQMP.pdf. Accessed: October 2016.

[31] Imperial County Air Pollution Control District. 2010. Final 2009 Reasonably Available Control Technology State Implementation Plan. July 13. Available at: http://www.co.imperial.ca.us/AirPollution/PlanningDocs/StatePlans/FINAL_RACTANALYSIS.pdf. Accessed: October 2016.

for each. The third and final part of the evaluation addressed the section of the CAA that refers to major stationary sources of ozone precursors that do not fall under a specific CTG category. For areas designated as Moderate nonattainment for the ozone standard, a "major" source is defined as one that either emits or has the potential to emit at least 100 tons per year of NO_x or VOCs. Ultimately, the USEPA found that ICAPCD's 2009 RACT SIP adequately addressed the RACT requirements for the 1997 8-hour ozone NAAQS.[32]

7.3 Updates to RACT Assessment

The previously discussed 2009 RACT SIP was authored to specifically address the 1997 8-hour ozone NAAQS. Since then, the USEPA has promulgated the currently effective 2008 8-hour ozone standard. In the 2015 Ozone Implementation Rule for the 2008 8-hour ozone standard,[33] the USEPA introduced an approach that allows states to conclude that "sources already addressed by RACT determinations for the 1-hour and/or 1997 ozone NAAQS do not need to implement additional controls to meet the 2008 ozone NAAQS RACT requirement."[34] The rationale behind this is that any new RACT determinations would result in similar control technologies to what have already been determined, because the fundamental control techniques outlined in the CTGs are still applicable. Additionally, the USEPA asserted that "any incremental emissions reductions from application of a second round of RACT controls may be small and, therefore, the cost for advancing that small additional increment of reduction may not be reasonable."[35] Instead, the USEPA suggests that a RACT analysis for currently uncontrolled sources would be much more likely to find that new RACT-level controls are feasible.

Following this guidance, ICAPCD assessed the sources under its jurisdiction and did not identify any new major sources subject to RACT nor did it identify uncontrolled sources subject to a CTG document for which RACT-level controls are economically and technically feasible. As part of this review, the information presented in the tables of the 2009 RACT SIP was evaluated to determine if it still applied in 2017, or if updates needed to be made. Overall, most of the information remained relevant because the majority of ICAPCD's rules pertinent to NO_x and VOC emissions have not been amended since 2009 and few pollutant sources within the District have changed. A few updates were made to the tables to reflect new information (see Tables 1 through 4 in Appendix B).

7.4 RACT Determination

The 2009 RACT SIP demonstrated that the District met or exceeded RACT for all applicable USEPA source categories at the time of its submittal. A more recent evaluation of the sources in Imperial County concludes that there are no additional source categories or major sources requiring new RACT controls. Furthermore, the implementation of additional controls would not cost-effectively impact attainment of the 2008 8-hour ozone standard. Based on these findings,

[32] United States Environmental Protection Agency. 2015. *Revisions to the California State Implementation Plan, Imperial County Air Pollution Control District; Proposed rule.* Fed. Reg. Vol. 80. No. 169. Sept. 1, 2015. p. 52710.
[33] United States Environmental Protection Agency. 2015. *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; Final rule.* Federal Register. Vol. 80. No. 44. March 6, 2015. p. 12279.
[34] Id.
[35] Id.

the District confirms that its existing Rule Book satisfies RACT requirements for the 2008 8-hour ozone standard.

8 Attainment Demonstration

8.1 Overview

As a Marginal nonattainment area for the 2008 ozone standard, Imperial County was originally provided three years from the effective date of designation, July 20, 2012, to attain the NAAQS (i.e., by July 20, 2015), but was not required to submit an attainment demonstration SIP. In contrast, areas originally designated as Moderate under the 2008 ozone standard were required to submit an attainment demonstration SIP within three years of the effective date of the area's designation (i.e., by July 20, 2015) and to show attainment within six years of the effective date of designation (i.e., by July 20, 2018). For areas like Imperial County that failed to attain the 2008 ozone standard and were reclassified from Marginal to Moderate, the USEPA established an alternative deadline for SIP revisions of no later than January 1, 2017.[36] However, these areas are still required to show attainment by the Moderate area attainment date of July 20, 2018.[37]

This Chapter presents the attainment demonstration for the Imperial County Nonattainment Area and shows through photochemical grid modeling and a weight of evidence analysis that but for emissions emanating from Mexico, the control measures discussed in this SIP are adequate to attain the 2008 ozone standard and maintain this status through the July 20, 2018 attainment date.

8.2 Attainment Demonstration

[Section 8.2 was provided by the California Air Resources Board]

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 Imperial County Federal Nonattainment Area (IFNA) is designated as a Moderate ozone nonattainment area for the 2008 0.075 ppm (or 75 ppb) 8-hour ozone standard and is required to demonstrate attainment of this standard by 2017. Consistent with USEPA guidelines for model attainment demonstrations,[38] photochemical modeling was used to estimate the future year 2017 ozone (O_3) design values (DVs) at each monitoring site in the IFNA in order to show attainment of the standard by 2017. Additional future year sensitivity modeling was conducted to assess the contribution that emissions from Mexico have on future year DVs in the IFNA, and whether the region would attain the ozone standard in the absence of Mexico emissions.

The findings of the IFNA's model attainment demonstration are summarized below. Additional information and a detailed description of the procedures employed in this modeling are available

36 United States Environmental Protection Agency. 2016. *Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Several Areas for the 2008 Ozone National Ambient Air Quality Standards; Final rule*. Federal Register. Vol. 81. No. 86. May 4, 2016. p. 26697.

37 While the attainment date is July 20, 2018, Imperial County must show attainment in the first complete ozone season prior to the attainment date (i.e. the 2017 ozone season).

38 USEPA. 2014. Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze. Available at: https://www.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf. Accessed: March 2017.

in the Modeling Attainment Demonstration Appendix (Appendix F) and Modeling Protocol Appendix (Appendix G).

The current modeling platform draws on the products of large-scale scientific studies, collaboration among technical staff from state, local, and federal regulatory agencies (see Appendix G for further details). In this modeling work, the Weather Research and Forecasting (WRF) numerical model version 3.6 was utilized to generate meteorological fields, while the Community Multiscale Air Quality (CMAQ) Model version 5.0.2 was used for modeling ozone in the IFNA. Other relevant information, including the modeling domain definition, chemical mechanism, initial and boundary conditions, and emissions preparation can be found in Appendix G and Modeling Emissions Inventory Appendix (Appendix H).

Based on USEPA modeling guidance,[39] modeling was used in a relative sense to project observed DVs to the future. The year 2012 was chosen as the starting point for the modeling and reference (or baseline) DV calculation based on analysis regarding the conduciveness of recent years' meteorological conditions to enhanced ozone formation and the availability of the most detailed emissions inventory. These reference DVs serve as the anchor point for estimating future year projected design values. The year 2017 was the future year modeled in this attainment demonstration since that is the year for which attainment must be demonstrated. An additional future year sensitivity simulation was conducted to assess the impact of Mexico emissions on 2017 DVs in the IFNA.

DVs are the three-year average of the annual fourth highest 8-hour O_3 mixing ratio observed at each monitor, and are used to determine compliance with the standard. In the attainment demonstration, the USEPA recommends using an average of three DVs to account for the year-to-year variability in meteorology, so DVs were calculated for the three year periods ending in 2012, 2013, and 2014 and then the three DVs were averaged. This average DV is called a baseline DV (see the 2nd column of Table 8-2 for the baseline DVs utilized in the attainment demonstration modeling).

In order to use the modeling in a relative sense, three sets of simulations were conducted: 1) <u>base year</u> simulation for 2012, which was used to verify that the model reasonably reproduced the observed air quality; 2) <u>reference year</u> simulation for 2012, which was the same as the base year simulation, but excluded exceptional event emissions such as wildfires; 3) <u>future year</u> simulations for 2017 (with and without Mexico emissions), which were the same as the reference year simulation, except that projected anthropogenic emissions for 2017 were used in lieu of the 2012 emissions.

Table 8-1 summarizes the 2012 and 2017 IFNA anthropogenic emissions used in the model attainment demonstration modeling, as well as the Mexicali emissions for the same years. Overall, anthropogenic NO_x in Imperial County was projected to decrease by 17% from 21.8 tpd in 2012 to 18.0 tons per day (tpd) in 2017. Over the same time period, NO_x emissions in the City of Mexicali were projected to increase to 8.4 tpd in 2017, while total emissions in the Mexicali

[39] USEPA. 2014. Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze. Available at: https://www.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf. Accessed: March 2017.

Municipality were expected to rise to 97.8 tpd. Anthropogenic ROG emissions in Imperial County were also projected to decrease between 2012 and 2017 to 16.9 tpd, while ROG emissions in the City of Mexicali and the Mexicali Municipality were expected to rise to 13.5 tpd and 65.8 tpd in 2017, respectively.

Table 8-1. Imperial County Summer Planning Emissions and the Mexicali Municipality Emissions within the Modeling Domain for 2012 and 2017 (tons/day)[1,2,3]

Source Category	NO_x [tpd]				ROG [tpd]			
	Imperial		Mexicali		Imperial		Mexicali	
	2012	2017	2012	2017	2012	2017	2012	2017
Stationary	1.7	1.5	15.3 (3.2)	24.8 (3.8)	1.3	1.4	14.2 (9.9)	17.4 (11.4)
Area	0.7	0.6	10.0 (0.3)	10.6 (0.4)	8.5	7.7	27.0 (0.8)	30.0 (0.9)
On-Road Mobile	10.0	6.5	55.7 (3.8)	58.2 (3.9)	4.3	3.1	17.4 (1.2)	18.0 (1.2)
Other Mobile	9.4	9.4	3.8 (0.2)	4.2 (0.3)	5.1	4.6	0.4 (0.0)	0.5 (0.0)
Total	**21.8**	**18.0**	**84.8 (7.5)**	**97.8 (8.4)**	**19.2**	**16.9**	**59.0 (11.9)**	**65.8 (13.5)**

Notes:
[1] Estimated emissions for the City of Mexicali are shown in parenthesis.
[2] Mexicali emissions were based on the USEPA 2011 Version 6.3 Platform inventory.
[3] Imperial County inventory totals do not include ERC balances.

As part of the model attainment demonstration, the fractional changes in ozone mixing ratios between the model reference year (2012) and the model future year (2017 with and without Mexico emissions) were calculated separately at each of the monitors following the USEPA modeling guidance[40] and procedures outlined in Appendix G. These ratios, called "relative response factors" or RRFs, were calculated based on the ratio of future year modeled maximum daily average 8-hour (MDA8) ozone to modeled reference year MDA8 ozone (Equation 1).

$$\mathrm{RRF} = \frac{\text{average MDA8 ozone}_{\text{future}}}{\text{average MDA8 ozone}_{\text{reference}}} \qquad (1)$$

The site-specific RRF for the future year 2017 was then multiplied by the weighted DV for the corresponding monitor to predict the future year DVs (Table 8-2). The RRF approach was previously applied in the 2013 Sacramento 8-Hour Ozone SIP[41] where the emission targets in SFNA were appropriately characterized for attaining the 1997 federal 8-hour ozone standard of 0.08 ppm (or 84 ppb) by 2018. The RRF approach has been applied in other regions of

[40] USEPA. 2014. Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze. Available at: https://www.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf. Accessed: March 2017.

[41] Sacramento Metropolitan Air Quality Management District. 2013. Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan. 2013 SIP Revisions. Available at: http://www.airquality.org/ProgramCoordination/Documents/4)%202013%20SIP%20Revision%20Report%201997%20Std.pdf. Accessed: March 2017.

California's Central valley including the SJV for the 2007 8-hour Ozone SIP[42] and later in the 2013 1-hour Ozone SIP,[43] as well as previous SIPs in Southern California. In addition, two peer-reviewed scientific publications focused primarily on areas outside of California (one from researchers at Rice University[44] and one from USEPA scientists[45]), both found that the RRF approach is highly robust in its ability to predict future DVs.

Table 8-2 shows that two of the three ozone monitoring sites in the IFNA were projected to attain the 8-hour ozone standard of 75 ppb by 2017 as a result of local Imperial County emission controls alone. However, the El Centro monitor was still projected to exceed the standard with a future DV of 79 ppb. To assess the impact of Mexico emissions on the 2017 DVs in Imperial County, a second future year simulation was conducted per USEPA guidance, which excluded emissions from Mexico. When Mexico emissions were excluded, future year DVs dropped significantly at all Imperial County monitors, resulting in projected attainment of the ozone standard at all three monitors. The largest decrease in DV occurred at the Calexico monitor, located adjacent to the United States-Mexico border, which was projected to exhibit a decrease of 13 ppb in the DV, from 75 ppb to 62 ppb. The next closest monitor to the United States-Mexico border, El Centro, was projected to have an 11 ppb drop in the DV from 79 ppb down to 68 ppb. The Niland monitor, which is located next to the Salton Sea and furthest from the United States-Mexico border, was projected to have a decrease in DV of only 3 ppb, from 67 ppb to 64 ppb. These results are consistent with previous work by Wang et al. (2009) that suggests the contribution of Mexico emissions to peak summertime 8-hour ozone in Imperial County is on the order of 10 ppb or greater.[46]

Table 8-2. Baseline Design Value, Modeled RRF, and Projected Future Year (2017 with and without Mexico Emissions) Design Value for Sites in the IFNA

Site	Base Year 2012	Future Year 2017		Future Year 2017 without Mexico Emission Inventory	
	Average DV (ppb)	RRF	Average DV (ppb)	RRF	Average DV (ppb)
Niland	70.3	0.9578	67	0.9238	64

[42] San Joaquin Valley Air Pollution Control District. 2007. 2007 Plan for the 1997 8-Hour Ozone Standard. April 30. Available at: http://www.valleyair.org/Air_Quality_Plans/docs/AQ_Ozone_2007_Adopted/2007_8HourOzone_CompletePlan.pdf. Accessed: March 2017.

[43] San Joaquin Valley Air Pollution Control District. 2013. 2013 Plan for the Revoked 1-Hour Ozone Standard. September 19. Available at: http://www.valleyair.org/Air_Quality_Plans/OzoneOneHourPlan2013/AdoptedPlan.pdf. Accessed: March 2017.

[44] Pegues, A.H., D.S. Cohan, A. Digar, C. Douglass, and R.S. Wilson. (2012). Efficacy of recent state implementation plans for 8-hour ozone. *Journal of the Air & Waste Management Association*, 62, 252-261. doi: 10.1080/10473289.2011.646049

[45] Foley. K., P. Dolwick, C. Hogrefe, H. Simon, B. Timin, and N. Possiel. (2015). Dynamic evaluation of CMAQ part II: Evaluation of relative response factor metrics for ozone attainment demonstrations. *Atmospheric Environment*, 103, 188-195. doi:10.1016/j.atmosenv.2014.12.039

[46] Wang, H., Jacob, D.J., Le Sager, P., Streets, D. G., Park, R. J., Gilliland, A. B., and van Donkelaar, A. (2009). Surface ozone background in the United States: Canadian and Mexican pollution influences. *Atmospheric Environment*, 43, 1310-1319.

El Centro	81.0	0.9749	79	0.8405	68
Calexico	76.3	0.9834	75	0.8231	62

8.3 Weight of Evidence Analysis

As demonstrated in Section 8.2, Imperial County is in attainment of the 2008 8-hour ozone NAAQS but for emissions coming from Mexico that increase the level of ozone in the ambient air. In these circumstances, Section 179B of the CAA allows the USEPA to approve a submitted SIP that demonstrates attainment and maintenance of the relevant NAAQS but for international emissions provided that the state meets all other applicable implementation plan requirements. To substantiate the use of the "but for" provision in this SIP, the following weight of evidence analysis has been included and provides a more in-depth examination of the conclusions reached in the attainment demonstration modeling.

According to the USEPA's December 2014 draft *Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze*[47] (2014 Modeling Guidance), there are three types of analyses that the USEPA recommends to supplement the primary modeling in an attainment demonstration. They are:

1) Additional modeling analyses;
2) Analyses of trends in ambient air quality and emissions; and
3) Additional emissions controls/reductions.

When determining which of these supplemental analyses to utilize and to what extent, an important factor to consider is the time remaining until the attainment date. In general, additional modeling analyses are most useful for areas with attainment dates far into the future (i.e., five or ten years or more). However, for areas like Imperial County with attainment deadlines that are sooner (i.e., one or two years away), an analysis of ambient air data and emissions trends can be a more reliable way to support the conclusions of an attainment demonstration. In fact, the 2014 Modeling Guidance specifies that, "if an area is only one or two years away from their attainment date, ambient data is in most cases the best predictor of likely air quality levels in the near future." Therefore, this weight of evidence analysis relies predominantly on trend analyses.

It's important to note that other nonattainment areas may utilize analyses in their weight of evidence demonstrations that do not apply to Imperial County. For instance, some areas attempt to look at the "weekend effect"[48] to determine if an area is a NO_x-sensitive or VOC-sensitive region and to explain non-linear relationships between precursor emissions and ozone concentrations; however, this analysis tends to only be appropriate in urban areas where weekday morning commute emissions are significant sources of ozone precursors. Other areas may use statistical analyses to find a direct correlation between precursor emissions and ozone concentrations; however, because Imperial County's ozone concentrations are heavily

[47] USEPA. 2014. Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. December. Available at: https://www3.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf. Accessed: October 2016.

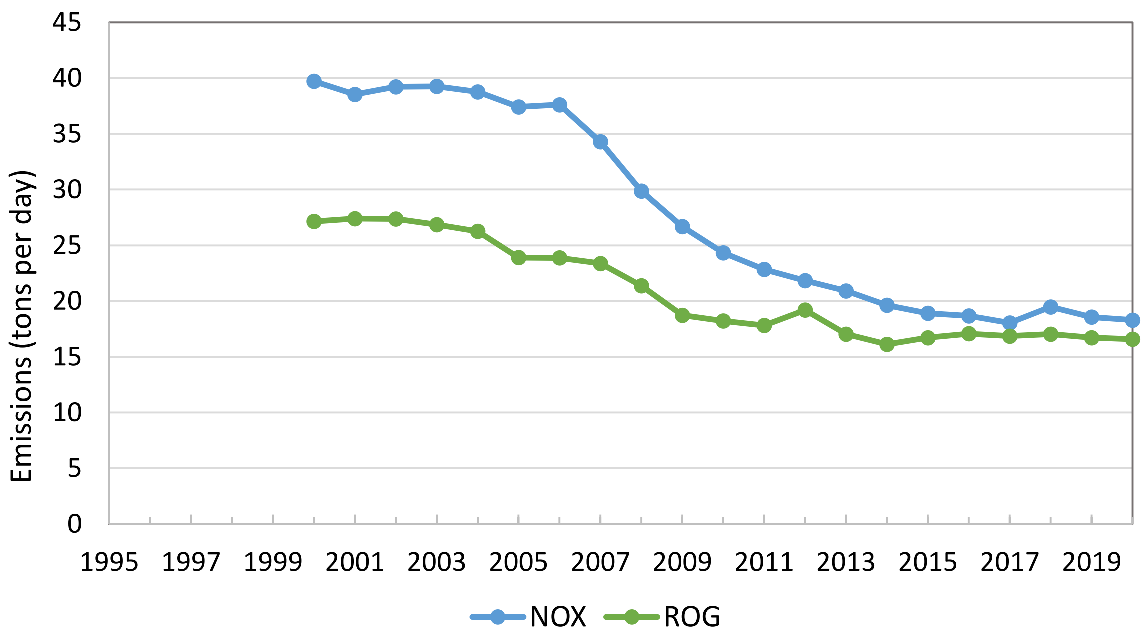
[48] The "weekend effect" is used to describe the phenomenon in which emissions of ozone precursors decrease over a weekend while the levels of measured ozone increase.

influenced by international emissions, of which reliable emission trend data is lacking, such an analysis would not be possible or very useful. The next sections present analyses appropriate to Imperial County.

8.3.1 Analyses and Trends in Ambient Air Quality and Emissions

According to the 2014 Modeling Guidance, “downward trends in observed air quality and in emissions (past and projected) are consistent with progress towards attainment”. Since ozone is not directly emitted, this emissions trend analysis focuses on ozone precursors, NO_x and ROG. Figure 8-1 shows the total emissions in Imperial County for NO_x and ROG from the years 2000 through 2020 as estimated by CARB’s California Emission Project Analysis Model, version 1.04.

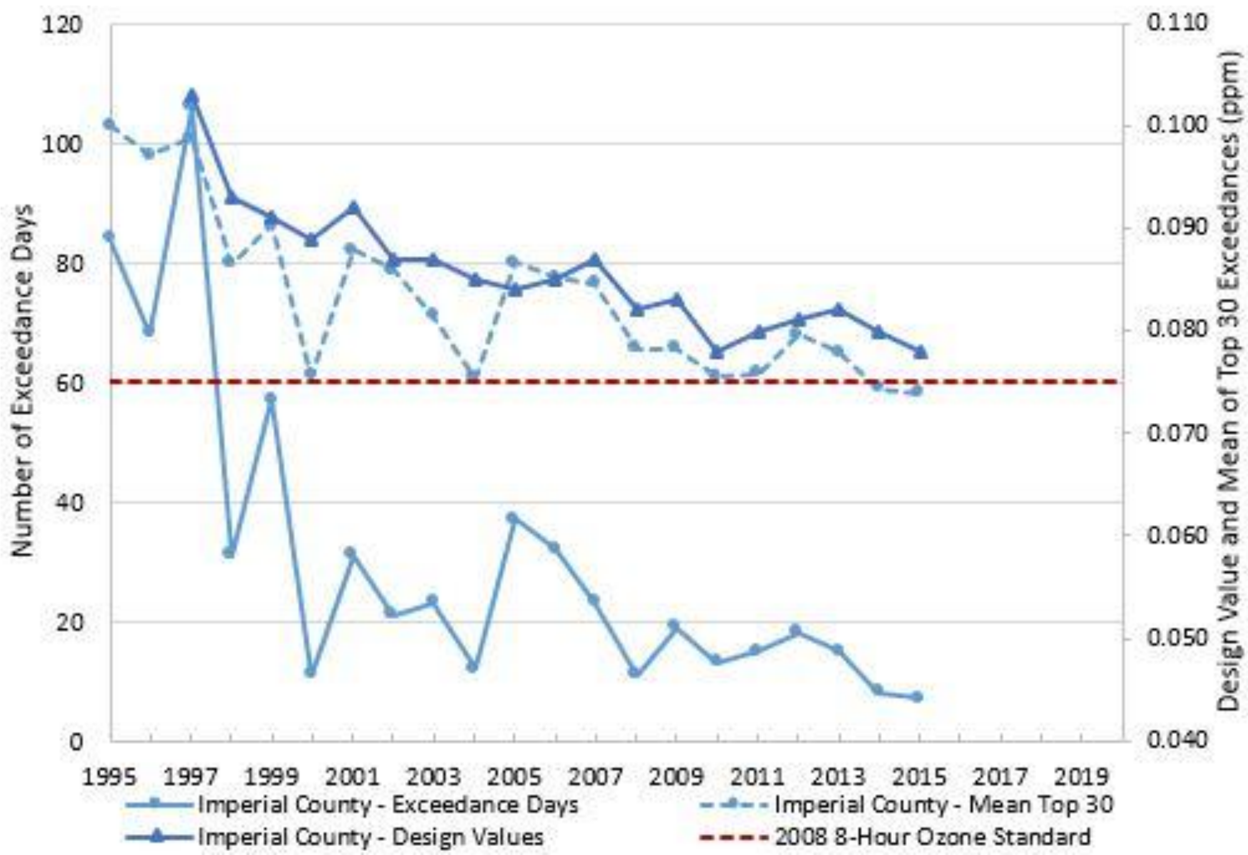
Figure 8-1. Total Nitrogen Oxides and Reactive Organic Gas Emissions, Imperial County, 1995 through 2020



Since 2000, the average tons per day of emitted ozone precursors in Imperial County has decreased significantly with an approximate 54 percent reduction in NO_x emissions and a 39 percent reduction in ROG emissions. ROG emissions have reduced fairly consistently over time, while NO_x emissions demonstrated a more drastic decrease from 2006 through 2015, a trend primarily driven by reductions in motor vehicle emissions. The concurrent trend in ozone concentrations in Imperial County is presented in Figure 8-2, which displays three air quality indicators: design value, exceedance days, and mean of the top thirty measurements. Together these indicators help one evaluate the overall trend of ozone concentrations within a region. The design value for the 8-hour ozone standard is calculated by taking the annual fourth highest daily maximum 8-hour ozone concentration and averaging it over three years for each monitoring site in a nonattainment area. The highest design value calculated out of all the monitoring sites becomes the design value for that nonattainment area and is what is used to determine compliance with the NAAQS. A region with a design value equal to or less than

0.075 ppm is determined to have met the NAAQS for the 2008 8-hour ozone standard. The exceedance day metric represents the number of days in a year that the daily maximum 8-hour ozone concentration was measured above the standard level of 0.075 ppm. Since this metric only considers the frequency of ozone exposure and not necessarily the magnitude, it generally displays the highest variability from year-to-year out of the three metrics. The last metric presented in the figure, mean of the top thirty, represents the average value of the top thirty daily maximum 8-hour ozone concentrations measured each year in the region.[49]

Figure 8-2. Ozone Concentration Trends, Imperial County, 1995 through 2020



As seen in Figure 8-2, all three indicators show a downward trend over time, illustrating that substantial progress has been made in Imperial County. However, when comparing with the trends in precursor emissions, it is difficult to discern a distinct correlation between the two datasets. This is primarily due to the fact that other factors (e.g., meteorological conditions, regional wildfires, international sources) influence ambient air ozone levels aside from emissions originating in Imperial County. As was shown in Section 8.2, emissions from the Mexicali metropolitan area greatly influence ozone levels across the border in Imperial County.

[49] For each of these three metrics, a certain "completeness" of the data sets is required for them to accurately represent ozone trends. For the purposes of analyzing and displaying these trends, data sets for each monitor in a given year are considered complete so long as there are measurements reported during the high ozone season (May-September). Data from years with no measurements during those months have been excluded from this analysis.

The magnitude of the impact from Mexicali is not surprising when one considers that while Imperial County's total population increased by approximately 10,000 people[50] from 2010 to 2015, Mexicali's population increased by approximately 50,000 people.

The ozone concentration trends at the individual monitoring sites in Imperial County can be evaluated through the use of the same three air quality indicators. These trends are presented in Figures 8-3 through 8-5. Figure 8-3 presents the annual design values for all four Imperial County ozone monitoring stations. As can be seen in the figure, after 2010 the design value measured at the Niland monitoring station (the station farthest from the US-Mexico border) fell below the 2008 8-hour ozone standard. Alternatively, in recent years the design values at the Calexico and El Centro monitoring stations have remained above the standard.

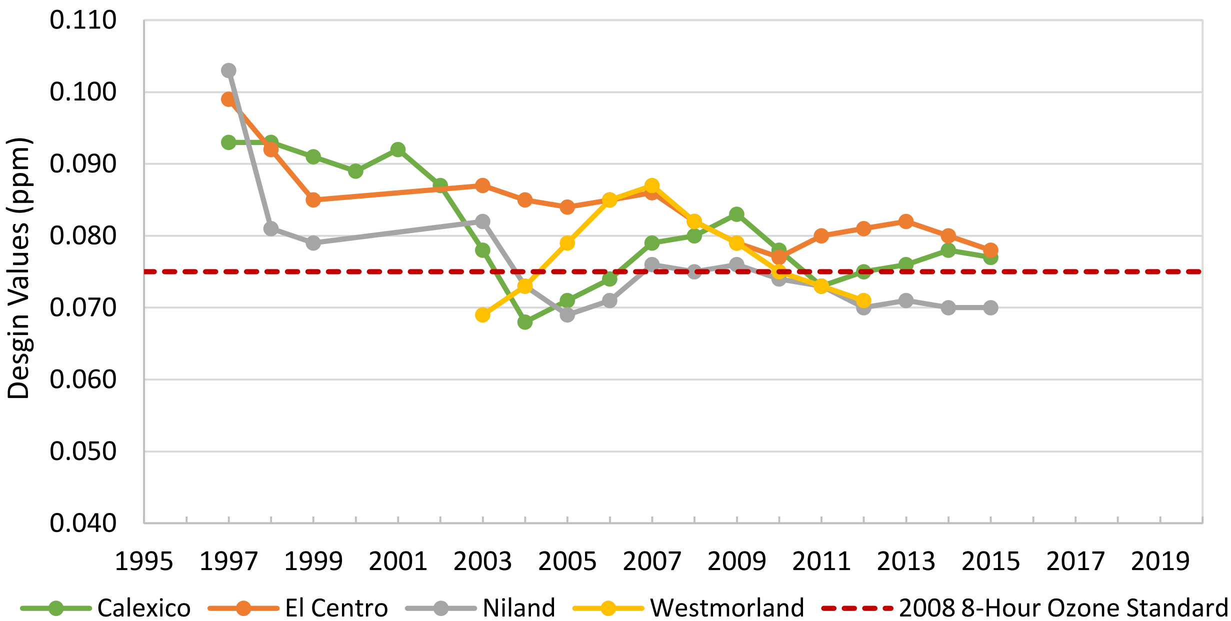


Figure 8-3. Design Value Trends, Imperial County Monitoring Sites, 1995 through 2020

Similar trends are observed among the Imperial County monitoring sites for the "exceedance days" and "mean of top 30" indicators, as presented in Figures 8-4 and 8-5, respectively.

[50] Specifically, the populations in the cities of El Centro and Calexico grew by approximately 2,400 and 1,600 people, respectively.

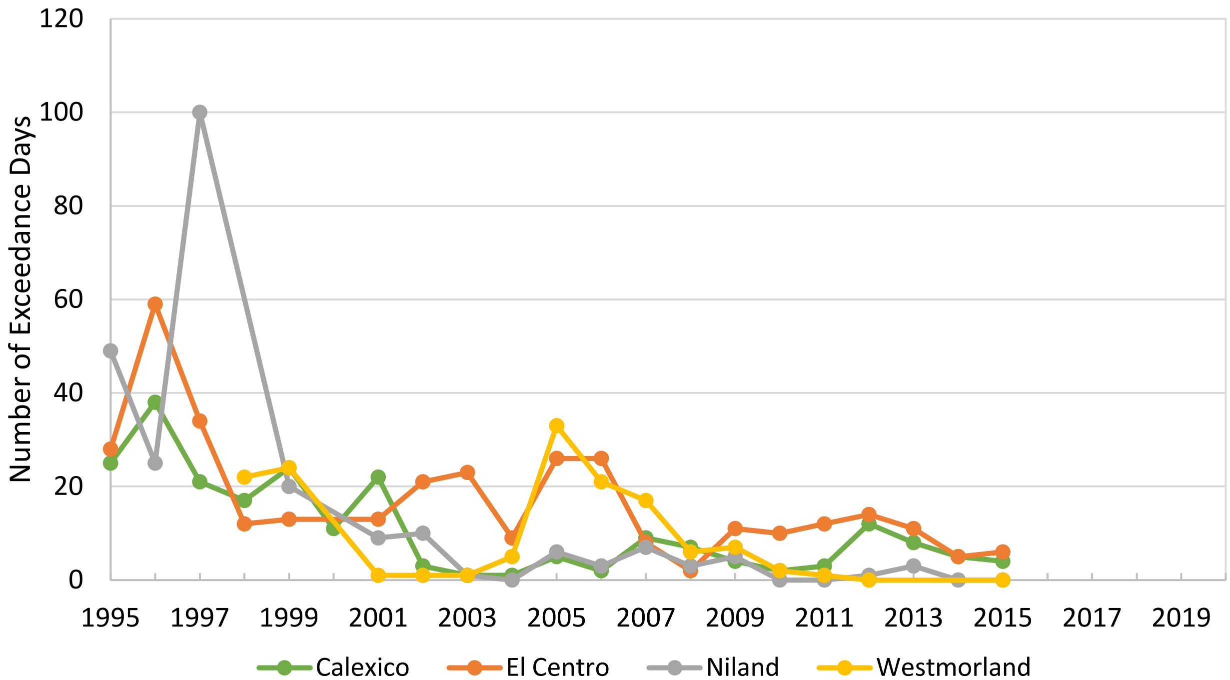


Figure 8-4. Exceedance Day Trends, Imperial County Monitoring Sites, 1995 through 2020

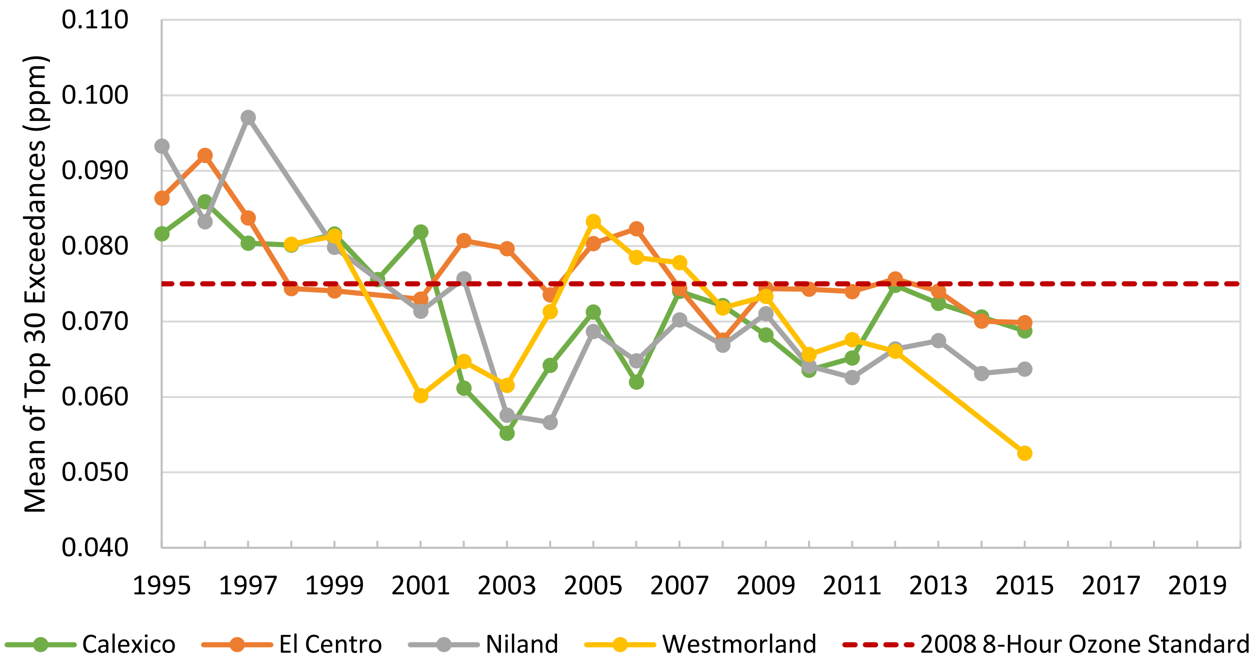


Figure 8-5. Mean of Top 30 Trends, Imperial County Monitoring Sites, 1995 through 2020

8.3.2 Additional Emissions Controls/Reductions

While the trends analysis supports the attainment demonstration, it is worth mentioning that additional measures have been put into place in order to ensure attainment is maintained long term. Since some emissions sources and controls are difficult to represent in modeling analyses, the 2014 Modeling Guidance suggests discussing any extra measures in a weight of evidence analysis that are otherwise difficult to quantify or might not be enforceable in the SIP. Examples of these types of control measures are state-wide energy efficiency or renewable energy programs, smart growth initiatives such as land use and transportation planning, voluntary measures such as ozone action days and no burn days, and other regional programs that may not have been accounted for in the attainment demonstration. For Imperial County, a few projects specific to improving air quality have been implemented as part of the greater United States – Mexico Border 2020 Program. One objective of this program is to "reduce pollutant emissions in order to approach attainment of respective national ambient air quality standards"[51] at four different airsheds near the border, including the Imperial County/Mexicali Airshed. Projects to address these and other goals of the 2020 Program are overseen by the Air Quality Task Force, which works with the Border Environment Cooperation Commission and other local agencies (including the ICAPCD) on initiatives specific to improving air quality in the region. An example of the type of projects underway as part of Border 2020 is a vehicle idling emissions study at the Calexico East and West points of entry. The goal of this study is to quantify the impacts of vehicle idling on emissions of pollutants, including nitrogen oxides, while people are in line to cross the border, and identify potential emission reduction strategies based on the findings. More information on this initiative and other facets of the Border 2020 program can be found in Chapter 9. The fact that there are efforts to improve air quality in Imperial County outside of SIP requirements and the direct influence of the ICAPCD adds another layer of confidence to the attainment demonstration.

8.4 Conclusion

The modeling results achieved and explained in the attainment demonstration for this SIP demonstrate that Imperial County has attained the 2008 ozone NAAQS when emissions sources originating in Mexico are excluded. The arguments presented in the weight of evidence section further support this conclusion. Furthermore, given the current ozone levels, the trends observed in recent years, and the regional programs implementing new control measures in the region, Imperial County is poised to maintain this attainment status through the July 2018 attainment date and into the future.

[51] United States Environmental Protection Agency. Border 2020: Objectives and Goals. Available at: https://www.epa.gov/border2020/goals-and-objectives. Accessed October 2016.

9 Border Strategic Concepts

9.1 Introduction

This chapter discusses the ICAPCD's overall involvement in working cooperatively with our counterparts from Mexico to discuss emissions reductions strategies and projects for air quality improvements at the border and provide public information and education and a forum to border residents. In August 2012, the U.S. and Mexico signed the U.S.-Mexico Environmental Program Border 2020. Border 2020 is a cooperative effort between the USEPA, Mexico's SEMARNAT (federal environmental agency and USEPA counterpart), the four U.S. border states (Texas, New Mexico, Arizona, and California) and the six Mexican border states (Tamaulipas, Nuevo León, Coahuila, Chihuahua, Sonora, and Baja California), plus 26 U.S. border tribes. The initiative is to improve the environment by focusing on cleaning the air, providing safe drinking water, reducing the risk of exposure to hazardous waste, and ensuring emergency preparedness along the U.S.-Mexico border. By improving the environment both countries ensure the protection of the health of the people who live on both sides along the border.

The two countries strive to achieve these goals through local input from states, local governments, and citizens. Within the Mexicali and Imperial Valley area, the Air Quality Task Force (AQTF) has been organized to address those issues unique to the border region known as the Mexicali/Imperial air shed. The AQTF membership includes representatives from federal, state and local governments from both sides of the border, as well as representatives from academia, environmental organizations, and the general public. This group was created to promote regional efforts to improve the air quality monitoring network, emission inventories, and air pollution transport modeling development, as well as the creation of programs and strategies to improve air quality. Air quality improvement programs are used as a valuable resource by the local environmental managers to determine connections between air quality, land use, communications infrastructure and economic development issues.

Following is a brief summary of some of the projects in which the ICAPCD, in conjunction with the AQTF, CARB, and USEPA, participate to address or evaluate emissions at the border and educate the communities on the impact of air pollution in this region.

9.1.1 Web-Based Air Quality and Health Information Center

The ICAPCD and the CARB, in cooperation with the USEPA, operates a Web-based air quality and health information center for Imperial County. Through this project, the ICAPCD provides the community with the real-time data collected by our monitoring stations, including Ozone and PM_{10}. The purpose of this project is to enable schools and after-school programs, as well as others in the county to make informed choices on the level of outdoor activity they deem appropriate in order to reduce exposure to air pollutants. The general population benefits from the information that enables them to protect their health on days when pollution exceeds the health-based air quality standards.

Hourly ozone and PM_{10} measurements are currently available in the form of an air quality index (AQI) through a web-based air quality and health information center. Next-day ozone forecast information is made available to the public through the website for the summer months. Health and other pertinent information links related to specific levels of these pollutants is also available.

The web-site is capable of notifying registered participants when the levels of air pollutants are unhealthy, including ozone and PM_{10} episodes. Notifications are sent to registered participants via e-mail and/or cell phone text message. The web-based air quality and health information center is available on the internet at the following web site: www.imperialvalleyair.org.

9.1.2 AQI Advertisement

Asthma is a common health issue in Imperial County. Education in daily air quality conditions is a great need for the community. In order to promote air quality awareness and prevention, the ICAPCD established an AQI Advertisement Campaign with the purpose to educate and alert the community of the daily particulate risk levels. The campaign serves as a visual communication method by utilizing a marquee at a highly trafficked area of county as well as a local radio and television stations which includes website exposure to display and make aware of AQI alerts. The advertisement is based on AQI colors that are easily understood by all ages. Overall, the goal of the program is to alert the community of daily air quality conditions to prevent children and adults prone to asthma.

AQI Marquee at Imperial Valley Mall is an electronic billboard the features advertising displays to the north and south. The billboard system allows for the customer to change the advertisement to display real-time data, if need be. For example, this system has the capability to display the AQI and can be utilized to display the AQI when there is an alert. In addition, the marquee may be modified any time of the day to provide other air quality information to residents in Imperial County and Mexicali who visit the Imperial Valley Mall. Such notifications may include ICAPCD board hearings, workshops, and incentive programs as well as AQTF events.

AQI Media Advertisements include a one-year advertisement agreement with Entravision/Univision, a local high-rated and frequency-viewed television station (KAJB-TV, Ch. 54, and NVYE-TV [CABLE] and KVYE-TV Ch. 7). Viewers will be informed of the air quality forecast, the current AQI, and the AQI website, while the company logo, telephone, and website will be displayed throughout the segment which occurs twice a day during the morning and evening news. The AQI Media Advertisements also include a one-year advertisement agreement with high-rated radio stations (KMXX-FM 99.3 FM and KSEH-FM 94.5 FM) which will announce the AQI, air quality forecast, and website Monday through Friday, three times a day for 30 seconds. This package deal also includes a one-year advertisement in three local websites: Jose, Tricolor, and El Centro News.

9.1.3 Vehicle Idling Emissions Study at Calexico East and Calexico West Ports of Entry

Reducing emissions of PM and NO_x from idling vehicles at ports of entry is one of the most important air quality challenges facing the Imperial County and Mexicali region. Even with standards taking effect over the next decade for idling vehicles, millions of vehicles will continue to emit large amounts of NO_x, PM, and air toxics, which contribute to serious public health problems.

It is important to understand the impacts and to evaluate the amount of air emissions generated by idling vehicles at the Calexico East and Calexico West ports of entry. On behalf of the AQTF, in 2014, the ICAPCD was selected as a grantee by the Boarder Environment Cooperative

Commission (BECC) to study border idling. The ICAPCD hired a consulting firm to develop an analysis with two essential elements. The first element is to determine the vehicle idling impacts at both ports of entry. The second element, crucial to any air quality improvement, is the identification of emission reduction strategies that U.S.-Mexican planning agencies could implement at both ports of entry in order to reduce impacts upon the general population. Estimating emissions from idling vehicles and identifying potential control strategies can be helpful in securing organizational support for federal, state, and local governments on both sides of the border. Overall, this project will (1) estimate PM and NO_x emissions from northbound idling vehicles waiting at two ports of entry and to (2) identify emission reduction strategies (with accompanying PM and NO_x reductions) that U.S.-Mexican planning agencies could implement at the port of entry (POE).

9.1.3.1 Results

The first phase of the study focused on the collection of real-world data to better characterize and understand the emissions and causes of delay at the ports of entry. The second and third phases of the study focused on estimating seasonal emissions of $PM_{2.5}$, ROG, and NO_x at the ports of entry under existing (2014) conditions and with several strategies to reduce those emissions. In addition, to analyze existing conditions and an idealized no port of entry delay scenario, seven emissions reduction scenarios were studied.

- Phase 1 of the Calexico West POE reconstruction project;
- Phase 2 of the Calexico West POE reconstruction project;
- Use of California fuel in Mexicali;
- A reduction in empty general-purpose truck trips;
- Replacing 10 percent of general-purpose truck trips to FAST truck trips;
- Streamlining commercial crossing by combining the Aduanas and CBP primary inspections; and
- The Section 559 Proposal to expand the Calexico East POE.

The results indicate that border delay accounts for about 63 percent of the ROG emissions, 46 percent of the NO_x emissions, and 53 percent of the $PM_{2.5}$ emissions from northbound vehicles crossing into the United States. The emissions associated with border delay are equivalent to the TOG emissions from 2,700 passenger vehicles in Imperial County, the NO_x emissions from 4,400 passenger vehicles in Imperial County, or the $PM_{2.5}$ emissions from 3,450 passenger vehicles in Imperial County. The results below are shown as the equivalent number of privately owned vehicles in Imperial County that would need to be removed from the vehicle fleet to achieve a comparable air quality benefit.

Table 9-1. POE Study Results Summary

Best Management Practice – Emission Reduction Strategy	Number of Privately Owned Vehicles That Would Need to be Removed or Subjected to a Scrappage Program to Achieve Similar Emission Reductions			Control Strategy Rank by Pollutant	
	NO_x	$PM_{2.5}$	ROG	NO_x and $PM_{2.5}$	ROG
Calexico East Section 559	634 vehicles	469 vehicles	1371 vehicles	1	2

Table 9-1. POE Study Results Summary					
Best Management Practice – Emission Reduction Strategy	Number of Privately Owned Vehicles That Would Need to be Removed or Subjected to a Scrappage Program to Achieve Similar Emission Reductions			Control Strategy Rank by Pollutant	
	NO_x	$PM_{2.5}$	ROG	NO_x and $PM_{2.5}$	ROG
Proposal, with Calexico West Phase 1 POE Project					
Combine Aduanas and CBP Primary	469 vehicles	366 vehicles	90 vehicles	2	5
Calexico West Phase 1 and 2 POE Project	315 vehicles	229 vehicles	1310 vehicles	3	3
Calexico West Phase 1 POE Project	98 vehicles	68 vehicles	681 vehicles	4	4
Shift 10 percent of Commercial General-Purpose to FAST	80 vehicles	68 vehicles	19 vehicles	5	6
Reduction in Empty Commercial General-Purpose Volume	33 vehicles	26 vehicles	6 vehicles	6	7
California Fuel	0 vehicles	0 vehicles	1638 vehicles	7	1

9.1.4 Program to Improve Air Quality in Mexicali 2011-2020

The Mexican government has developed a very ambitious program to reduce air emissions in Mexicali. Reducing $PM_{2.5}$ emissions in Mexicali is crucial to the reduction of the transport of air emissions into Imperial County. The reduction of such transport of air emissions will greatly reduce the impact of poor air quality in both air sheds. The ICAPCD actively participated during the development of the air program for Mexicali, as an expert air quality agency, by reviewing and providing constructive comments through bi-national meetings such as the AQTF. It is worthy to note that the ICAPCD, CARB, nor the USEPA has any jurisdictional authority over emission sources in Mexico. This program includes actions to reduce air emissions from different source categories.

10 Other Clean Air Act Requirements

10.1 Emissions Statement Rule

Section 182(a)(3)(B) of the CAA requires ozone nonattainment areas to include a provision in their SIPs that requires owners or operators of stationary sources of NO_X and/or VOCs within their jurisdiction to provide the state with a statement showing the actual emissions of those pollutants from those sources. These statements are to be submitted at least once per year and must include a certification that the information within them is accurate to the best knowledge of the certifying individual.

According to the 2015 Ozone Implementation Rule for the 2008 standard, "if an area has a previously approved emission statement rule in force for the 1997 ozone NAAQS or the 1-hour ozone NAAQS that covers all portions of the nonattainment area for the 2008 ozone NAAQS, such rule should be sufficient for purposes of the emissions statement requirement for the 2008 ozone NAAQS".[52] This condition is applicable to Imperial County because ICAPCD adopted an emissions statement rule in 2010, Rule 116, which fulfills this obligation. When Rule 116 was adopted by ICAPCD, it applied to the entire ozone nonattainment area for the 1997 ozone NAAQS, which covers the same area as the 2008 ozone NAAQS. Rule 116 has been included in the ICAPCD-portion of the California SIP and has been approved by the USEPA.[53]

In order for previously adopted rules to satisfy this CAA requirement, they must be periodically reviewed by the state to ensure that they remain adequate. According to the 2015 Ozone Implementation Rule, this is accomplished by "identifying the various requirements and how each is met by the existing emission statement program."[54] Thus, the following is a summary of the requirements of CAA Section 182(a)(3)(B) and how Rule 116 fulfills them. The first requirement is that the state require that owners or operators of each stationary source of NO_X or VOCs provide a statement showing the actual emissions of those pollutants from those sources. As previously discussed, this is the explicit purpose of ICAPCD's Rule 116. The next requirement of is that the statements be submitted at least every year and that they must include a certification by a responsible official of the company submitting the statement. Again, Rule 116 includes these details. Finally, CAA Section 182(a)(3)(B)(ii) includes a provision that allows states to waive the application of the emissions statement requirements for any specific sources which emit less than 25 tons per year of VOCs and NO_X as long as the state provides an inventory of emissions from that specific class or category of sources. Since Rule 116 also addresses this clause, it covers all of the requirements of CAA Section 182(a)(3)(B) as intended and is adequate in fulfilling the emissions statement requirement for the 2008 ozone NAAQS.

[52] United States Environmental Protection Agency. 2015. *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; Final Rule*. Federal Register. Vol. 80. No. 44. March 6, 2015. p. 12291.

[53] United States Environmental Protection Agency. 2012. *Revisions to the California State Implementation Plan, for Imperial County, Placer County and Ventura County Air Pollution Control Districts; Direct final Rule*. Federal Register. Vol. 77. No. 236. December 7, 2012. p. 72968.

[54] United States Environmental Protection Agency. 2015. *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; Final Rule*. Federal Register. Vol. 80. No. 44. March 6, 2015. p. 12291.

10.2 Transportation Conformity

[Section 10.2 was provided by the California Air Resources Board]

10.2.1 Background

Section 176(c) of the Federal Clean Air Act (CAA) establishes transportation conformity requirements which are intended to ensure that transportation activities do not interfere with air quality progress. The CAA requires that transportation plans, programs, and projects that obtain federal funds or approvals be consistent with, or *conform to* applicable state implementation plans (SIP) before being approved by a Metropolitan Planning Organization (MPO). Conformity to the SIP means that proposed transportation activities must not:

(1) Cause or contribute to any new violation of any standard,
(2) Increase the frequency or severity of any existing violation of any standard in any area, or
(3) Delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

A SIP analyzes the region's total emissions inventory from all sources necessary to demonstrate reasonable further progress (RFP), attainment, or maintenance of the National Ambient Air Quality Standards (NAAQS). The portion of the total emissions inventory from on-road highway and transit vehicles which provides RFP and attainment or maintenance of the NAAQS in these analyses becomes the "motor vehicle emissions budget".[55] Motor vehicle emissions budgets are the mechanism for ensuring that transportation planning activities conform to the SIP. Budgets are set for each criteria pollutant or its precursors that the area does not attain. Budgets are set for each RFP milestone year and the attainment year.

10.2.2 Requirements for Demonstrating Conformity

The Southern California Association of Governments (SCAG), the MPO in Southern California, in consultation with the Imperial County Transportation Commission, prepares a long range regional transportation plan (RTP) at least every four years and a short range funding program, or regional transportation improvement program (RTIP) every two years. Content of both the RTP and RTIP are specified in federal transportation law found at Titles 23 and 49 of the federal code of regulations and applicable sections of state transportation planning law.

Before adopting the RTP/RTIP, SCAG prepares a regional emissions analysis using the proposed plan and program as specified in the federal conformity regulation and compares those emissions to the emission budgets in the SIP. The MPO may determine the RTP/RTIP conforms if the emissions from the proposed actions are less than the emissions budgets in the SIP. The conformity determination also signifies that the MPO has met other transportation conformity requirements such as interagency consultation and financial constraint.

[55] Federal transportation conformity regulations are found in 40 CFR Parts 51 and 93 – Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Titles 23 or 49 of the United States Code.

10.2.3 Conformity Budgets in the 2017 Imperial County Ozone AQMP

The 2017 AQMP establishes transportation conformity emissions budgets for ozone in Imperial County for the year 2017. This plan demonstrates that Imperial county will attain the 2008 federal ozone NAAQS in 2017 “but for” the emissions from Mexico. The budgets below are consistent with the emissions inventory used in the “but for” attainment demonstration.

The emissions budgets presented below use EMFAC2014 with SCAG modeled VMT and speed distributions. The VMT and speed distribution data are from the 2016 RTP/SCS adopted by SCAG in April 2016. CARB staff released a revised emission rate program, EMFAC2014, which updates the emission rates and planning assumptions used in calculating conformity budgets. EMFAC2014 was approved for use in SIPs and transportation conformity by U.S. EPA on December 14, 2015.

Calculation Methodology

All the budgets in this plan have been constructed in consultation with SCAG and U.S. EPA using emissions for a summer average day consistent with the ozone “but for” attainment demonstrations using the following method:

1) Calculate the on road motor vehicle emissions totals for VOC and NO_x from EMFAC2014.
2) Sum each pollutant and round each total up to the nearest ton for VOC and NO_x.

Table 10-1 below contains the emissions budgets for Imperial County.

Table 10-1. Transportation Conformity Budgets* for the 2008 8-hour Ozone standard in Imperial County

Imperial County (tons per summer day)	2017	
	VOC	NO_x
Baseline Emissions	3.13	6.53
Total	3.13	6.53
Conformity Budget	**4**	**7**

*Budgets calculated with EMFAC2014 using SCAG 2016 RTP activity. Budgets are rounded up to the nearest ton.

10.3 General Conformity

As a requirement of the CAA, emissions of air pollutants from planned federal activities must not affect a state’s ability to achieve its goal of meeting a NAAQS. According to CAA Section 176(c), federal projects must conform to a state’s SIP, meaning that they cannot cause new violations of the NAAQS, increase the severity or frequency of NAAQS violations, or delay a timely attainment of the NAAQS if the area is not in attainment. This concept is known as general conformity, and the details for how it is to be maintained are laid out in the General Conformity Regulations found in 40 CFR Part 93, Subpart B. Essentially, it is an emissions based system that requires federal agencies to evaluate potential emissions before taking or sponsoring any actions that might cause them. Once the emissions have been evaluated and the agency has confirmed that they conform to the most current, approved SIP for the area, the projects can be approved and funded.

From time to time, USEPA updates the General Conformity Regulations as necessary. However, with the promulgation of the 2008 ozone standard, it retained the already existing General Conformity Regulations. These regulations became applicable for the 2008 ozone standard in 2013, one year after the effective date of nonattainment designations for the standard. According to the 2015 Ozone Implementation Rule, states with approved general conformity SIPs should not need to revise their SIPs unless they need to do so to ensure they are consistent with the April 4, 2010 revisions to the general conformity regulations or to ensure existing regulations apply in the appropriate newly designated areas.

In order to demonstrate general conformity, a federal agency has a few options. One way is to have the federal agency responsible for a project show that the total of direct and indirect emissions from actions involved is accounted for in the applicable SIP's attainment demonstration. Thus, the emissions inventory section of this SIP intentionally includes emissions sourced from specific and already planned federal projects. In the event that the project will cause emissions in excess of those allowed by the SIP, it is the responsibility of the federal agency involved to either offset the emissions by reducing others in the same area, or perform air quality monitoring that shows the emissions will not cause or contribute to new violations of the NAAQS. Accomplishing this satisfies the requirements of general conformity for both the federal agency and the state involved, and allows the project to be approved and funded.

11 SIP Checklist

A checklist of the 8-hour ozone requirements pertinent to this SIP as outlined in Part D of Title I of the CAA is presented in Table 11-1.

Table 11-1. State Implementation Plan Checklist

Required Element	Document Location	Comments
Attainment Demonstration, (CAA, Section182(b)(1))	Chapter 8	
Subpart 1 Reasonable Available Control Measures (RACM), (CAA, Section 172(c)(1))	Chapter 6 and Appendix C	
RFP (CAA, Sections 172(c)(2), 182(b)(1))	Chapter 5	
Emissions Inventory, (CAA, Sections 172(c)(3) and 182(a)(1))	Chapter 4 and Appendix A	
New Source Review (CAA, Sections172(c)(4) and (5); and 182(a)(2)(C)	Section 6.2	There are two versions of NSR rule that are enforced by the ICAPCD. A current version adopted as an amendment by the ICAPCD Air Board on October 10, 2006 and a SIP version of Rule 207, Standards for Permit to Construct, approved on November 10, 1980. Both versions of Rule 207 fulfill the requirements of CAA Sections 172(c)(4) and (5), 182(a)(2)(C).
Contingency Measures (CAA, Section 172(c)(9)	Chapter 5 (RFP Contingency)	Attainment contingency not required.
Subpart 2 RACT for VOCs and NO_x, (CAA, Sections 182(b)(2), 182(f))	Chapter 7 and Appendix B	
Vehicle Inspection and Maintenance (I/M), (CAA, Sections 182(a)(2)(B), (b)(4))		Not applicable to Imperial County because population below 200,000.
Periodic Inventory, (CAA, Section 182(a)(3)(A))	Chapter 4 and Appendix A	
Emissions Statement Rule, (CAA, Section 182(a)(3)(B))	Section 10.1	
Offset Ratio 1.15 to 1 (CAA, Sections 182(a)(4) and 182(b)(5))	Section 6.2	There are two versions of NSR rule that are enforced by the ICAPCD. A current version adopted as an amendment by the ICAPCD Air Board on October 10, 2006 and a SIP version of Rule 207, Standards for Permit to Construct, approved on November 10, 1980. Both versions of Rule 207 fulfill the 1.15 to 1 offset ratio required by CAA, Sections 182(a)(4) and 182(b)(5).

Table 11-1. State Implementation Plan Checklist

Required Element	Document Location	Comments
Stage 2 Gasoline Vapor Recovery (GVR), (CAA, Section 182(b)(3))	N/A	Stage 2 GVR requirements no longer apply to moderate areas following promulgation of Onboard Refueling Vapor Recovery rule. CAA 202(a)(6); 59 FR 16262, April 6, 1994.

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Appendix A
Ozone Precursor Emission Inventories for Imperial County

Table A-1. Ozone Precursor Emissions by Major Source Category in Imperial County, 2008

Source Category	ROG (tons/day)	% Total	NO_X (tons/day)	% Total
Stationary Sources				
Fuel Combustion	0.16	0.76%	3.85	12.88%
Electric Utilities	*0.08*	*0.36%*	*1.27*	*4.24%*
Cogeneration	*0.00*	*0.00%*	*0.00*	*0.00%*
Manufacturing and Industrial	*0.03*	*0.16%*	*1.23*	*4.11%*
Food and Agricultural Processing	*0.03*	*0.14%*	*0.89*	*2.99%*
Service and Commercial	*0.01*	*0.06%*	*0.33*	*1.09%*
Other (Fuel Combustion)	*0.01*	*0.05%*	*0.13*	*0.45%*
Waste Disposal	0.02	0.08%	0.00	0.00%
Other (Waste Disposal)	*0.02*	*0.08%*	*0.00*	*0.00%*
Cleaning and Surface Coatings	0.60	2.81%	0.00	0.00%
Laundering	*0.01*	*0.04%*	*0.00*	*0.00%*
Degreasing	*0.35*	*1.64%*	*0.00*	*0.00%*
Coatings and Related Process Solvents	*0.15*	*0.69%*	*0.00*	*0.00%*
Adhesives and Sealants	*0.10*	*0.45%*	*0.00*	*0.00%*
Petroleum Production and Marketing	0.74	3.45%	0.00	0.00%
Petroleum Refining	*0.00*	*0.01%*	*0.00*	*0.00%*
Petroleum Marketing	*0.73*	*3.40%*	*0.00*	*0.00%*
Other (Petroleum Production and Marketing)	*0.01*	*0.04%*	*0.00*	*0.00%*
Industrial Processes	0.01	0.05%	0.01	0.04%
Food and Agriculture	*0.00*	*0.00%*	*0.00*	*0.00%*
Mineral Processes	*0.01*	*0.04%*	*0.01*	*0.04%*
Other (Industrial Processes)	*0.00*	*0.00%*	*0.00*	*0.00%*
Total Stationary Sources	**1.53**	**7.14%**	**3.86**	**12.92%**
Areawide Sources				
Solvent Evaporation	4.86	22.76%	0.00	0.00%
Consumer Products	*1.15*	*5.36%*	*0.00*	*0.00%*
Architectural Coatings and Related Process Solvents	*0.57*	*2.68%*	*0.00*	*0.00%*
Pesticides/Fertilizers	*3.02*	*14.12%*	*0.00*	*0.00%*
Asphalt Paving/Roofing	*0.13*	*0.60%*	*0.00*	*0.00%*
Miscellaneous Processes	4.24	19.84%	0.81	2.71%
Residential Fuel Combustion	*0.01*	*0.04%*	*0.07*	*0.22%*
Farming Operations	*2.67*	*12.50%*	*0.00*	*0.00%*
Fires	*0.00*	*0.01%*	*0.00*	*0.00%*
Managed Burning and Disposal	*1.55*	*7.24%*	*0.74*	*2.48%*
Cooking	*0.01*	*0.05%*	*0.00*	*0.00%*
Total Areawide Sources	**9.11**	**42.60%**	**0.81**	**2.71%**
Mobile Sources				
On-Road Vehicles	5.03	23.52%	13.99	46.84%
Off-Road Vehicles	5.72	26.74%	11.21	37.53%
Total Mobile Sources	**10.74**	**50.25%**	**25.20**	**84.37%**
Total for Imperial County	**21.38**	**100.00%**	**29.87**	**100.00%**

Note:
Emissions for Imperial County were queried from the California Emissions Projection Analysis Model (CEPAM), Version 1.04.
Totals may not add up due to rounding.

Table A-2. Ozone Precursor Emissions by Major Source Category in Imperial County, 2012

Source Category	ROG (tons/day)	% Total	NO_X (tons/day)	% Total
Stationary Sources				
Fuel Combustion	0.11	0.58%	1.66	7.61%
Electric Utilities	*0.05*	*0.27%*	*0.50*	*2.27%*
Cogeneration	*0.00*	*0.00%*	*0.04*	*0.19%*
Manufacturing and Industrial	*0.02*	*0.13%*	*0.53*	*2.44%*
Food and Agricultural Processing	*0.02*	*0.09%*	*0.25*	*1.14%*
Service and Commercial	*0.01*	*0.07%*	*0.34*	*1.56%*
Other (Fuel Combustion)	*0.01*	*0.03%*	*0.00*	*0.01%*
Waste Disposal	0.00	0.00%	0.00	0.00%
Other (Waste Disposal)	*0.00*	*0.00%*	*0.00*	*0.00%*
Cleaning and Surface Coatings	0.50	2.60%	0.00	0.00%
Laundering	*0.01*	*0.04%*	*0.00*	*0.00%*
Degreasing	*0.25*	*1.28%*	*0.00*	*0.00%*
Coatings and Related Process Solvents	*0.17*	*0.89%*	*0.00*	*0.00%*
Adhesives and Sealants	*0.07*	*0.38%*	*0.00*	*0.00%*
Petroleum Production and Marketing	0.72	3.74%	0.00	0.00%
Petroleum Refining	*0.00*	*0.01%*	*0.00*	*0.00%*
Petroleum Marketing	*0.71*	*3.72%*	*0.00*	*0.00%*
Other (Petroleum Production and Marketing)	*0.00*	*0.01%*	*0.00*	*0.00%*
Industrial Processes	0.00	0.02%	0.07	0.30%
Food and Agriculture	*0.00*	*0.00%*	*0.02*	*0.08%*
Mineral Processes	*0.00*	*0.02%*	*0.03*	*0.15%*
Other (Industrial Processes)	*0.00*	*0.00%*	*0.02*	*0.07%*
Total Stationary Sources	**1.33**	**6.95%**	**1.73**	**7.91%**
Areawide Sources				
Solvent Evaporation	4.70	24.47%	0.00	0.00%
Consumer Products	*1.03*	*5.37%*	*0.00*	*0.00%*
Architectural Coatings and Related Process Solvents	*0.43*	*2.25%*	*0.00*	*0.00%*
Pesticides/Fertilizers	*3.11*	*16.22%*	*0.00*	*0.00%*
Asphalt Paving/Roofing	*0.12*	*0.63%*	*0.00*	*0.00%*
Miscellaneous Processes	3.81	19.86%	0.67	3.07%
Residential Fuel Combustion	*0.01*	*0.05%*	*0.07*	*0.30%*
Farming Operations	*2.55*	*13.29%*	*0.00*	*0.00%*
Fires	*0.00*	*0.01%*	*0.00*	*0.00%*
Managed Burning and Disposal	*1.24*	*6.45%*	*0.60*	*2.76%*
Cooking	*0.01*	*0.06%*	*0.00*	*0.00%*
Total Areawide Sources	**8.51**	**44.33%**	**0.67**	**3.07%**
Mobile Sources				
On-Road Vehicles	4.25	22.16%	10.01	45.84%
Off-Road Vehicles	5.10	26.56%	9.43	43.18%
Total Mobile Sources	**9.35**	**48.72%**	**19.44**	**89.02%**
Total for Imperial County	**19.20**	**100.00%**	**21.83**	**100.00%**

Note:
Emissions for Imperial County were queried from the California Emissions Projection Analysis Model (CEPAM), Version 1.04.
Totals may not add up due to rounding.

Table A-3. Ozone Precursor Emissions by Major Source Category in Imperial County, 2014

Source Category	ROG (tons/day)	% Total	NO_X (tons/day)	% Total
Stationary Sources				
Fuel Combustion	0.11	0.67%	1.61	8.18%
Electric Utilities	*0.05*	*0.30%*	*0.46*	*2.36%*
Cogeneration	*0.00*	*0.00%*	*0.04*	*0.19%*
Manufacturing and Industrial	*0.03*	*0.16%*	*0.56*	*2.84%*
Food and Agricultural Processing	*0.02*	*0.10%*	*0.24*	*1.20%*
Service and Commercial	*0.01*	*0.07%*	*0.31*	*1.58%*
Other (Fuel Combustion)	*0.01*	*0.04%*	*0.00*	*0.01%*
Waste Disposal	0.00	0.00%	0.00	0.00%
Other (Waste Disposal)	*0.00*	*0.00%*	*0.00*	*0.00%*
Cleaning and Surface Coatings	0.56	3.50%	0.00	0.00%
Laundering	*0.01*	*0.06%*	*0.00*	*0.00%*
Degreasing	*0.29*	*1.78%*	*0.00*	*0.00%*
Coatings and Related Process Solvents	*0.18*	*1.14%*	*0.00*	*0.00%*
Adhesives and Sealants	*0.09*	*0.53%*	*0.00*	*0.00%*
Petroleum Production and Marketing	0.69	4.30%	0.00	0.00%
Petroleum Refining	*0.00*	*0.01%*	*0.00*	*0.00%*
Petroleum Marketing	*0.69*	*4.27%*	*0.00*	*0.00%*
Other (Petroleum Production and Marketing)	*0.00*	*0.01%*	*0.00*	*0.00%*
Industrial Processes	0.01	0.03%	0.07	0.36%
Food and Agriculture	*0.00*	*0.00%*	*0.02*	*0.09%*
Mineral Processes	*0.00*	*0.03%*	*0.04*	*0.18%*
Other (Industrial Processes)	*0.00*	*0.00%*	*0.02*	*0.09%*
Total Stationary Sources	**1.37**	**8.50%**	**1.68**	**8.54%**
Areawide Sources				
Solvent Evaporation	3.32	20.61%	0.00	0.00%
Consumer Products	*1.04*	*6.44%*	*0.00*	*0.00%*
Architectural Coatings and Related Process Solvents	*0.48*	*2.99%*	*0.00*	*0.00%*
Pesticides/Fertilizers	*1.66*	*10.28%*	*0.00*	*0.00%*
Asphalt Paving/Roofing	*0.15*	*0.91%*	*0.00*	*0.00%*
Miscellaneous Processes	2.82	17.48%	0.26	1.31%
Residential Fuel Combustion	*0.01*	*0.06%*	*0.06*	*0.29%*
Farming Operations	*2.38*	*14.79%*	*0.00*	*0.00%*
Fires	*0.00*	*0.01%*	*0.00*	*0.00%*
Managed Burning and Disposal	*0.41*	*2.55%*	*0.20*	*1.02%*
Cooking	*0.01*	*0.08%*	*0.00*	*0.00%*
Total Areawide Sources	**6.14**	**38.10%**	**0.26**	**1.31%**
Mobile Sources				
On-Road Vehicles	3.73	23.12%	8.04	40.96%
Off-Road Vehicles	4.88	30.28%	9.66	49.19%
Total Mobile Sources	**8.61**	**53.40%**	**17.70**	**90.15%**
Total for Imperial County	**16.12**	**100.00%**	**19.63**	**100.00%**

Note:
Emissions for Imperial County were queried from the California Emissions Projection Analysis Model (CEPAM), Version 1.04.
Totals may not add up due to rounding.

Table A-4. Ozone Precursor Emissions by Major Source Category in Imperial County, 2017

Source Category	ROG (tons/day)	% Total	NO_X (tons/day)	% Total
Stationary Sources				
Fuel Combustion	0.09	0.55%	1.44	7.98%
Electric Utilities	*0.04*	*0.24%*	*0.39*	*2.17%*
Cogeneration	*0.00*	*0.00%*	*0.04*	*0.22%*
Manufacturing and Industrial	*0.03*	*0.16%*	*0.56*	*3.10%*
Food and Agricultural Processing	*0.01*	*0.05%*	*0.14*	*0.78%*
Service and Commercial	*0.01*	*0.07%*	*0.31*	*1.70%*
Other (Fuel Combustion)	*0.00*	*0.03%*	*0.00*	*0.01%*
Waste Disposal	0.00	0.00%	0.00	0.00%
Other (Waste Disposal)	*0.00*	*0.00%*	*0.00*	*0.00%*
Cleaning and Surface Coatings	0.59	3.51%	0.00	0.00%
Laundering	*0.01*	*0.06%*	*0.00*	*0.00%*
Degreasing	*0.30*	*1.76%*	*0.00*	*0.00%*
Coatings and Related Process Solvents	*0.20*	*1.16%*	*0.00*	*0.00%*
Adhesives and Sealants	*0.09*	*0.53%*	*0.00*	*0.00%*
Petroleum Production and Marketing	0.66	3.94%	0.00	0.00%
Petroleum Refining	*0.00*	*0.01%*	*0.00*	*0.00%*
Petroleum Marketing	*0.66*	*3.92%*	*0.00*	*0.00%*
Other (Petroleum Production and Marketing)	*0.00*	*0.01%*	*0.00*	*0.00%*
Industrial Processes	0.01	0.04%	0.08	0.44%
Food and Agriculture	*0.00*	*0.00%*	*0.02*	*0.10%*
Mineral Processes	*0.01*	*0.03%*	*0.04*	*0.23%*
Other (Industrial Processes)	*0.00*	*0.00%*	*0.02*	*0.11%*
Total Stationary Sources	**1.36**	**8.04%**	**1.52**	**8.42%**
Areawide Sources				
Solvent Evaporation	4.07	24.17%	0.00	0.00%
Consumer Products	*1.14*	*6.74%*	*0.00*	*0.00%*
Architectural Coatings and Related Process Solvents	*0.55*	*3.29%*	*0.00*	*0.00%*
Pesticides/Fertilizers	*2.21*	*13.12%*	*0.00*	*0.00%*
Asphalt Paving/Roofing	*0.17*	*1.03%*	*0.00*	*0.00%*
Miscellaneous Processes	3.66	21.69%	0.59	3.28%
Residential Fuel Combustion	*0.01*	*0.05%*	*0.06*	*0.31%*
Farming Operations	*2.53*	*15.00%*	*0.00*	*0.00%*
Fires	*0.00*	*0.01%*	*0.00*	*0.00%*
Managed Burning and Disposal	*1.10*	*6.55%*	*0.54*	*2.97%*
Cooking	*0.01*	*0.08%*	*0.00*	*0.00%*
Total Areawide Sources	**7.73**	**45.86%**	**0.59**	**3.28%**
Mobile Sources				
On-Road Vehicles	3.13	18.60%	6.52	36.17%
Off-Road Vehicles	4.63	27.50%	9.40	52.13%
Total Mobile Sources	**7.77**	**46.10%**	**15.93**	**88.29%**
Total for Imperial County	**16.85**	**100.00%**	**18.04**	**100.00%**

Note:

Emissions for Imperial County were queried from the California Emissions Projection Analysis Model (CEPAM), Version 1.04.

Totals may not add up due to rounding.

Appendix B
Reasonably Available Control Technology Analysis for the 2017 Imperial County State Implementation Plan for the 2008 8-Hour Ozone Standard

REASONABLY AVAILABLE CONTROL TECHNOLOGY ANALYSIS FOR THE 2017 IMPERIAL COUNTY STATE IMPLEMENTATION PLAN FOR THE 2008 8-HOUR OZONE STANDARD

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September 12, 2017

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Overview and Criteria

According to the Clean Air Act (CAA), Moderate nonattainment areas for the 8-hour ozone National Ambient Air Quality Standard (NAAQS) are required to implement Reasonably Available Control Technology (RACT) to control certain emission sources of ozone precursors (volatile organic compounds [VOCs] and oxides of nitrogen [NOx]). This requirement, specified by Sections 182(b)(2) and 182(f) of the CAA, applies to sources that are subject to Control Technique Guidelines (CTGs), documents issued by the United States Environmental Protection Agency (USEPA) that define RACT for existing sources of air pollution. In addition, the CAA requires major stationary sources of ozone precursors without applicable CTGs to be controlled via RACT. Compared with Best Available Control Technology (BACT) and Maximum Achievable Control Technology (MACT), RACT requirements are less stringent. They represent the necessary methods to achieve the lowest emissions limitation that a particular source is capable of meeting via the application of control technology that is reasonably available considering technological and economic feasibility.[1] While the aim of RACT is not to eliminate or completely control ozone precursor emissions, the implementation of RACT ensures that all major sources are at least controlled to a “reasonable” extent.

In 2010, in conjunction with the release and adoption of the 2009 1997 8-Hour Ozone Modified Air Quality Management Plan (2009 Ozone AQMP),[2] Imperial County Air Pollution Control District adopted the 2009 Reasonably Available Control Technology State Implementation Plan (2009 RACT SIP).[3] This plan summarized each of the ozone-specific CTGs established by the USEPA to date and either addressed the ICAPCD rule which implements the CTG or made a negative declaration for the CTG if there were no sources subject to it within the District. The plan also identified the major sources of VOCs and NOx emissions (ozone precursors) in the District and evaluated the rules applicable to those sources for RACT. Since the CTGs and most of the District’s rules and major pollutant sources have not changed since 2009, this 2017 RACT analysis builds upon the analysis and conclusions in the 2009 RACT SIP to demonstrate that the District’s rules meet RACT stringency for the 2008 8-hour ozone standard.

Background

On July 18, 1997, the USEPA promulgated an 8-hour ozone NAAQS of 0.08 parts per million (ppm) in order to promote greater protection of public health by strengthening the already

[1] United States Environmental Protection Agency. 1979. *State Implementation Plans; General Preamble for Proposed Rulemaking on Approval of Plan Revisions for Nonattainment Areas – Supplement (on Control Technique Guidelines); General preamble for proposed rulemaking – Supplement*. Federal Register. Vol. 44. No. 181. September 17, 1979. p. 53761.

[2] Imperial County Air Pollution Control District. 2010. Final 2009 1997 8-Hour Ozone Modified Air Quality Management Plan. July 13. Available at: http://www.co.imperial.ca.us/AirPollution/PlanningDocs/StatePlans/8_HR_OZONE_AQMP.pdf. Accessed: October 2016.

[3] Imperial County Air Pollution Control District. 2010. Final 2009 Reasonably Available Control Technology State Implementation Plan. July 13. Available at: http://www.co.imperial.ca.us/AirPollution/PlanningDocs/StatePlans/FINAL_RACTANALYSIS.pdf. Accessed: October 2016.

existing 1-hour ozone standard.[4] The new standard, henceforth referred to as the 1997 8-hour ozone NAAQS, was much more stringent than the previous 1-hour ozone standard. With the promulgation of the 1997 8-hour ozone NAAQS, the USEPA classified Imperial County as a Marginal nonattainment area on April 30, 2004.[5] Subsequently, on February 13, 2008 the USEPA found that Imperial County failed to meet attainment for the 1997 8-hour ozone NAAQS by the Marginal area deadline of June 15, 2007.[6] As a result, Imperial County was reclassified as a Moderate nonattainment area for the 1997 8-hour ozone NAAQS. Those areas originally classified as Moderate for the 1997 8-hour ozone NAAQS were required to attain the standard "as expeditiously as practicable," but no later than 6 years after designation (i.e., by June 15, 2010).

On December 3, 2009, the USEPA issued a final ruling determining that Imperial County had attained the 1997 8-hour ozone NAAQS. This determination was based upon complete, quality-assured, and certified ambient air monitoring data for the years 2006 through 2008. This determination effectively suspended the requirement for the state to submit an attainment demonstration, a Reasonable Further Progress (RFP) plan, contingency measures, and other planning requirements for so long as Imperial County continued to attain the 1997 8-hour ozone NAAQS. However, this determination did not constitute a redesignation to attainment under CAA Section 107(d)(3). Therefore, the classification and designation status for Imperial County remained as a Moderate nonattainment area for the 1997 8-hour ozone NAAQS. As such, Imperial County was required to submit for USEPA approval an 8-hour ozone "modified" Air Quality Management Plan (AQMP). On July 30, 2010, the 2009 Ozone AQMP[7] was adopted by ICAPCD along with the 2009 RACT SIP.[8] Both plans were approved by the California Air Resources Board (CARB) on November 18, 2010 and sent on to the USEPA as revisions to the state of California's SIP.[9] Together, these plans addressed the CAA requirements for areas of Moderate nonattainment for the 1997 8-hour ozone NAAQS.

On March 12, 2008, the USEPA announced revisions to the primary and secondary NAAQS for 8-hour ozone that included a new standard level of 0.075 ppm.[10] In accordance with the CAA, the USEPA is required to designate areas with their attainment status whenever a new NAAQS

[4] United States Environmental Protection Agency. 1997. *National Ambient Air Quality Standards for Ozone; Final rule.* Federal Register. Vol. 62. No. 138. July 18, 1997. p. 38856.

[5] United States Environmental Protection Agency. 2004. *Air Quality Designations and Classifications for the 8-Hour Ozone National Ambient Air Quality Standards; Early Action Compact Areas with Deferred Effective Dates; Final rule*. Federal Register. Vol. 69. No. 84. April 30, 2004. p. 23858.

[6] United States Environmental Protection Agency. 2008. *Determination of Nonattainment and Reclassification of the Imperial County, 8-Hour Ozone Nonattainment Area; Final rule.* Federal Register. Vol. 73. No. 30. February 13, 2008. p. 8209.

[7] Imperial County Air Pollution Control District. 2010. Final 2009 1997 8-Hour Ozone Modified Air Quality Management Plan. July 13. Available at: http://www.co.imperial.ca.us/AirPollution/PlanningDocs/StatePlans/8_HR_OZONE_AQMP.pdf. Accessed: October 2016.

[8] Imperial County Air Pollution Control District. 2010. Final 2009 Reasonably Available Control Technology State Implementation Plan. July 13. Available at: http://www.co.imperial.ca.us/AirPollution/PlanningDocs/StatePlans/FINAL_RACTANALYSIS.pdf. Accessed: October 2016.

[9] California Air Resources Board. 2010. Letter from James Goldstene, CARB Executive Officer, to Jared Blumenfeld, Regional Administrator of USEPA Region 9. December 21. Available at: http://www.arb.ca.gov/planning/sip/planarea/imperial/arb_subltr.pdf. Accessed: August 2016.

[10] Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.

is promulgated. Thus, on May 21, 2012, the USEPA designated Imperial County as Marginal nonattainment for the 2008 8-hour ozone NAAQS.[11] On May 4, 2016, the USEPA issued a final rule declaring that 11 areas previously classified as Marginal nonattainment had failed to attain the 2008 8-hour ozone NAAQS by the applicable attainment date of July 20, 2015, and thus were reclassified as Moderate nonattainment areas.[12] Imperial County was identified as one of these areas. With the assignment of a Moderate nonattainment classification to an area, the state containing this area must submit a revised SIP that meets the statutory and regulatory requirements that specifically apply to 2008 8-hour ozone nonattainment areas classified as Moderate, including a RACT assessment.

2009 RACT Analysis

Within the 2009 RACT SIP, the District performed a three-part evaluation of the area's main sources of ozone precursors. First, ICAPCD identified the sources of ozone precursors under its jurisdiction subject to a CTG category. The District then compared the rules pertaining to these sources with those of other air districts and concluded that the District's rules met RACT stringency levels. Upon its review of this analysis, the USEPA found no basis to disagree that ICAPCD had successfully implemented RACT for all relevant CTG categories.[13] For the second part of ICAPCD's evaluation, the District determined which CTGs were not applicable to any sources under its jurisdiction and made negative declarations for each. These negative declarations were assertions that the ICAPCD did not have, nor did it anticipate to have sources subject to these categories in the future. CTG source categories for which negative declarations were made include such categories as Aerospace, Fiberglass Boat Manufacturing, Large Petroleum Dry Cleaners, and Shipbuilding/Repair. Again, the USEPA agreed with the determinations made by the District with the exception that it identified two additional CTGs for which the District should make negative declarations.

The third and final part of the evaluation addressed the section of the CAA that refers to major stationary sources of ozone precursors that do not fall under a specific CTG category. For areas designated as Moderate nonattainment for the ozone standard, a "major" source is defined as one that either emits or has the potential to emit at least 100 tons per year of NOx or VOCs. For the 2009 RACT SIP, nine facilities in Imperial County were initially identified as major sources of NO_X and/or VOCs. However, during its review of the 2009 RACT SIP the USEPA determined that three of those facilities were under the major source threshold. The six remaining facilities were determined to be subject to ICAPCD rules that had been incorporated into the California SIP and approved by the USEPA as satisfying RACT requirements. Ultimately, the USEPA found that ICAPCD's 2009 RACT SIP adequately addressed the RACT requirements for the 1997 8-hour ozone NAAQS.[14]

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[11] United States Environmental Protection Agency. 2012. *Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards; Final rule*. Federal Register. Vol. 77. No. 98. May 21, 2012. p. 30088.

[12] United States Environmental Protection Agency. 2016*. Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Several Areas for the 2008 Ozone National Ambient Air Quality Standards; Final rule*. Federal Register. Vol. 81. No. 86. May 4, 2016. p. 26697.

[13] United States Environmental Protection Agency. 2015. *Approval of California Air Plan Revisions, Imperial County Air Pollution Control District; Final rule.* Federal Register. Vol. 80. No. 218. November 12, 2015. p. 69876.

[14] United States Environmental Protection Agency. 2015. *Approval of California Air Plan Revisions, Imperial County Air Pollution Control District; Final rule.* Federal Register. Vol. 80. No. 218. November 12, 2015. p. 69876.

Updates to RACT Assessment

The previously discussed 2009 RACT SIP was authored to specifically address the 1997 8-hour ozone NAAQS. Since then, the USEPA has promulgated the currently effective 2008 8-hour ozone standard. In the 2015 Ozone Implementation Rule for the 2008 8-hour ozone standard,[15] the USEPA introduced an approach that allows states to conclude that "sources already addressed by RACT determinations for the 1-hour and/or 1997 ozone NAAQS do not need to implement additional controls to meet the 2008 ozone NAAQS RACT requirement."[16] The rationale behind this is that any new RACT determinations would result in similar control technologies to what have already been determined, because the fundamental control techniques outlined in the CTGs are still applicable. Additionally, the USEPA asserted that "any incremental emissions reductions from application of a second round of RACT controls may be small and, therefore, the cost for advancing that small additional increment of reduction may not be reasonable."[17] Instead, the USEPA suggests that a RACT analysis for currently uncontrolled sources would be much more likely to find that new RACT-level controls are feasible.

Following this guidance, ICAPCD assessed the sources under its jurisdiction and did not identify any new major sources subject to RACT nor did it identify uncontrolled sources subject to a CTG document for which RACT-level controls are economically and technically feasible. As part of this review, the information presented in the tables of the 2009 RACT SIP was evaluated to determine if it still applied in 2017, or if updates needed to be made. Overall, most of the information remained relevant because the majority of ICAPCD's rules pertinent to NOx and VOC emissions have not been amended since 2009 and few pollutant sources within the District have changed. A few updates were made to the tables to reflect new information (see Tables 1 through 4).

First, consistent with the USEPA's ruling on the 2009 RACT SIP,[18] negative declarations were made for additional ozone precursor source categories after it was determined that no sources within those categories exist in the ICAPCD. These source categories are solvent metal cleaning and industrial cleaning solvents and have been moved from Table 1, a summary of the CTGs that apply to District sources, to Table 2, a summary of the CTGs that do not apply to District sources. One additional source, automobile refinishing, was removed from Table 1, but not added to Table 2. As pointed out in the USEPA's ruling on the 2009 RACT SIP,[19] this source category is not subject to RACT since it is not a CTG category and there are no automobile refinishing operations that are major sources of VOCs in Imperial County. A new CTG was issued by the USEPA in October 2016 which establishes guidelines for the oil and natural gas industry. Upon evaluation, the District concluded that there are no applicable sources within the District; therefore, a negative declaration is made here for this CTG and the details of it have been added to Table 2. Table 3, a listing of the major sources of NOx and VOCs in Imperial

[15] United States Environmental Protection Agency. 2015. *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; Final rule.* Federal Register. Vol. 80. No. 44. March 6, 2015. p. 12279.
[16] Id.
[17] Id.
[18] United States Environmental Protection Agency. 2015. *Approval of California Air Plan Revisions, Imperial County Air Pollution Control District; Final rule.* Federal Register. Vol. 80. No. 218. November 12, 2015. p. 69876.
[19] United States Environmental Protection Agency. 2015. *Approval of California Air Plan Revisions, Imperial County Air Pollution Control District; Final rule.* Federal Register. Vol. 80. No. 218. November 12, 2015. p. 69876.

County and applicable District rules, has been updated to remove three facilities that were erroneously identified as major sources in the 2009 RACT SIP. These facilities include CalEnergy, ORMAT Nevada, Inc., and GEM Resources. In addition, the applicability of certain rules has been updated for several of the listed sources.

Finally, Table 4 presents a summary of the District rules subject to RACT requirements. The majority of these rules were identified as RACT in the original USEPA rule approvals and were re-confirmed as meeting RACT requirements in the USEPA's ruling on the 2009 RACT SIP in 2015.[20] In this 2017 analysis, these rules were re-evaluated for their relative stringency in comparison to similar rules in other California air districts.[21] The majority of these rules had not been updated since the authoring of the 2009 RACT SIP with the exception of rules in some air districts addressing NOx emissions from larger (i.e., > 5 MMBTU/hr) boilers and heaters. Most of the updates in the other air districts resulted in stricter limits on maximum allowable NOx emissions. The adoption of Rule 400.2 in 2010 established RACT-level NOx limits[22] on facilities and applied a compliance deadline of June 30, 2011. In response to this rule, several local owners/operators invested significantly in control equipment to comply with the new limits.[23] These modifications have resulted in continued realized positive emission reductions for Imperial County, which are expected to continue for the life of the modification (i.e., 10+ years). The District will continue its compliance monitoring and outreach efforts with the sources subject to this rule.

RACT Determination

The 2009 RACT SIP demonstrated that the District met or exceeded RACT for all applicable USEPA source categories at the time of its submittal. Furthermore, in 2015 the USEPA maintained that it was not aware of any information suggesting that additional controls were required to fulfil RACT since the original approval of the District's rules as RACT.[24] A more recent evaluation of the sources in Imperial County concludes that there are no additional source categories or major sources requiring new RACT controls and that the District's rules continue to apply RACT-level stringency. Based on these findings, the District confirms that its existing Rule Book satisfies RACT requirements for the 2008 8-hour ozone standard.

Negative Declarations

The District has reviewed its permit and emissions inventory systems and consulted with knowledgeable staff and has determined that there are no stationary sources or emitting facilities within the nonattainment area for the CTG categories listed in Table 2. Moreover, the District does not anticipate these sources in the future. If such sources locate to Imperial County in the future, then they will be subject to the District's New Source Review requirements, which

[20] United States Environmental Protection Agency. 2015. *Approval of California Air Plan Revisions, Imperial County Air Pollution Control District; Final rule.* Federal Register. Vol. 80. No. 218. November 12, 2015. p. 69876.

[21] Rules were evaluated against similar rules in the following California air districts: Mojave Desert AQMD, Ventura County APCD, San Joaquin Valley APCD, and South Coast AQMD.

[22] Rule 400.2 was approved by the USEPA as implementing RACT on January 7, 2013 (78 FR 896).

[23] See the ICAPCD Staff Report on Rule 400.2. Available at: http://www.co.imperial.ca.us/AirPollution/Attainment%20Plans/SIP%20PACKAGES%20FEB%2023%202010%20HEARING%20NOX/RULE%20400.2/09%2001%20PUBLIC%20HEARING%20STAFF%20REPORT%20FEB%2023%202010.pdf. Accessed: June 2017.

[24] United States Environmental Protection Agency. 2015. *Approval of California Air Plan Revisions, Imperial County Air Pollution Control District; Final rule.* Federal Register. Vol. 80. No. 218. November 12, 2015. p. 69876.

are more stringent than RACT. This constitutes the District’s negative declarations for the RACT analysis for the 2008 8-hour ozone standard.

Table 1. CTG Listings with Applicable Sources in Imperial County by Source Category

Source Category	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Federal Register Rule Approval
Petroleum (VOC)						
Gasoline Service Stations	Design Criteria for Stage I Vapor Control Systems – Gasoline Service Stations (PDF 15 pp, 766 KB) **EPA-450/R-75-102 1975/11**	Control of gasoline vapors during storage tank filling (Stage I sources). Vehicle fueling (Stage II sources).	415, Transfer and Storage of Gasoline	11/4/1977	5/18/2004	70 FR 8520 02/22/2005
Tank Trucks, Gasoline Loading Terminals	Control of Hydrocarbons from Tank Truck Gasoline Loading Terminals (PDF 62 pp, 1.6 MB) **EPA-450/2-77-026 1977/10**	Control of Volatile Organic Compounds (VOC) from tank truck terminals with daily throughputs of greater than 76,000 liters (20,077 gallons) of gasoline	415, Transfer and Storage of Gasoline	11/4/1977	5/18/2004	70 FR 8520 02/22/2005
Bulk Gasoline Plants	Control of Volatile Organic Emissions from Bulk Gasoline Plants (PDF 49 pp, 1.3 MB) **EPA-450/2-77-035 1977/12**	Control VOC emissions from bulk plants with daily throughputs of 76,000 liters (20,077 gallons) of gasoline or less. Bulk gasoline plants are typically secondary distribution facilities which receive gasoline from bulk terminals via trailer and store it in above ground storage tanks.	415, Transfer and Storage of Gasoline	11/4/1977	5/18/2004	70 FR 8520 02/22/2005
External Floating Roof Tanks, Petroleum Liquid Storage in External Floating Roof Tanks	Control of Volatile Organic Emissions from Petroleum Liquid Storage in External Floating Roof Tanks (PDF 66 pp, 2.0 MB) **EPA-450/2-78-047 1978/12**	This document is related to the control of volatile organic compounds (VOC) from the storage of petroleum liquids in external floating roof tanks.	414, Storage of Reactive Organic Compound Liquids	12/11/1979	5/18/2004	73 FR 70883 11/24/2008

Table 1. CTG Listings with Applicable Sources in Imperial County by Source Category

Source Category	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Federal Register Rule Approval
Tank Trucks, Gasoline and Vapor Collection Systems	Control of Volatile Organic Compound Leaks from Gasoline Tank Trucks and Vapor Collection Systems (PDF 32 pp, 887 KB) **EPA-450/2-78-051 1978/12**	This document is related to the control of volatile organic compounds (VOC) from gasoline tank trucks and vapor collection systems at bulk terminals, bulk plants and service stations. The intent is to define leak tight conditions and related test procedures for vapor collection systems and tank trucks while loading and unloading at these facilities. VOC emitted from leaks in collection equipment are primarily C4 and C5 paraffins and olefins which are photo chemically reactive.	415, Transfer and Storage of Gasoline	11/4/1977	5/18/2004	70 FR 8520 02/22/2005
Coatings and Solvents (VOC)						
Storage of Petroleum Liquids in Fixed Roof Tanks	Control of Volatile Organic Emissions from Storage of Petroleum Liquids in Fixed-Roof Tanks (PDF 43 pp, 1.1 MB) **EPA-450/2-77-036 1977/12**	Control of VOC emissions from the storage of petroleum liquids affecting facilities with fixed roof storage tanks with greater than 150,000 liter (39,626 gallons) capacity with a true vapor pressure greater than 10.5 kilo-Pascals. This does not apply to tanks with external floating roofs or storage tanks having capacities less than 1,600,000 liters used to store crude oil.	414, Storage of Reactive Organic Compound Liquids	12/11/1979	5/18/2004	73 FR 70883 11/24/2008

Table 1. CTG Listings with Applicable Sources in Imperial County by Source Category

Source Category	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Federal Register Rule Approval
Stationary Source (VOC)						
Cutback Asphalt	Control of Volatile Organic Emissions from Use of Cutback Asphalt (PDF 18 pp, 481 KB) **EPA-450/2-77-037 1977/12**	This document addresses the control of volatile organic compounds (VOC) from paving asphalts liquefied with petroleum distillate. Such liquefied asphalt is generally referred to as cutback asphalt. The substitution of emulsions for cutback asphalt nearly eliminates the release of VOC air pollutants from paving operations. The VOC emitted from the cutback asphalts are photochemically reactive (precursors to oxidants).	426, Cutback Asphalt and Emulsified Paving	2/10/1981	9/14/1999	66 FR 20084 04/19/2001
Stationary Source (NOx)						
Stationary Combustion Turbines	NOx Emissions from Stationary Combustion Turbines (PDF 399 pp, 1.2 MB) **EPA-453/R-93-007 1993/01**	This document identifies as a category stationary gas turbines as emitting more than 25 tons of Nitrogen oxide (NOx) per year. NOx emission levels and ACT must be analyzed for applicability for every gas turbine according to the size and design of the turbine, the operating duty cycle, site conditions, and other site-specific factors must be taken into consideration.	400, Fuel Burning Equipment - Oxides of Nitrogen	2/21/1972	9/14/1999	68 FR 14161 03/24/2003
			400.1, Stationary Gas Turbines	2/23/2010		77 FR 2469 01/18/2012
			403, General Limitations on the Discharge of Air Contaminants	11/19/1985	5/18/2004	69 FR 67058 11/16/2004
Process Heaters	NOx Emissions from Process Heaters (PDF 277 pp, 2.5 MB) EPA-453/R-93-034 1993/09	This document has identified process heaters as a category which emits more than 25 tons of nitrogen oxide (NOx) per year. This document identifies ACT for the control of	403, General Limitations on the Discharge of Air Contaminants	11/19/1985	5/18/2004	69 FR 67058 11/16/2004

Table 1. CTG Listings with Applicable Sources in Imperial County by Source Category

Source Category	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Federal Register Rule Approval
	Note – Revised September 1993.	NOx emissions from process heaters.	400.2, Boilers, Process Heaters and Steam Generators	2/23/2010		78 FR 896 01/07/2013
Stationary Internal Combustion Engines	NOx Emissions from Stationary Internal Combustion Engines (PDF 340 pp, 13.3 MB) EPA-453/R-93-032 1993/07 **Note – Updated September 2000.**	This document identifies stationary reciprocating engines as emitting more than 25 tons of nitrogen oxide (NOx) per year. The ACT and corresponding achievable NOx emission levels may not be applicable for every reciprocating engine application. The size and design of the engine, the operating duty cycle, site conditions and other site-specific factors must be taken into consideration and the suitability of an alternative control technique must be determined on a case by case basis.	400, Fuel Burning Equipment - Oxides of Nitrogen	2/21/1972	9/14/1999	68 FR 14161 03/24/2003
			403, General Limitations on the Discharge of Air Contaminants	11/19/1985	5/18/2004	69 FR 67058 11/16/2004
Cement Manufacturing	NOx Emissions from Cement Manufacturing (PDF 198 pp, 624 KB) EPA-453/R-94-004 1994/03 **Note – Updated September 2000.**	This document identifies cement kilns as a stationary source which emits more than 25 tons of nitrogen oxide (NOx) per year. There are four different types of cement kilns used in the industry: long wet kiln, long dry kilns, kilns with a preheater and kilns with a precalciner.	400, Fuel Burning Equipment - Oxides of Nitrogen	2/21/1972	9/14/1999	68 FR 14161 03/24/2003
			403, General Limitations on the Discharge of Air Contaminants	11/19/1985	5/18/2004	69 FR 67058 11/16/2004

Table 1. CTG Listings with Applicable Sources in Imperial County by Source Category

Source Category	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Federal Register Rule Approval
Industrial, Commercial and Institutional Boilers	NOx Emissions from Industrial, Commercial & Institutional Boilers (PDF 589 pp, 776 KB) **EPA-453/R-94-022 1994/03**	This document identifies industrial, commercial and institutional (ICI) boilers as source categories which emit more than 25 tons of oxides of nitrogen (NOx) per year. ICI boilers include steam and hot water generators, the applications for these boilers range from commercial space heating to process steam generation. The furnace design, method of fuel firing, condition of existing equipment, operating duty cycle, site conditions, and other site-specific factors must be taken into consideration to properly evaluate the applicability and performance of any given control technique.	403, General Limitations on the Discharge of Air Contaminants	11/19/1985	5/18/2004	69 FR 67058 11/16/2004
			400.2, Boilers, Process Heaters and Steam Generators	2/23/2010		78 FR 896 01/07/2013
Utility Boilers	Alternative Control Techniques Document – NOx Emissions from Utility Boilers (PDF 538 pp, 18.8 MB) **EPA-453/R-94-023 1994/03**	This document identifies fossil fuel fired utility boilers as sources which emit more than 25 tons of oxides of nitrogen (NOx) per year. Three principal NOx forms are "thermal" NOx, "prompt" NOx, and "fuel" NOx. Thermal and fuel NOx account for the majority of the NOx formed in coal - and oil-fired utility boilers.	403, General Limitations on the Discharge of Air Contaminants	11/19/1985	5/18/2004	69 FR 67058 11/16/2004
			400.2, Boilers, Process Heaters and Steam Generators	2/23/2010		78 FR 896 01/07/2013

Table 1. CTG Listings with Applicable Sources in Imperial County by Source Category

Source Category	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Federal Register Rule Approval
Stationary Sources - Second Edition	Control Techniques for Nitrogen Oxides Emissions from Stationary Sources – Second Edition (PDF 396 pp, 14.0 MB) EPA-450/1-78-001 1978/01 **Note – This document is the second edition of the EPA document entitled: Control Techniques for Nitrogen Oxides Emissions**	This guidance document stress the importance of equipment process conditions and fuel type as important in the determination of NOx emissions, the characterization of emissions and the evaluation of control potential. Detailed classification of stationary sources according to factors known to influence NOx formation.	400, Fuel Burning Equipment - Oxides of Nitrogen	2/21/1972	9/14/1999	68 FR 14161 03/24/2003
			400.1, Stationary Gas Turbines	2/23/2010		77 FR 2469 01/18/2012
			400.2, Boilers, Process Heaters and Steam Generators	2/23/2010		78 FR 896 01/07/2013
			403, General Limitations on the Discharge of Air Contaminants	11/19/1985	5/18/2004	69 FR 67058 11/16/2004

Table 2. CTG Listings with No Applicable Sources in Imperial County

Pollutant	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Applied Sources
VOC	Control of Volatile Organic Emissions from Existing Stationary Sources–Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks (PDF 232 pp, 2.7 MB) **EPA-450/2-77-008 1977/05**	Applies to Automobile and light duty truck, can, coil, fabric and paper coating operations. The limitations are stated in terms of solvent content of the coating and are different for the Can Industry, Coil Coating Industry, Fabric Coating, Paper Coating and Automotive and Light Duty Truck Assembly Plants. There are no known sources of this type in Imperial County.	1101, New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control of Refinery Vacuum Producing Systems, Wastewater Separators, and Process Unit Turnarounds (PDF 50 pp, 1.3 MB) **EPA-450/2-77-025 1977/10**	Control of Volatile Organic Compounds (VOC) from petroleum refineries specifically vacuum producing systems, wastewater separators and process unit turnarounds. There are no known sources of this type in Imperial County	1101, New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control of Volatile Organic Emissions from Solvent Metal Cleaning (PDF 229 pp, 7.0 MB) **EPA-450/2-77-022 1977/11**	Applies to organic solvent degreasing operations. The categories are cold cleaners, open top vapor degreasers and conveyorized degreasers.	413 Organic Solvent Degreasing Operations	1/16/2001		**No Sources**
VOC	Control of Volatile Organic Emissions from Existing Stationary Sources–Volume III: Surface Coating of Metal Furniture (PDF 66 pp, 1.9 MB) **EPA-450/2-77-032 1977/12**	VOC reductions of surface coating of metal furniture. Metal furniture includes any furniture made of metal or any meta part which will be assembled with other metal, wood, fabric, plastic or glass parts to form a furniture piece. There are no known sources of this type in Imperial County	1101, New Source Performance Standards (NSPS)	9/14/1999		**No Sources**

Table 2. CTG Listings with No Applicable Sources in Imperial County

Pollutant	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Applied Sources
VOC	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume IV: Surface Coating of Insulation of Magnet Wire (PDF 44 pp, 1.1 MB) **EPA-450/2-77-033 1977/12**	VOC emissions from wire coating ovens. Magnet wire coating to electrical insulating varnish or enamel to aluminum or copper wire for use in electrical machinery. There are no known sources of this type in Imperial County	**No Current Rule**			**No Sources**
VOC	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume V: Surface Coating of Large Appliances (PDF 70 pp, 2.1 MB) **EPA-450/2-77-034 1977/12**	Applies to large appliance industry. VOC emissions from coating of these large appliances. Coatings are typically, epoxy, epoxy acrylic, acrylic or polyester enamels. There are no known sources of this type in Imperial County	1101, New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VI: Surface Coating of Miscellaneous Metal Parts and Products (PDF 82 pp, 2.6 MB) **EPA-450/2-78-015 1978/06**	This document deals with the surface coating of miscellaneous metal parts and products, and is intended to provide guidance on VOC emission control for job shop and original equipment manufacturing (OEM) industries which apply coatings on metal substrates. There are no known sources of this type in Imperial County	**No Current Rule**			**No Sources**
VOC	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VII: Factory Surface Coating of Flat Wood Paneling (PDF 66 pp, 2.0 MB) **EPA- 450/2-78-032 1978/06**	It deals with the surface coating of metal furniture. "Metal furniture" includes any furniture made of metal of any metal part which will be assembled with other metal, wood, fabric, plastic or glass parts to form a furniture piece. There are no known sources of this type in Imperial County	1101 – New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control of Volatile Organic	This document addresses the control of volatile	1101 - New	9/14/1999		**No Sources**

Table 2. CTG Listings with No Applicable Sources in Imperial County

Pollutant	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Applied Sources
	Compound Leaks from Petroleum Refinery Equipment (PDF 78 pp, 6.0 MB) **EPA-450/2-78-036 1978/06**	organic compounds (VOC) from equipment leaks in petroleum refineries. Equipment considered includes pump seals, compressor seals, seal oil degassing vents, pipeline valves, flanges and other connections. There are no known sources of this type in Imperial County	Source Performance Standards (NSPS)			
VOC	Control of Volatile Organic Emissions from Manufacture of Synthesized Pharmaceutical Products (PDF 134 pp, 3.8 MB) **EPA-450/2-78-029 1978/12**	This report deals with volatile organic emissions from the production of synthesized pharmaceutical products. The pharmaceutical industry uses many volatile organic compounds either as raw materials or as solvents. There are no known sources of this type in Imperial County	**No Current Rule**			**No Sources**
VOC	Control of Volatile Organic Emissions from Manufacture of Pneumatic Rubber Tires (PDF 72 pp, 1.6 MB) **EPA-450/2-78-030 1978/12**	This document is concerned with emissions of volatile organic compounds (VOC) from rubber tire manufacturing plants and applicable air pollution control technology. Tire manufacture includes passenger car, light and medium duty truck tires. There are no known sources of this type in Imperial County	1101 - New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VIII: Graphic Arts-Rotogravure and Flexography (PDF 64 pp, 1.9 MB) **EPA-450/2-78-033 1978/12**	The report deals with VOC emissions from the graphic arts operations which utilize inks containing volatile organic solvents. This guideline is applicable to both the flexographic and rotogravure processes as applied to both publication and packaging printing. It does not apply to offset Lithography or letterpress printing. There are no known sources of this type in Imperial County	1101 - New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control of Volatile Organic Compound Emissions from	Identifies petroleum dry cleaners as offered by industrial and commercial operations only. It is	1101 - New Source	9/14/1999		**No Sources**

Table 2. CTG Listings with No Applicable Sources in Imperial County						
Pollutant	**Referenced Document**	**Applicability**	**ICAPCD Rule**	**Date Adopted**	**Last Amended**	**Applied Sources**
	Large Petroleum Dry Cleaners (PDF 174 pp, 5.0 MB) **EPA-450/3-82-009 1982/09**	described as a service industry involved in cleaning and/or renting of articles ranging from personal clothing to mops and mats. The model plants were based on 15.5 to 45kg VOC per 100kg of clothes cleaned. Typically, dry cleaning plants are classified by their through puts, which are reflected in the type and size of equipment present. There are no known industrial size sources of this magnitude in Imperial County.	Performance Standards (NSPS)			
VOC	Control of Volatile Organic Compound Emissions from Manufacture of High-Density Polyethylene, Polypropylene, and Polystyrene Resins (PDF 308 pp, 14.0 MB) **EPA-450/3-83-008 1983/11**	The manufacturing process of high-density polyethylene, polypropylene and polystyrene. Raw materials to rage and preparation. The polymerization reaction and material recovery. Product finishing and storage. Fabrication, blending or formation of resin materials. There are no known sources in Imperial County	**No Current Rule**			**No Sources**
VOC	Control of Volatile Organic Compound Equipment Leaks from Natural Gas/Gasoline Processing Plants (PDF 194 pp, 6.3 MB) **EPA-450/3-83-007 1983/12**	This document applies to natural gas/gasoline processing plants. The gas maybe compressed at field stations for the purpose of transporting to a treatment or processing facility. There are no known sources in Imperial County	1101 - New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control of Volatile Organic Compound Leaks from Synthetic Organic Chemical Polymer and Resin Manufacturing Equipment (PDF 148 pp, 6.2 MB) **EPA-450/3-83-006 1984/03**	This document applies to equipment in process units operated to produce one or more of the synthetic organic chemicals listed in Appendix E of the proposed standards of performance for SOCMI and polymer manufacturing industries. There are no known sources of this type in Imperial County	1101 - New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control of Volatile Organic	This document describes the air oxidation	1101 - New	9/14/1999		**No Sources**

Table 2. CTG Listings with No Applicable Sources in Imperial County

Pollutant	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Applied Sources
	Compound Emissions from Air Oxidation Processes in Synthetic Organic Chemical Manufacturing Industry (PDF 259 pp, 9.4 MB) **EPA-450/3-84-015 1984/12**	industry structure, its processes and the associated emissions. Includes Synthetic Organic Chemical Manufacturing Industries as well as those industries which combine ammonia and air or halogens and air. There are no known sources of this type in Imperial County	Source Performance Standards (NSPS)			
VOC	Control of Volatile Organic Compound Emissions from Reactor Processes and Distillation Operations in Synthetic Organic Chemical Manufacturing Industry (PDF 277 pp, 8.7 MB) **EPA-450/4-91-031 1993/08**	RACT for the control of Volatile Organic Compound emissions from two types of process vents occurring at plants in the Synthetic Organic Chemical Manufacturing Industry: Reactors (other than those involving air oxidation processes) and distillation. There are no known sources of this type in Imperial County	1101 - New Source Performance Standards (NSPS) Subpart NNN, Subpart RRR	9/14/1999		**No Sources**
VOC	Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations (PDF 288 pp, 13.8 MB) **EPA-453/R-96-007 1996/04**	This document identifies the Wood Furniture Industry and those products manufactured of wood and wood products. The document identifies the low – medium – and high-end furniture designations. In addition, the finishing process and the application techniques. **Note– Wood Furniture (CTG-MACT) – Draft MACT out 5-1994; Final CTG issued 4-1996. See also 61FR-25223, May 20, 1996 and 61 FR-50823, September 27, 1996.** There are no known sources of this type in Imperial County	**No Current Rule**			**No Sources**

Table 2. CTG Listings with No Applicable Sources in Imperial County

Pollutant	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Applied Sources
VOC	Control Techniques Guidelines for Ship building and Ship Repair Operations (Surface Coating) (PDF 30 pp, 4.0 MB) **61 FR-44050 8/27/96 1996/08**	This document identifies the Control Technologies for the control of Volatile Organic Control (VOC) emissions from surface coating operations in the ship building and ship repair industry. **Note–See also EPA-453/R-94-032.** There are no known sources of this type in Imperial County	**No Current Rule**			**No Sources**
VOC	Aerospace MACT (PDF 37 pp, 5.6 MB) **59 FR-29216 6/06/94 1994/06**	This limits the emissions of hazardous air pollutants (HAP) from new and existing commercial, civil and military aerospace original equipment manufacturing (OEM) and rework facilities that are major sources of HAP emissions. **Note–See also EPA-453/R-97-004.** There are no known sources of this type in Imperial County	Rule 425 Aerospace Coating Operations	8/5/1989	2/23/2010	**No Sources**
VOC	Aerospace (CTG&MACT) (PDF 62 pp, 288 KB) **EPA-453/R-97-004 1997/12**	This document explains the Control Techniques for the control of VOC emissions from coatings and solvents used in the aerospace industry. Supersedes any potential applicability of the Miscellaneous Metal Part and Products requirements for manufacturing. **Note–See also 59FR-29216, June 6, 1994.** There are no known sources of this type in Imperial County	Rule 425 Aerospace Coating Operations	8/5/1989	2/23/2010	**No Sources**
VOC	Control Techniques Guidelines for Industrial Cleaning Solvents (PDF 290 pp, 7.6 MB) **EPA-453/R-06-001 2006/09**	This document specifies RACT for industrial cleaning solvents resulting in an evaluation of sources of VOC emissions from the use of industrial cleaning solvents. This category of consumer and commercial products includes the industrial cleaning solvents used by many industries. It includes such products that are	417 Organic Solvents	11/4/1977	9/14/1999	**No Sources**

Table 2. CTG Listings with No Applicable Sources in Imperial County

Pollutant	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Applied Sources
		used to remove contaminants such as adhesives, inks, paint, dirt, soil, oil and grease.				
VOC	Control Techniques Guidelines for Offset Lithographic Printing and Letterpress Printing (PDF 52 pp, 349 KB) **EPA-453/R-06-002 2006/09**	This document provides control recommendations for reducing VOC emissions stemming from the use of fountain solutions, cleaning materials and inks in offset lithographic printing and cleaning materials and inks in letterpress printing. The threshold trigger for regulation according to the CTG is when Offset Lithographic Printing and Letterpress Printing operations emit at least 6.8kg/day (15lb/day) of actual emissions. There are no known sources equaling or meeting the CTG threshold in Imperial County	1101 - New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control Techniques Guidelines for Flexible Package Printing (PDF 33 pp, 216 KB) **EPA-453/R-06-003 2006/09**	This Control Technology Guideline recommends the reduction of VOC emissions from inks, coatings, adhesives and cleaning materials used in flexible packaging printing. The threshold trigger for regulation according to the CTG is when flexible packaging printing operations emit at least 6.8kg/day (15lb/day) of actual emissions. There are no known sources of this type in Imperial County	**No Current Rule**			**No Sources**
VOC	Control Techniques Guidelines for Flat Wood Paneling Coatings (PDF 27 pp, 212 KB) **EPA-453/R-06-004 2006/09**	The control of VOC emissions from surface coating operations that include flat wood paneling. Applies to facilities that apply flat wood paneling coatings that emit at least 6.8kg/day of VOC before consideration of controls. There are no known sources of this type in Imperial County	**No Current Rule**			**No Sources**
VOC	Control Techniques	This document recommends techniques for the	**No Current**			**No Sources**

Table 2. CTG Listings with No Applicable Sources in Imperial County

Pollutant	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Applied Sources
	Guidelines for Paper, Film, and Foil Coatings (PDF 102 pp, 488 KB) **EPA453/R-07-003 2007/09**	control of VOC emissions stemming from the use of coatings in paper, film and foil surface coating operations. These controls apply to facilities with a total actual VOC emissions from all paper, film and foil. There are no known sources of this type in Imperial County	**Rule**			
VOC	Control Techniques Guidelines for Large Appliance Coatings (PDF 44 pp, 374 KB) **EPA453/R-07-004 2007/09**	This document recommends techniques for the control of VOC emissions stemming from the use of coatings in large appliance coating operations. Coatings include paints, sealants, caulks, inks, adhesives and maskants. There are no known sources of this type in Imperial County	1101 - New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control Techniques Guidelines for Metal Furniture Coatings (PDF 100 pp, 293 KB) **EPA453/R-07-005 2007/09**	This document recommends techniques for the control of VOC emissions stemming from the use of coatings in metal furniture surface coating operations. Coatings include paints, sealants, caulks, inks, adhesives and maskants. There are no known sources of this type in Imperial County	1101 - New Source Performance Standards (NSPS)	9/14/1999		**No Sources**
VOC	Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings **EPA453/R-08-003 2008/09**	This CTG provides control recommendations for reducing VOC emissions from the use of coatings in miscellaneous metal products and miscellaneous plastic parts surface coating operations. The CTG applies to manufacturers of miscellaneous metal and plastic parts that surface-coat the parts they produce. An example of product type are fabricated metal products, molded plastic parts, small and large farm machinery, pleasure craft, laboratory and	**No Current Rule**			**No Sources**

Table 2. CTG Listings with No Applicable Sources in Imperial County

Pollutant	Referenced Document	Applicability	ICAPCD Rule	Date Adopted	Last Amended	Applied Sources
		medical equipment etc.				
VOC	Control Techniques Guidelines for Fiberglass Boat Manufacturing Materials **EPA 453/R-08-004**	This CTG provides control recommendations for reducing VOC emissions from the use of gel coats, resins, and materials used to clean application equipment in fiber glass boat manufacturing operations	**No Current Rule**			**No Sources**
VOC	Control Techniques Guidelines for Miscellaneous Industrial Adhesives **EPA 453/R-08-005**	This CTG provides control recommendations for reducing VOC emissions from miscellaneous industrial adhesives and adhesive primer application processes. The miscellaneous industrial adhesives product category does not include adhesives that are addressed by CTG's already issued for categories listed under CAA Section 183(e) or by earlier CTG's	**No Current Rule**			**No Sources**
VOC	Control Techniques Guidelines for Automobile and Light-Duty Truck Assembly Coatings **EPA 453/R-08-006**	This CTG provides control recommendations for reducing VOC emissions stemming from the use of coatings in automobile and light-duty truck assembly coating operations. All automobile and light-duty truck surface coating facilities within an ozone non-attainment area are considered as emitting above the set threshold of 6.8Kg/day (15 lb/day) of VOC or more.	**No Current Rule**			**No Sources**
VOC	Control Techniques Guidelines for the Oil and Natural Gas Industry **EPA-453/B-16-001**	This CTG provides recommendations to inform state, local, and tribal air agencies as to what constitutes RACT for VOC emissions from select oil and natural gas industry emission sources.	**No Current Rule**			**No Sources**

Table 3. Major Sources of NOx and VOCs in Imperial County

Pollutant	Facility	Permit No.	Evaluated Rules which apply to NOx and VOC Major Source Facilities in Imperial County																
			109	110	207	400	400.1	400.2	400.4	403	413	414	415	416	417	425	426	427	1022
NOx	Imperial Irrigation District (Rockwood)	1365		X	X	X	X			X									
NOx	Spreckels Sugar	V-1697			X	X		X		X									
NOx	Mesquite Lake Water & Power	1929	X	X	X	X		X		X									
NOx	Imperial Irrigation District (ECGS)	2152		X	X	X	X	X		X									
NOx	United States Gypsum (USG)	2834			X	X			X	X			X						
VOC	SFPP, L.P.	2046			X	X				X		X	X						

Table 4. 2017 RACT SIP Summary for Imperial County

Imperial County Regulation	RACT Rule Applicability and Requirements	Original RACT Basis	Federal Register Rule Approval	RACT for the 2008 8-Hour Ozone NAAQS?
400 Fuel Burning Equipment	General fuel burning rule with 140 lbs/hr NOx limitation.	Rule similar in emissions limitations to rules in other California air districts.[1]	05/31/1972 37 FR 10842	This rule and its equivalents in other California air districts have not been updated since the 2009 RACT SIP. Rule meets RACT-level stringency for the 2008 ozone standard.
400.1 Stationary Gas Turbine(s) - Reasonably Available Control Technology (RACT)	Applies to new or existing Stationary Gas Turbines of 1 megawatt (MW) and/or larger - NOx limits on any new or existing Stationary Gas Turbine(s) - 42 ppmv when operated on a gaseous fuel. 65 ppmv when operated on a liquid fuel except when operating less than 400 hours per calendar year or during start-up, shutdown or a change in load.	Determined to meet RACT requirements in USEPA rule approval.	01/18/2012 77 FR 2469	This rule and its equivalents in other California air districts[1] have not been updated since the 2009 RACT SIP. Rule meets RACT-level stringency for the 2008 ozone standard.
400.2 Boilers, Process heaters and Steam Generators	Applies to new or existing process heaters, boilers, or steam generators with a heat input rating of 5 million Btu per hour. NOx limits of 30 ppmv or 0.036 lbs/million Btu on gaseous fuel; 40 ppmv or 0.052 lbs/million Btu on liquid fuels; when combined gaseous and liquid fuels the limit is the heat-input weighted average of the individual gaseous and liquid limits. Units with an annual capacity factor less than or equal to 30% shall not emit NOx in excess of 70 ppmv. Biomass boilers or process heaters: i) shall not emit NOx in excess of 120 ppmv corrected to 12% by volume CO_2 on a 3-hr average basis, ii) shall reduce NOx emissions by 80% of the uncontrolled exhaust gas stream. Coal-fired units installed or erected prior to December 31, 2009 are exempt.	Determined to meet RACT requirements in USEPA rule approval.	01/7/2013 78 FR 896	The adoption of Rule 400.2 in 2010 established RACT-level NOx limits[2] on facilities and applied a compliance deadline of June 30, 2011. In response to this rule, several local owners/operators invested significantly in control equipment to comply with the new limits.[3] These modifications have resulted in continued realized positive emission reductions for Imperial County, which are expected to continue for the life of the modification (i.e., 10+ years). It's important to note that the one coal-fired unit that was originally exempt under the rule was converted to natural gas in 2012 and was determined to be in compliance with the rule at the time of the conversion. The District will continue its compliance monitoring and

Table 4. 2017 RACT SIP Summary for Imperial County

Imperial County Regulation	RACT Rule Applicability and Requirements	Original RACT Basis	Federal Register Rule Approval	RACT for the 2008 8-Hour Ozone NAAQS?
				outreach efforts with the sources subject to this rule.
400.4 Emissions of Oxides of Nitrogen from Wallboard Kilns	Applies to any new or existing kilns with a heat input rating of 5 million Btu per hour or more. NOx limits of 30 ppmv or 0.036 lbs/million Btu on gaseous fuels; 400 ppmv or 0.052 lbs/million Btu on liquid fuels; when combined gaseous and liquid fuels the limit is the heat-input weighted average of the individual gaseous and liquid limits.	Determined to meet RACT requirements in USEPA rule approval.	10/6/2014 79 FR 60070	Rule 400.4 was assessed for RACT-level stringency by comparing the nitrogen oxide limits it establishes for kilns with those established by nearby air districts.[1] The emission limits in Rule 400.4 are as stringent or more stringent than the nearby air district emission limits (see SCAQMD Rule 1147, VCAPCD Rule 74.34, SJVAPCD Rule 4313, and MDAQMD Rule 1161). A broader search of the USEPA's RACT/BACT/LAER Clearinghouse (RBLC) database identified 5 facilities with kiln processes permitted in the last ten years with similar NO_X emission limits. These include RBLC ID AL-0268, AL-0245, WI-0250, OH-0321, and FL-0302, All of which are governed by emission limits that are less stringent than those established by Rule 400.4. Lastly, a search of gypsum wallboard facilities in California identified three facilities in the BAAQMD that have permitted NO_X limits similar to those in Imperial Rule 400.4. For this reason, Rule 400.4 has been determined to meet RACT-level stringency for the 2008 8-hour ozone standard.
414	Applies to any storage tank with capacity equal	Determined to meet	11/24/2008	This rule and its equivalents in other

Table 4. 2017 RACT SIP Summary for Imperial County

Imperial County Regulation	RACT Rule Applicability and Requirements	Original RACT Basis	Federal Register Rule Approval	RACT for the 2008 8-Hour Ozone NAAQS?
Storage of Reactive Organic Compound	to or greater than 1,500 gallons used to store ROC liquids with a true vapor pressure equal to or greater than 0.50 pounds per square inch absolute (psia). No storage with Tank capacity less than 40,000 gallons with a true vapor pressure equal to or greater than 0.5 psia must have a submerged fill pipe or a vapor loss control device. Tank capacity greater than or equal to 40,000 with a true vapor pressure equal to or greater than 1.5 psia must have a vapor control device. Tank capacity of 10,000 or more but less than 20,000 with a 1.5 psia must have a pressure vacuum relief valve. Tank capacity of 20,000 or more but less than 40,000 with a 1.5 psia must have a vapor loss control device. No storage tank with a true vapor pressure equal to or greater than 11.0 without having a working pressure tank.	RACT requirements in USEPA rule approval.	73 FR 70883	California air districts[1] have not been updated since the 2009 RACT SIP. Rule meets RACT-level stringency for the 2008 ozone standard.
415 Transfer and Storage of Gasoline	Applies to the transfer and storage of gasoline. Stationary container with a capacity of more than 250 gallons must have a permanent submerged fill pipe, phase I Vapor Recovery System, vapor return lines for connection between tank truck and stationary storage container, gravity-drained lines, pressure vacuum relief valve, and vapor control systems. Vapor pressure of 11.0 psia or greater not allowed in any container with a floating roof.	Determined to meet RACT requirements in USEPA rule approval.	02/22/2005 70 FR 8520	This rule and its equivalents in other California air districts[1] have not been updated since the 2009 RACT SIP. Rule meets RACT-level stringency for the 2008 ozone standard.
426 Cutback Asphalt	Applies to the manufacture, mixing, storage, use and application of cutback and emulsified	Determined to meet RACT requirements	04/19/2001 66 FR 20084	This rule and its equivalents in other California air districts[1] have not been

Table 4. 2017 RACT SIP Summary for Imperial County

Imperial County Regulation	RACT Rule Applicability and Requirements	Original RACT Basis	Federal Register Rule Approval	RACT for the 2008 8-Hour Ozone NAAQS?
and Emulsified Paving Materials	asphalt for paving materials. Applicable entities shall not use rapid cure cutback asphalt, medium cure cutback asphalt, slow cure cutback asphalt (containing more than 0.5% by volume ROC), or emulsified asphalt (containing petroleum solvents in excess of 3% by volume).	in USEPA rule approval.		updated since the 2009 RACT SIP. Rule meets RACT-level stringency for the 2008 ozone standard.

Notes:

[1] Rules were evaluated against similar rules in the following California air districts: Mojave Desert AQMD, Ventura County APCD, San Joaquin Valley APCD, and South Coast AQMD.

[2] Rule 400.2 was approved by the USEPA as implementing RACT on January 7, 2013 (78 FR 896).

[3] See the ICAPCD Staff Report on Rule 400.2. Available at: http://www.co.imperial.ca.us/AirPollution/Attainment%20Plans/SIP%20PACKAGES%20FEB%2023%202010%20HEARING%20NOX/RULE%20400.2/09%2001%20PUBLIC%20HEARING%20STAFF%20REPORT%20FEB%2023%202010.pdf. Accessed: June 2017.

Appendix C
Reasonably Available Control Measure Analysis for Area Source Control Measures

Table C-1. Reasonably Available Control Measure Analysis in support of Imperial County 2017 Ozone State Implementation Plan

Control Category	Source Category	USEPA (or Other) Emission Reduction Measure(s) from Menu of Controls[1]	Evaluation of USEPA Measure
NO_X Control for Non-Point Sources	Commercial/ Institutional - Natural Gas	Water heater replacement	The control measure recommended by the USEPA involves replacing existing water heaters with new water heaters (emitting less than or equal to 40 nanograms [ng] NOx per joule of heat output). ICAPCD Rule 400.2, Boilers, Process Heaters and Steam Generators, applies to fuel-burning equipment of this description with a heat rating of 5 million British thermal units (BTUs) per hour and limits NOx emissions to 30 parts per million (ppm) or 0.036 lbs/MMBTU for gaseous fuels and 40 ppm or 0.052 lbs/MMBTU for liquid fuels. It should be noted that in conjunction with the 2017 $PM_{2.5}$ SIP, ICAPCD is proposing a new rule to limit NO_X emissions from boilers, steam generators, and process heaters rated 0.075 to 5 MMBTU/hour to 14 ng NO_X per joule of heat output or no more than 20 ppm of NO_X emissions. ICAPCD is proposing to adopt this rule in 2019 and have it implemented by January 1, 2020. The rule is anticipated to achieve the largest emission reductions in 2035, with a reduction of 0.25 tons per day of NO_X. This rule was not proposed under this SIP as the timeframe between final reclassification of the area on June 3, 2016 and the modeled attainment year, 2017, was too short to achieve even partial implementation of the rule prior to the attainment date.
NO_X Control for Non-Point Sources	Industrial Coal/Natural Gas/Oil Combustion (Boilers)	RACT to 25 tpy, and to 50 tpy (Low NOx Burner)	ICAPCD Rule 400.2, Boilers, Process Heaters, and Steam Generators, includes ppm and lbs/MMBtu limits on NO_X emissions from these sources. A combustion source may choose to use low NO_X burners to meet the limits of this rule. Note, Rule 400.2 addresses natural gas and oil combustion sources of NO_X, but coal sources are exempt. However, there are currently no industrial-scale coal combustion boilers/process heaters/steam generators in Imperial County.

Table C-1. Reasonably Available Control Measure Analysis in support of Imperial County 2017 Ozone State Implementation Plan

Control Category	Source Category	USEPA (or Other) Emission Reduction Measure(s) from Menu of Controls[1]	Evaluation of USEPA Measure
NO_X Control for Non-Point Sources	Open Burning	Episodic Ban (Daily Only)	Imperial County is subject to the California Air Resources Board's statewide Smoke Management Program.[2] This program derives its legal basis from the Smoke Management Guidelines for Agricultural and Prescribed Burning,[3] which allow CARB to specify each day of the year as either a permissive burn day or a no-burn day for each air basin. In fulfillment of these guidelines, Imperial County has developed its own Smoke Management Program.[4] Under this program, Imperial County has authority to declare its own no-burn days based on local meteorological and air quality conditions. Together, these state and local no-burn policies are more protective of public health compared to the USEPA's episodic banning control measure.
NO_X Control for Non-Point Sources	Process Heaters - Distillate Oil, Residual Oil, or Other Fuel	Low NOx Burner and Selective Noncatalytic Reduction	ICAPCD Rule 400.2, Boilers, Process Heaters, and Steam Generators, sets ppm and lbs/MMBtu limits on NOX emissions from process heaters. A combustion source may choose to use low NOx burners or Selective Noncatalytic Reduction to meet the limits of this rule.
NO_X Control for Non-Point Sources	Residential/ Commercial/ Institutional Water Heaters and/or Space Heaters	Low NOx Water Heaters and Low NOx Burner Space Heaters	As mentioned above, in conjunction with the 2017 $PM_{2.5}$ SIP, ICAPCD is proposing a new rule that will limit NOx emissions from boilers, steam generators, and process heaters rated 0.075 to 5 MMBTU/hour. Also under the 2017 $PM_{2.5}$ SIP, ICAPCD is proposing a new rule to limit NOx emissions from new and replacement residential water heaters to 10 ng NOx per joule of heat output for all residential water heaters rated less than 0.075 MMBTU/hour. ICAPCD is proposing to adopt this rule in 2019 and have it implemented by January 1, 2020. The rule is anticipated to achieve the largest emission reductions in 2029, with a reduction of 0.017 tons per day of NOx. This rule was not proposed under this SIP as the timeframe between final reclassification of the area on June 3, 2016 and the modeled attainment year, 2017, was too short to achieve even partial implementation of the rule prior to the attainment date. ICAPCD continues to evaluate residential space heaters. Residential space heating is a very small source of NOx emissions in Imperial County, especially during the ozone season (approx. 0.007 tons per day in the summer).

Table C-1. Reasonably Available Control Measure Analysis in support of Imperial County 2017 Ozone State Implementation Plan

Control Category	Source Category	USEPA (or Other) Emission Reduction Measure(s) from Menu of Controls[1]	Evaluation of USEPA Measure
VOC Control for Non-Point Sources	Aerosol Coatings	National Rule	The nonattainment area is subject to a national rule regarding VOCs sourced from aerosol coatings that was finalized by the USEPA in 2008 - National Volatile Organic Compound Emission Standards for Aerosol Coatings (73 FR 15604). This rule is primarily aimed at manufacturers of aerosol coatings, of which there are none in Imperial County.
VOC Control for Non-Point Sources	Architectural, Traffic, and Industrial Maintenance Coatings	OTC Model Rule and South Coast - Rule 1113 Phase III VOC limits	Architectural coatings, including traffic and industrial maintenance coatings, are governed by ICAPCD Rule 424, Architectural Coatings, which is modeled off of the latest version of CARB's Suggested Control Measure for Architectural Coatings.[5]
VOC Control for Non-Point Sources	Consumer Products	California Consumer Products Rules Cumulative through 2010 Proposed Amendments, Reformulation (2001 OTC Model Rule), Reformulation (2006 OTC Model Rule)	The nonattainment area is subject to a national ruling regarding VOCs sourced from consumer products that was finalized by USEPA in 1999 - 15 Percent Rate of Progress Federal Implementation Plan (64 FR 36243). Additionally, the nonattainment area is subject to CARB's Consumer Products Program[6] which has established regulations to set VOC limits for a total of 129 different consumer product categories.
VOC Control for Non-Point Sources	Cutback Asphalt	Reformulation-Process Modification	ICAPCD Rule 426, Cutback Asphalt and Emulsified Paving Materials, prohibits the manufacture and use of rapid cure and medium cure cutback asphalt, slow cure cutback asphalt containing more than 0.5% ROC, and emulsified asphalt containing petroleum solvents in excess of 3% for paving and road construction and maintenance, except for in the months of November, December, January, and February.
VOC Control for Non-Point Sources	Mobile Equipment Repair and Refinishing	California Air Resources Board - Suggested Control Measures for Automotive Coatings; and OTC Model Rule	The coating of motor vehicles, motor equipment, and associated parts and components in Imperial County is currently governed by ICAPCD Rule 427, Automotive Refinishing Operations, which is modeled off of CARB's Suggested Control Measure for Automotive Refinishing.[7]

Table C-1. Reasonably Available Control Measure Analysis in support of Imperial County 2017 Ozone State Implementation Plan

Control Category	Source Category	USEPA (or Other) Emission Reduction Measure(s) from Menu of Controls[1]	Evaluation of USEPA Measure
VOC Control for Non-Point Sources	Municipal Solid Waste Landfill	Gas Recovery	ICAPCD does not have a specific rule regulating landfills, but all landfills in the nonattainment area are required to have permits which are reviewed every 5 years and must be compliant with CARB and USEPA waste management statutes and regulations. Notably, these regulations include CARB's *Methane Emissions from Municipal Solid Waste Landfills*[8] and EPA's *Municipal Solid Waste Landfills: New Source Performance Standards, Emission Guidelines, and Compliance Times*.[9]
VOC Control for Non-Point Sources	Pesticide Application	Reformulation	The Department of Pesticide Regulation (DPR) is the State agency responsible for regulating the application of pesticides, which are a source of VOCs in Imperial County. DPR is also required to annually prepare and make available to the public a pesticide emission inventory to track VOCs and determine compliance in the applicable areas. Due to the timing of the Moderate area reclassification and the date by which RACM would need to be implemented, it was not possible for the State to implement regulations to limit VOC emissions from agricultural pesticides in Imperial County.
VOC Control for Non-Point Sources	Stage II Service Stations - Underground Tanks (Breathing and Emptying)	LPV Relief Valve	ICAPCD Rule 414, Storage of Reactive Organic Compound Liquids, regulates the storage of reactive organic compound (ROC) liquids and prohibits the storage of ROCs in large tanks (>40,000 gal) unless they have a submerged fill pipe or vapor loss control devices and in medium tanks (10,000-20,000 gal) unless they have a pressure-vacuum relief valve or a vapor loss control device, such as an LPV relief valve. Additionally, the state-level Vapor Recovery Program10 exists to regulate these sources, providing testing for new or modified vapor recovery systems to assure that they meet all certification requirements.
VOC Control for Non-Point Sources	Storage Tanks at Petroleum Facilities	SCAQMD Rule 1178	ICAPCD Rule 414, Storage of Reactive Organic Compound Liquids, controls VOC emissions resulting from the storage of petroleum liquids in external floating roof and fixed roof tanks by requiring that these tanks be equipped with vapor loss control devices and establishing vapor pressure limits for their contents.

Table C-1. Reasonably Available Control Measure Analysis in support of Imperial County 2017 Ozone State Implementation Plan

Control Category	Source Category	USEPA (or Other) Emission Reduction Measure(s) from Menu of Controls[1]	Evaluation of USEPA Measure
Control Categories/Measures that do not Apply to the Imperial County Nonattainment Area			
VOC Control for Non-Point Sources	Adhesives - Industrial	Reformulation	No industrial sources present in the nonattainment area.
VOC Control for Non-Point Sources	Bakery Products	Catalytic Incineration	This control measure is designed for large-scale commercial bread bakeries. There are no sources present in the nonattainment area.
VOC Control for Non-Point Sources	Coating Operations at Aerospace Manufacturing and Rework Operations	Control Technology Guidelines	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Cold Cleaning Degreasing	Process Modification	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Cold Cleaning Degreasing	Reformulation-Process Modification (OTC Rule)	No sources present in the nonattainment area.

Table C-1. Reasonably Available Control Measure Analysis in support of Imperial County 2017 Ozone State Implementation Plan

Control Category	Source Category	USEPA (or Other) Emission Reduction Measure(s) from Menu of Controls[1]	Evaluation of USEPA Measure
VOC Control for Non-Point Sources	Flexographic Printing	Permanent Total Enclosure (PTE)	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Metal Can Surface Coating	Incineration	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Metal Can Surface Coating	Permanent Total Enclosure (PTE)	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Metal Can Surface Coating	Process Modification	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Metal Furniture Surface Coating	Reduced Solvent Utilization	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Metal Furniture, Appliances, Parts	Reformulation-Process Modification	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Metal Part and Products Coating	Reformulation-Process Modification	No sources present in the nonattainment area.

Table C-1. Reasonably Available Control Measure Analysis in support of Imperial County 2017 Ozone State Implementation Plan

Control Category	Source Category	USEPA (or Other) Emission Reduction Measure(s) from Menu of Controls[1]	Evaluation of USEPA Measure
VOC Control for Non-Point Sources	Open Top Degreasing	Process Modification	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Open Top Degreasing	Reformulation-Process Modification	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Petroleum Refinery Fugitives	Process Modification	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Pharmaceutical and Cosmetic Manufacturing Operations	SCAQMD Rule 1103	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Polystyrene Foam Manufacturing	Control Technology Guidelines	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Rubber/Plastics Coating	Reformulation-Process Modification	This control measure focuses on rubber/plastic coating operations. No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Shipbuilding and Ship Repair (Surface Coating)	Incineration	No sources present in the nonattainment area.

Table C-1. Reasonably Available Control Measure Analysis in support of Imperial County 2017 Ozone State Implementation Plan

Control Category	Source Category	USEPA (or Other) Emission Reduction Measure(s) from Menu of Controls[1]	Evaluation of USEPA Measure
VOC Control for Non-Point Sources	Wood Furniture Surface Coating	Add-On Controls	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Wood Furniture Surface Coating	Control Technology Guidelines	No sources present in the nonattainment area.
VOC Control for Non-Point Sources	Wood Product Surface Coating	Incineration	No wood product surface coating facilities present in the nonattainment area.
VOC Control for Non-Point Sources	Wood Product Surface Coating	Reformulation	This control measure is primarily based off of SCAQMD Rule 1136, which does not apply to residential non-commercial operations. No commercial sources present in the nonattainment area.

Notes:

[1] List of control measures obtained from USEPA. 2012. Menu of Control Measures for NAAQS Implementation. April 12. Available at: https://www.epa.gov/criteria-air-pollutants/menu-control- measures-naaqs-implementation. Accessed: March 2017.

[2] Background and details available at: https://www.arb.ca.gov/smp/smp.htm.

[3] Title 17 of the California Code of Regulations. Subchapter 2: Smoke Management Guidelines for Agricultural and Prescribed Burning. 14 March 2001. Available at: https://www.arb.ca.gov/smp/regs/RevFinRegwTOC.pdf.

[4] Available at: https://www.arb.ca.gov/smp/district/imp2010.pdf. Accessed: May 2017.

[5] Background and details available at: https://www.arb.ca.gov/coatings/arch/docs.htm.

[6] Background and details available at: https://www.arb.ca.gov/consprod/consprod.htm.

[7] Background and details available at: https://www.arb.ca.gov/coatings/autorefin/autorefin.htm.

[8] Title 17 of the California Code of Regulations. Subchapter 10. Article 4. Subarticle 6: Methane Emissions from Municipal Solid Waste Landfills. Available at: https://www.arb.ca.gov/regact/2009/landfills09/landfillfinalfro.pdf.

[9] United States Federal Register, Vol. 81, No. 167, p. 59322. Environmental Protection Agency final rule: Standards of Performance for Municipal Solid Waste Landfills. 29 August 2016. Available at: https://www.gpo.gov/fdsys/pkg/FR-2016-08-29/pdf/2016-17687.pdf.

[10] Background and details available at: https://www.arb.ca.gov/vapor/vapor.htm.

Table C-1. Reasonably Available Control Measure Analysis in support of Imperial County 2017 Ozone State Implementation Plan

Control Category	Source Category	USEPA (or Other) Emission Reduction Measure(s) from Menu of Controls[1]	Evaluation of USEPA Measure

Abbreviations:
CARB - California Air Resources Board
CEQA - California Environmental Quality Act
DPR – Department of Pesticide Regulation
FR - Federal Register
g - grams
gal - gallons
ICAPCD - Imperial County Air Pollution Control District
L - liters
lbs – pounds
LPV - low pressure/vacuum
MMBtu - million British thermal units
NAAQS – National Ambient Air Quality Standards
NOx - oxides of nitrogen
OTC - Ozone Transport Commission
PM2.5 – particulate matter less than 2.5 microns in diameter
ppm - parts per million
PTE - permanent total enclosure
RACT - reasonably available control technology
ROC - reactive organic compound
SCAQMD - South Coast Air Quality Management District
tpy - tons per year
USEPA - United States Environmental Protection Agency
VOC – volatile organic compound

Appendix D
California Air Resources Board's Key Mobile Source Regulations and Programs Providing Emission Reductions

I. Key Mobile Source Regulations and Programs Providing Emission Reductions

Given the severity of California's air quality challenges and the need for ongoing emission reductions, the Air Resources Board (ARB) has implemented the most stringent mobile source emissions control program in the nation. ARB'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 pay for early adoption of the cleanest available 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 ARB'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, the ARB has consistently sought and obtained waivers and authorizations for its new motor vehicle regulations. ARB's history of progressively strengthening standards as technology advances, coupled with the waiver process requirements, ensures that California's regulations remain the most stringent in the nation. A list of regulatory actions ARB has taken since 1985 is provided at the end of this analysis to highlight the scope of ARB's actions to reduce mobile source emissions.

Recently, ARB adopted numerous regulations aimed at reducing exposure to diesel particulate matter and oxides of nitrogen, from freight transport sources like heavy-duty diesel trucks, transportation sources like passenger cars and buses, and off-road sources like large construction equipment. Phased implementation of these regulations will produce increasing emission reduction benefits from now until 2017 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.

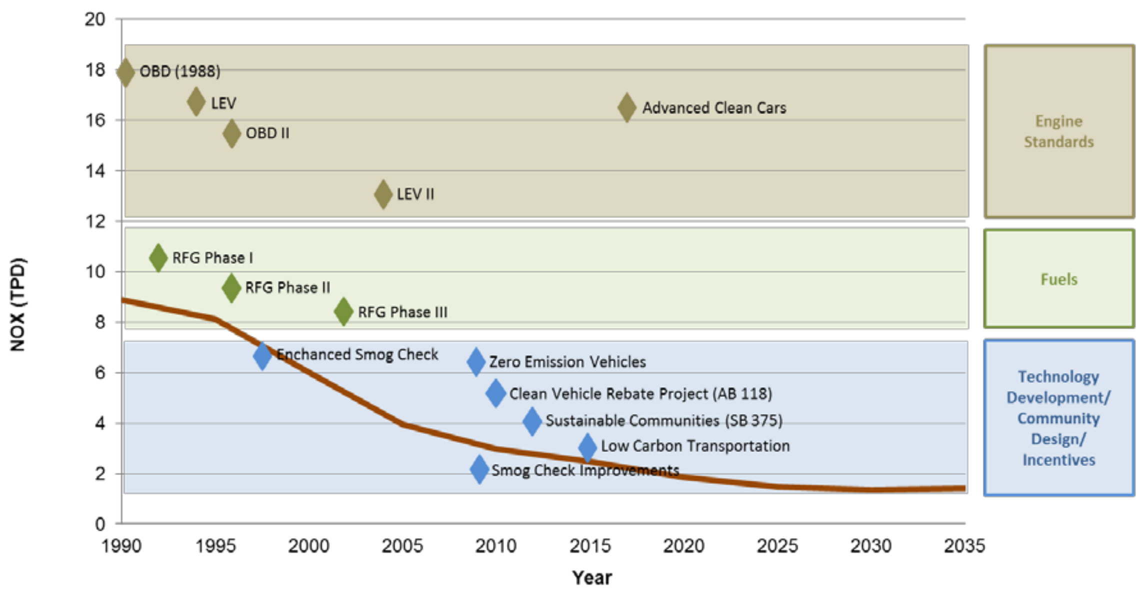
Further, ARB and the Imperial County APCD staff work closely on identifying and distributing incentive funds to accelerate cleanup of engines. Key incentive programs include: the Carl Moyer Program; the Goods Movement Program; the Lower-Emission

School Bus Program; and the Air Quality Improvement Program (AQIP). These incentive-based programs work in tandem with regulations to accelerate deployment of cleaner technology.

Light-Duty Vehicles

Figure 1 illustrates the trend in NOx emissions from light-duty vehicles and key programs contributing to those reductions. As a result of these efforts, light-duty vehicle emissions in Imperial County have been reduced significantly since 1990 and will continue to go down through 2017 due to the benefits of ARB's longstanding light-duty mobile source program. From 2008, light-duty vehicle NOx emissions are reduced by more than 25 percent in 2017. Key light-duty programs include Advanced Clean Cars, On-Board Diagnostics, Reformulated Gasoline, and Incentive Programs.

Figure 1: Key Programs to Reduce Light-Duty NOx Emissions



Since setting the nation's first motor vehicle exhaust emission standards in 1966 that led to the first pollution controls, California has dramatically tightened emission standards for light-duty vehicles. Through ARB regulations, today's new cars pollute 99 percent less than their predecessors did thirty years ago. In 1970, ARB 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 ARB 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.

Advanced Clean Cars

ARB's groundbreaking Advanced Clean Cars (ACC) program is now providing the next generation of emission reductions in California, and ushering in a new zero-emission passenger transportation system. The success of these programs is evident: California is the world's largest market for ZEVs, with over 21 models available today, and a wide variety are now available at lower price points, attracting new consumers. As of January 2015, Californians drive 40 percent of all ZEVs on the road in the United States, while the U.S. makes up about half of the world market. This movement towards commercialization of advanced clean cars has occurred due to ARB's ZEV regulation, part of ACC, which affects passenger cars and light-duty trucks.

ARB's ACC Program, approved in January 2012, is a pioneering approach of a 'package' of regulations, that although separate in construction, are related in terms of the synergy developed to address both ambient air quality needs and climate change. The ACC program combines the control of smog, soot causing pollutants and greenhouse gas emissions into a single coordinated package of requirements for model years 2015 through 2025. The program assures the development of environmentally superior cars that will continue to deliver the performance**,** utility, and safety vehicle owners have come to expect.

The ACC program approved by ARB in January 2012 also included amendments affecting the current ZEV regulation through the 2017 model year in order to enable manufacturers to successfully meet 2018 and subsequent model year requirements. These ZEV amendments are intended to achieve commercialization through simplifying the regulation and pushing technology to higher volume production in order to achieve cost reductions. The ACC Program benefits will increase over time as new cleaner cars enter the fleet displacing older and dirtier vehicles.

On Board Diagnostics

California's first OBD regulation required manufacturers to monitor some of the emission control components on vehicles starting with the 1988 model year. In 1989, ARB adopted OBD II, which required 1996 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles and engines to be equipped with second generation OBD systems. OBD systems are designed to identify when a vehicle's emission control systems or other emission-related computer-controlled components are malfunctioning, causing emissions to be elevated above the vehicle manufacturer's specifications. ARB subsequently strengthened OBD II requirements and added OBD II specific enforcement requirements for 2004 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles and engines.

Reformulated Gasoline

Since 1996, ARB has been regulating the formulation of gasoline resulting in California gasoline being the cleanest in the world. California's cleaner-burning gasoline regulation is one of the cornerstones of the State's efforts to reduce air pollution and cancer risk. Reformulated gasoline is fuel that meets specifications and requirements established by ARB. The specifications reduced motor vehicle toxics by about 40 percent and reactive organic gases by about 15 percent. The results from cleaning up fuel can have an immediate impact as soon as it is sold in the State. Vehicle manufacturers design low-emission emission vehicle to take full advantage of cleaner-burning gasoline properties.

Incentive Programs

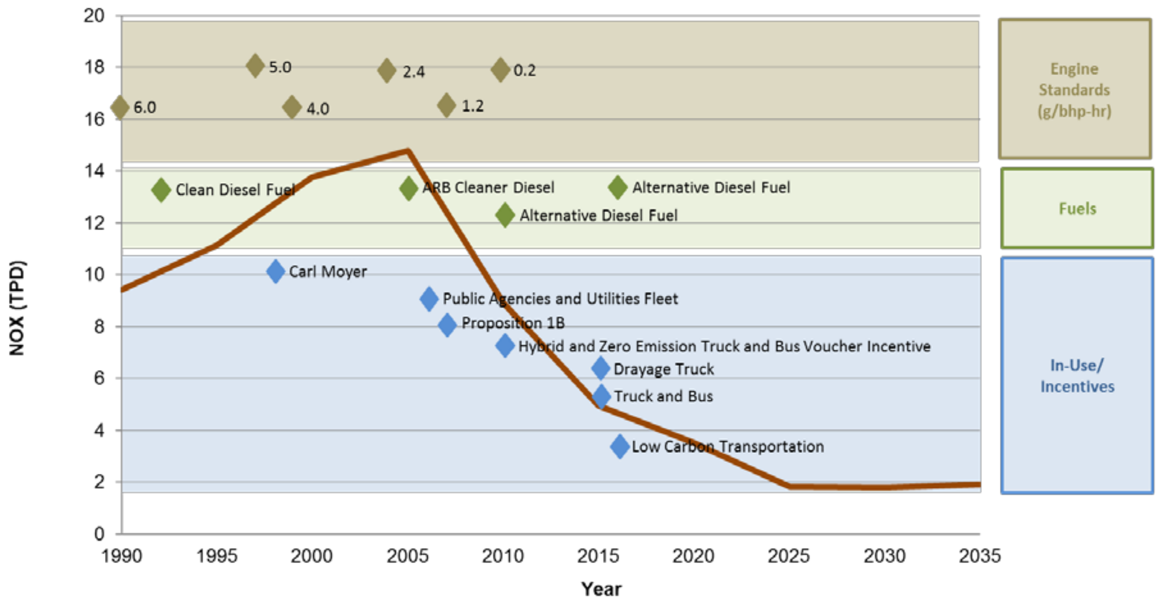
There are a number of different incentive programs focusing on light-duty vehicles that produce extra emission reductions beyond traditional regulations. The incentive programs work in two ways, encouraging the retirement of dirty older cars and encouraging the purchase of a cleaner vehicle.

The AQIP, established by AB 118, is an ARB voluntary incentive program to fund clean vehicle and equipment projects. The Clean Vehicle Rebate Project (CVRP) is one of the current projects under AQIP. CVRP, started in 2009, is designed to accelerate widespread commercialization of zero-emission vehicles and plug-in hybrid electric vehicles by providing consumer rebates up to $2,500 to partially offset the higher cost of these advanced technologies. The CVRP is administered statewide by the California Center for Sustainable Energy. In Fiscal Years 2009-2012, $26.1 million, including $2 million provided by the California Energy Commission, funded approximately 8,000 rebates. In June 2012, the ARB allocated up to $15-21 million to the CVRP as outlined in the AQIP FY2012-2013 Funding Plan.

Heavy-Duty Trucks

Figure 2 illustrates the trend in NOx emissions from heavy-duty vehicles and key programs contributing to those reductions. As a result of these efforts, heavy-duty vehicle emissions in Imperial County have been reduced significantly since 1990 and will continue to go down through 2017 due to the benefits of ARB's longstanding heavy-duty mobile source program. From 2008, heavy-duty NOx emissions are reduced by about 60 percent in 2017. Key programs include Heavy-Duty Engine Standards, Clean Diesel Fuel, Truck and Bus Regulation and Incentive Programs.

Figure 2: Key Programs to Reduce Heavy-Duty Emissions



Heavy-Duty Engine Standards

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

Clean Diesel Fuel

Since 1993, ARB has required that diesel fuel have a limit on the aromatic hydrocarbon content and sulfur content of the fuel. Diesel powered vehicles account for a disproportionate amount of the diesel particulate matter which is considered a toxic air contaminant. In 2006, ARB required a low-sulfur diesel fuel to be used not only by on-road diesel vehicles but also for off-road engines. The diesel fuel regulation allows alternative diesel formulations as long as emission reductions are equivalent to the ARB formulation.

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

The Truck and Bus Regulation was first adopted in December 2008. This rule represents a multi-year effort to turn over the legacy fleet of engines and replace them with the cleanest technology available. In December 2010, ARB revised specific provisions of the in-use heavy-duty truck rule, in recognition of the deep economic effects of the recession on businesses and the corresponding decline in emissions.

Starting in 2012, the Truck and Bus Regulation phases in requirements applicable to an increasingly larger percentage of the truck and bus fleet over time, so that by 2023 nearly all older vehicles would need to be upgraded to have exhaust emissions meeting 2010 model year engine emissions levels. The regulation applies to nearly all diesel-fueled trucks and buses with a gross vehicle weight rating (GVWR) greater than 14,000 pounds that are privately or federally owned, including on-road and off-road agricultural yard goats, and privately and publicly owned school buses. Moreover, the regulation applies to any person, business, school district, or federal government agency that owns, operates, leases or rents affected vehicles. The regulation also establishes requirements for any in-state or out-of-state motor carrier, California-based broker, or any California resident who directs or dispatches vehicles subject to the regulation. Finally, California sellers of a vehicle subject to the regulation would have to disclose the regulation's potential applicability to buyers of the vehicles. Approximately 170,000 businesses in nearly all industry sectors in California, and almost a million vehicles that operate on California roads each year are affected. Some common industry sectors that operate vehicles subject to the regulation include: for-hire transportation, construction, manufacturing, retail and wholesale trade, vehicle leasing and rental, bus lines, and agriculture.

ARB compliance assistance and outreach activities that are key in support of the Truck and Bus Regulation include:

- The Truck Regulations Upload and Compliance Reporting System, an online reporting tool developed and maintained by ARB 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.

ARB 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, ARB's approach to ensuring compliance is based on a comprehensive outreach and education effort.

Incentive Programs

There are a number of different incentive programs focusing on heavy-duty vehicles that produce extra emission reductions beyond traditional regulations. The incentive programs encourage the purchase of a cleaner truck.

Several State and local incentive funding pools have been used historically -- and remain available -- to fund the accelerated turnover of on-road heavy-duty vehicles. Since 1998, the Carl Moyer Program (Moyer Program) has provided funding for replacement, new purchase, repower and retrofit of trucks. Beginning in 2008, the Goods Movement Emission Reduction Program funded by Proposition 1B has funded cleaner trucks for the region’s transportation corridors; the final increment of funds will implement projects in through 2018.

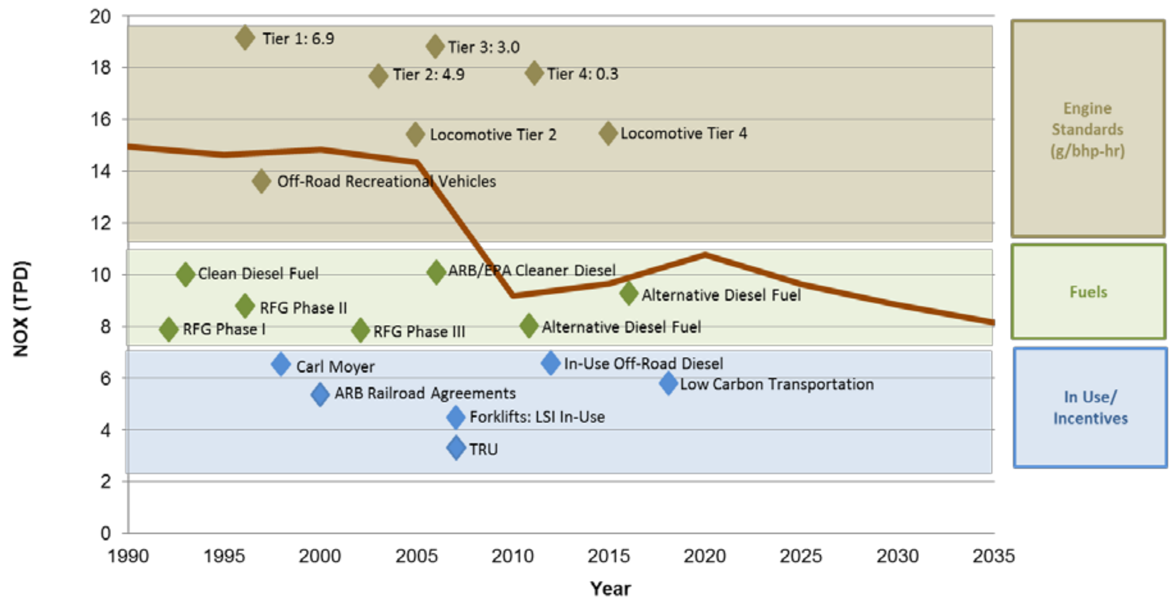
The Air Quality Improvement Program has funded the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) since 2010. ARB has also administered a Truck Loan Assistance Program since 2009.

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 3 illustrates the trend in NOx emissions from off-road equipment and key programs contributing to those reductions. As a result of these efforts, off-road emissions in Imperial County have been reduced significantly since 1990 and will continue to go down through 2017 due to the benefits of ARB’s and U.S. EPA longstanding programs. From 2008, off-road NOx emissions are reduced by about 16 percent in 2017. Key programs include Off-Road Engine Standards, Locomotive Engine Standards, Clean Diesel Fuel, Cleaner In-Use Off-Road Regulation and In-Use LSI Fleet Regulation.

Figure 3: Key Programs to Reduce Off-Road Emissions



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.

The Board 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 and 2003. These regulations were implemented through three tiers of progressively more stringent exhaust emission standards that were phased in between 1995 and 2008.

Manufacturers of forklift engines are subject to new engine standards for both diesel and Large Spark Ignition (LSI) engines. Off-road diesel engines were first subject to engine standards and durability requirements in 1996 while the most recent Tier 4 Final emission standards were phased in starting in 2013. Tier 4 emission standards are based on the use of advanced after-treatment technologies such as diesel particulate filters and selective catalytic reduction. LSI engines have been subject to new engine standards that include both criteria pollutant and durability requirements since 2001 with the cleanest requirements phased-in starting in 2010.

Locomotive Engine Standards

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

In 2008, U.S. EPA approved a second set of national locomotive regulations. Older locomotives upon remanufacture are required to meet more stringent particulate matter (PM) emission standards which are about 50 percent cleaner than Tier 0-2 PM emission standards. U.S. EPA refers to the PM locomotive remanufacture emission standards as Tier 0+, Tier 1+, and Tier 2+. The new Tier 3 PM emission standard (0.1 g/bhp-hr), for model years 2012-2014, is the same as the Tier 2+ remanufacture PM emission standard. The 2008 regulations also included new Tier 4 (2015 and later model years) locomotive NOx and PM emission standards. The U.S. EPA Tier 4 NOx and PM emission standards further reduced emissions by approximately 95 percent from uncontrolled levels.

Clean Diesel Fuel

Since 1993, ARB has required that diesel fuel have a limit on the aromatic hydrocarbon content and sulfur content of the fuel. Diesel powered vehicles account for a disproportionate amount of the diesel particulate matter which is considered a toxic air contaminant. In 2006, ARB required a low-sulfur diesel fuel to be used not only by on-road diesel vehicles but also for off-road engines. The diesel fuel regulation allows alternative diesel formulations as long as emission reductions are equivalent to the ARB formulation.

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

The Off-Road Regulation which was first approved in 2007 and subsequently amended in 2010 in light of the impacts of the economic recession. These off-road vehicles are used in construction, manufacturing, the rental industry, road maintenance, airport ground support and landscaping. In December 2011, the Off-Road Regulation was modified to include on-road trucks with two diesel engines.

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

The Off-Road Regulation imposes idling limits on off-road diesel vehicles, requires a written idling policy, and requires a disclosure when selling vehicles. The regulation also requires that all vehicles be reported to ARB 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 will be 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 are 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 ARB staff.
- The Diesel Hotline (866-6DIESEL), which provides the regulated public with questions about the regulations and access to ARB staff. Staff is able to respond to questions in English, Spanish and Punjabi.
- The Off-road Listserv, providing equipment owners and dealerships with timely announcement of regulatory changes, regulatory assistance documents, and reminders for deadlines.

LSI In-Use Fleet Regulation

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

Appendix E
California Air Resources Board Control Measures, 1985-2016

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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

Air Resources Board Control Measures, 1985 - 2016

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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
Gasoline and diesel fuel test standards Adopted amendments to add test standards for the measurement of prohibited oxygenates at trace levels specified in existing regulations.	1/25/13
LEV III and ZEV Programs for Federal Compliance Option Adopted amendments to deem compliance with national GHG new vehicle standards in 2017-2025 as compliance with California GHG standards for the same model years.	11/15/12 12/6/12 EO
Consumer products (automotive windshield washing fluid) Adopted amendments to add portions of 14 California counties to the list of areas with freezing temperatures where 25% VOC content windshield washing fluid could be sold.	10/18/2012 EO 03/15/13
GHG mandatory reporting, Fee Regulation, and Cap and Trade 2012 Adopted amendments to eliminate emission verification for facilities emitting less than 25,000 MTCO2e and make minor changes in definitions and requirements.	9/20/12 11/2/12 EO
Amendments to Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines Approved amendments to the verification procedure used to evaluate diesel retrofits through emissions, durability, and field testing. Amendments will lower costs associated with required in-use compliance testing, streamline the in-use compliance process, and will extend time allowed to complete verifications.	8/23/2012 EO 07/02/13
Amendments to On-Board Diagnostics (OBD I and II) Regulations Approved amendments to the light- and medium-duty vehicle and heavy-duty engine OBD regulations.	8/23/2012 EO 06/26/13
Cap and Trade: Amendments to CA Cap on GHG Emissions and Market-Based Compliance Mechanisms, and Amendments Allowing Use of Compliance Instruments Issued by Linked Jurisdictions Amends Cap-and-Trade and compliance mechanisms to add security to the market system and to aid staff in implementation. Amendments include first auction rules, offset registry, market monitoring provisions, and information gathering necessary for the financial services operator.	6/28/12 7/31/12 EO
Vapor recovery defect list Adopted amendments to add defects and verification procedures for equipment approved since 2004, and make minor changes to provide clarity	6/11/12 EO
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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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

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Board Action	Hearing Date
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

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Board Action	Hearing Date
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

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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

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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

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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.	9/15/05 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

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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

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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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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

Air Resources Board Control Measures, 1985 - 2016

Board Action	Hearing Date
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 F

Modeling Attainment Demonstration: Photochemical Modeling for the Imperial County Nonattainment Area 8-Hour Ozone State Implementation Plan

MODELING ATTAINMENT DEMONSTRATION

Photochemical Modeling for the Imperial County Nonattainment Area 8-Hour Ozone State Implementation Plan

Prepared by

California Air Resources Board

Imperial County Air Pollution Control District

Prepared for

United States Environmental Protection Agency Region IX

September 12, 2017

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ACRONYMS

ARB – Air Resources Board

BCs – Boundary Conditions

CMAQ Model – Community Multi-scale Air Quality Model

DV – Design Value

GEOS-5 – Goddard Earth Observing System Model, Version 5

GMAO – Global Modeling and Assimilation Office

ICs – Initial Conditions

MCAB Mountain Counties Air Basin

MOZART – Model for Ozone and Related chemical Tracers

MDA8 – Maximum Daily Average 8-hour Ozone

NASA – National Aeronautics and Space Administration

NARR - North American Regional Reanalysis

NCAR – National Center for Atmospheric Research

NOAA - National Oceanic and Atmospheric Administration

NO_x – Oxides of nitrogen

ROG – Reactive Organic Gases

RH – Relative Humidity

RRF – Relative Response Factor

SAPRC – Statewide Air Pollution Research Center

SIP – State Implementation Plan

U.S. EPA – United States Environmental Protection Agency

VOCs – Volatile Organic Compounds

WRF Model – Weather and Research Forecast Model

1. INTRODUCTION

The purpose of this document is to summarize the findings of the model attainment demonstration for the 0.075 ppm (or 75 ppb) 8-hour ozone standard in the Imperial County Federal 8-hour ozone Non-attainment Area, which forms the scientific basis for the Imperial County 2016 8-hour ozone SIP. The 75 ppb standard was promulgated by the U.S. EPA in 2008 and became effective in 2010. Imperial County has been classified as a moderate ozone non-attainment area for this standard and is mandated to demonstrate attainment of the standard by 2017.

Findings from the model attainment demonstration are summarized for each of the three ozone monitoring sites within the non-attainment area. The three sites are located in Calexico, just north of the U.S.-Mexico border, El Centro, northwest of the Interstate 8 and Highway 111 intersection, and Niland (near the Salton Sea) (Figure 1), respectively. Each site is characterized by distinct features in terms of geography, meteorology, and air quality as described in Section 2 of the Photochemical Modeling Protocol Appendix. The general approach utilized in the attainment demonstration is described in Section 2, while the remaining sections discuss the meteorological modeling (Section 3), the emissions inventory (Section 4), and the photochemical modeling and results (Section 5). A more detailed description of the modeling and development of the model-ready emissions inventory are presented in the Photochemical Modeling Protocol Appendix and Modeling Emissions Inventory Appendix.

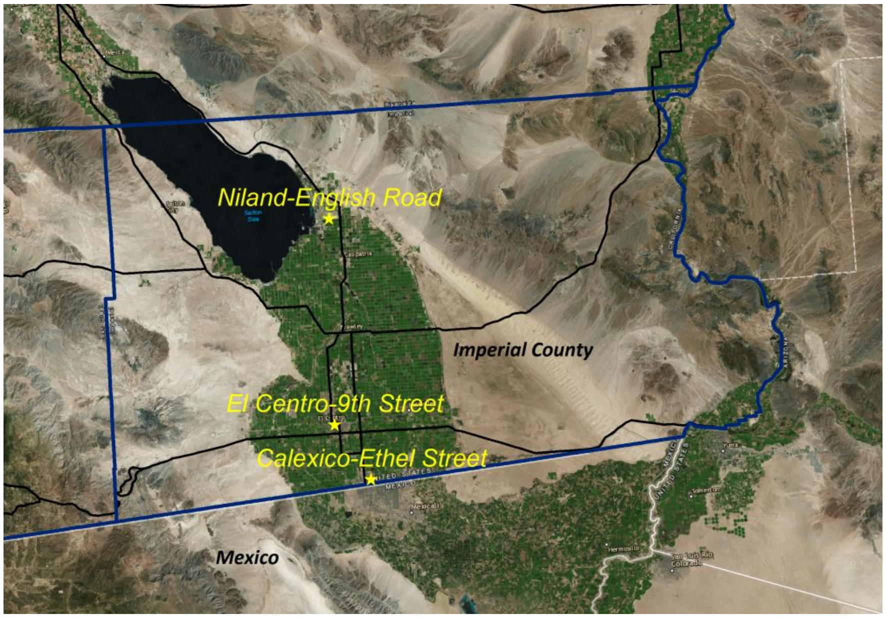

Figure 1. Map of Imperial County with the location of the three ozone monitoring sites.

2. APPROACH

This section describes the Air Resources Board's (ARB's) procedures, based on U.S. EPA guidance[1], for projecting ozone Design Values (DVs) to the future using model output and a Relative Response Factor (RRF) approach in order to show future year 2017 attainment of the 0.075 ppm 8-hour ozone standard, as well as assessing the impact of cross border emissions from Mexico on ozone levels in Imperial County.

2.1. METHODOLOGY

The U.S. EPA modeling guidance[1] outlines the approach for utilizing models to predict future attainment of the 0.075 ppm 8-hour ozone standard. Consistent with previous modeling guidance[2], which was utilized in past ozone SIPs in the region, including the 2012 South Coast SIP[3] for the 0.075 ppm 8-hour ozone standard, the current guidance recommends utilizing modeling in a relative sense. A brief summary of how models are applied in the attainment demonstration, as prescribed by U.S. EPA modeling guidance (U.S. EPA, 2014[1]), is provided below. A more detailed description of the methodology in this and subsequent sections is provided in the Photochemical Modeling Protocol Appendix.

2.2. MODELING PERIOD

The year 2012 was selected as the year for both baseline modeling and design value calculation based on how conducive the 2012 meteorology was towards ozone formation, as well as the availability of the most detailed emissions inventory. These baseline design value mixing ratios serve as the anchor point for estimating future year projected design values. The non-attainment designation for Imperial County requires that attainment of the 2008 8-hour ozone standard be demonstrated by 2017. Therefore, 2017 was the future year modeled in this attainment demonstration. The revised U.S. EPA modeling guidance requires that the 8-hour ozone model attainment demonstration utilize the top ten modeled days when projecting design values to the future. Recent ozone SIP modeling applications in California have generally simulated the entire ozone season (May – September) as the peak ozone mixing ratios for a given year at any monitor tend to occur between May and September. The same May to

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

[2] U.S. EPA, 2007. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. EPA-454/B07-002, 2007, available at https://www.epa.gov/ttn/scram/guidance/guide/final-03-pm-rh-guidance.pdf

September period was modeled in this attainment demonstration for both 2012 and 2017 to ensure that all of the top ozone days in Imperial County were simulated.

2.3. BASELINE DESIGN VALUES

Specifying the baseline design value is a key consideration in the model attainment test, since this value is projected forward and used to predict future attainment at each site. The starting point for the attainment demonstration is with the observational based design value (DV), which represents the three-year average of the annual 4^{th} highest 8-hour ozone mixing ratio observed at a specific monitor for the year in consideration. For example, a DV for 2012 would represent the average of the 4^{th} highest 8-hour ozone mixing ratio from 2010, 2011, and 2012.

The U.S. EPA recommends using an average of three DVs that straddle the baseline year in order to better account for the year-to-year variability inherent in meteorology. Since 2012 was chosen as the base year for projecting DVs to the future, site-specific DVs were calculated for the three three-year periods ending in 2012, 2013, and 2014 and then these three DVs were averaged. This average DV is called a weighted DV (in the context of this SIP, the weighted DV will also be referred to as the reference year DV or DV_R). Table 1 illustrates the observational data from each year that goes into the calculation of average DV at a particular monitoring site.

Table 1. Illustrates the observational 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 (4^{th} highest observed 8-hr O_3)				
2012	2010	2011	2012		
2013		2011	2012	2013	
2014			2012	2013	2014

Table 2 lists the design values of the three Imperial County ozone monitoring sites that are used in this model attainment demonstration. Both the El Centro and Calexico sites have weighted DVs that exceed the 75 ppb standard, with El Centro having the highest weighted DV at 81 ppb, and is thus designated as the design site for the region.

Table 2. Year-specific 8-hr ozone design values for 2012, 2013, and 2014, and the weighted design value (represented as the average of the three year-specific design values) for the monitoring sites located in Imperial County.

Site	8-hr Ozone Design Value (ppb)			
	2012	2013	2014	2012-2014 Average
Niland - English Road	70.0	71.0	70.0	70.3
El Centro - 9th Street	81.0	82.0	80.0	81.0
Calexico - Ethel Street	75.0	76.0	78.0	76.3

2.4. BASE, REFERENCE, AND FUTURE YEARS

The model attainment demonstration consists of the following four primary model simulations, which all utilized the same model inputs, including meteorology, chemical boundary conditions (to the outer coarse domain), and biogenic emissions. The only difference between the simulations was in the year represented by the anthropogenic emissions (2012 or 2017) and certain day-specific emissions.

1. ***Base Year (or Base Case) Simulation***
   The base year simulation for 2012 was used to assess model performance and includes as much day-specific detail as possible in the emissions inventory, such as hourly adjustments to the motor vehicle and biogenic inventories based on observed local meteorological conditions, as well as known wildfire and agricultural burning events.

2. ***Reference (or Baseline) 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 were removed from the emissions inventory. For the 2012 reference year modeling, wildfires were excluded due to the difficulty in predicting future fires and since they can influence the model response to anthropogenic emissions reductions in regions and times when large fires occur.

3. ***Future Year Simulation***
   The future year simulation is identical to the reference year simulation, except that projected future year (2017) anthropogenic emission levels were used rather

than the 2012 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. Note that although the chemical boundary conditions provided to the outer coarse domain were the same as those for the base/reference simulations, the boundary conditions for the inner domain differ from the base/reference simulations, because those are influenced by California emissions, which reflect future year levels.

4. ***Future Year Sensitivity Simulation with Mexico Anthropogenic Emissions Excluded (Zero out)***
   To investigate the impacts of Mexico anthropogenic emissions on future year design values, a future year sensitivity simulation was conducted, which followed the same approach as the Future Year Simulation (3) above, but where future year (2017) Mexico anthropogenic emissions were zeroed out for all species.

To summarize (Table 3), the base year 2012 simulation was used for evaluating model performance, while the reference (or baseline) 2012 and future year 2017 (including the sensitivity simulation) were used to project the average DVs to the future year as described in the Photochemical Modeling Protocol Appendix and in subsequent sections of this document.

Table 3. Description of CMAQ model simulations.

Simulation	Anthropogenic Emissions	Biogenic Emissions	Meteorology	Chemical Boundary Conditions
Base year (2012)	2012 w/ wildfires	2012 MEGAN	2012 WRF	2012 MOZART
Reference year (2012)	2012 w/o wildfires	2012 MEGAN	2012 WRF	2012 MOZART
Future year (2017)	2017 w/o wildfires w/ Mexico emissions	2012 MEGAN	2012 WRF	2012 MOZART
Future year sensitivity (2017)	2017 w/o wildfires w/o Mexico emissions	2012 MEGAN	2012 WRF	2012 MOZART

2.5. RELATIVE RESPONSE FACTORS

As part of the model attainment demonstration, the fractional changes in ozone mixing ratios between the model future year and model reference year were calculated at each of the monitors. These ratios, called "relative response factors" (RRFs), were calculated based on the ratio of future year modeled maximum daily average 8-hour (MDA8) ozone to modeled reference year MDA8 ozone (Equation 1).

$$RRF = \frac{\text{average MDA8 ozone}_{\text{future}}}{\text{average MDA8 ozone}_{\text{reference}}} \qquad (1)$$

The MDA8 values, used in calculating the RRF, were based on the maximum simulated ozone within a 3x3 array of cells with the grid cells containing the monitor located at the center of the array[1]. The future and reference year ozone values used in the RRF calculations were paired in space and time (i.e., using the future year MDA8 ozone for the same modeled day and at the same grid cell where the MDA8 ozone for the reference year is located within the 3x3 array of cells). The modeled days utilized in the RRF calculation were selected based on the following U.S. EPA recommended criteria[1].

- Begin with days that have simulated baseline MDA8 >= 60 ppb and calculate RRFs based on the top 10 high ozone days.
- If there are fewer than 10 days with MDA8 >= 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 is not calculated at that monitor.
- Restrict the simulated days used in the RRF calculation by only including days with reference MDA8 within +/- 20% of the observed value at the monitor. This ensures that only modeled days which are consistent with the observed ozone levels are used in the RRF calculation.

2.6. FUTURE YEAR DESIGN VALUE CALCULATION

Future year design values for each site were calculated by multiplying the corresponding baseline design value (Table 2 lists the design values of the three Imperial County ozone monitoring sites that are used in this model attainment demonstration. Both the El Centro and Calexico sites have weighted DVs that exceed

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

the 75 ppb standard, with El Centro having the highest weighted DV at 81 ppb, and is thus designated as the design site for the region.

Table 2) by the site-specific RRF (Equation 2).

$$DV_F = DV_R \times RRF \quad (2)$$

where,

DV_F = the future year design value,
DV_R = the reference year design value (from Table 2), and
RRF = the site specific RRF from Equation 1

Future year design values from the model attainment demonstration are discussed in Section 5.3.

3. METEOROLOGICAL MODELING

California's proximity to the ocean, complex terrain, and diverse climate represent a unique challenge for developing meteorological fields that adequately represent the synoptic and mesoscale features of the regional meteorology. Imperial County contains the northern portion of the Imperial Valley with the Salton Sea defining the northern extent of the Valley. The orientation of the Imperial Valley results in winds that are usually from the southeast or the northwest, depending on synoptic conditions. High PM concentrations in the area occur more often in wintertime when both upper-air and surface pressure gradients are weak and atmospheric conditions are stagnant (Chow and Watson, 1997), while maximum ground-level ozone concentrations are associated with hot summer days and upper-air high pressure systems in the southwest U.S.

For this modeling assessment, meteorological model results with 4 km horizontal spatial resolution were obtained from the South Coast Air Quality Management District (SCAQMD). These meteorological fields were evaluated against observations and used in the subsequent photochemical model simulations.

3.1. WRF MODEL SETUP

The state-of-the-science Weather Research and Forecasting (WRF) prognostic model[1] version 3.6.1 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 1. The 4-km innermost domain has 163x115 grid points and spans 652 km in the east-west direction and 460 km in the north-south direction. There are 30 vertical layers with the lowest layer extending to 30 m above the surface. The North America Model (NAM) reanalysis fields, enhanced with surface and upper-air observations, was 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 NAM data is 40 km. The planetary boundary layer (PBL) scheme, cumulus parameterization for the outer two domains, and the land surface model were the Yon-Sei University (YSU) PBL, Kain-Fritsch scheme, and the thermal diffusion model, respectively. Details about the meteorological modeling are available in Appendix V: Modeling & Attainment Demonstrations of the South Coast AQMD draft 2016 AQMP (http://www.aqmd.gov/home/library/clean-air-plans/air-quality-mgt-plan/Draft2016AQMP)

[1] Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, D. M. Barker, W. Wang, and J. G. Powers, 2005: A description of the Advanced Research WRF Version 2. NCAR Tech Notes-468+STR

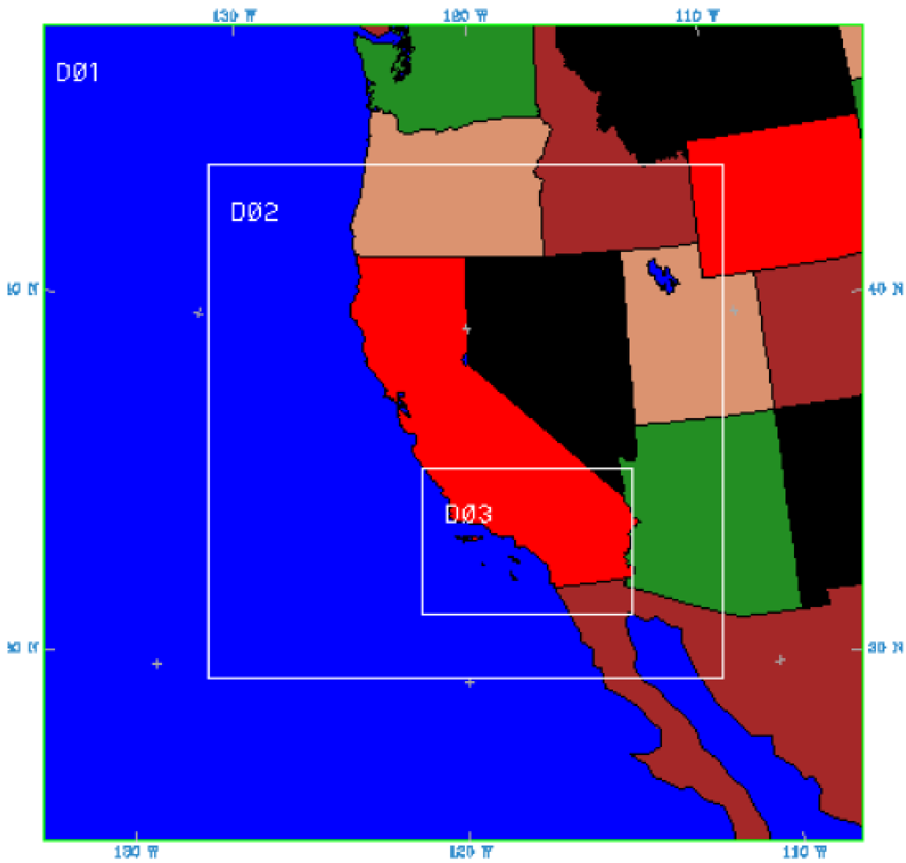

Figure 2. WRF modeling domains (D01 36km; D02 12km; and D03 4km).

3.2. WRF MODEL RESULTS AND EVALUATION

3.2.1. STATISTICS

The simulated surface wind speed, temperature, and relative humidity from the 4 km domain were validated against hourly observations at 15 surface stations in Imperial County. Observational data for the surface stations were obtained from the ARB archived meteorological database (http://www.arb.ca.gov/aqmis2/aqmis2.php).

Table 4 lists the monitoring stations and parameters measured at each station, including wind speed and direction (wind), temperature (T), and relative humidity (RH). The location of each of these sites is shown in Figure 2. The following quantitative performance metrics for May-September 2012 were used to compare hourly surface observations and modeled estimates based on recommendations from Simon et al. (2012): mean bias (MB), mean error (ME), and index of agreement (IOA). A summary of these statistics for Imperial County is shown in Table 5. The model performance statistical metrics were calculated using the available data at all 15 sites in the area. The distribution of daily mean bias and mean error are shown in Figure 3, while Figure 4 shows hourly observed wind speed, temperature, and relative humidity vs. modeled predictions.

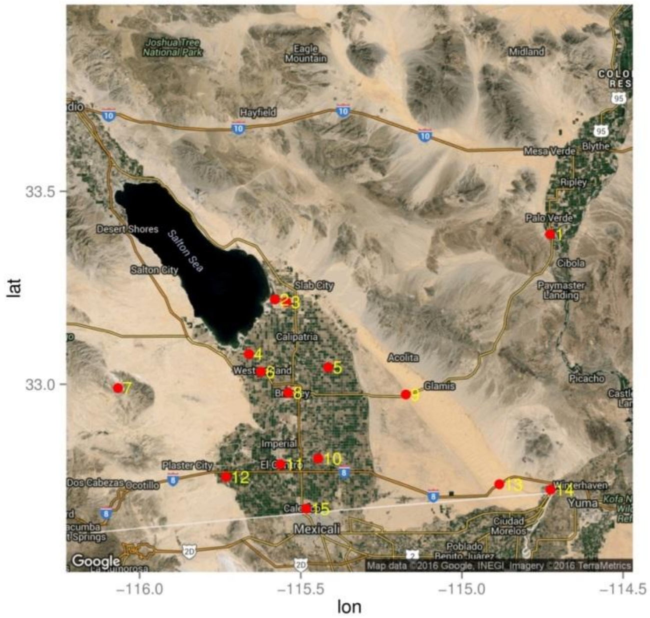

Figure 3. Meteorological observation sites in Imperial County. Numbers reflect the sites listed in Table 4.

Table 4. Meteorological monitor location and parameter(s) measured.

Site Number (Figure 3)	Site ID	Site Name	Parameter(s) Measured
1	5817	Palo Verde II	T, RH
2	5774	Salton Sea East	T, RH
3	3186	Niland-English Road	Wind, T
4	5822	Westmorland North	T, RH
5	5724	Calipatria-Mulberry	T, RH
6	3143	Westmorland-W 1st Street	Wind, T
7	3434	Fish Creek Mountains	Wind, T, RH
8	3675	Brawley-220 Main Street	T
9	3516	Cahuilla	Wind, T, RH
10	5747	Meloland	T, RH
11	2551	El Centro-9th Street	Wind, T
12	5735	Seeley	T, RH
13	3541	Buttercup	Wind, T, RH
14	6735	UC-Andrade	T, RH
15	3135	Calexico-Ethel Street	Wind, T, RH

The average hourly wind speed bias for May-September 2012 is relatively small at -0.21 m/s, while the average mean error is 1.33 m/s. The index of agreement for the wind speed in this period is 0.6. The temperature is biased low with an average bias of 2.47 K. Hourly time series (supplemental material) show that low biases in the temperature generally occur during daytime hours on days with the highest temperatures. The IOA for the temperature is 0.91. Consistent with the negative temperature bias, relative humidity has a positive bias of 16.35%. These results are comparable to other recent WRF modeling efforts in California investigating ozone formation in Central California[1] and modeling analysis for the CalNex and CARES field studies[2,3,4,5]. Detailed hourly time-series of surface temperature, relative humidity, wind speed, and wind direction for Imperial County can be found in the supplementary material, together with spatial distributions of the mean bias and mean error.

Table 5. Hourly surface wind speed, temperature and relative humidity statistics for May-September 2012.

Observed Mean	Modeled Mean	Mean Bias	Mean Error	IOA
Wind Speed (m/s)				
2.51	2.30	-0.21	1.33	0.60
Temperature (K)				
304.55	302.07	-2.47	3.14	0.91
Relative Humidity (%)				
39.10	55.44	16.35	19.29	0.71

[1] Hu, J., Howard, C. J., Mitloehner, F., Green, P. G., and Kleeman, M. J., 2012: Mobile Source and Livestock Feed Contributions to Regional Ozone Formation in Central California, Environmental Science & Technology, 46, 2781-2789

[2] Fast, J. D., Gustafson Jr, W. I., Berg, L. K., Shaw, W. J., Pekour, M., Shrivastava, M., Barnard, J. C., Ferrare, R. A., Hostetler, C. A., Hair, J. A., Erickson, M., Jobson, B. T., Flowers, B., Dubey, M. K., Springston, S., Pierce, R. B., Dolislager, L., Pederson, J., and Zaveri, R. A., 2012: Transport and mixing patterns over Central California during the carbonaceous aerosol and radiative effects study (CARES), Atmos. Chem. Phys., 12, 1759-1783, doi:10.5194/acp-12-1759-2012

[3] Baker, K. R., Misenis, C., Obland, M. D., Ferrare, R. A., Scarino, A. J., and Kelly, J. T., 2013: Evaluation of surface and upper air fine scale WRF meteorological modeling of the May and June 2010 CalNex period in California, Atmos. Environ., 80, 299-309.

[4] Kelly, J. T., Baker, K. R., Nowak, J. B., Murphy, J. G., Milos, Z. M., VandenBoer, T. C., Ellis, R. A., Neuman, J. A., Weber, R. J., Roberts, J. M., Veres, P. R., de Gouw, J. A., Beaver, M. R., Newman, S., and Misenis, C., 2014: Fine-scale simulation of ammonium and nitrate over the South Coast Air Basin and San Joaquin Valley of California during CalNex-2010, J. Geophysical Research, 119, 3600-3614, doi:10.1002/2013JD021290

[5] Angevine, W. M., Eddington, L., Durkee, K., Fairall, C., Bianco, L., Brioude, J., 2012: Meteorological model evaluation for CalNex 2010, Monthly Weather Review, 140, 3885-3906

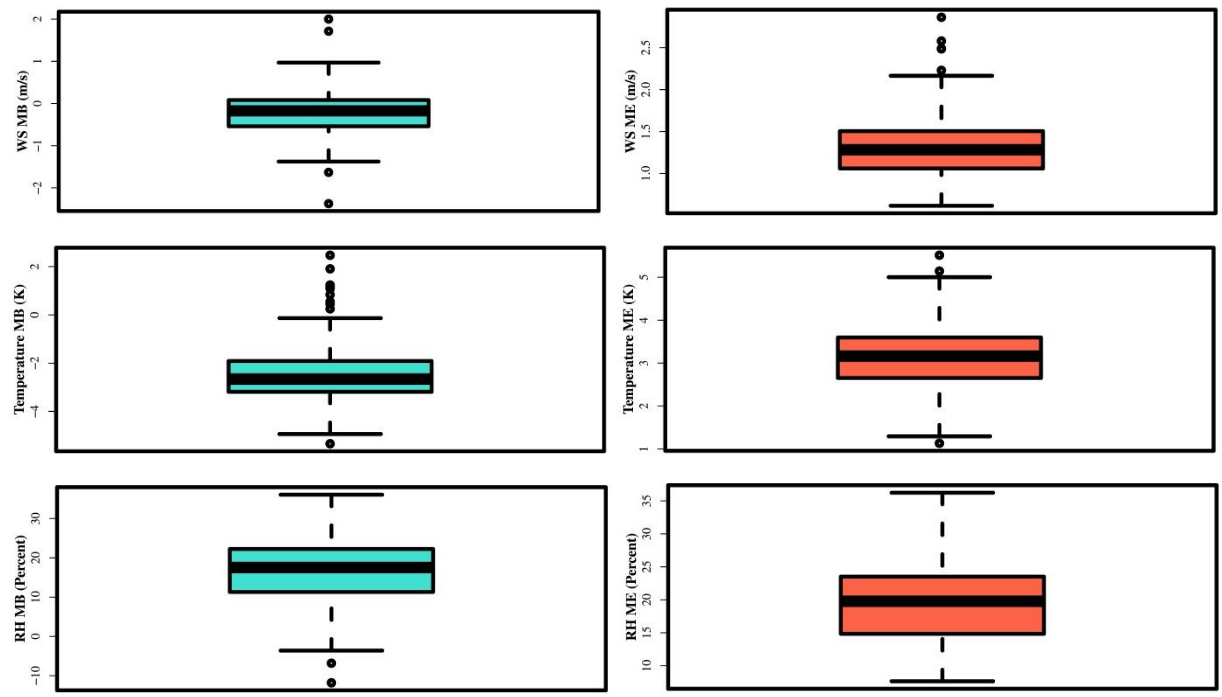

Figure 4. Distribution of modeled daily mean bias (left) and mean error (right) for wind speed (top), temperature (middle), and relative humidity (bottom) for May-September 2012.

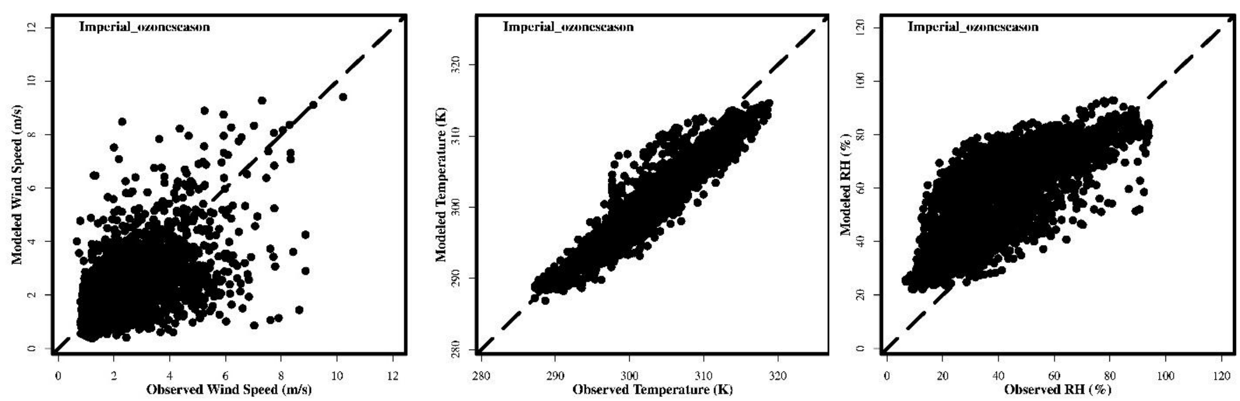

Figure 5. Comparison of modeled and observed hourly wind speed (left), 2-meter temperature (middle), and relative humidity (right), for May-September 2012.

3.2.2. PHENOMENOLOGICAL EVALUATION

Conducting a detailed phenomenological evaluation for all modeled days can be resource intensive given that five months were modeled for the attainment demonstration. However, some insight and confidence in the model's ability to reproduce meteorological conditions that lead to ozone exceedances in Imperial County can be gained by investigating days with the high observed ozone levels in more detail. In 2012, the highest observed ozone in Imperial County occurred on August 2, 2012, which exhibited daily maximum 8 hour ozone mixing ratios that exceeded 90 ppb at both Calexico and El Centro. On that day, upper-air weather charts show that a 500 mb ridge formed off the California coast over the Pacific Ocean and the Southwest US was under a high pressure system with a very low pressure gradient. Atmospheric conditions were stagnant and temperatures in the afternoon exceeded 100 ˚F. Figure 5 and Figure 6 show the wind fields in the early morning and afternoon of August 2, where modeled winds are shown with black arrows and observations with red arrows. In Imperial County, a large portion of the area is below sea level (Figure 5), with mountainous areas to the east/northeast and west. These figures show that the winds during the early morning hours are influenced by down slope flows, while in the afternoon the predominant flow is up slope. Some lake effects due to the Salton Sea in the northwest of the county are also noticeable. In both the model and the observations, wind speeds at Calexico were very low and generally from the south in the afternoon, consistent with cross border transport conditions.

In addition to examining the meteorological conditions on the peak ozone day in Imperial County, average meteorological conditions for the top 10 days with the highest observed ozone levels at Calexico in 2012 were also evaluated. The top 10 days with the highest observed ozone at Calexico occurred on August 2, May 21, June 20, June 7, June 12, July 18, May 19, May 20, May 28 and June 1, respectively. Figure 7 shows the average wind field for 13:00 PST, while Figure 8 displays the average wind field for 21:00 PST. Overall, the surface wind distribution indicates that on the days that high ozone levels occurred, the model was able to capture many of the important features of the observed meteorological fields.

Figure 9 and Figure 10 depict the 500 hPa geopotential height at Calexico at 12:00 UTC and 00:00 UTC for each of the top 10 ozone days. These times were chosen to coincide with timing of the upper-air observations. In these figures, the North American Regional Reanalysis (NARR) data is used to represent the observations. The NARR dataset is a product of observational data assimilated into some of the NOAA model products for the purpose of producing a snap shot of the weather over North America at any given time. The 500 hPa geopotential height is a useful metric to evaluate, because most weather systems follow the winds at this level. Overall, the WRF model is able to reasonably capture the 500 hPa geopotential height at the Calexico monitor on peak ozone days.

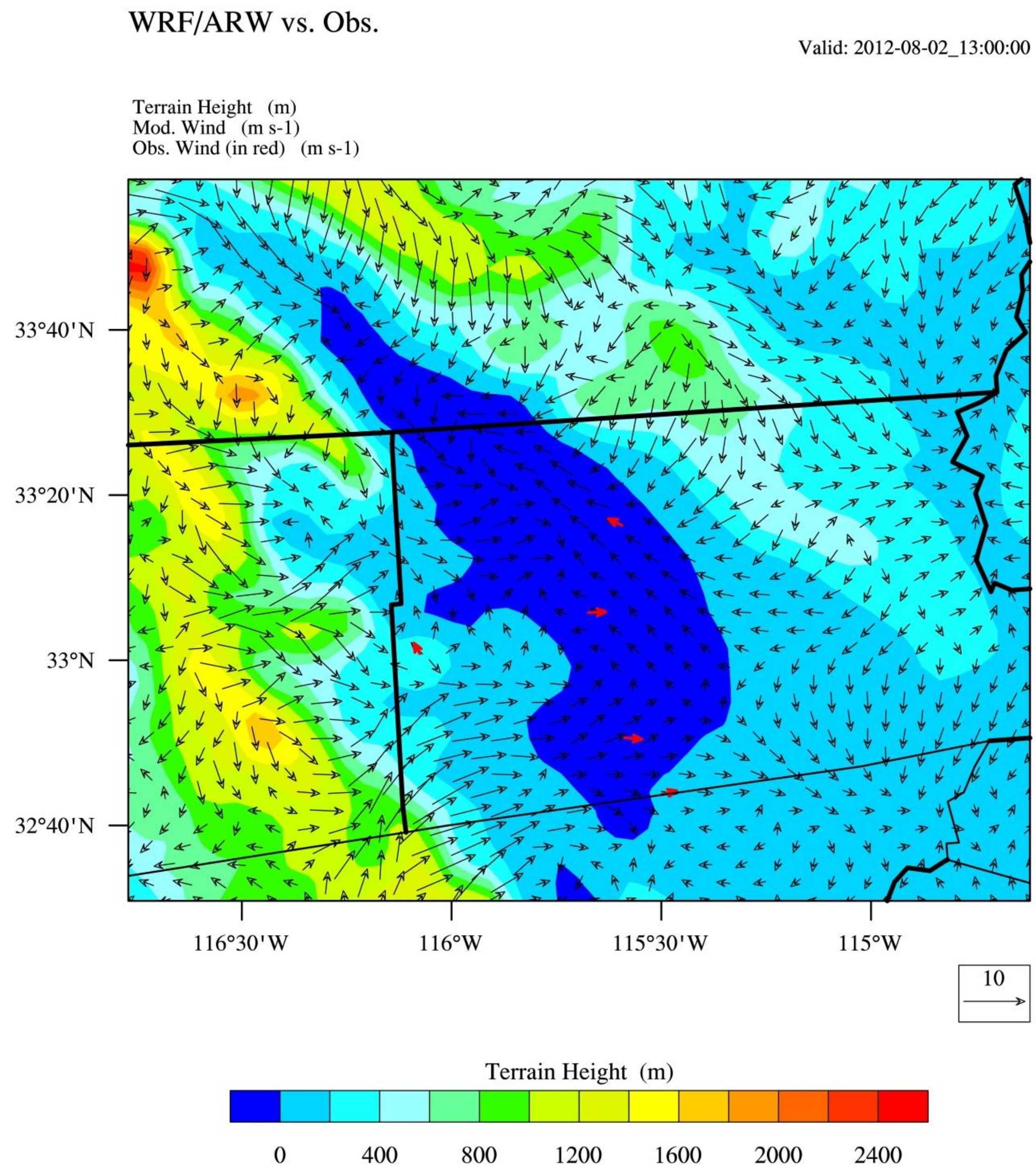

Figure 6. Surface wind field at 05:00 PST August 2, 2012. Modeled wind field is shown with black wind vectors, while observations are shown in red.

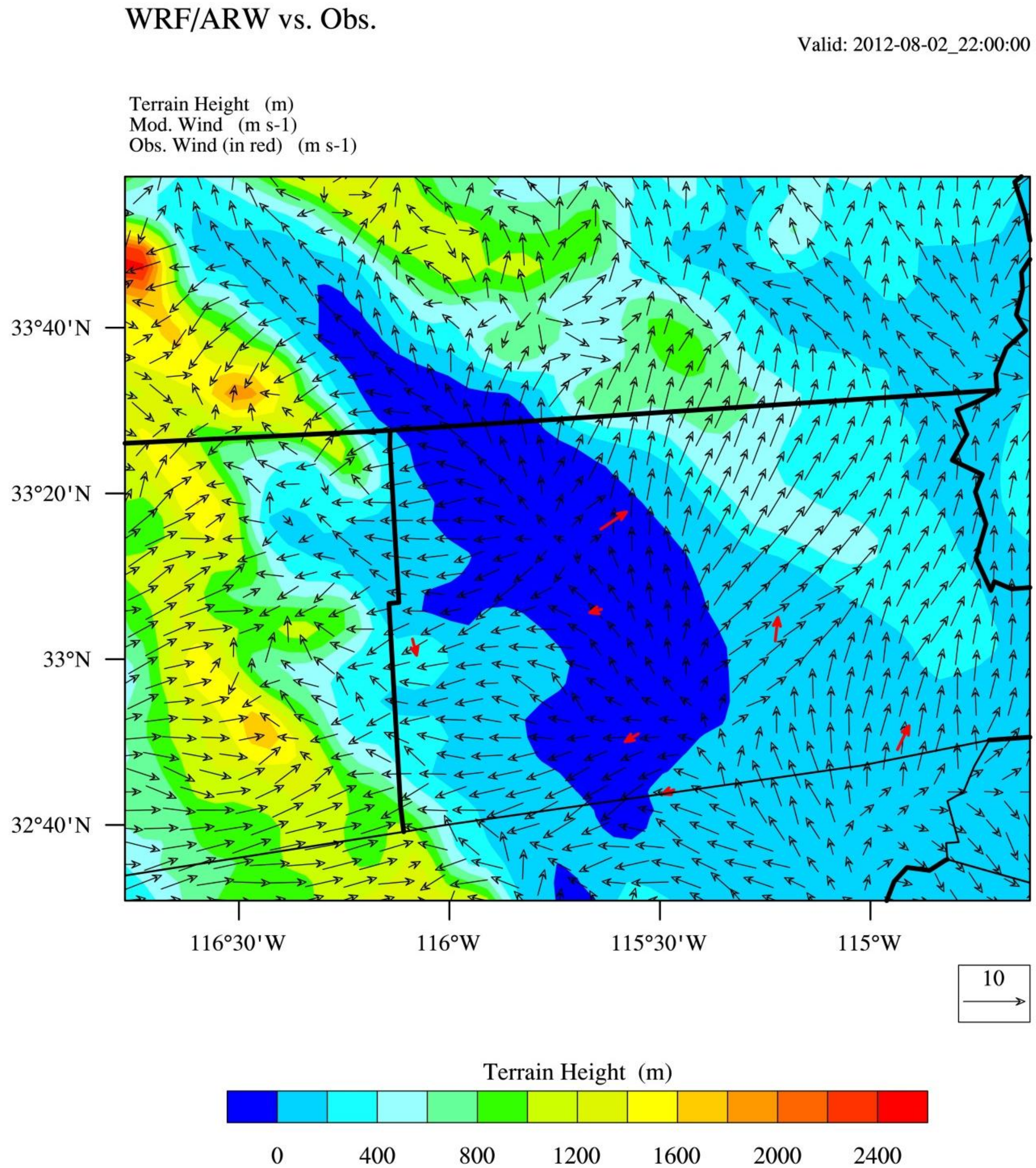

Figure 7. Surface wind field at 14:00 PST August 2, 2012. Modeled wind field is shown with black wind vectors, while observations are shown in red.

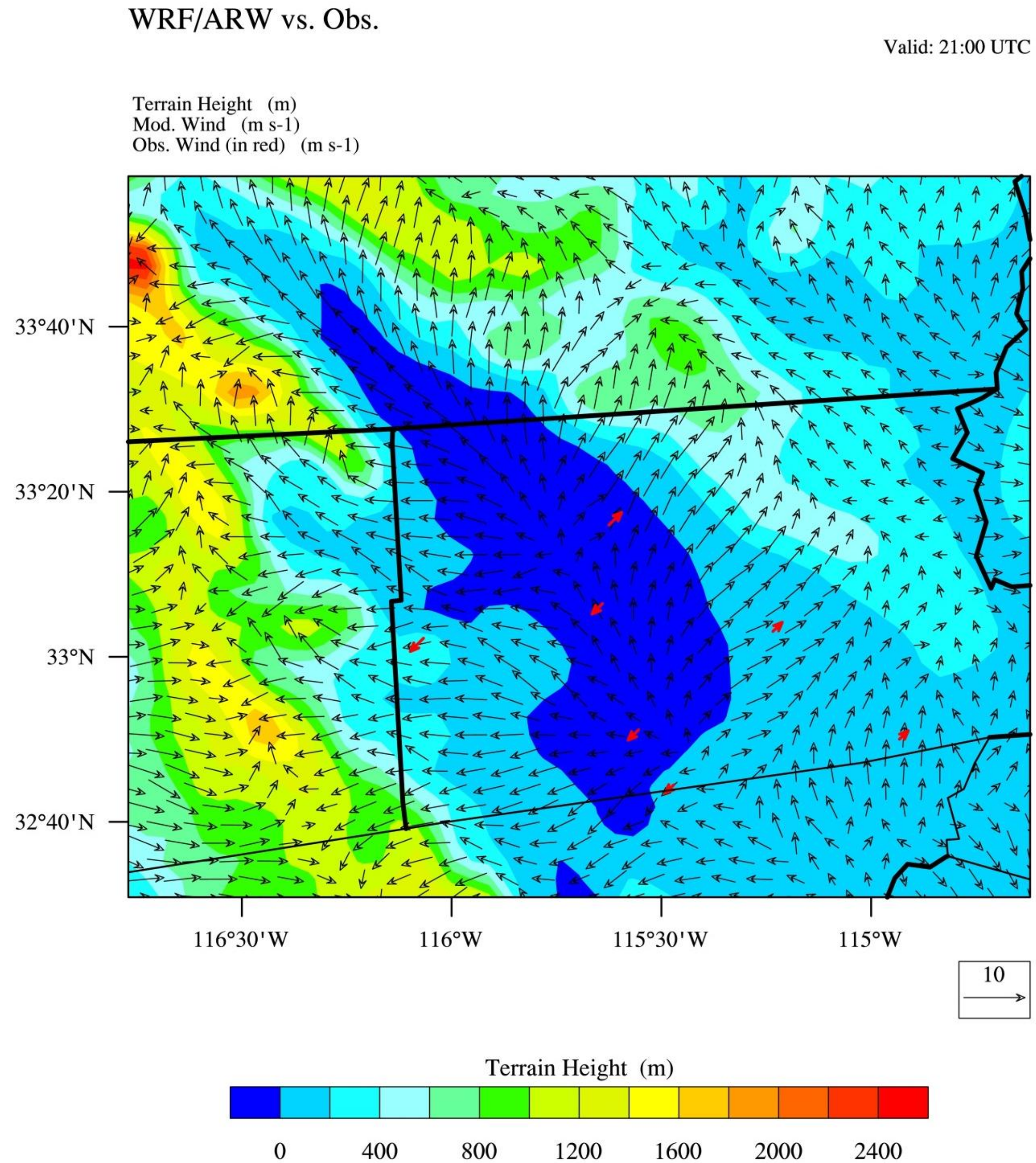

Figure 8. Average wind field at 13:00 PST for the top 10 ozone days. Modeled wind field is shown with black wind vectors, while observations are shown in red.

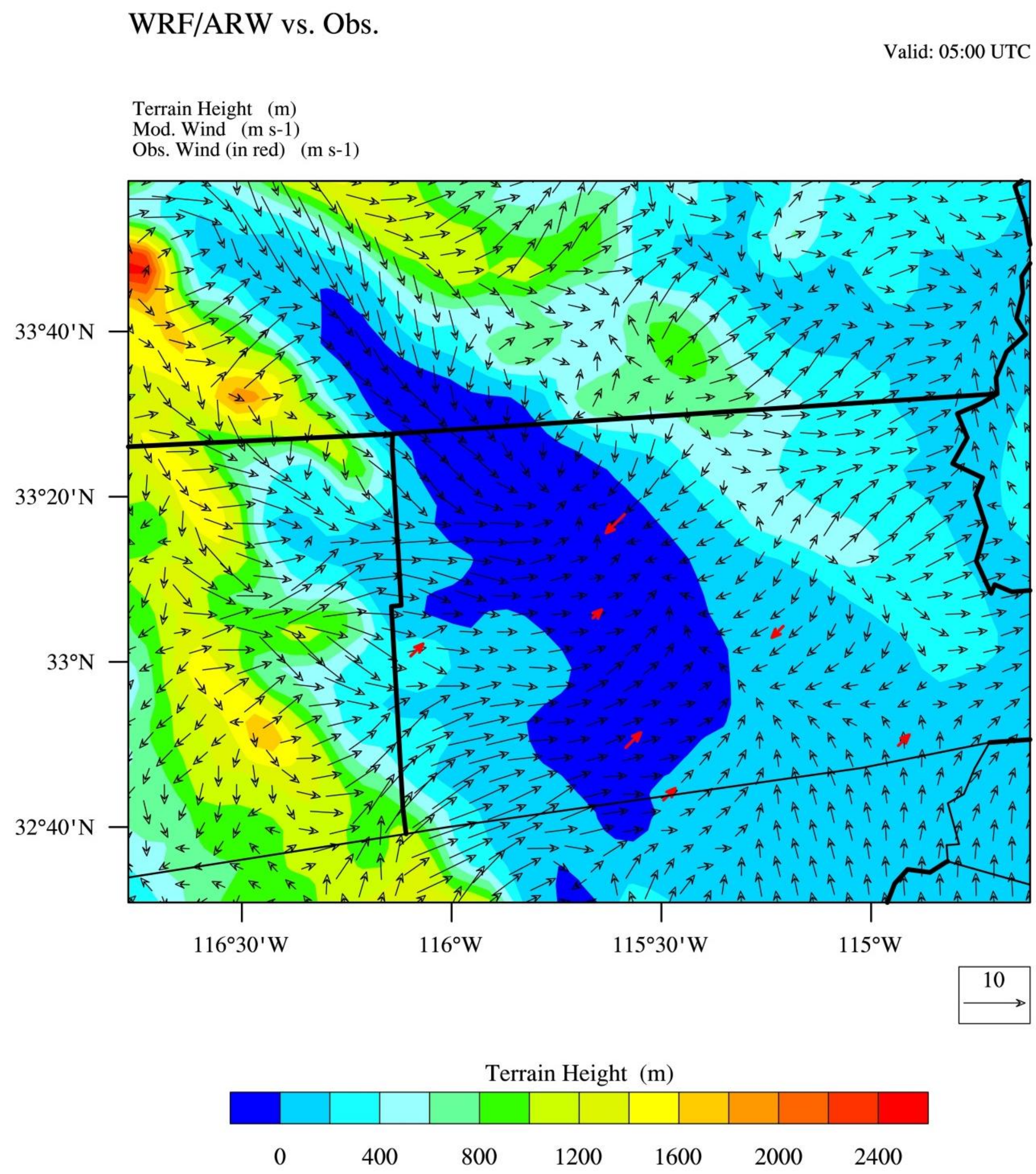

Figure 9. Average wind field at 21:00 PST for the top 10 ozone days. Modeled wind field is shown with black wind vectors, while observations are shown in red.

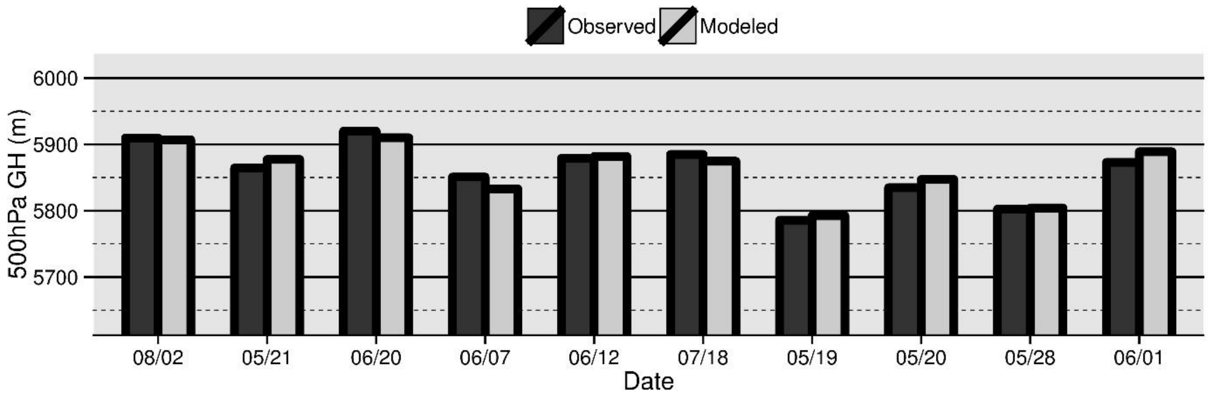

Figure 10. Modeled and observed 500 hPa geopotential height at 12:00 UTC for the top 10 ozone days.

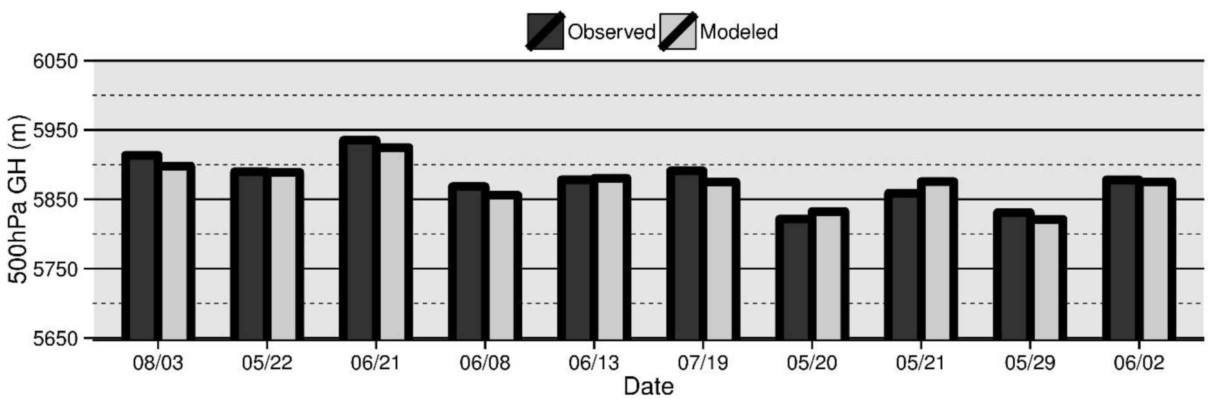

Figure 11. Modeled and observed 500 hPa geopotential height at 00:00 UTC for the top 10 ozone days.

4. EMISSIONS

The emissions inventory used in this modeling was based on the most recent inventory submitted to the U.S. EPA, with base year 2012 (http://www.arb.ca.gov/planning/sip/2012iv/2012iv.htm), while the Mexico inventory was based on the latest inventory from U.S. EPA (2011 Version 6.3 Platform). A detailed description of the emissions inventory, updates to the inventory, and how it was processed from the planning totals to a gridded inventory for modeling is provided in the Modeling Emissions Inventory Appendix.

4.1 EMISSIONS SUMMARIES

Table 6 summarizes the 2012 and 2017 Imperial County and Mexicali (Municipality and City) anthropogenic emissions used in this work. Figure 12 shows the region used to estimate the Mexicali (City) emissions. Overall, anthropogenic NO_x in Imperial County was projected to decrease from 21.8 tons per day (tpd) in 2012 to 18.0 tpd in 2017, while the city of Mexicali NO_x emissions were projected to grow from 7.5 tpd to 8.4 tpd, respectively. Similarly, Imperial County ROG emissions were projected to decrease over the same time period from 19.2 tpd to 16.9 tpd, respectively, while ROG emissions in the city of Mexicali were projected to grow from 11.9 tpd in 2012 to 13.5 tpd in 2017. When emissions from the portion of the Mexicali Municipality within the modeling domain are considered, the total NO_x emissions in Mexicali are approximately 6 times greater than NO_x emissions in Imperial County in 2017, while ROG emissions are approximately 4 times greater.

Table 6. Imperial County summer planning emissions and the Mexicali Municipality (estimated emissions for the City of Mexicali are shown in parenthesis) emissions within the modeling domain for 2012 and 2017 (tons/day).

Source Category	NO_x [tpd]				ROG [tpd]			
	Imperial		Mexicali		Imperial		Mexicali	
	2012	2017	2012	2017	2012	2017	2012	2017
Stationary	1.7	1.5	15.3 (3.2)	24.8 (3.8)	1.3	1.4	14.2 (9.9)	17.4 (11.4)
Area	0.7	0.6	10.0 (0.3)	10.6 (0.4)	8.5	7.7	27.0 (0.8)	30.0 (0.9)
On-Road Mobile	10.0	6.5	55.7 (3.8)	58.2 (3.9)	4.3	3.1	17.4 (1.2)	18.0 (1.2)
Other Mobile	9.4	9.4	3.8 (0.2)	4.2 (0.3)	5.1	4.6	0.4 (0.0)	0.5 (0.0)
Total	21.8	18.0	84.8 (7.5)	97.8 (8.4)	19.2	16.9	59.0 (11.9)	65.8 (13.5)

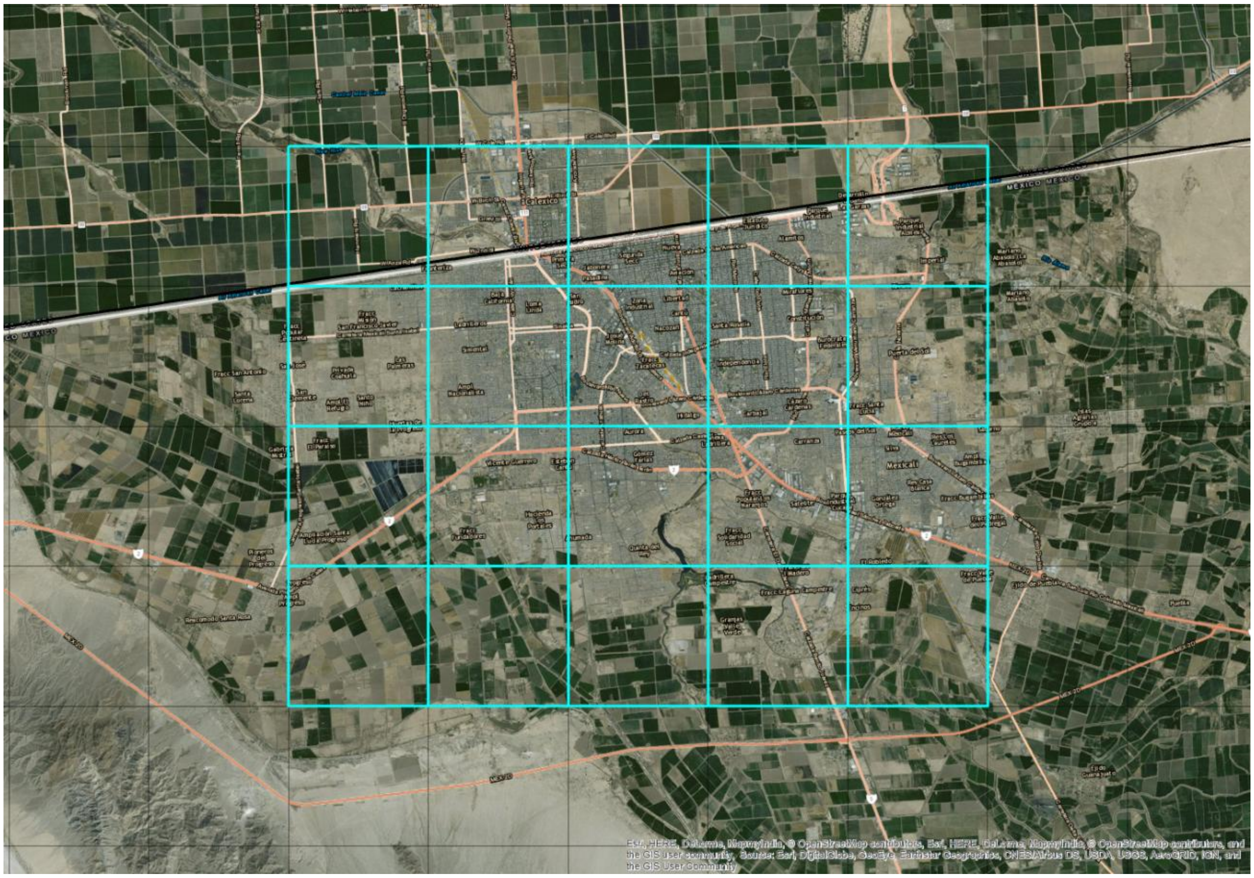

Figure 12. Definition of the geographic region used to estimate emissions for the City of Mexicali in Table 6. Note that emission totals were calculated on the gridded Mexico inventory prior to combining with the California inventory.

Monthly biogenic ROG totals for 2012 within the Salton Sea Air Basin are shown in Figure 13 (note that the same biogenic emissions were used in all 2012 and 2017 modeling). Throughout the summer, biogenic ROG emissions ranged from ~75 tpd in May to nearly 100 tpd in June and July, with the difference in emissions primarily due to differences in temperature and leaf area from month-to-month.

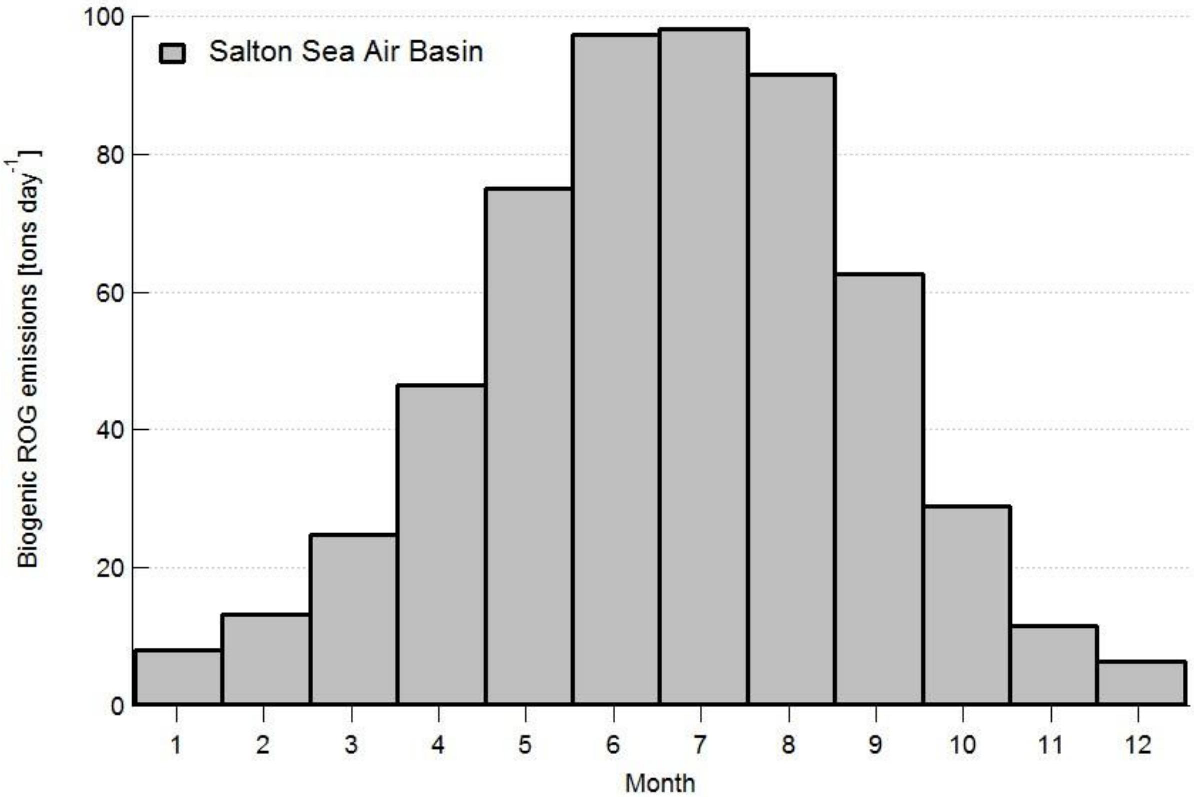

Figure 13. Monthly average biogenic ROG emissions within the Salton Sea Air Basin for 2012.

5. OZONE MODELING

5.1. CMAQ MODEL SETUP

Figure 14 shows the 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 (red outline) covering Southern California including the South Coast, San Diego and Salton Sea air basins has a finer scale 4km grid resolution and includes 156x102 lateral grid cells. The 12km and 4km 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 30 vertical layers from WRF were mapped onto 18 vertical layers for CMAQ, extending from the surface to 100 mb such that majority of the vertical layers fall within the planetary boundary layer.

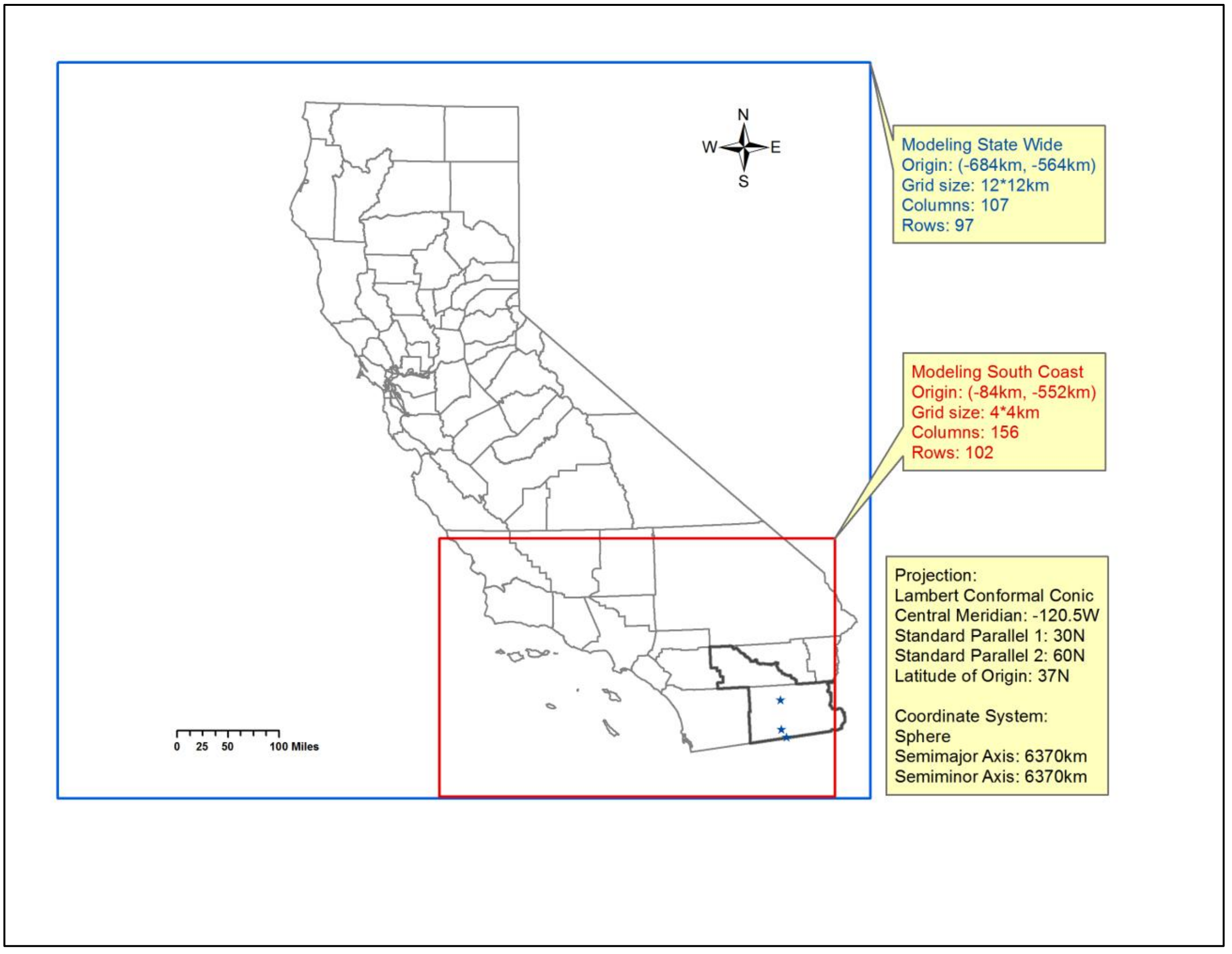

Figure 14. CMAQ modeling domains. The blue box represents the California statewide 12 km modeling domain, while the inner red box represents the 4km modeling domain covering Southern California. The three ozone monitoring sites in Imperial County are shown as blue stars.

The photochemical modeling for this attainment demonstration utilized CMAQ version 5.0.2, released by the U.S. EPA (https://www.cmascenter.org/cmaq/) in May 2014. The SAPRC07 mechanism was selected as the photochemical mechanism for the CMAQ simulations. Further details of the CMAQ configuration used in this work are summarized in Table 7 and in the Photochemical Modeling Protocol Appendix. The same configuration was used for all simulations including the base, reference, and future years. CMAQ was compiled using the Intel FORTRAN compiler version 12.

The entire ozone season (May – September 2012) was simulated through parallel individual monthly simulations. 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.

Chemical boundary conditions for the outer 12 km domain were extracted from the global chemical transport Model for Ozone and Related chemical Tracers, version 4 (MOZART-4; Emmons et al., 2010[1]). The MOZART-4 data for 2012 was obtained from the National Center for Atmospheric Research (NCAR; http://www.acom.ucar.edu/wrf-chem/mozart.shtml) for the simulations driven by meteorological fields from the NASA GMAO GEOS-5 model. The same MOZART derived BCs for the 12 km outer domain, were used for all simulations (e.g., Base, Reference, Future, and any sensitivity simulation). The inner 4 km domain simulations utilized BCs that were based on the output from the corresponding day of the 12 km domain simulation.

Table 7. CMAQ configuration and settings.

Process	**Scheme**
Horizontal advection	Yamo (Yamartino scheme for mass-conserving advection)
Vertical advection	WRF-based scheme for mass-conserving advection
Horizontal diffusion	Multi-scale
Vertical diffusion	ACM2 (Asymmetric Convective Model version 2)
Gas-phase chemical mechanism	SAPRC-07 gas-phase mechanism with version “C” toluene updates
Chemical solver	EBI (Euler Backward Iterative solver)
Aerosol module	Aero6 (the sixth-generation CMAQ aerosol mechanism with extensions for sea salt emissions and thermodynamics; includes a new formulation for secondary organic aerosol yields)
Cloud module	ACM_AE6 (ACM cloud processor that uses the ACM methodology to compute convective mixing with heterogeneous chemistry for AERO6)
Photolysis rate	phot_inline (calculate photolysis rates in-line using simulated aerosols and ozone concentrations)

[1] Emmons, L. K., Walters, S., Hess, P. G., Lamarque, J.-F., Pfister, G. G., Fillmore, D., Granier, C., Guenther, A., Kinnison, D., Laepple, T., Orlando, J., Tie, X., Tyndall, G., Wiedinmyer, C., Baughcum, S. L., and Kloster, S.: Description and evaluation of the Model for Ozone and Related chemical Tracers, version 4 (MOZART-4), Geosci. Model Dev., 3, 43-67, doi:10.5194/gmd-3-43-2010, 2010.

5.2. CMAQ MODEL EVALUATION

Observed ozone data from the Air Quality and Meteorological Information System (AQMIS) database (www.arb.ca.gov/airqualitytoday/) was used to evaluate the accuracy of the 4 km CMAQ modeling for all ozone monitors listed in Table 2 and Figure 13. Table 2 lists the design values of the three Imperial County ozone monitoring sites used in this model attainment demonstration. Both the El Centro and Calexico sites have weighted DVs that exceed the 75 ppb standard, with El Centro having the highest weighted DV at 81 ppb, and is thus designated as the design site for the region.

The U.S. EPA modeling guidance[1] recommends using the grid cell value where the monitor is located, to pair observations with simulated values in operational evaluation of model predictions. To give more attention to the model outputs that could potentially impact the outcome of the attainment test, U.S. EPA also suggests the days with simulated values > 60 ppb should receive higher priority in the evaluation.

As recommended by U.S. EPA modeling guidance, a number of statistical metrics have been used to evaluate the model performance for ozone at each design site, where only model outputs above the 60 ppb threshold were used. 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, and scatter plots for comparing the magnitude of the simulated and observed mixing ratios.

Model performance statistics for Maximum Daily Average 8-hour ozone (MDA8), Maximum Daily 1-hour ozone (MDA1), and hourly ozone (all hours of the day) for all three monitoring sites are shown in Table 8, 9 and 10, respectively. Overall, model performance statistics shown here are consistent with other studies conducted in the South Coast Air Basin (2016 drafted Air Quality Management Plan http://www.aqmd.gov/home/library/clean-air-plans/air-quality-mgt-plan/Draft2016AQMP, 2012 final Air Quality Management Plan http://www.aqmd.gov/home/library/clean-air-plans/air-quality-mgt-plan/final-2012-air-quality-management-plan), where all the normalized mean bias is within a range of ±15%, and normalized mean error is less than 30%.

Among all three sites, El Centro shows the best agreement between model predictions and observations for daily maximum 8-hour ozone, daily maximum 1-hour ozone, and

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

hourly ozone, where the normalized mean bias for the three ozone metrics is 2.8%, -1.9%, and 6.8%, respectively (Table 8). The El Centro monitor is located in the middle of the Imperial Valley with relatively flat terrain, which makes it easier to more accurately simulate the local meteorology, and is surrounded by residential communities and farmland, which represent emission sources that are reasonably well understood. Similarly, the Calexico monitor is also located in a region of relatively flat terrain, but its proximity to the U.S.-Mexico border and a large metropolitan city (Mexicali) on the Mexico side of the border make the emissions inventory in the region highly uncertain. Given the uncertainty in the Mexico emissions inventory, greater uncertainty is also expected in the simulated ozone at Calexico compared to El Centro, which translates to greater model bias. In contrast to the El Centro and Calexico monitors, the Niland monitor is located in a region of complex terrain at the northern edge of Imperial Valley, and is surrounded by the Salton Sea and Chocolate Mountains, leading to greater uncertainty in the simulated meteorology and as a result uncertainty in simulated ozone as well.

Table 8. Daily maximum 8-hour ozone performance statistics during the 2012 ozone season (May – September 2012) for each ozone monitoring site in Imperial County.

Site	**Calexico** Ethel street	**El Centro** 9th street	**Niland** English road
Number of data points	59	54	58
Mean obs (ppb)	62.1	65.5	59.2
Standard Deviation obs (ppb)	11.9	11.1	7.9
Mean Bias (ppb)	6.9	1.9	8.2
Mean Error (ppb)	10.1	8.4	9.3
RMSE (ppb)	13.1	10.2	10.8
Normalized Mean Bias (%)	11.1	2.8	13.9
Normalized Mean Error (%)	16.2	12.8	15.6
R-squared	0.13	0.16	0.22

Table 9. Daily maximum 1-hour ozone performance statistics during the 2012 ozone season (May – September 2012) for each ozone monitoring site in Imperial County.

Site	**Calexico** Ethel street	**El Centro** 9th street	**Niland** English road
Number of data points	84	79	77
Mean obs (ppb)	68.7	71.9	62.2
Standard Deviation obs (ppb)	15.8	14.2	9.6
Mean Bias (ppb)	3.4	-1.3	6.8
Mean Error (ppb)	12.4	11.4	8.4
RMSE (ppb)	15.3	13.7	10.7
Normalized Mean Bias (%)	5	-1.9	10.9
Normalized Mean Error (%)	18	15.8	13.6
R-squared	0.13	0.1	0.28

Table 10. Hourly ozone performance statistics during the 2012 ozone season (May – September 2012) for each ozone monitoring site in Imperial County.

Site	**Calexico** Ethel street	**El Centro** 9th street	**Niland** English road
Number of data points	530	467	569
Mean obs (ppb)	59.2	63.6	57.6
Standard Deviation obs (ppb)	15.8	14.5	10.2
Mean Bias (ppb)	9.9	4.3	9.7
Mean Error (ppb)	14.1	10.9	10.7
RMSE (ppb)	18.1	14.6	13.2
Normalized Mean Bias (%)	16.8	6.8	16.8
Normalized Mean Error (%)	23.8	17.1	18.6
R-squared	0.09	0.09	0.22

Simon et al. (2012)[1] conducted a review of photochemical model performance statistics published between 2006 and 2012 for North America (from 69 peer-reviewed articles). In Figure 14, the statistical evaluation of this model attainment demonstration is compared to the model performance summary presented in Simon et al. (2012) by overlaying the various summary statistics from this attainment demonstration onto the Simon et al. (2012) model performance summary. Note that the box-whisker plot (colored in gray) shown in Figure 14 is reproduced using data from Figure 4 of Simon et al. (2012). The blue, red and green colored horizontal line markers in each of the panels of Figure 15 denote the model performance statistics calculated using simulated data at Niland, El Centro and Calexico, respectively from the current modeling work. Figure 14 clearly shows that the modeling performance statistical metrics for hourly, daily maximum 8-hour and daily maximum 1-hour ozone from this work are consistent with, and in many cases superior to, values reported by other studies in the literature. In particular, the Simon et al. (2012) study found that mean bias for daily maximum 8-hour ozone ranged from approximately -7 ppb to 13 ppb, while mean error ranged from around 4 ppb to 22 ppb, and RMSE ranged from approximately 8 ppb to 23 ppb; all of which are similar in magnitude to the statistics presented in Table 10. Time series plots of the hourly, 1-hr daily maximum and 8-hour daily maximum ozone data can be found in the supplementary material.

5.2.1 DIAGNOSITC EVALUATION

In addition to the statistical evaluation presented above, since modeling is utilized in a relative sense, it is also useful to consider whether the model is able to reproduce observable relationships between changes in emissions and ozone. One real world metric that is often used to conduct such analysis is the “weekend effect.” The so called weekend effect is a well-known phenomenon in some major urbanized areas where emissions of NO_x are substantially lower on weekends than on weekdays, but measured levels of ozone are higher on weekends than on weekdays. This is due to the complex and non-linear relationship between NO_x and ROG precursors and ozone (e.g., Sillman, 1999)[2].

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[1] Simon, H., Baker, K. R., and Phillips, S.: Compilation and interpretation of photochemical model performance statistics published between 2006 and 2012, *Atmospheric Environment*, 61, 124-139, 2012.
2 Sillman, S., 1999. The relation between ozone, NOx, and hydrocarbons in urban and polluted rural environments. Atmospheric Environment, 33, 1821-1845.

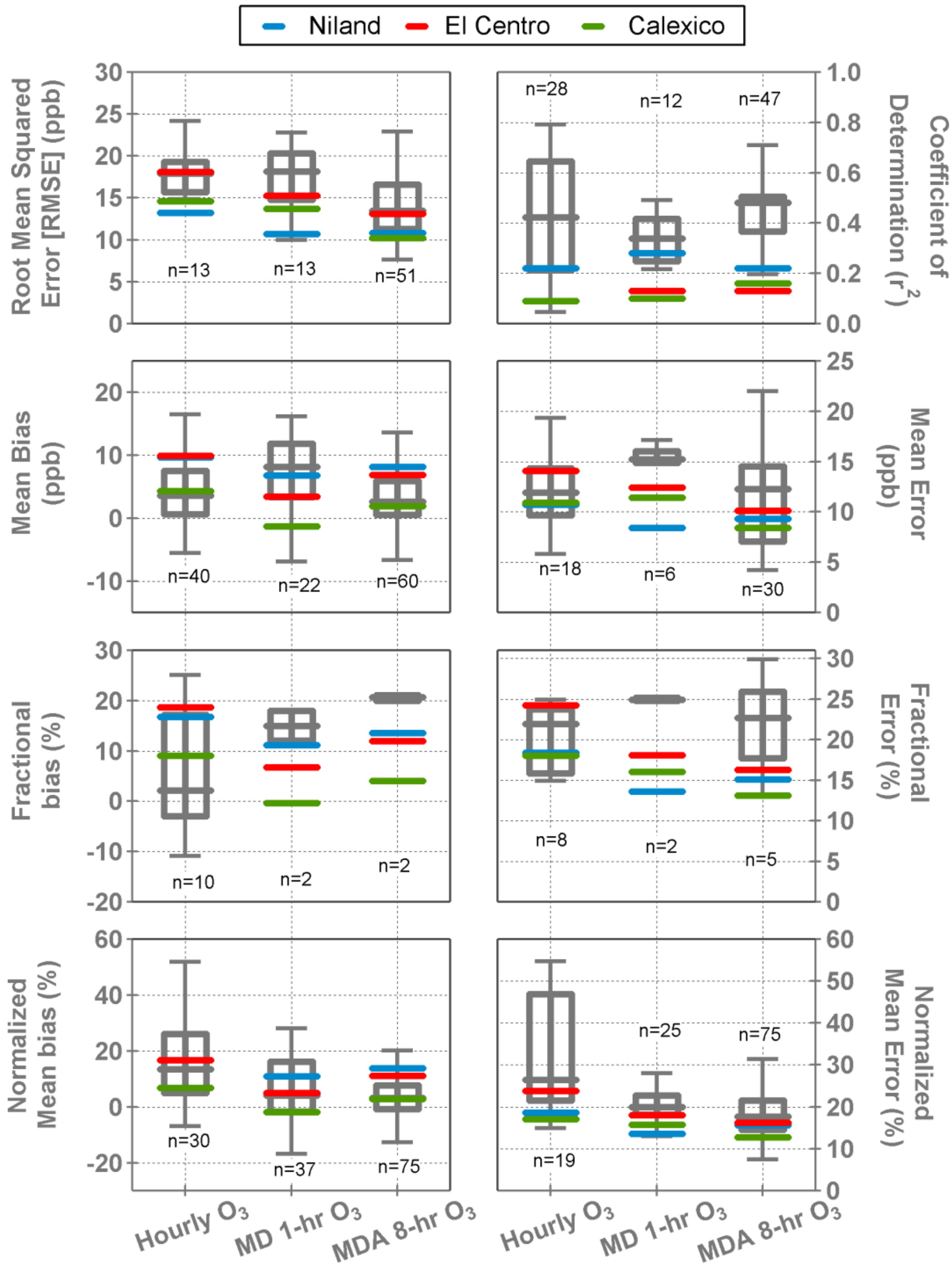

Figure 15. Comparison of various statistical metrics from the model attainment demonstration modeling to the range of statistics from the 69 peer-reviewed studies summarized in Simon et al. (2012).

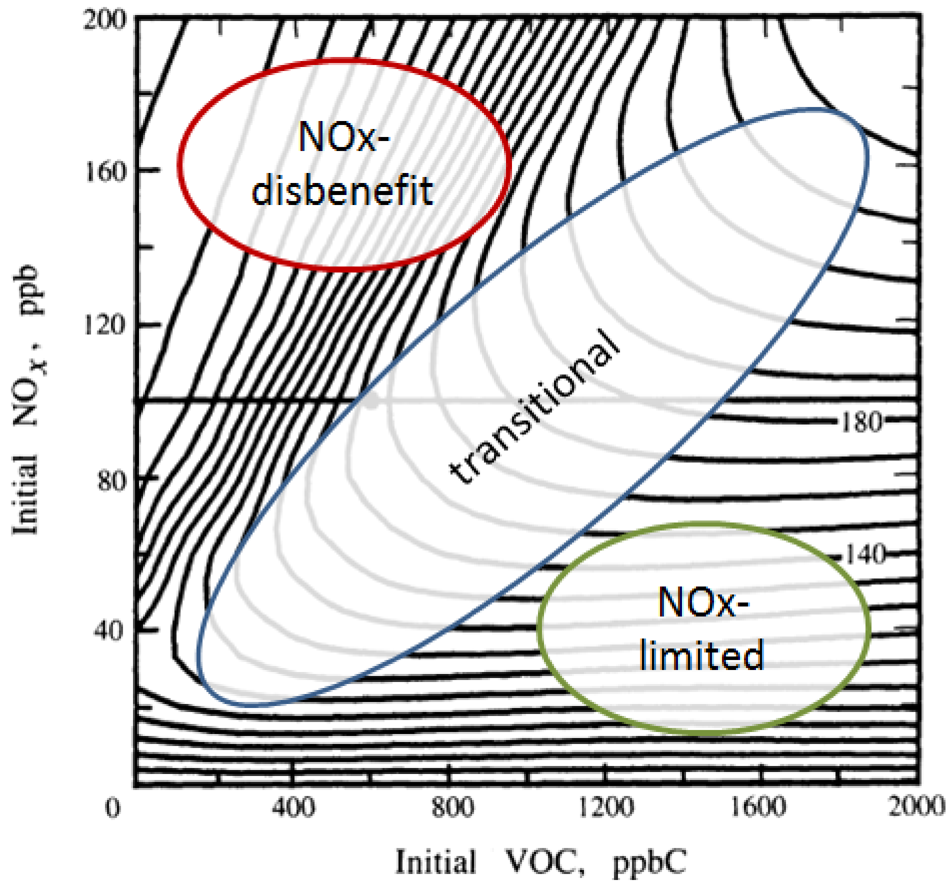

Figure 16. Illustrates a typical ozone isopleth plot, where each line represents ozone mixing ratio, in 10 ppb increments, as a function of initial NO_x and VOC (or ROG) mixing ratio (adapted from Seinfeld and Pandis, 1998[1], Figure 5.15). General chemical regimes for ozone formation are shown as NO_x-disbenefit (red circle), transitional (blue circle), and NO_x-limited (green circle).

In general terms, under ambient conditions of high-NO_x and low-ROG (NO_x-disbenefit region in Figure 16), 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 16), 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 16 along with a transitional regime that can exhibit characteristics of both the NO_x-disbenefit and NOx-limited regimes. Note that Figure 16 is shown for illustrative purposes only, and does not represent the actual ozone sensitivity within Imperial County for a given combination of NO_x and ROG (VOC) emissions.

1 Seinfeld J. H. and Pandis S. N. (1998) Atmospheric Chemistry and Physics: From Air Pollution to Climate Change, 1st edition, J. Wiley, New York.

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)[1]. 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 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 Imperial County and how well it is represented in the modeling. The trend in day-of-week dependence in Imperial County was analyzed using the ozone observations at all three sites between 2001 and 2013 and the average site-specific weekday (Wednesday and Thursday) and weekend (Sunday) observed summertime (May through September) averaged Daily Maximum 8-hour Ozone value by year were compared (Figure 17). Different definitions of weekday and weekend days were also investigated and did not show appreciable differences from the Wednesday/Thursday and Sunday definitions.

As shown in Figure 17, Imperial County has generally been in a NO_x limited regime as seen from the greater weekday ozone when compared to weekend ozone, but different sites show somewhat different patterns over time. The Niland monitor is farther away from major anthropogenic NO_x sources, such that low NO_x and high ROG conditions are more prevalent, which is consistent with the region being in a NO_x-limited regime. In contrast, the El Centro and Calexico monitors are located in urban areas and closer to Mexicali emissions sources, and are therefore in closer proximity to large anthropogenic NO_x sources. Consequently, there may be greater opportunity for these monitors to move into the transitional or NO_x-disbenefit chemistry regimes under certain meteorological conditions and transport patterns (seen as more points falling on or below the 1:1 line in Figure 17).

The simulated baseline 2012 weekday/weekend values (black triangle markers in Figure 17) from the attainment demonstration modeling show greater weekday ozone compared to weekend ozone in all three sites in Imperial County. These predicted values are consistent with observed findings in 2012 that show a prevalence of NO_x-limited conditions at the Niland and El Centro monitors. Observations at the Calexico monitor are consistent with a more transitional ozone chemistry regime in 2012 as opposed to the modeled NO_x-limited regime. Since Niland and El Centro monitors did not exhibit these differences, this may be an indicator of Mexicali NO_x emissions being under-predicted or VOC emission being over-predicted.

1 Heuss, J.M., Kahlbaum, D.F., and Wolff, G.T., 2003. Weekday/weekend ozone differences: What can we learn from them? Journal of the Air & Waste Management Association 53(7), 772-788

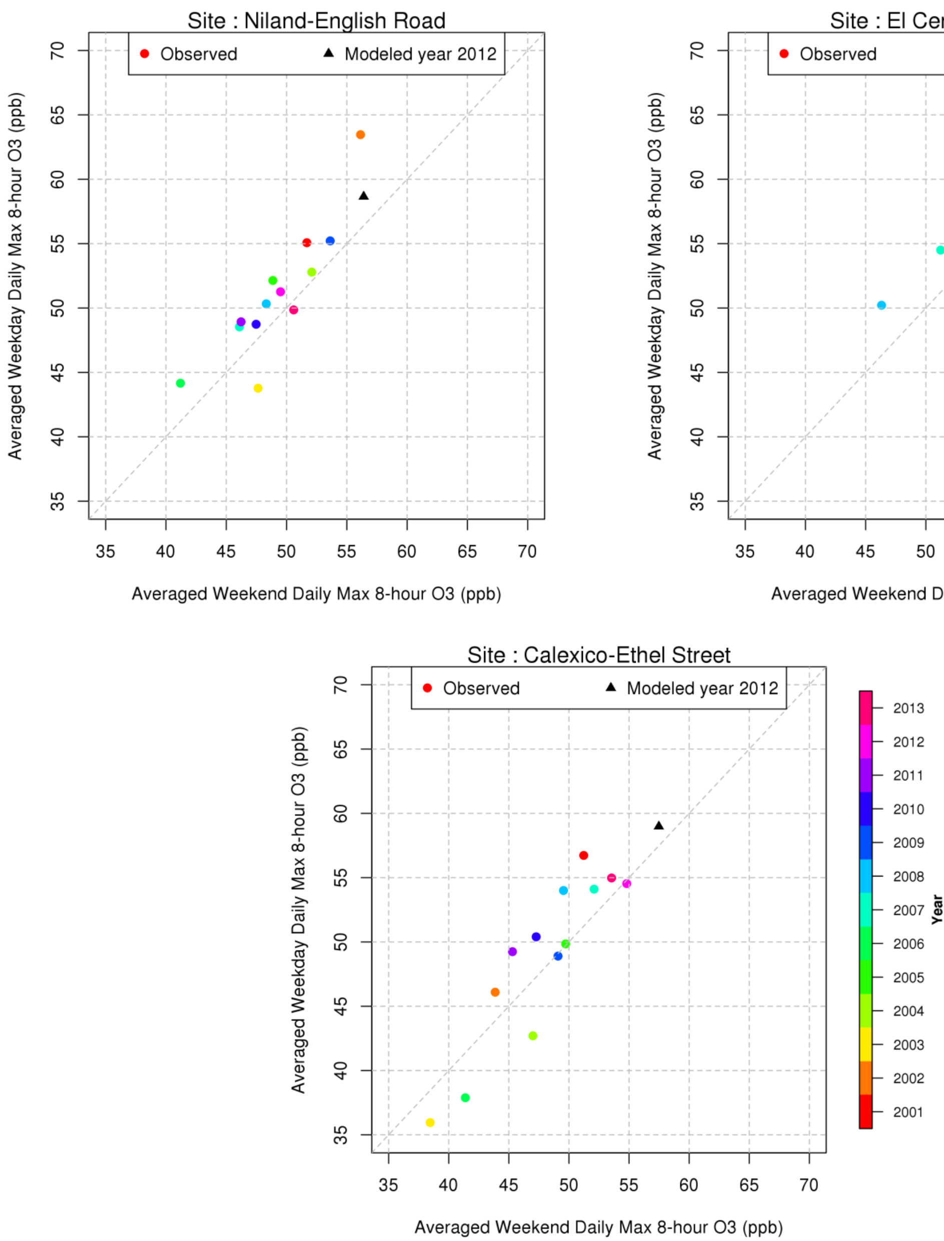

Figure 17. Site-specific average weekday and weekend averaged Daily Maximum 8-hour Ozone for each year from 2001 to 2013 in Imperial County. The colored circle markers denote observed values while the black triangle markers denote the simulated baseline 2012 values. Points falling below the 1:1 dashed line represent a NO_x-disbenefit regime, those on the 1:1 dashed line represent a transitional regime, and those above the 1:1 dashed line represent a NO_x-limited regime.

5.3. RELATIVE RESPONSE FACTORS, FUTURE YEAR DESIGN VALUES, AND THE IMPACT FROM MEXICO ANTHROPOGENIC EMISSIONS

The RRFs, future year 2017 design values, and future year 2017 design values with zeroed out Mexico emission for all three ozone monitoring sites in Imperial County were calculated using the procedures outlined in Section 2.5 and 2.6 of this document. The results are summarized in Table 11.

Table 11. Summary of key parameters related to the calculation of future year 2017 8-hour ozone design values (DV). Note that final 2017 DVs are truncated and decimal point values are shown for reference only.

Site	Base year 2012	Future year 2017		Future year 2017 w/o Mexico EI	
	Average DV (ppb)	RRF	Average DV (ppb)	RRF	Average DV (ppb)
Niland	70.3	0.9578	67.3	0.9238	64.9
El Centro	81.0	0.9749	79.0	0.8405	68.1
Calexico	76.3	0.9834	75.0	0.8231	62.8

From base year (2012) to future year (2017), Imperial County anthropogenic NO_X emissions were predicted to decrease by ~17% (21.8 tpd to 18.0 tpd), with VOC emissions dropping by ~12% (19.2 tpd to 16.9 tpd) (Table 6). However, over the same time period, anthropogenic emissions in Mexicali were predicted to increase, with NO_x emissions within the Mexicali Municipality increasing from 84.8 tpd to 97.8 tpd, while emissions within the city of Mexicali increasing from 7.5 tpd to 8.4 tpd. Similarly, VOC emissions within the Mexicali Municipality increase from 59.0 tpd in 2012 to 65.8 tpd in 2017, while VOC emissions within the city of Mexicali increase from 11.9 tpd to 13.5 tpd, respectively.

The reduction in DVs from 2012 to 2017 at all monitors (Table 11) suggests that the decrease in emissions in Imperial County was not fully offset by an increase in Mexicali emissions, but the overall change in the regions' emissions was also not sufficient to bring Imperial County into attainment by 2017, with the El Centro monitor still exceeding the standard with a DV of 79 ppb. The relative change in DV was also not consistent across all monitors, with the RRF decreasing as the distance to Mexicali increases.

However, when emissions from Mexico were excluded from the 2017 modeling, DVs dropped by up to 13 ppb, and all Imperial County monitors showed attainment of the ozone standard with the El Centro monitor showing the highest DV at 68 ppb. In this case, the relative change in DV was reversed, with the RRF now increasing as the distance to Mexicali increases, which is consistent with the Mexicali source region exhibiting a strong influence on nearby monitors in Imperial County. These results are consistent with global chemical transport modeling conducted by Wang et al. (2009)[1] which showed that the average enhancement to Imperial County daily maximum 8-hour ozone from Mexican emissions, exceeded 10 ppb over the June to August, 2001 time period. Note that the contributions from Mexico emissions to ozone DV calculated above represent a lower bound to the contribution, and the actual contribution is likely to be somewhat higher. Since only Mexico emissions within the modeling domain (Figure 14) were excluded from the modeling, there was still a contribution from Mexico sources outside of the modeling domain (reflected in the MOZART boundary conditions for the outer 12-km domain) that was included in the analysis.

5.4. 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, 2014[2]). 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 the Model Attainment Test Software (MATS) (Abt, 2014[3]). 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 (https://www.r-project.org/) 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 2012 and future year 2017 4 km CMAQ model outputs. The steps followed in the unmonitored area analysis are as follows:

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[1] Wang, H., Jacob, D.J., Le Sager, P., Streets, D. G., Park, R. J., Gilliland, A. B., and van Donkelaar, A.: Surface ozone background in the United States: Canadian and Mexican pollution influences, *Atmospheric Environment*, 43, 1310-1319, 2009.

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

[3] Abt, 2014. Modeled Attainment Test Software: User's Manual. MATS available at: http://www.epa.gov/scram001/modelingapps_mats.htm

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-hr ozone DV fields was generated based on the observed 5-year weighted base year 8-hr ozone DVs from the available monitors. The interpolation is done using normalized inverse distance squared weightings for all monitors within a grid cell's Voronoi Region (calculated with the R tripack library; https://cran.r-project.org/web/packages/tripack/README), 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 8.3 of the Modeling Protocol Appendix, 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-hr ozone DVs were calculated by multiplying the gradient-adjusted interpolated 8-hr ozone DVs from Step 2 with the gridded RRFs from Step 3

Step 5: The future-year gridded 8-hr 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-hr ozone NAAQS.

Figure 18 shows the spatial distribution of gridded DVs in 2017 for Imperial County, in the absence of Mexico anthropogenic emissions, based on the unmonitored area analysis (described above). The maroon colored stars denote the ozone monitoring sites used in the analysis. The lower right corner of Imperial County, shown in light blue color in Figure 18, is outside the modeling domain and is not part of the non-attainment region, so that region was not included in the analysis. The unmonitored area analysis predicts that all unmonitored regions within Imperial County would attain the 75 ppb 8-hour O_3 standard by 2017 in the absence of Mexico emissions.

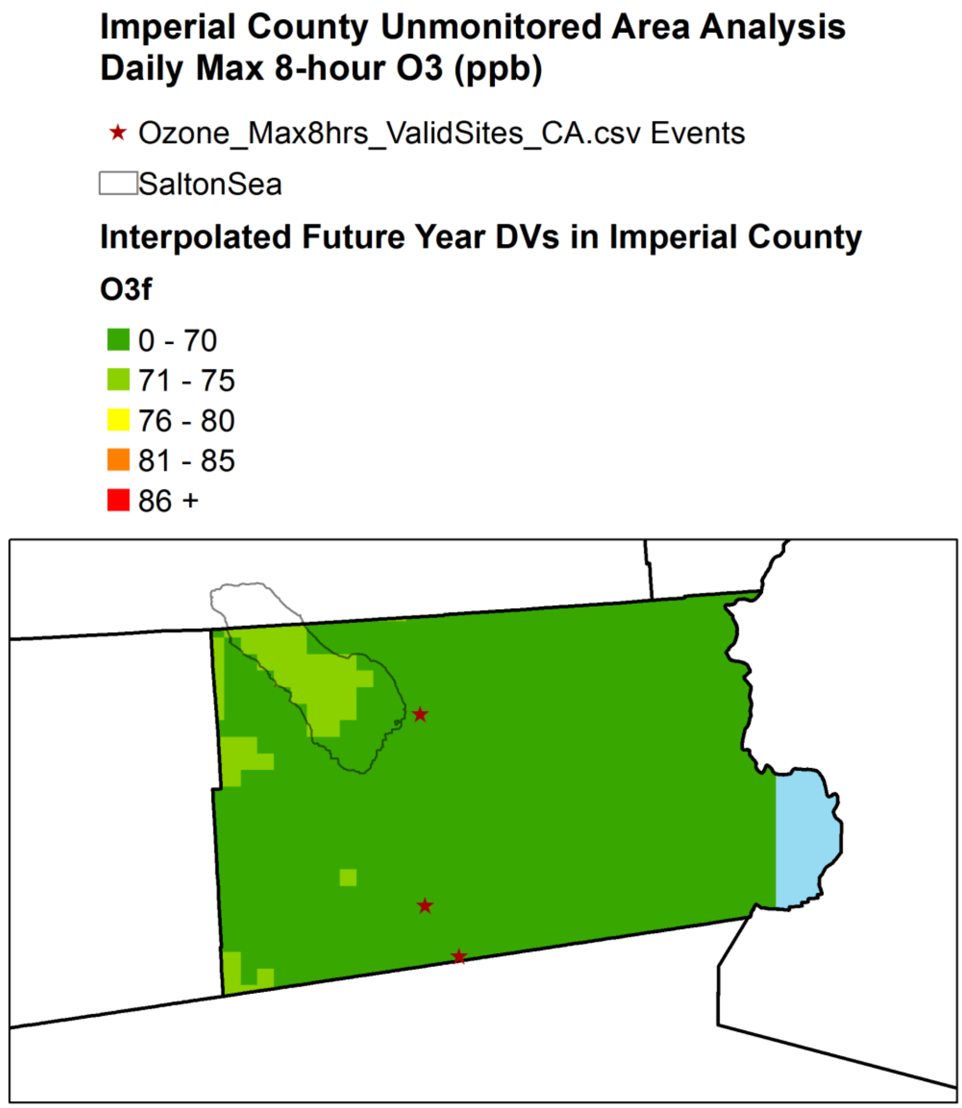

Figure 18. Spatial distribution of the future 2017 DVs based on the unmonitored area analysis in Imperial County. Color scale is in ppb.

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MONTHLY METEROLOGICAL TIME SERIES PLOTS

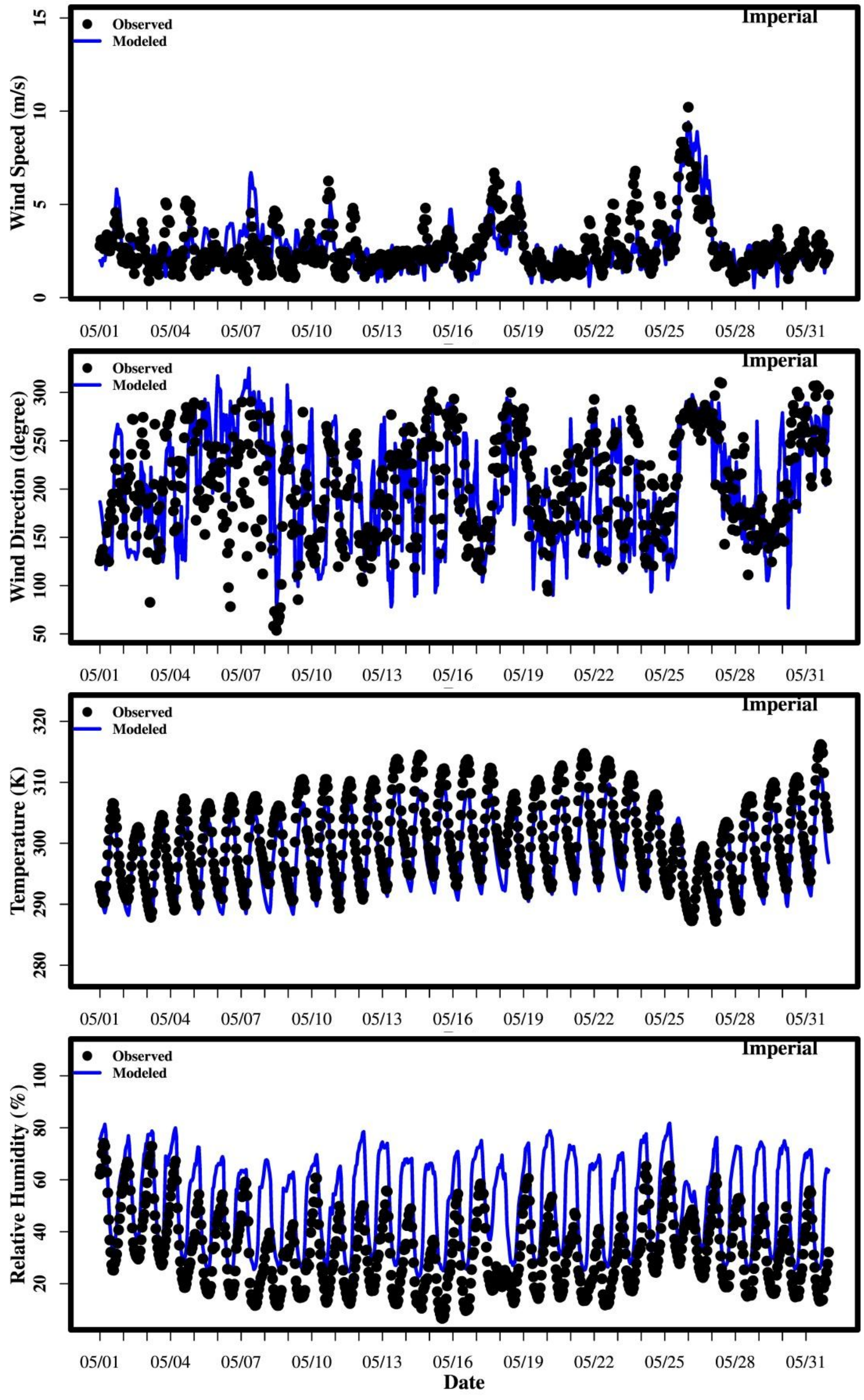

Figure S 1 Time series of wind speed, direction, temperature and relative humidity for Imperial County in May 2012.

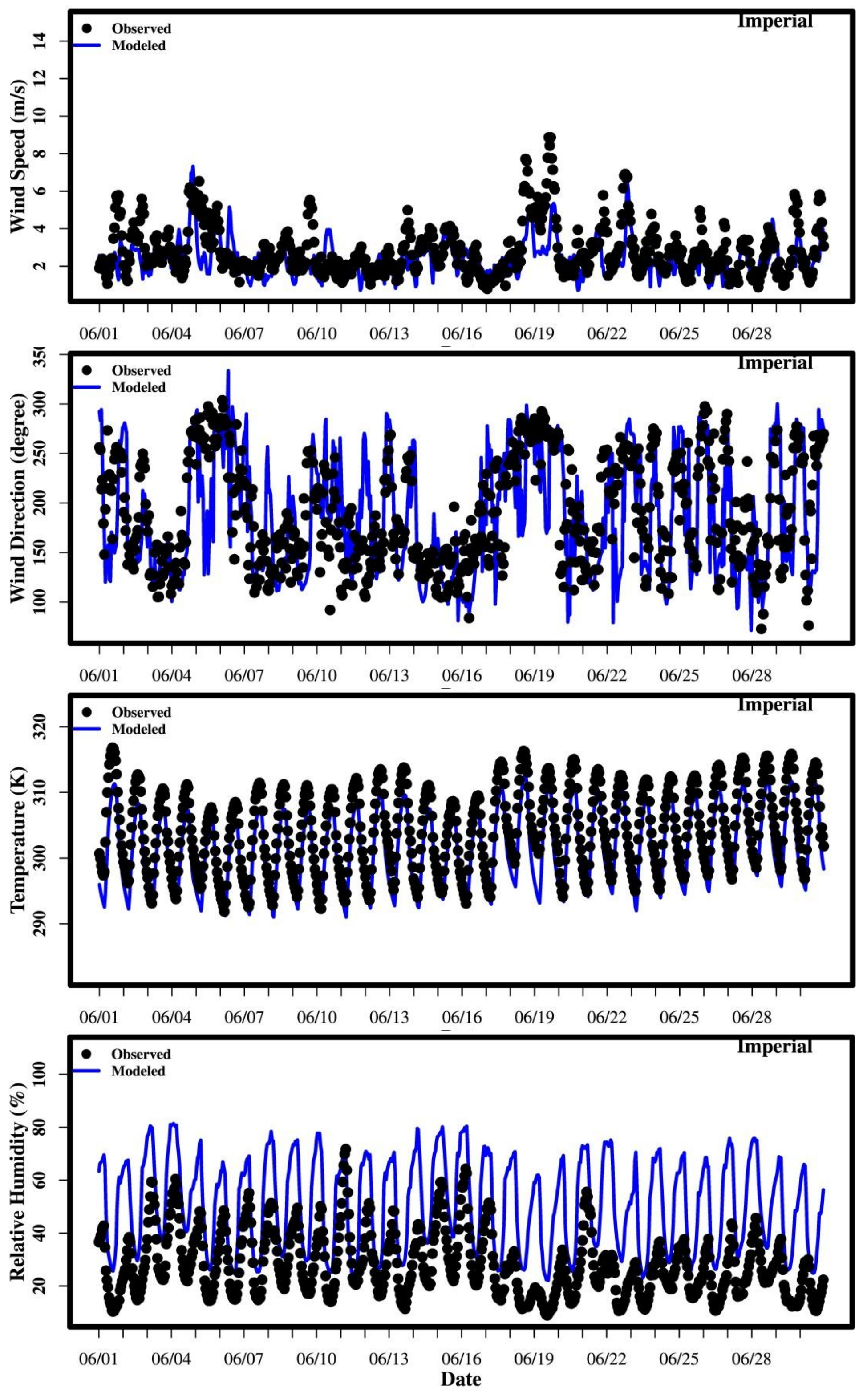

Figure S 2 Time series of wind speed, direction, temperature and relative humidity for Imperial County in June 2012

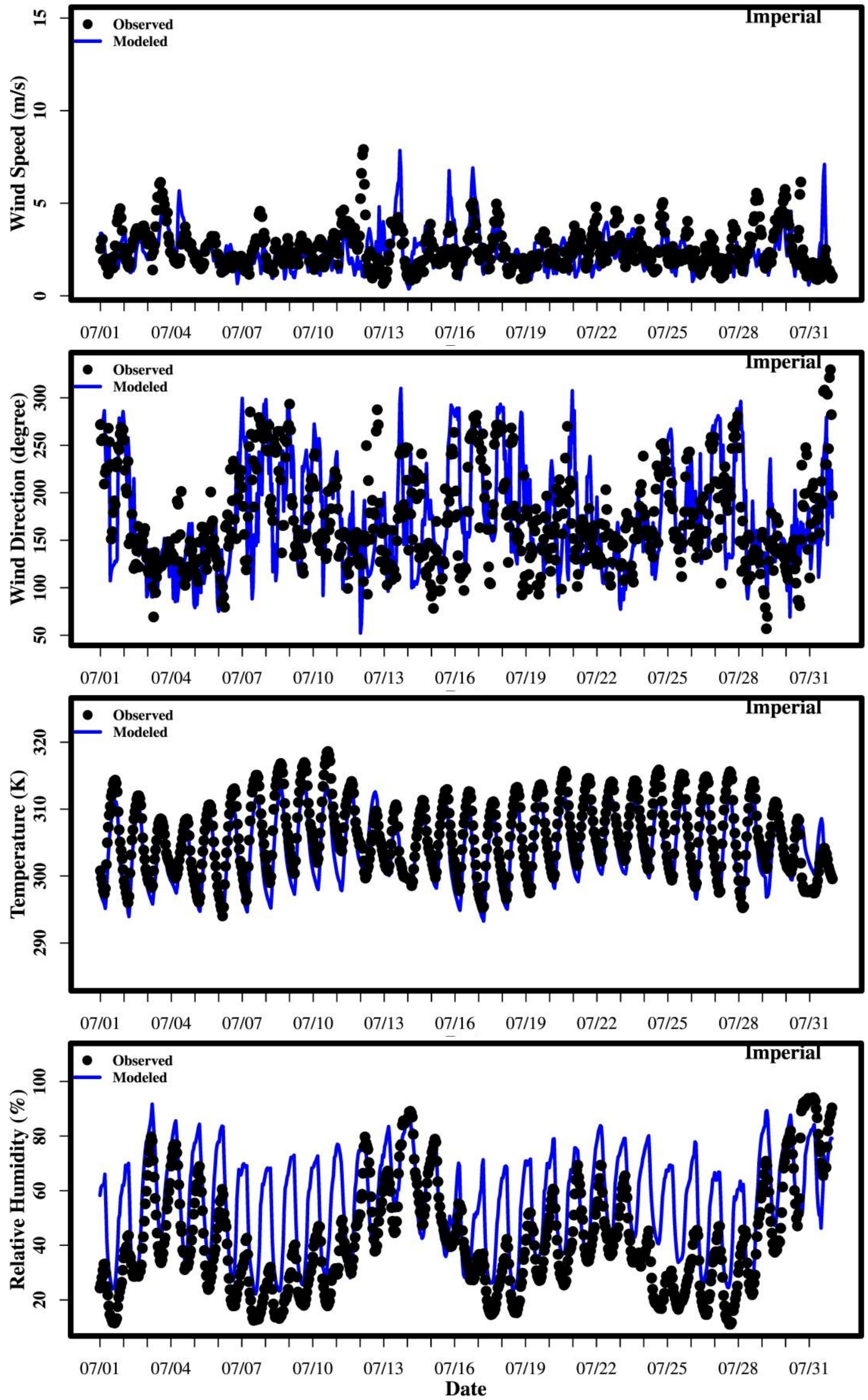

Figure S 3 Time series of wind speed, direction, temperature and relative humidity for Imperial County in July 2012.

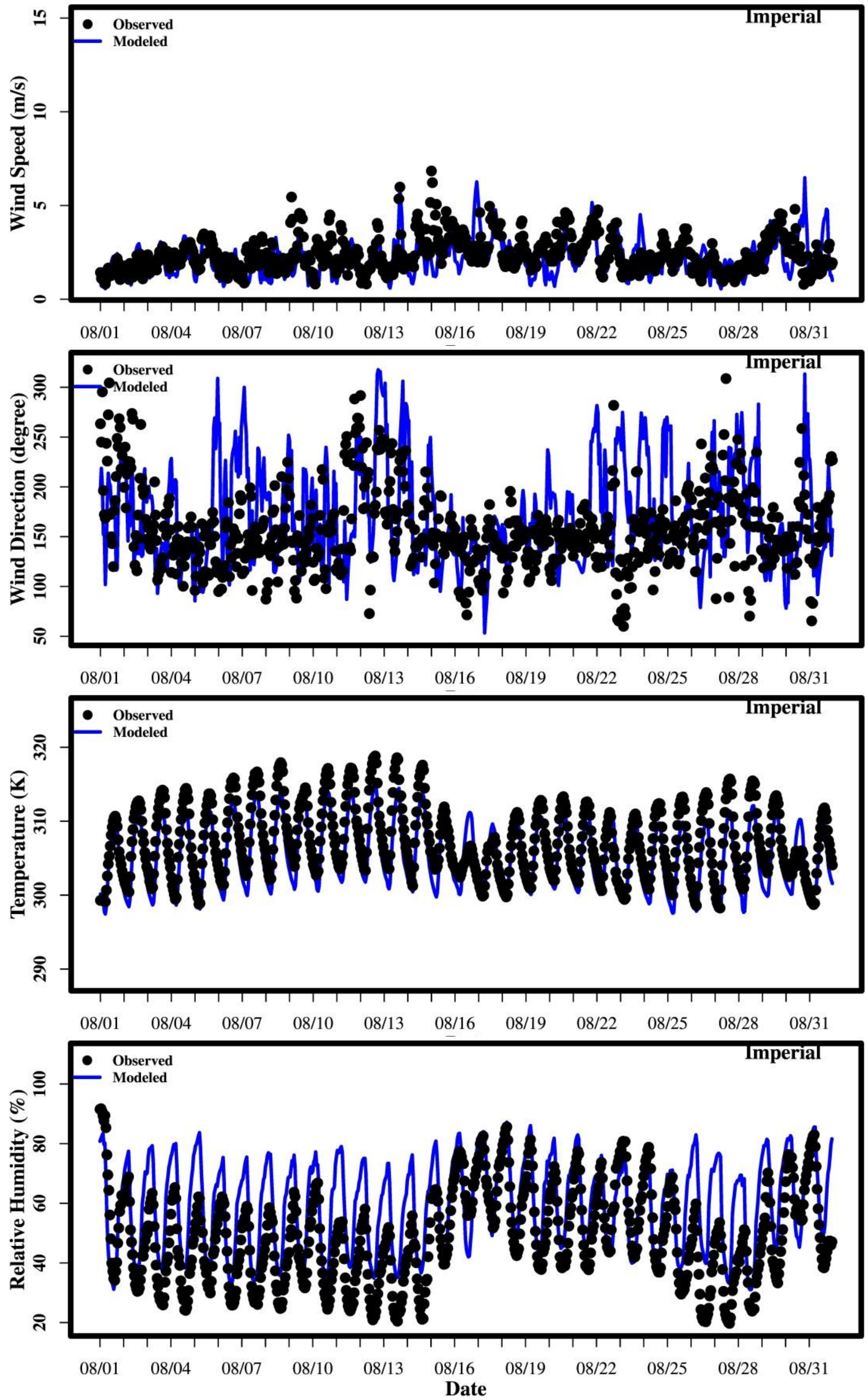

Figure S 4 Time series of wind speed, direction, temperature and relative humidity for Imperial County in August 2012.

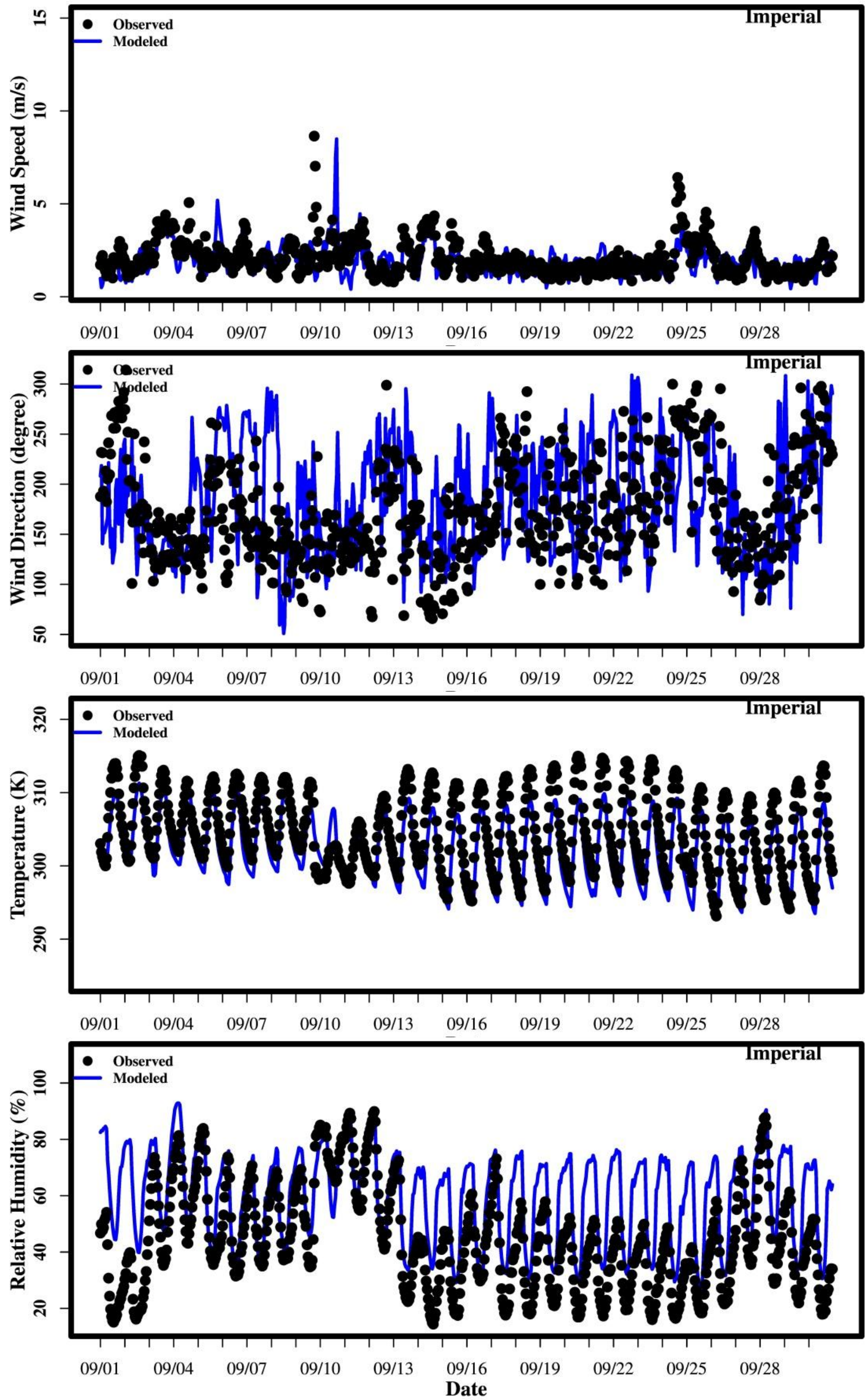

Figure S 5 Time series of wind speed, direction, temperature and relative humidity for Imperial County in September 2012.

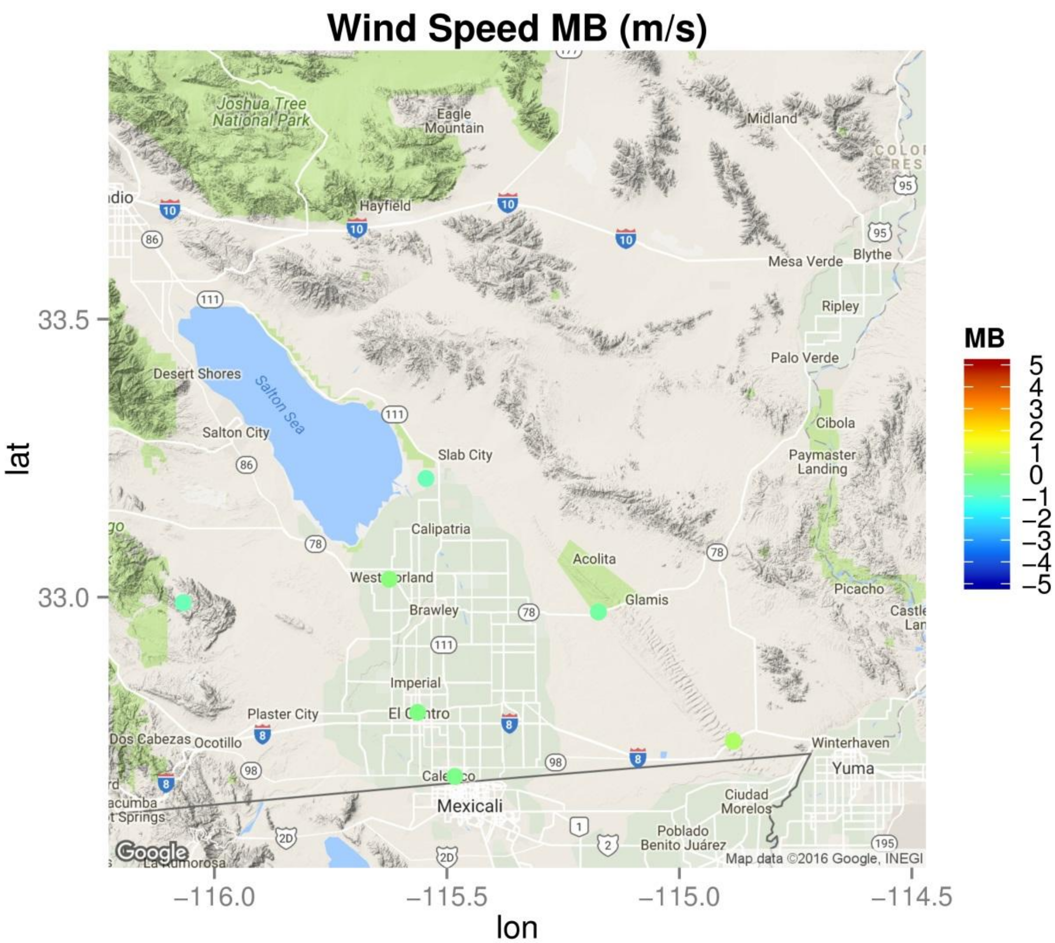

Figure S 6 Wind speed mean bias for May-September, 2012

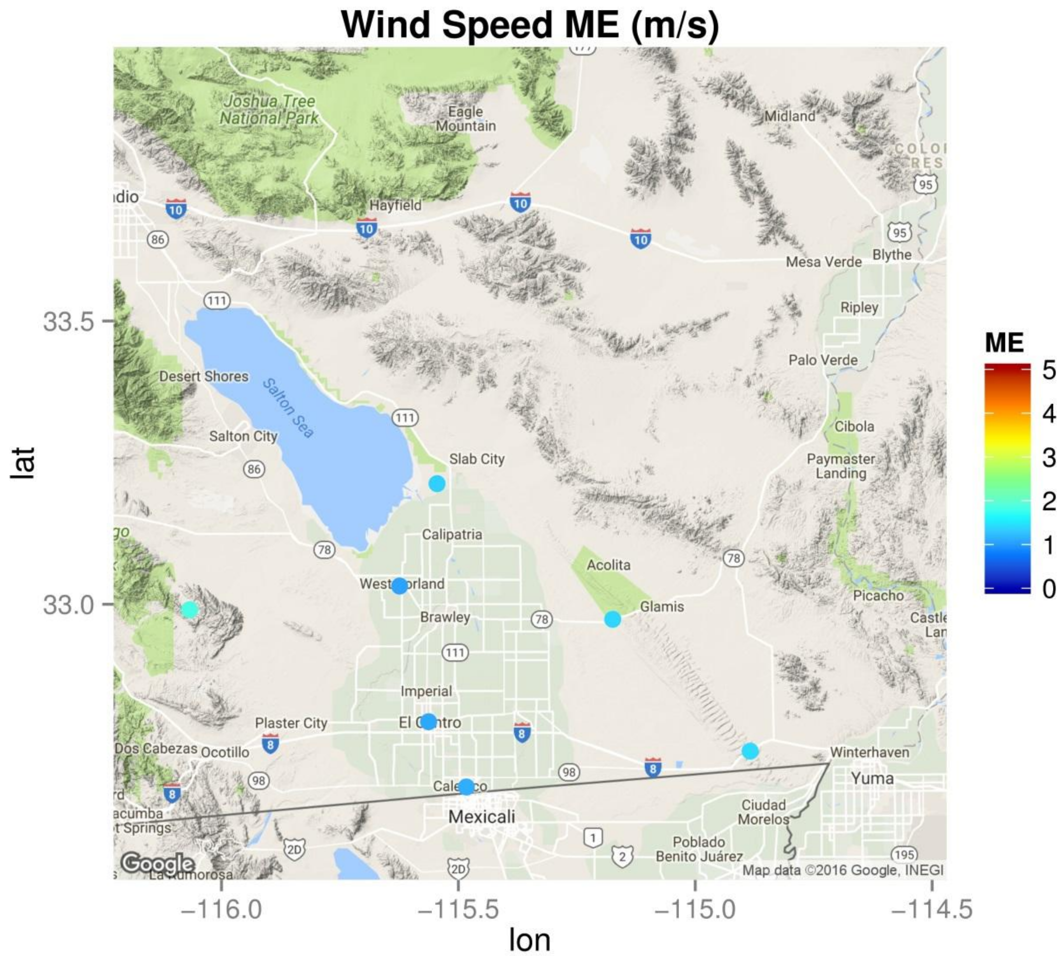

Figure S 7 Wind speed mean error for May-September, 2012

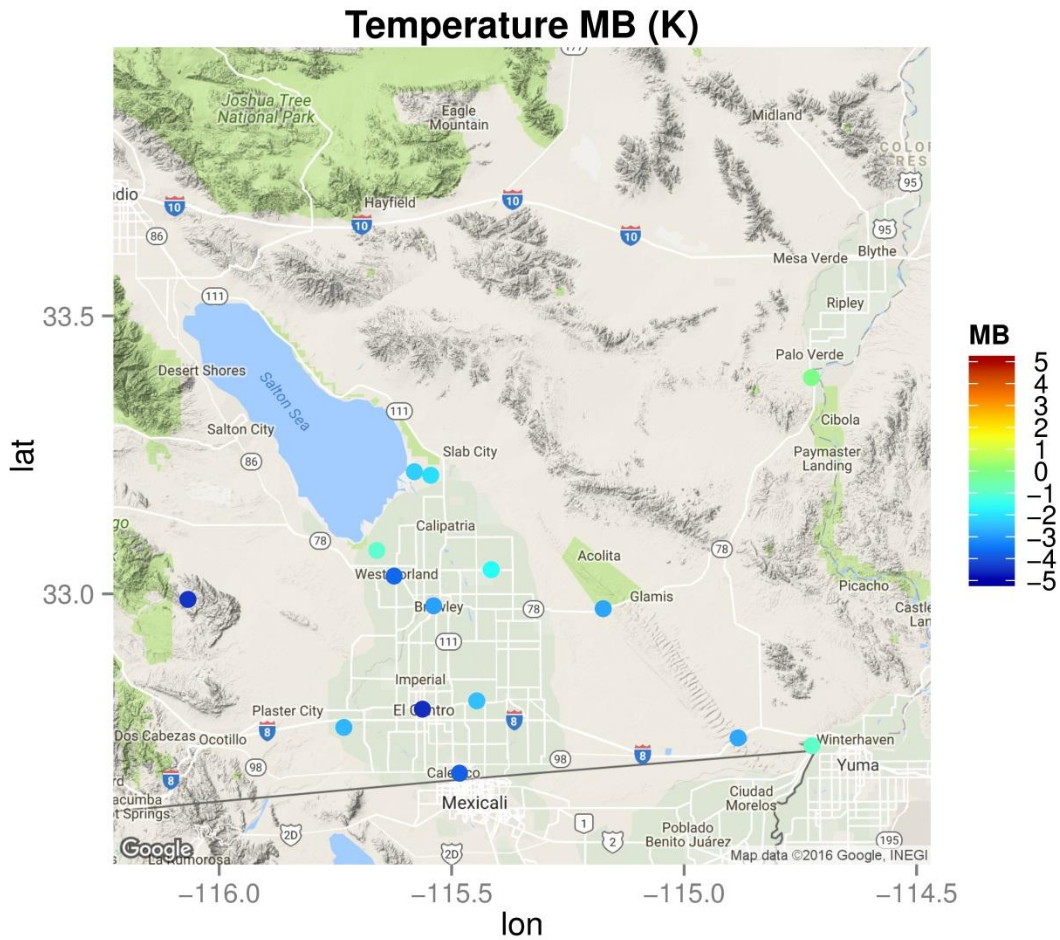

Figure S 8 Temperature mean bias for May-September, 2012

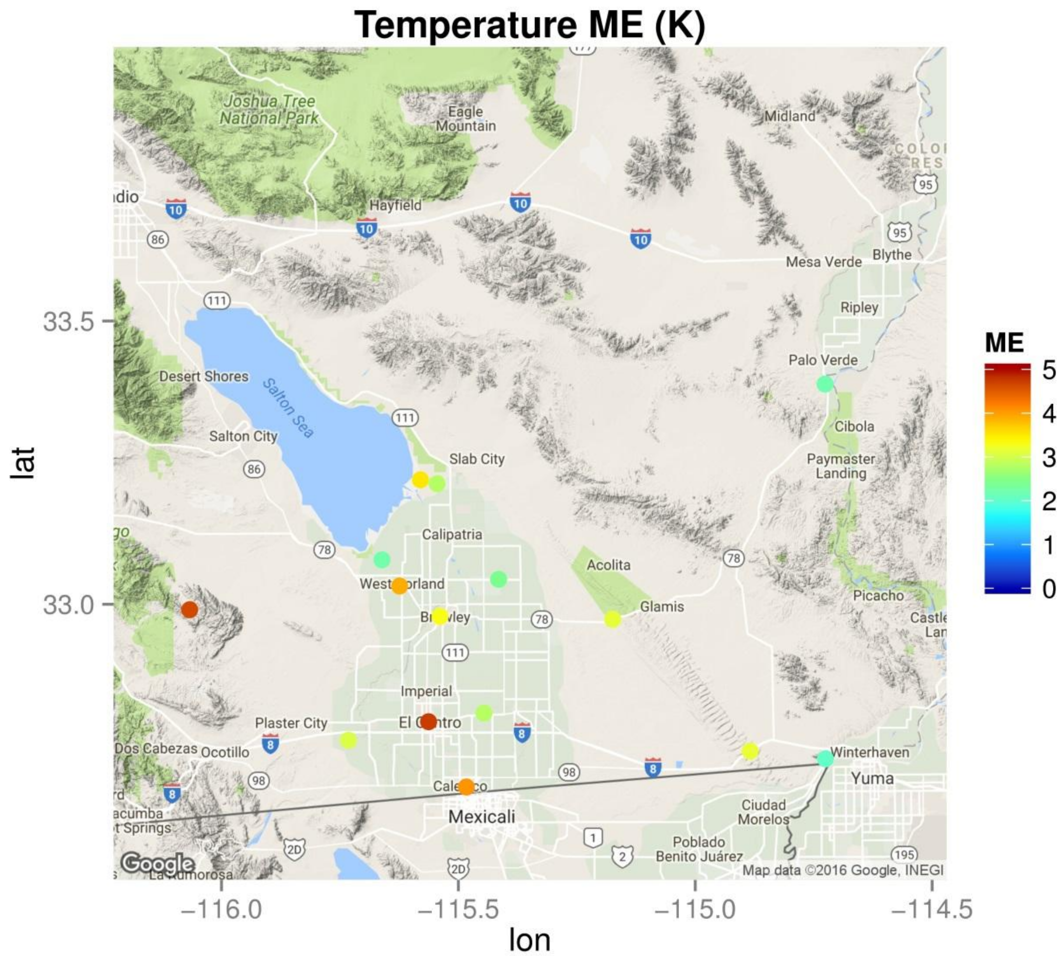

Figure S 9 Temperature mean error for May-September, 2012

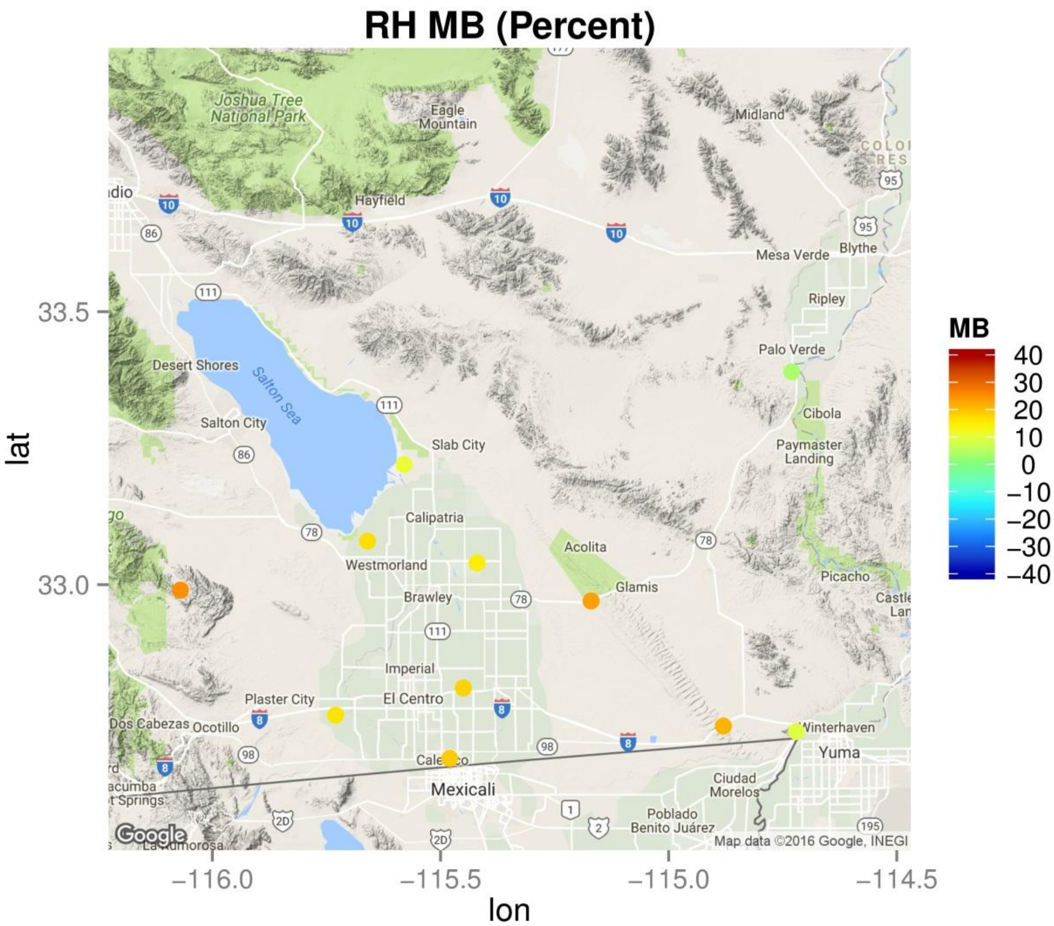

Figure S 10 Relative humidity mean bias for May-September, 2012

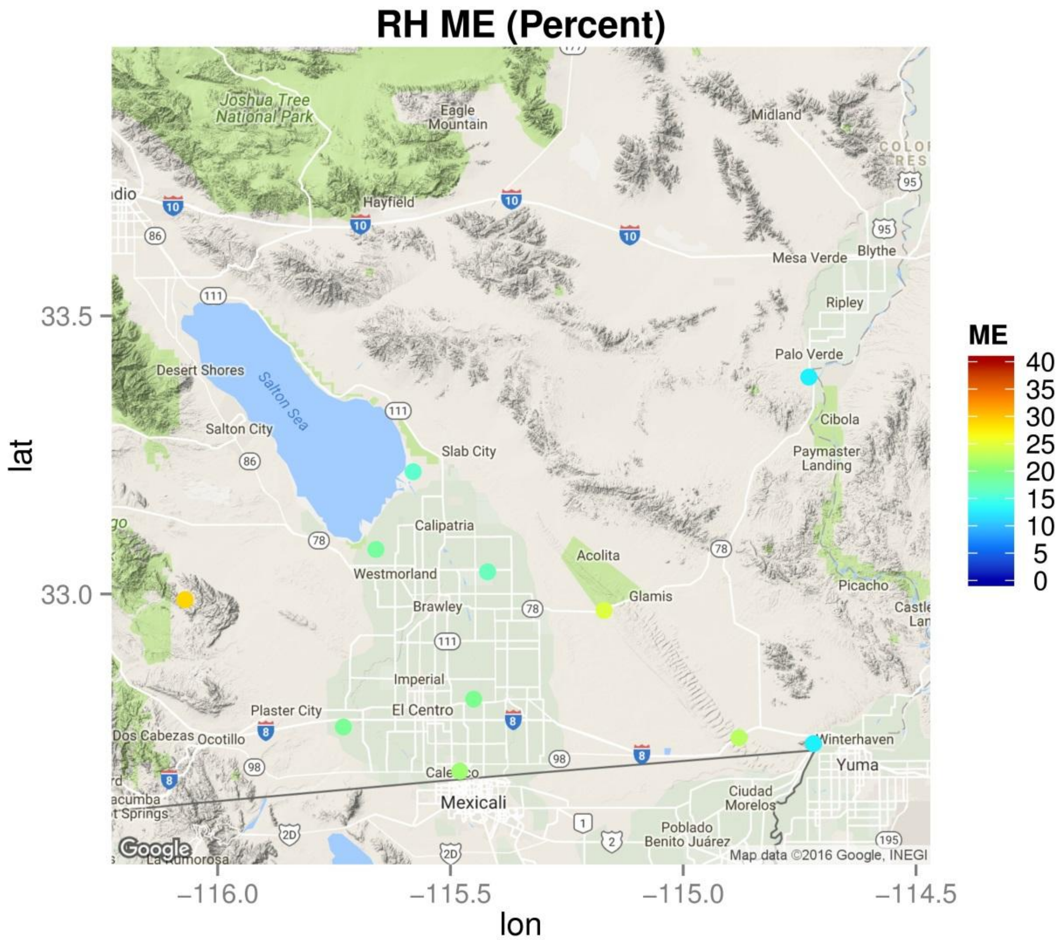

Figure S 11 Relative humidity mean error for May-September, 2012

HOURLY TIMESERIES OZONE PLOTS

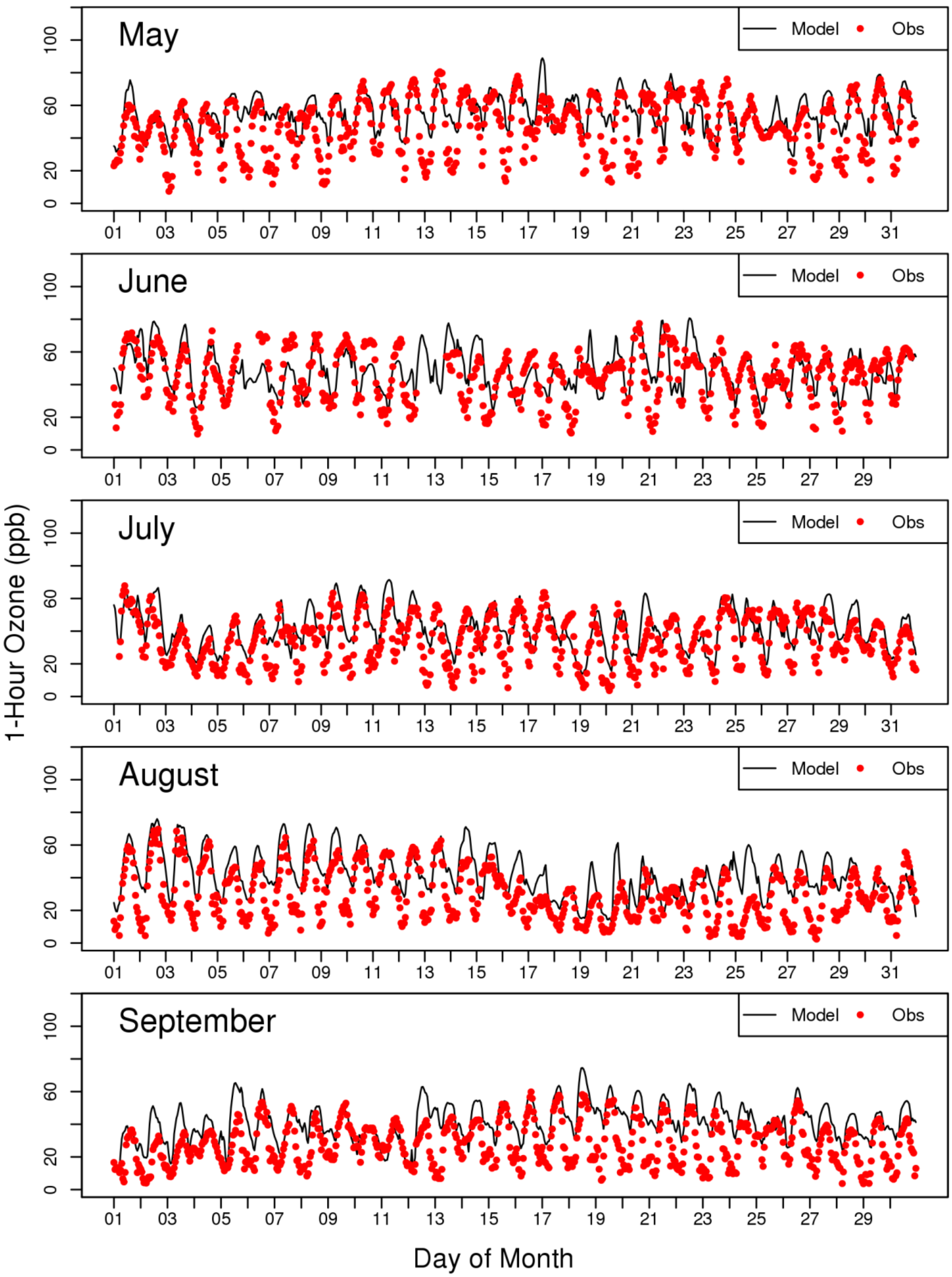

Figure S 12 Time-series of hourly ozone at Niland – English Road

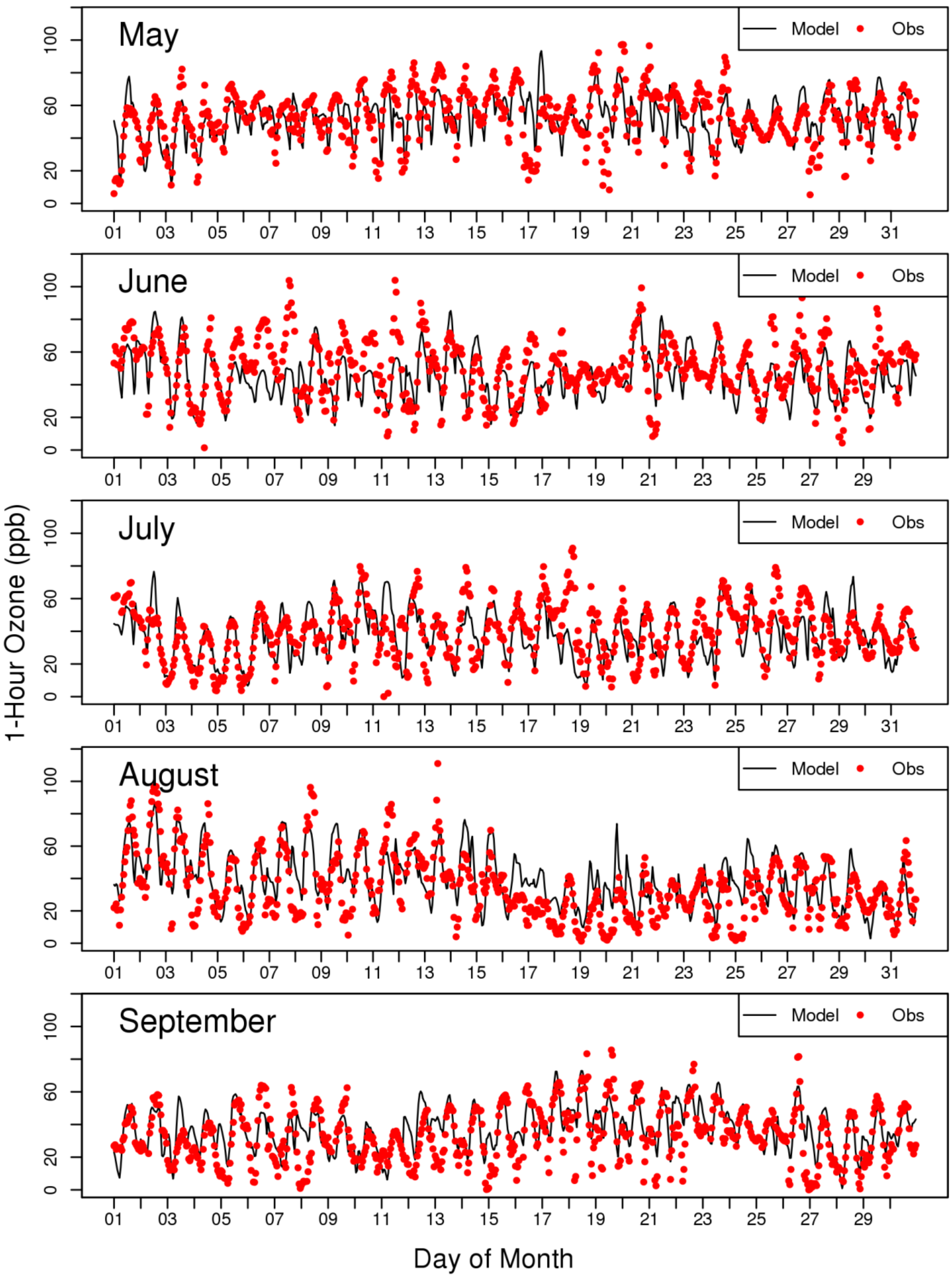

Figure S 13 Time-series of hourly ozone at El Centro – 9th Street

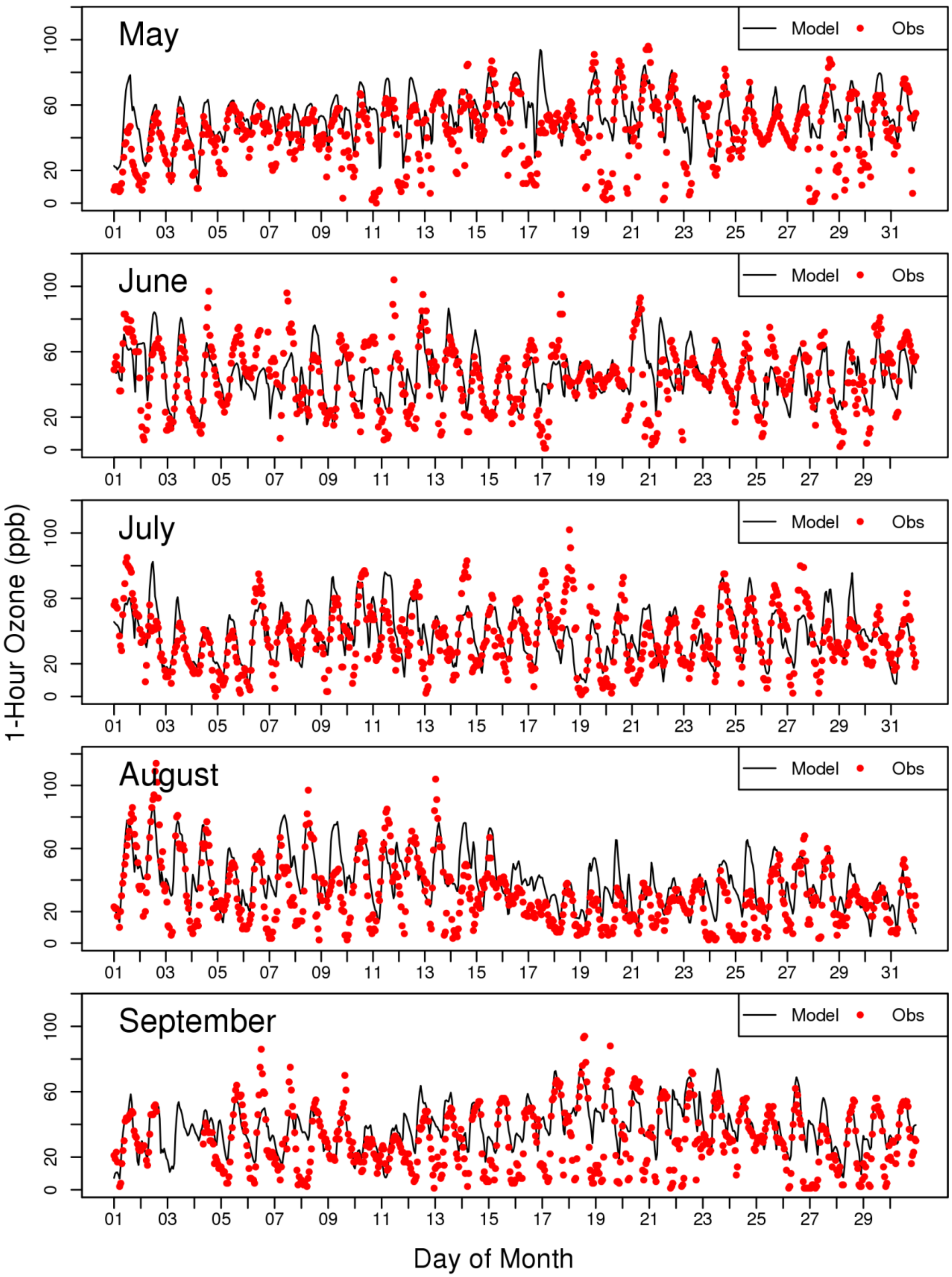

Figure S 14 Time-series of hourly ozone at Calexico – Ethel Street

DAILY MAXIMUM 1 – HOUR OZONE TIME SERIES PLOTS

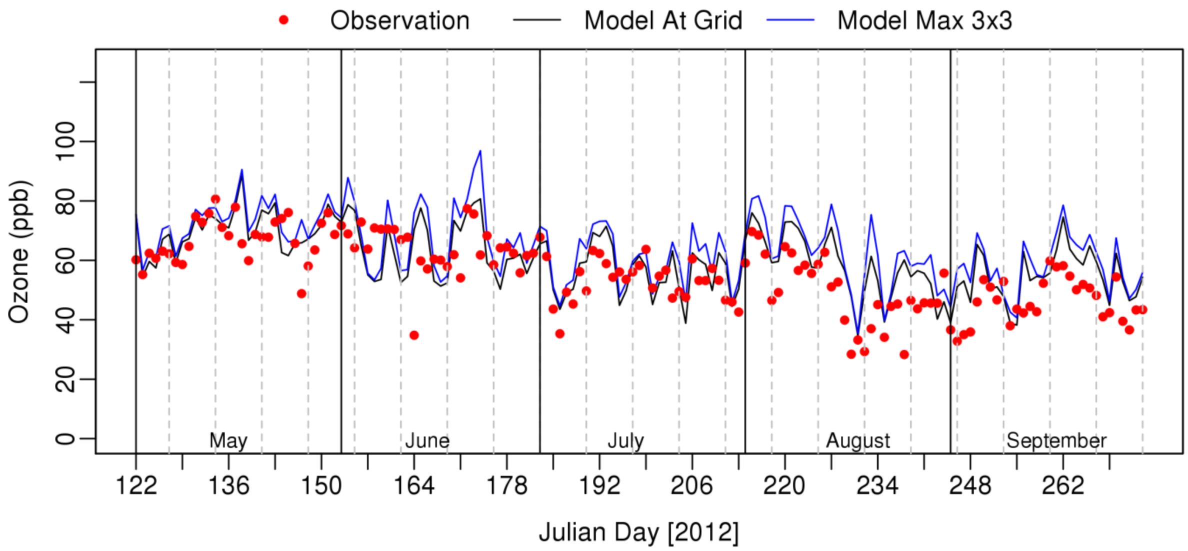

Figure S 15 Time-series of daily maximum 1-hour ozone at Niland – English Road

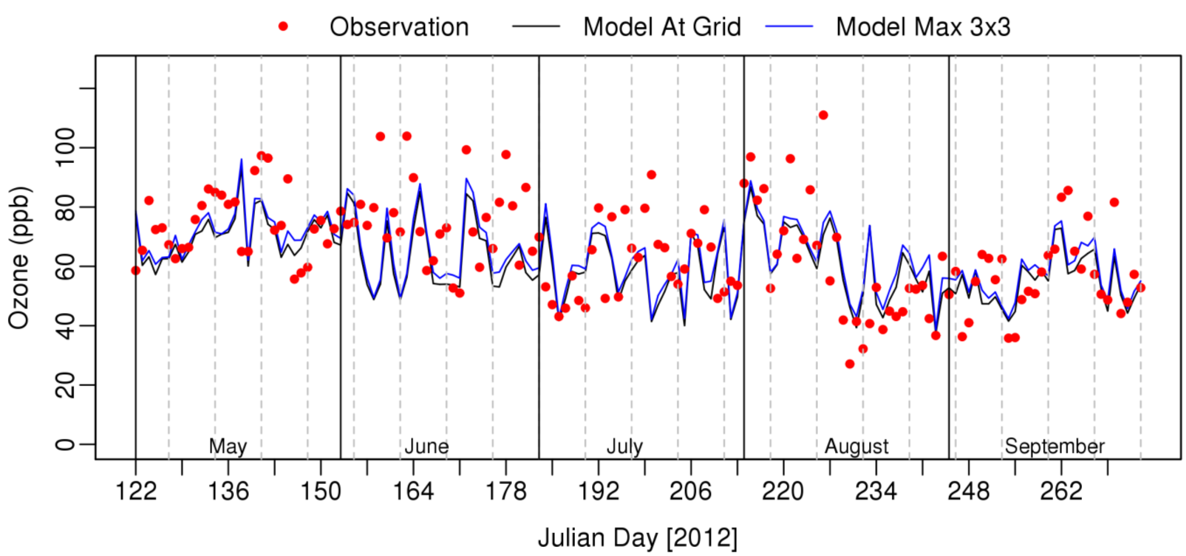

Figure S 16 Time-series of daily maximum 1-hour ozone at El Centro – 9th Street

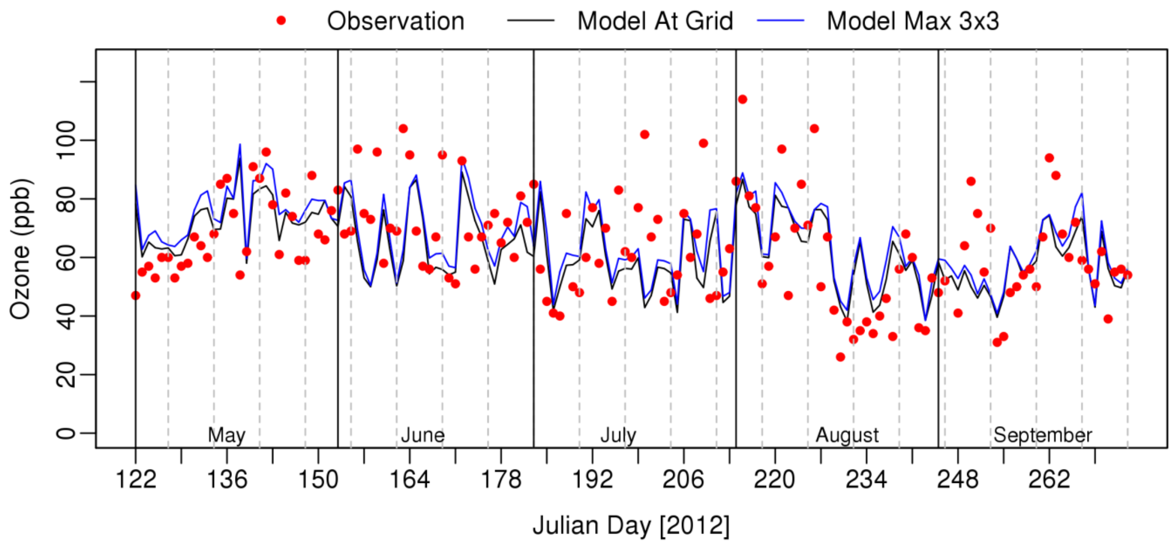

Figure S 17 Time-series of daily maximum 1-hour ozone at Calexico – Ethel Street

DAILY MAXIMUM 8 – HOUR OZONE TIME SERIES PLOTS

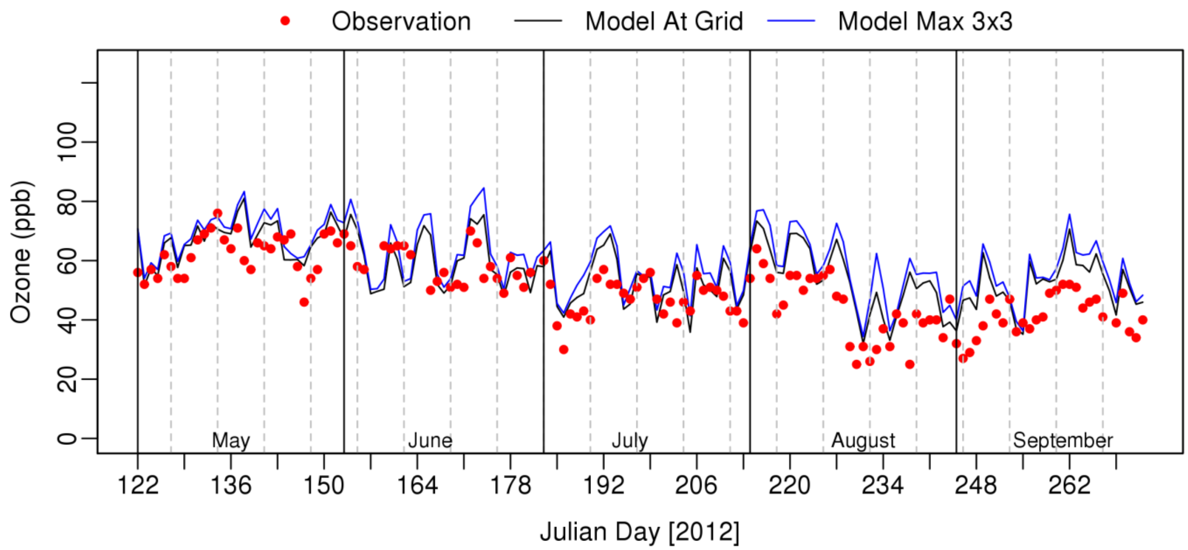

Figure S 18 Time-series of daily maximum average 8-hour ozone at Niland – English Road

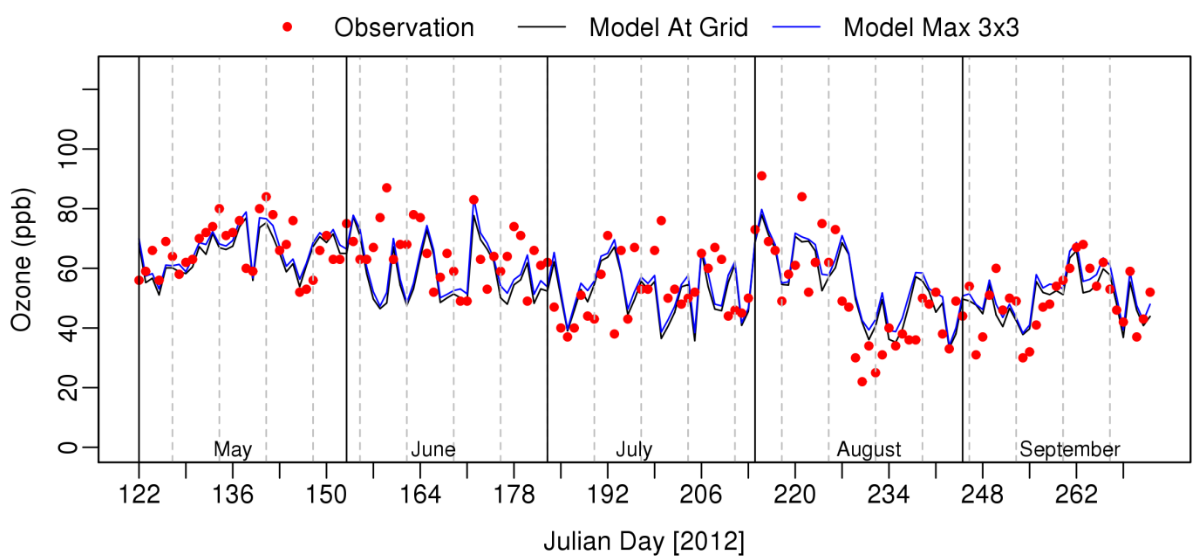

Figure S 19 Time-series of daily maximum average 8-hour ozone at El Centro – 9th Street

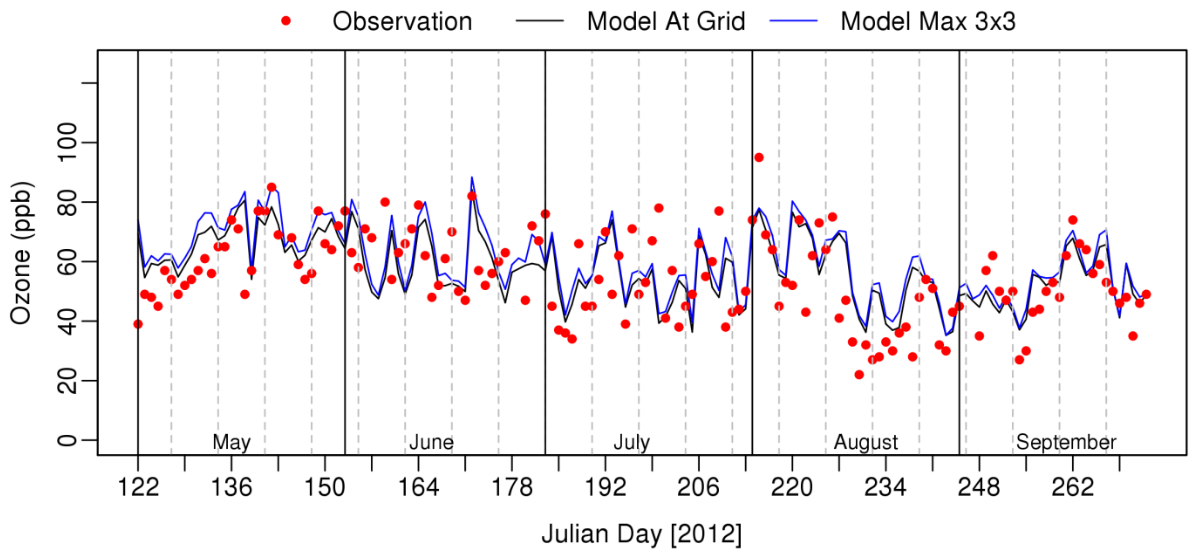

Figure S 20 Time-series of daily maximum average 8-hour ozone at Calexico – Ethel Street

Appendix G
Photochemical Modeling Protocol: Photochemical Modeling for the 8-Hour Ozone and Annual/24-hour $PM_{2.5}$ State Implementation Plans

PHOTOCHEMICAL MODELING PROTOCOL

Photochemical Modeling for the 8-Hour Ozone and Annual/24-hour $PM_{2.5}$ State Implementation Plans

Prepared by
California Air Resources Board

Prepared for
United States Environmental Protection Agency Region IX

September 12, 2017

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ACRONYMS

ARB – Air Resources Board

ARCTAS-CARB – California portion of the Arctic Research of the Composition of the Troposphere from Aircraft and Satellites conducted in 2008

BCs – Boundary Conditions

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

CCOS - Central California Ozone Study

CMAQ Model – Community Multi-scale Air Quality Model

CIT – California Institute of Technology

CRPAQS – California Regional PM_{10}/$PM_{2.5}$ Air Quality Study

DISCOVER-AQ - Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality

DV – Design Value

FDDA – Four-Dimensional Data Assimilation

FEM – Federal Equivalence Monitors

FRM – Federal Reference Monitors

HNO_3 – Nitric Acid

ICs – Initial Conditions

IMPROVE – Interagency Monitoring of Protected Visual Environments

IMS-95 – Integrated Monitoring Study of 1995

LIDAR – Light Detection And Ranging

MDA – Maximum Daily Average

MM5 – Mesoscale Meteorological Model Version 5

MOZART – Model for Ozone and Related chemical Tracers

NARR - North American Regional Reanalysis

NCAR – National Center for Atmospheric Research

NCEP – National Centers for Environmental Prediction

NH_3 – Ammonia

NOAA - National Oceanic and Atmospheric Administration

NO_x – Oxides of nitrogen

OC – Organic Carbon

OFP - Ozone Forming Potential

PAMS – Photochemical Assessment Monitoring Stations

PAN – Peroxy Acetyl Nitrate

$PM_{2.5}$ – Particulate Matter with aerodynamic diameter less than 2.5 micrometers

PM_{10} – Particulate Matter with aerodynamic diameter less than 10 micrometers

RH – Relative Humidity

ROG – Reactive Organic Gases

RRF – Relative Response Factor

RSAC – Reactivity Scientific Advisory Committee

SANDWICH – Application of the Sulfate, Adjusted Nitrate, Derived Water, Inferred Carbonaceous Material Balance Approach

SAPRC – Statewide Air Pollution Research Center

SARMAP – SJVAQS/AUSPEX Regional Modeling Adaptation Project

SCAQMD – South Coast Air Quality Management District

SIP – State Implementation Plan

SJV – San Joaquin Valley

SJVAB – San Joaquin Valley Air Basin (SJVAB)

SJVUAPCD – San Joaquin Valley Unified Air Pollution Control District

SJVAQS/AUSPEX – San Joaquin Valley Air Quality Study/Atmospheric Utilities Signatures Predictions and Experiments

SLAMS – State and Local Air Monitoring Stations

SMAQMD – Sacramento Metropolitan Air Quality Management District

SMAT – Application of the Speciated Modeled Attainment Test

SOA – Secondary Organic Aerosol

SO_x – Oxides of Sulfur

STN – Speciated Trend Network

UCD – University of California at Davis

U.S. EPA – United States Environmental Protection Agency

VOC – Volatile Organic Compounds

WRF Model – Weather and Research Forecast Model

1. INTRODUCTION

The purpose of this modeling protocol is to detail and formalize the procedures for conducting the photochemical modeling that forms the basis of the attainment demonstration for the 8-hour ozone and annual/24-hour $PM_{2.5}$ State Implementation Plans (SIPs) for California. The protocol is intended to communicate up front how the model attainment test will be performed. In addition, this protocol discusses analyses that are intended to help corroborate the findings of the model attainment test.

1.1 Modeling roles for the current SIP

The Clean Air Act (Act) establishes the planning requirements for all those areas that routinely exceed the health-based air quality standards. These nonattainment areas must adopt and implement a SIP that demonstrates how they will attain the standards by specified dates. Air quality modeling is an important technical component of the SIP, as it is used in combination with other technical information to project the attainment status of an area and to develop appropriate emission control strategies to achieve attainment.

ARB and local Air Districts will jointly develop the emission inventories, which are an integral part of the modeling. Working closely with the Districts, the ARB will perform the meteorological and air quality modeling. Districts will then develop and adopt their local air quality plan. Upon approval by the ARB, the SIP will be submitted to U.S.EPA for approval.

1.2 Stakeholder participation

Public participation constitutes an integral part of the SIP development. It is equally important in all technical aspects of SIP development, including the modeling. As the SIP is developed, the Air Districts and ARB will hold public workshops on the modeling and other SIP elements. Representatives from the private sector, environmental interest groups, academia, and the federal, state, and local public sectors are invited to attend and provide comments. In addition, Draft Plan documents will be available for public review and comment at various stages of plan development and at least 30 days before Plan consideration by the Districts' Governing Boards and subsequently by the ARB Board. These documents will include descriptions of the technical aspects of the SIP. Stakeholders have the choice to provide written and in-person comments at any of the Plan workshops and public Board hearings. The agencies take the comments into consideration when finalizing the Plan.

1.3 Involvement of external scientific/technical experts and their input on the photochemical modeling

During the development of the modeling protocol for the 2012 SJV 24-hour $PM_{2.5}$ SIP (SJVUAPCD, 2012), ARB and the San Joaquin Valley Air Pollution Control District (SJVAPCD) engaged a group of experts on prognostic meteorological modeling and photochemical/aerosol modeling to help prepare the modeling protocol document.

The structure of the technical expert group was as follows:

Conveners: John DaMassa – ARB
Samir Sheikh – SJVAPCD
Members: Scott Bohning – U.S. EPA Region 9
Ajith Kaduwela – ARB
James Kelly – U.S. EPA Office of Air Quality Planning and Standards
Michael Kleeman – University of California at Davis
Jonathan Pleim – U.S. EPA Office of Research and Development
Anthony Wexler – University of California at Davis

The technical consultant group provided technical consultations/guidance to the staff at ARB and SJVAPCD during the development of the protocol. Specifically, the group provided technical expertise on the following components of the protocol:

- Selection of the physics and chemistry options for the prognostic meteorological and photochemical air quality models
- Selection of methods to prepare initial and boundary conditions for the air quality model
- Performance evaluations of both prognostic meteorological and photochemical air quality models. This includes statistical, diagnostic, and phenomenological evaluations of simulated results.
- Selection of emissions profiles (size and speciation) for particulate-matter emissions.
- Methods to determine the limiting precursors for $PM_{2.5}$ formation.
- Application of the Sulfate, Adjusted Nitrate, Derived Water, Inferred Carbonaceous Material Balance Approach (SANDWICH) with potential modifications.
- Application of the Speciated Modeled Attainment Test (SMAT).
- Selection of methodologies for the determination of $PM_{2.5}$ precursor equivalency ratios.
- Preparation of Technical Support Documents.

The current approach to regional air quality modeling has not changed significantly since the 2012 SJV 24-hour $PM_{2.5}$ SIP (SJVUAPCD, 2012), so the expertise provided on the above components to the protocol remain highly relevant. In addition, since regional air quality modeling simulates ozone chemistry and PM chemistry/formation simultaneously, there is generally no difference in how the models are configured and simulations conducted for ozone vs. PM. Therefore, development of this modeling protocol will rely heavily on the recommendations made by this group of technical experts, as well as recently published work in peer-review journals related to regional air quality modeling.

1.4 Schedule for completion of the Plan

Final area designations kick-off the three year SIP development process. For the first two years, efforts center on updates and improvements to the Plan's technical and scientific underpinnings. These include the development of emission inventories, selection of modeling periods, model selection, model input preparation, model performance evaluation and supplemental analyses. During the last year, modeling, further supplemental analyses and control strategy development proceed in an iterative manner and the public participation process gets under way. After thorough review the District Board and subsequently the ARB Board consider the Plan. The Plan is then submitted to U.S. EPA. Table 1-1 in the Appendix corresponding to the appropriate region/standard (e.g., SJV 0.075 ppm 8-hour ozone) summarizes the overall anticipated schedule for Plan completion.

2. DESCRIPTION OF THE CONCEPTUAL MODEL FOR THE NONATTAINMENT AREA

See Section 2 in the Appendix corresponding to the appropriate region/standard (e.g., SJV 0.075 ppm 8-hour ozone).

3. SELECTION OF MODELING PERIODS

3.1 Reference Year Selection and Justification

From an air quality and emissions perspective, ARB and the Districts have selected 2012 as the base year for design value calculation and for the modeled attainment test.

For the SJV, the $PM_{2.5}$ model attainment test will utilize 2013 instead of 2012. These baseline values will serve as the anchor point for estimating future year projected design values.

The selection of 2012/13 is based on the following four considerations:

- Most complete and up to date emissions inventory, which reduces the uncertainty associated with future emissions projections.
- Analysis of meteorological adjusted air quality trends to determine recent years with meteorology most conducive to ozone and $PM_{2.5}$ formation and buildup.
- Availability of research-grade wintertime field measurements in the Valley, which captured two significant pollution episodes during the DISCOVER-AQ field study (January-February 2013).
- The SJV $PM_{2.5}$ design values for year 2013 were some of the highest in recent years, making 2013 a conservative choice for attainment demonstration modeling.

Details and discussion on these analyses can be found in the Weight of Evidence Appendix.

3.2 Future Year Selection and Justification

The future year modeled is determined by the year for which attainment must be demonstrated. Table 3-1 lists the year in which attainment must be demonstrated for the various ozone and $PM_{2.5}$ standards and non-attainment regions in California.

Table 3-1. Future attainment year by non-attainment region and NAAQS. 0.08 ppm and 0.075 ppm refer to the 1997 and 2008 8-hour ozone standards, respectively. 15 ug/m^3 and 12 ug/m^3 refer to the 1997 and 2012 annual $PM_{2.5}$ standards, respectively. 35 ug/m^3 refers to the 2006 24-hour $PM_{2.5}$ standard, and 1-hr ozone refers to the revoked 1979 0.12 ppm 1-hour ozone standard.

Area	Year								
	2031	2026	2025	2024	2023	2021	2020	2019	2017
Southern California Modeling Domain									
South Coast	0.075 ppm	--	--	--	0.08 ppm	12 µg/m^3	--	--	--
Mojave/Coachella	--	0.075 ppm	--	--	--	--	--	--	0.08 ppm
Imperial County	--	--	--	--	--	12 µg/m^3	--	--	0.075 ppm
Ventura County	--	--	--	--	--	--	0.075 ppm	--	--
San Diego	--	--	--	--	--	--	--	--	0.075 ppm
Northern California Modeling Domain									
San Joaquin Valley	0.075 ppm	--	[1]12 µg/m^3	35 µg/m^3	--	[2]12 µg/m^3	15 µg/m^3	35 µg/m^3	1-hr ozone
Sacramento Metropolitan	--	0.075 ppm	--	--	--	--	--	--	--
Portola-Plumas County	--	--	--	--	--	12 µg/m^3	--	--	--
East Kern	--	--	--	--	--	--	--	--	0.075 ppm
W. Nevada County	--	--	--	--	--	--	--	--	0.075 ppm

[1] Serious classification attainment date
[2] Moderate classification attainment date

3.3 Justification for Seasonal/Annual Modeling Rather than Episodic Modeling

In the past, computational constraints restricted the time period modeled for a SIP attainment demonstration to a few episodes (e.g., 2007 SJV 8-hr ozone SIP (SJVUAPCD, 2007), 2007 SC 8-hr ozone SIP (SCAQMD, 2012) and 2009 Sacramento 8-hr ozone SIP (SMAQMD, 2012)). However, as computers have become faster and large amounts of data storage have become readily accessible, there is no longer a need to restrict modeling periods to only a few episodes. In more recent years, SIP modeling in California has covered the entire ozone or peak $PM_{2.5}$ seasons (2012 SC 8-hour ozone and 24-hour $PM_{2.5}$ SIP (SCAQMD, 2012), 2012 SJV 24-hour $PM_{2.5}$ SIP (SJVUAPCD, 2012) and 2013 SJV 1-hr ozone SIP (SJVUAPCD,2013)), or an entire year in the case of annual $PM_{2.5}$ (2008 SJV annual $PM_{2.5}$ SIP (SJVUAPCD, 2008)) The same is true for other regulatory modeling platforms outside of California (Boylan and Russell, 2006; Morris et al., 2006; Rodriguez et al., 2009; Simon et al., 2012; Tesche et al., 2006; U.S. EPA, 2011a, b).

Recent ozone based studies, which focused on model performance evaluation for regulatory assessment, have recommended the use of modeling results covering the full synoptic cycles and full ozone seasons (Hogrefe et al., 2000; Vizuete et al., 2011). This enables a more complete assessment of ozone response to emission controls under a wide range of meteorological conditions. The same is true for modeling conducted for peak 24-hour $PM_{2.5}$. Consistent with the shift to seasonal or annual modeling in most regulatory modeling applications, modeling for the 8-hour ozone standard will cover the entire ozone season (May – September), modeling for the annual 24-hour $PM_{2.5}$ standard will be conducted for the entire year, and modeling for the 24-hour $PM_{2.5}$ standard will, at a minimum, cover the months in which peak 24-hour $PM_{2.5}$ occurs (e.g., October – March in the SJV) and will be conducted annually whenever possible.

4. DEVELOPMENT OF EMISSION INVENTORIES

For a detailed description of the emissions inventory, updates to the inventory, and how it was processed from the planning totals to a gridded inventory for modeling, see the Emissions Inventory Appendix.

5. MODELS AND INPUTS

5.1 Meteorological Model

Meteorological model selection is based on a need to accurately simulate the synoptic and mesoscale meteorological features observed during the selected modeling period. The main difficulties in accomplishing this are California's extremely complex terrain and its diverse climate. It is desirable that atmospheric modeling adequately represent essential meteorological fields such as wind flows, ambient temperature variation, evolution of the boundary layer, and atmospheric moisture content to properly characterize the meteorological component of photochemical modeling.

In the past, the ARB has applied prognostic, diagnostic, and hybrid models to prepare meteorological fields for photochemical modeling. There are various numerical models that are used by the scientific community to study the meteorological characteristics of an air pollution episode. For this SIP modeling platform, the Weather and Research Forecasting (WRF) model (Skaramock et al, 2005) will be used to develop the meteorological fields that drive the photochemical modeling. The U.S. EPA (2014) recommends the use of a well-supported grid-based mesoscale meteorological model for generating meteorological inputs. The WRF model is a community-based mesoscale prediction model, which represents the state-of-the-science and has a large community of model users and developers who frequently update the model as new science becomes available. In recent years, WRF has been applied in California to generate meteorological fields for numerous air quality studies (e.g., Angevine, et al., 2012; Baker et al., 2015; Ensberg et al., 2013; Fast et al., 2014; Hu et al., 2014a, 2014b; Huang et al., 2010; Kelly et al., 2014; Lu et al., 2012; Mahmud et al., 2010), and has been shown to reasonably reproduce the observed meteorology in California.

5.1.1 Meteorological Modeling Domain

The WRF meteorological modeling domain consists of three nested grids of 36 km, 12 km and 4 km uniform horizontal grid spacing (illustrated in Figure 5-1). The purpose of the coarse, 36 km grid (D01) is to provide synoptic-scale conditions to all three grids, while the 12 km grid (D02) is used to provide finer resolution data that feeds into the 4 km grid (D03). The D01 grid is centered at 37 ˚N and 120.5 ˚W and was chosen so that the inner two grids, D02 and D03, would nest inside of D03 and be sufficiently far away from the boundaries to minimize boundary influences. The D01 grid consists of 90 x 90 grid cells, while the D02 and D03 grids encompass 192 x 192 and 327 x 297 grid cells, respectively, with an origin at -696 km x -576 km (Lambert Conformal projection). WRF will be run for the three nested domains simultaneously with two-way feedback between the parent and the nest grids. The D01 and D02 grids are meant to resolve the larger scale synoptic weather systems, while the D03 grid is intended to resolve the finer details of the atmospheric conditions and will be used to drive the air quality model simulations. All three domains will utilize 30 vertical sigma layers (defined in Table 5-1), as well as the various physics options listed in Table 5-2 for each domain.

The initial and boundary conditions (IC/BCs) for WRF will be prepared based on 3-D North American Regional Reanalysis (NARR) data that are archived at the National Center for Atmospheric Research (NCAR). These data have a 32 km horizontal resolution. Boundary conditions to WRF are updated at 6-hour intervals for the 36 km grid (D01). In addition, surface and upper air observations obtained from NCAR will be used to further refine the analysis data that are used to generate the IC/BCs. Analysis nudging will be employed in the outer 36km grid (D01) to ensure that the simulated meteorological fields are constrained and do not deviate from the observed meteorology.

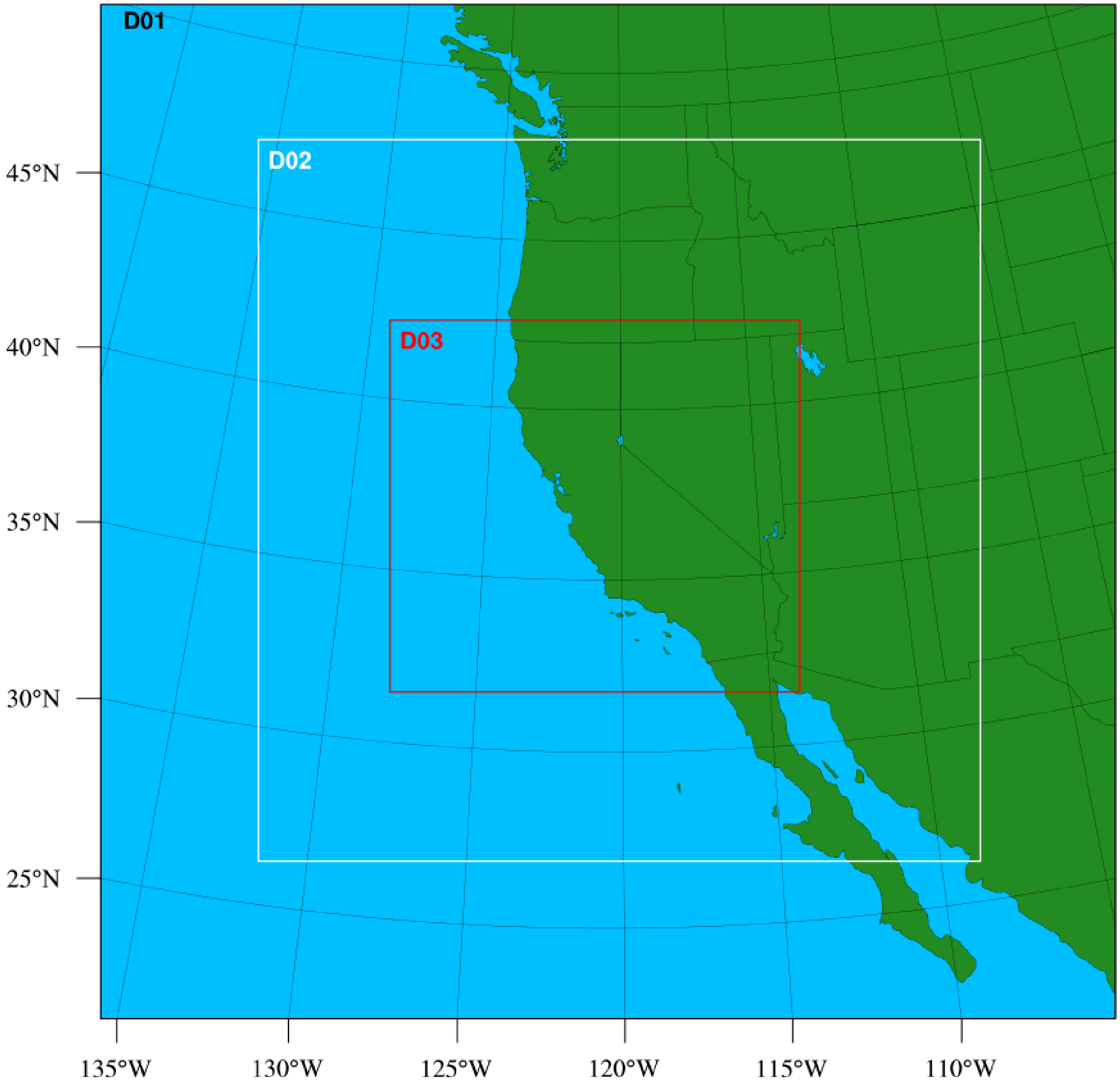

Figure 5-1. The three nested grids for the WRF model (D01 36km; D02 12km; and D03 4km).

Table 5-1. WRF vertical layer structure.

Layer Number	Height (m)	Layer Thickness (m)
30	16082	1192
29	14890	1134
28	13756	1081
27	12675	1032
26	11643	996
25	10647	970
24	9677	959
23	8719	961
22	7757	978
21	6779	993
20	5786	967
19	4819	815
18	4004	685
17	3319	575
16	2744	482
15	2262	403
14	1859	334
13	1525	279
12	1246	233
11	1013	194
10	819	162
9	657	135
8	522	113
7	409	94
6	315	79
5	236	66
4	170	55
3	115	46
2	69	38
1	31	31
0	0	0

Note: Shaded layers denote the subset of vertical layers to be used in the CMAQ photochemical model simulations. Further details on the CMAQ model configuration and settings can be found in subsequent sections.

Table 5-2. WRF Physics Options.

Physics Option	Domain		
	D01 (36 km)	D02 (12 km)	D03 (4 km)
Microphysics	WSM 6-class graupel scheme	WSM 6-class graupel scheme	WSM 6-class graupel scheme
Longwave radiation	RRTM	RRTM	RRTM
Shortwave radiation	Dudhia scheme	Dudhia scheme	Dudhia scheme
Surface layer	Revised MM5 Monin-Obukhov	Revised MM5 Monin-Obukhov	Revised MM5 Monin-Obukhov
Land surface	Pleim-Xiu LSM	Pleim-Xiu LSM	Pleim-Xiu LSM
Planetary Boundary Layer	YSU	YSU	YSU
Cumulus Parameterization	Kain-Fritsch scheme	Kain-Fritsch scheme	None

5.2 Photochemical Model

The U.S. EPA modeling guidance (U.S. EPA, 2014) requires several factors to be considered as criteria for choosing a qualifying air quality model to support the attainment demonstration. These criteria include: (1) It should have received a scientific peer review; (2) It should be appropriate for the specific application on a theoretical basis; (3) It should be used with databases which are available and adequate to support its application; (4) It should be shown to have performed well in past modeling applications; and (5). It should be applied consistently with an established protocol on methods and procedures (U.S. EPA, 2014). In addition, it should be well documented with a user's guide as well as technical descriptions. For the ozone modeled attainment test, a grid-based photochemical model is necessary to offer the best available representation of important atmospheric processes and the ability to analyze the impacts of proposed emission controls on ozone mixing ratios. In ARB's SIP modeling platform, the Community Multiscale Air Quality (CMAQ) Modeling System has been selected as the air quality model for use in attainment demonstrations of NAAQS for ozone and $PM_{2.5}$.

The CMAQ model, a state-of-the-science "one-atmosphere" modeling system developed by U.S. EPA, was designed for applications ranging from regulatory and policy analysis to investigating the atmospheric chemistry and physics that contribute to air pollution. CMAQ is a three-dimensional Eulerian modeling system that simulates ozone, particulate matter, toxic air pollutants, visibility, and acidic pollutant species throughout the troposphere (UNC, 2010). The model has undergone peer review every few years and represents the state-of-the-science (Brown et al., 2011). The CMAQ model is regularly updated to incorporate new chemical and aerosol mechanisms, algorithms, and data as they become available in the scientific literature (e.g., Appel et al., 2013; Foley, et al., 2010; Pye and Pouliot, 2012;). In addition, the CMAQ model is well documented in terms of its underlying scientific algorithms as well as guidance on operational uses (e.g., Appel et al., 2013; Binkowski and Roselle, 2003; Byun and Ching, 1999; Byun and Schere, 2006; Carlton et al., 2010; Foley et al., 2010; Kelly, et al., 2010a; Pye and Pouliot, 2012; UNC, 2010).

The CMAQ model was the regional air quality model used for the 2008 SJV annual $PM_{2.5}$ SIP (SJVUAPCD, 2008), the 2012 SJV 24-hour $PM_{2.5}$ SIP (SJVUAPCD, 2012) and the 2013 SJV 1-hr ozone SIP (SJVUAPCD, 2013). A number of previous studies have also used the CMAQ model to study ozone and $PM_{2.5}$ formation in the SJV (e.g., Jin et al., 2008, 2010b; Kelly et al., 2010b; Liang and Kaduwela, 2005; Livingstone, et al., 2009; Pun et al, 2009; Tonse et al., 2008; Vijayaraghavan et al., 2006; Zhang et al., 2010). The CMAQ model has also been used for regulatory analysis for many of U.S. EPA's rules, such as the Clean Air Interstate Rule (U.S. EPA, 2005) and Light-duty and Heavy-duty Greenhouse Gas Emissions Standards (U.S. EPA, 2010, 2011a). There have been numerous applications of the CMAQ model within the U.S. and abroad (e.g., Appel, et al., 2007, 2008; Civerolo et al., 2010; Eder and Yu, 2006; Hogrefe et al., 2004; Lin et al., 2008, 2009; Marmur et al., 2006; O'Neill, et al., 2006; Philips and Finkelstein, 2006; Smyth et al., 2006; Sokhi et al., 2006; Tong et al., 2006; Wilczak et al., 2009; Zhang et al., 2004, 2006), which have shown it to be suitable as a regulatory and scientific tool for investigating air quality. Staff at the CARB has developed expertise in applying the CMAQ model, since it has been used at CARB for over a decade. In addition, technical support for the CMAQ model is readily available from the Community Modeling and Analysis System (CMAS) Center (http://www.cmascenter.org/) established by the U.S. EPA.

The version 5.0.2 of the CMAQ model released in May 2014, (http://www.airqualitymodeling.org/cmaqwiki/index.php?title=CMAQ_version_5.0.2_%28April_2014_release%29_Technical_Documentation), will be used in this SIP modeling platform. Compared to the previous version, CMAQv4.7.1, which was used for the 2012 SJV 24-hour $PM_{2.5}$ SIP (SJVUAPCD, 2012) and the 2013 SJV 1-hour ozone SIP (SJVUAPCD, 2013), CMAQ version 5 and above incorporated substantial new features and enhancements to topics such as gas-phase chemistry, aerosol algorithms, and structure of the numerical code (http://www.airqualitymodeling.org/cmaqwiki/index.php?title=CMAQ_version_5.0_%28February_2012_release%29_Technical_Documentation#RELEASE_NOTES_for_CMAQv5.0_-.C2.A0February_2012).

5.2.1 Photochemical Modeling Domain

Figure 5-2 shows the photochemical modeling domains used by ARB in this modeling platform. The larger domain (dashed black colored box), covering all of California, has a horizontal grid resolution of 12 km and extends from the Pacific Ocean in the west to Eastern Nevada in the east and runs from south of the U.S.-Mexico border in the south to north of the California-Oregon border in the north. The smaller 4 km Northern (green box) and Southern (red box) modeling domains are nested within the outer 12 km domain and utilized to better reflect the finer scale details of meteorology, topography, and emissions. Consistent with the WRF modeling, the 12 km and 4 km CMAQ 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. The 30 vertical layers from WRF were mapped onto 18 vertical layers for CMAQ, extending from the surface to 100 mb such that the majority of the vertical layers fall within the planetary boundary layer. This vertical layer structure is based on the WRF sigma-pressure coordinates and the exact layer structure used can be found in Table 5-1. A third 4 km resolution modeling domain (blue box) is nested within the Northern California domain and covers the SJV air basin. This smaller SJV domain may be utilized for $PM_{2.5}$ modeling in the SJV if computational constraints (particularly for annual modeling) require the use of a smaller modeling domain. In prior work, modeling results from the smaller SJV domain were compared to results from the larger Northern California domain and no appreciable differences were noted, provided that both simulations utilized chemical boundary conditions derived from the same statewide 12 km simulation.

For the coarse portions of nested regional grids, the U.S. EPA guidance (U.S. EPA, 2014) suggests a grid cell size of 12 km if feasible but not larger than 36 km. For the fine scale portions of nested regional grids, it is desirable to use a grid cell size of ~4 km (U.S. EPA, 2014). Our selection of modeling domains and grid resolution is consistent with this recommendation. The U.S. EPA guidance (U.S. EPA, 2014) does not require a minimum number of vertical layers for an attainment demonstration, although typical applications of “one- atmosphere” models (with the model top at 50-100 mb) are anywhere from 14 to 35 vertical layers. In the ARB’s current SIP modeling platform, 18 vertical layers will be used in the CMAQ model. The vertical structure is based on the sigma-pressure coordinate, with the layers separated at 1.0, 0.9958, 0.9907, 0.9846, 0.9774, 0.9688, 0.9585, 0.9463, 0.9319, 0.9148, 0.8946, 0.8709, 0.8431, 0.8107, 0.7733, 0.6254, 0.293, 0.0788, and 0.0. As previously noted, this also ensures that the majority of the layers are in the planetary boundary layer.

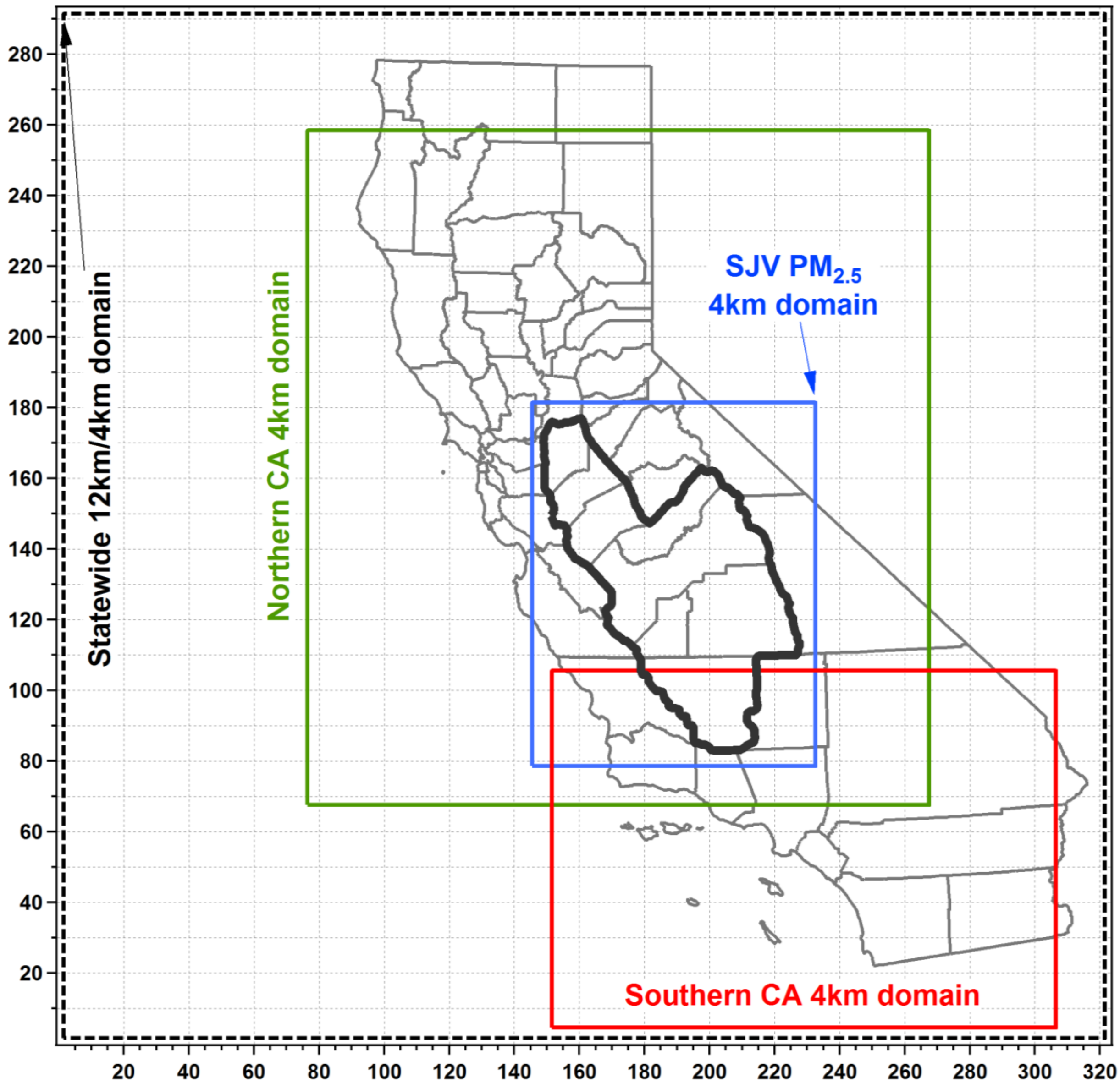

Figure 5-2. CMAQ modeling domains used in this SIP modeling platform. The outer domain (dashed black line) represents the extent of the California statewide domain (shown here with a 4 km horizontal resolution, but utilized in this modeling platform with a 12 km horizontal resolution). Nested higher resolution 4 km modeling domains are highlighted in green and red for Northern/Central California and Southern California, respectively. The smaller SJV $PM_{2.5}$ 4 km domain (colored in blue) is nested within the Northern California 4 km domain.

5.2.2 CMAQ Model Options

Table 5-3 shows the CMAQv5.0.2 configuration utilized in this modeling platform. The same configuration will be used in all simulations for both ozone and $PM_{2.5}$, and for all modeled years. The Intel FORTRAN compiler version 12 will be used to compile all source codes.

Table 5-3. CMAQ v5.0.2 configuration and settings.

Process	Scheme
Horizontal advection	Yamo (Yamartino scheme for mass-conserving advection)
Vertical advection	WRF-based scheme for mass-conserving advection
Horizontal diffusion	Multi-scale
Vertical diffusion	ACM2 (Asymmetric Convective Model version 2)
Gas-phase chemical mechanism	SAPRC07 gas-phase mechanism with version “C” toluene updates
Chemical solver	EBI (Euler Backward Iterative solver)
Aerosol module	Aero6 (the sixth-generation CMAQ aerosol mechanism with extensions for sea salt emissions and thermodynamics; includes a new formulation for secondary organic aerosol yields)
Cloud module	ACM_AE6 (ACM cloud processor that uses the ACM methodology to compute convective mixing with heterogeneous chemistry for AERO6)
Photolysis rate	phot_inline (calculate photolysis rates in-line using simulated aerosols and ozone)

5.2.3 Photochemical Mechanism

The SAPRC07 chemical mechanism will be utilized for all CMAQ simulations. SAPRC07, developed by Dr. William Carter at the University of California, Riverside, is a detailed mechanism describing the gas-phase reactions of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) (Carter, 2010a, 2010b). It represents a complete update to the SAPRC99 mechanism, which has been used for previous ozone SIP plans in the SJV. The well-known SAPRC family of mechanisms have been used widely in California and the U.S. (e.g., Baker, et al., 2015; Cai et al., 2011; Chen et al., 2014; Dennis et al., 2008; Ensberg, et al., 2013; Hakami, et al., 2004a, 2004b; Hu et al., 2012, 2014a, 2014b; Jackson, et al., 2006; Jin et al., 2008, 2010b; Kelly, et al., 2010b; Lane et al., 2008; Liang and Kaduwela, 2005; Livingstone et al., 2009; Lin et al., 2005; Napelenok, 2006; Pun et al., 2009; Tonse et al., 2008; Ying et al., 2008a, 2008b; Zhang et al., 2010; Zhang and Ying, 2011).

The SAPRC07 mechanism has been fully reviewed by four experts in the field through an ARB funded contract. These reviews can be found at http://www.arb.ca.gov/research/reactivity/rsac.htm. Dr. Derwent's (2010) review compared ozone impacts of 121 organic compounds calculated using SAPRC07 and the Master Chemical Mechanism (MCM) v 3.1 and concluded that the ozone impacts using the two mechanisms were consistent for most compounds. Dr. Azzi (2010) used SAPRC07 to simulate ozone formation from isoprene, toluene, m-xylene, and evaporated fuel in environmental chambers performed in Australia and found that SAPRC07 performed reasonably well for these data. Dr. Harley discussed implementing the SAPRC07 mechanism into 3-D air quality models and brought up the importance of the rate constant of NO_2 + OH. This rate constant in the SAPRC07 mechanism in CMAQv5.0.2 has been updated based on new research (Mollner et al., 2010). Dr. Stockwell (2009) compared individual reactions and rate constants in SAPRC07 to two other mechanisms (CB05 and RADM2) and concluded that SAPRC07 represented a state-of-the-science treatment of atmospheric chemistry.

5.2.4 Aerosol Module

The aerosol mechanism with extensions version 6 with aqueous-phase chemistry (AE6-AQ) will be utilized for all SIP modeling. When coupled with the SAPRC07 chemical mechanism, AE6-AQ simulates the formation and evaporation of aerosol and the evolution of the aerosol size distribution (Foley et al., 2010). AE6-AQ includes a comprehensive, yet computationally efficient, inorganic thermodynamic model ISORROPIA to simulate the physical state and chemical composition of inorganic atmospheric aerosols (Fountoukis and Nenes, 2007). AE6-AQ also features the addition of new $PM_{2.5}$ species, an improved secondary organic aerosol (SOA) formation module, as well as new treatment of atmospheric processing of primary organic aerosol (Appel et al., 2013; Carlton et al., 2010; Simon and Bhave, 2011). These updates to AE6-AQ in CMAQv5.0.2 continue to represent state-of-the-art treatment of aerosol processes in the atmosphere (Brown et al., 2011).

5.2.5 CMAQ Initial and Boundary Conditions (IC/BC) and Spin-Up period

Air quality model initial conditions define the mixing ratio (or concentration) of chemical and aerosol species within the modeling domain at the beginning of the model simulation. Boundary conditions define the chemical species mixing ratio (or concentration) within the air entering or leaving the modeling domain. This section discusses the initial and boundary conditions utilized in the ARB modeling system.

U.S. EPA guidance recommends using a model “spin-up” period by beginning a simulation 3-10 days prior to the period of interest (U.S. EPA, 2014). This “spin-up” period allows the initial conditions to be “washed out” of the system, so that the actual initial conditions have little to no impact on the modeling over the time period of interest, as well as giving sufficient time for the modeled species to come to chemical equilibrium. When conducting annual or seasonal modeling, it is computationally more efficient to simulate each month in parallel rather than the entire year or season sequentially. For each month, the CMAQ simulations will include a seven day spin-up period (i.e., the last seven days of the previous month) for the outer 12 km domain to ensure that the initial conditions are “washed out” of the system. Initial conditions at the beginning of the seven day spin-up period will be based on the default initial conditions that are included with the CMAQ release. The 4 km inner domain simulations will utilize a three day spin-up period, where the initial conditions will be based on output from the corresponding day of the 12 km domain simulation.

In recent years, the use of global chemical transport model (CTM) outputs as boundary conditions (BCs) in regional CTM applications has become increasingly common (Chen et al., 2008; Hogrefe et al., 2011; Lam and Fu, 2009; Lee et al., 2011; Lin et al., 2010), and has been shown to improve model performance in many cases (Appel et al., 2007; Borge et al., 2010; Tang et al., 2007, 2009; Tong and Mauzerall, 2006). The advantage of using global CTM model outputs as opposed to fixed climatological-average BCs is that the global CTM derived BCs capture spatial, diurnal, and seasonal variability, as well as provide a set of chemically consistent pollutant mixing ratios. In the ARB’s SIP modeling system, the Model for Ozone And Related chemical Tracers (MOZART; Emmons et al., 2010) will be used to define the boundary conditions for the outer 12 km CMAQ domain, while boundary conditions for the 4 km domain will be derived from the 12 km output. MOZART is a comprehensive global model for simulating atmospheric composition including both gases and bulk aerosols (Emmons et al., 2010). It was developed by the National Center for Atmospheric Research (NCAR), the Max-Planck-Institute for Meteorology (in Germany), and the Geophysical Fluid Dynamics Laboratory (GFDL) of the National Oceanic and Atmospheric Administration (NOAA), and is widely used in the scientific community. In addition to inorganic gases and VOCs, BCs were extracted for aerosol species including elemental carbon, organic matter, sulfate, soil and nitrate. MOZART has been extensively peer-reviewed and applied in a range of studies that utilize its output in defining BCs for regional modeling studies within California and other regions of the U.S. (e.g., Avise et al., 2008; Chen et al., 2008, 2009a, 2009b; Fast et al., 2014; Jathar et al., 2015).

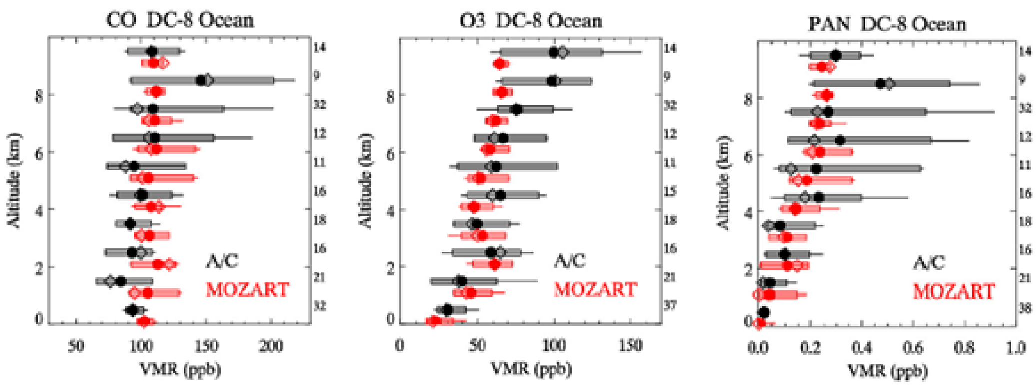

Figure 5-3. Comparison of MOZART (red) simulated CO (left), ozone (center), and PAN (right) to observations (black) along the DC-8 flight track. Shown are mean (filled symbol), median (open symbols), 10th and 90th percentiles (bars) and extremes (lines). The number of data points per 1-km wide altitude bin is shown next to the graphs. Adapted from Figure 2 in Pfister et al. (2011).

In particular, MOZART version 4 (MOZART-4) was recently used in a study characterizing summertime air masses entering California from the Pacific Ocean (Pfister et al., 2011). In their work, Pfister et al. (2011) compared MOZART-4 simulation results to measurements of CO, ozone, and PAN made off the California coast during the ARCTAS-CARB airborne field campaign (Jacob et al., 2010) and showed good agreement between the observations and model results (see Figure 5-3).
The specific MOZART simulations to be utilized in this modeling platform are the MOZART4-GEOS5 simulations by Louisa Emmons (NCAR) for the years 2012 and 2013, which are available for download at http://www.acom.ucar.edu/wrf-chem/mozart.shtml. These simulations are similar to those of Emmons et al. (2010), but with updated meteorological fields. Boundary condition data will be extracted from the MOZART-4 output and processed to CMAQ model ready format using the "mozart2camx" code developed by the Ramboll Environ Corporation (available at http://www.camx.com/download/support-software.aspx). The final BCs represent day-specific mixing ratios, which vary in both space (horizontal and vertical) and time (every six hours).

Per U.S. EPA guidance, the same MOZART derived BCs for the 12 km outer domain will be used for all simulations (e.g., Base Case, Reference, Future, and any sensitivity simulation).

5.3 Quality Assurance of Model Inputs

In developing the IC/BCs and Four Dimensional Data Assimilation (FDDA) datasets for WRF, quality control is performed on all associated meteorological data. Generally, all surface and upper air meteorological data are plotted in space and time to identify extreme values that are suspected to be "outliers". Data points are also compared to other, similar surrounding data points to determine whether there are any large relative discrepancies. If a scientifically plausible reason for the occurrence of suspected outliers is not known, the outlier data points are flagged as invalid and may not be used in the modeling analyses.

In addition, the model-ready emissions files used in CMAQ will be evaluated and compared against the planning inventory totals. Although deviations between the model-ready and planning inventories are expected due to temporal adjustments (e.g., month-of-year and day-of-week) and adjustments based on meteorology (e.g., evaporative emissions from motor vehicles and biogenic sources), any excessive deviation will be investigated to ensure the accuracy of the temporal and meteorology based adjustments. If determined to be scientifically implausible, then the adjustments which led to the deviation will be investigated and updated based on the best available science.

Similar to the quality control of the modeling emissions inventory, the chemical boundary conditions derived from the global CTM model will be evaluated to ensure that no errors were introduced during the processing of the data (e.g., during vertical interpolation of the global model data to the regional model vertical structure or mapping of the chemical species). Any possible errors will be evaluated and addressed if they are determined to be actual errors and not an artifact of the spatial and temporal dynamics inherent in the boundary conditions themselves.

6. METEOROLOGICAL MODEL PERFORMANCE

The complex interactions between the ocean-land interface, orographic induced flows from the mountain-valley topography, and the extreme temperature gradients between the ocean, delta region, valley floor, and mountain ranges surrounding the valley, make the SJV one of the most challenging areas in the country to simulate using prognostic meteorological models. Although there is a long history of prognostic meteorological model applications in California (e.g., Bao et al., 2008; Hu at al., 2010; Jackson et al., 2006; Jin et al., 2010a, 2010b; Livingstone et al., 2009; Michelson et al., 2010; Seaman, Stauffer, and Lario-Gibbs, 1995; Stauffer et al., 2000; Tanrikulu et al., 2000), there is no single model configuration that works equally well for all years and/or seasons, which makes evaluation of the simulated meteorological fields critical for ensuring that the fields reasonably reproduce the observed meteorology for any given time period.

6.1 Ambient Data Base and Quality of Data

Observed meteorological data used to evaluate the WRF model simulations will be obtained from the Air Quality and Meteorological Information System (AQMIS) database, which is a web-based source for real-time and official air quality and meteorological data (www.arb.ca.gov/airqualitytoday/). This database contains surface meteorological observations from 1969-2016, with the data through 2013 having been fully quality assured and deemed official. In addition ARB also has quality-assured upper-air meteorological data obtained using balloons, aircraft, and profilers.

6.2 Statistical Evaluation

Statistical analyses will be performed to evaluate how well the WRF model captured the overall structure of the observed atmosphere during the simulation period, using wind speed, wind direction, temperature, and humidity. The performance of the WRF model against observations will be evaluated using the METSTAT analysis tool (Emery et al, 2001) and supplemented using statistical software tools developed at ARB. The model output and observations will be processed, and data points at each observational site for wind speed, wind direction, temperature, and moisture data will be extracted. The following values will be calculated: Mean Obs, Mean Model, Mean Bias (MB), Mean (Gross) Error (ME/MGE), Normalized Mean Bias (NMB), Root Mean Squared error (RMSE), and the Index Of Agreement (IOA) when applicable. Additional statistical analysis may also be performed.

The mathematical expressions for these quantities are:

$$\mathrm{MB} = \frac{1}{\mathrm{N}} \sum_{1}^{\mathrm{N}} (\mathrm{Model - Obs}) \tag{6-1}$$

$$\mathrm{ME} = \frac{1}{\mathrm{N}} \sum_{1}^{\mathrm{N}} \left| \mathrm{Model - Obs} \right| \tag{6-2}$$

$$\mathrm{NMB} = \frac{\sum_{1}^{\mathrm{N}} (\mathrm{Model} - \mathrm{Obs})}{\sum_{1}^{\mathrm{N}} \mathrm{Obs}} \times 100\%, \tag{6-3}$$

$$\mathrm{RSME} = \sqrt{\frac{\sum_{1}^{\mathrm{N}} (\mathrm{Model} - \mathrm{Obs})^2}{\mathrm{N}}} \tag{6-4}$$

$$IOA = 1 - \frac{\sum_{1}^{N} (Model - Obs)^2}{\sum_{1}^{N} \left[(Model - Obs) + (Model + Obs) \right]^2}, \tag{6-5}$$

where, "*Model*" is the simulated values, "*Obs*" is the observed value, and *N* is the number of observations. These values will be tabulated and plotted for all monitoring sites within the air basin of interest, and summarized by subregion when there are distinct differences in the meteorology within the basin. Statistics may be compared to other prognostic model applications in California to place the current model performance within the context of previous studies. In addition to the statistics above, model performance may also be evaluated through metrics such as frequency distributions, time-series analysis, and wind-rose plots. Based on previous experience with meteorological simulations in California, it is expected that the analysis will show wind speed to be overestimated at some stations with a smaller difference at others. The diurnal variations of temperature and wind direction at most stations are likely to be captured reasonably well. However, the model will likely underestimate the larger magnitudes of temperature during the day and smaller magnitudes at night.

6.3 Phenomenological Evaluation

In addition to the statistical evaluation described above, a phenomenological based evaluation can provide additional insights as to the accuracy of the meteorological modeling. A phenomenological evaluation may include analysis such as determining the relationship between observed air quality and key meteorological parameters (e.g., conceptual model) and then evaluating whether the simulated meteorology and air quality is able to reproduce those relationships. Another possible approach would be to generate geopotential height charts at 500 and 850 mb using the simulated results and compare those to the standard geopotential height charts. This would reveal if the large-scale weather systems at those pressure levels were adequately simulated by the regional prognostic meteorology model. Another similar approach is to identify the larger-scale meteorological conditions associated with air quality events using the National Centers for Environmental Prediction (NCEP) Reanalysis dataset. These can then be visually compared to the simulated meteorological fields to determine whether those large-scale meteorological conditions were accurately simulated and whether the same relationships observed in the NCEP reanalysis are present in the simulated data.

7. PHOTOCHEMICAL MODEL PERFORMANCE

7.1 Ambient Data

Air quality observations are routinely made at state and local monitoring stations. Gas species and PM species are measured on various time scales (e.g., hourly, daily, weekly). The U.S. EPA guidance recommends model performance evaluations for the following gaseous pollutants: ozone (O_3), nitric acid (HNO_3), nitric oxide (NO), nitrogen dioxide (NO_2), peroxyacetyl nitrate (PAN), volatile organic compounds (VOCs), ammonia (NH_3), NO_y (sum of NO_x and other oxidized compounds), sulfur dioxide (SO_2), carbon monoxide (CO), and hydrogen peroxide (H2O2). The U.S. EPA recognizes that not all of these species are routinely measured (U.S. EPA, 2014) and therefore may not be available for evaluating every model application. Recognizing that $PM_{2.5}$ is a mixture, U.S. EPA recommends model performance evaluation for the following individual $PM_{2.5}$ species: sulfate (SO_4^{2-}), nitrate (NO_3^-), ammonium (NH_4^+), elemental carbon (EC), organic carbon (OC) or organic mass (OM), crustal, and sea salt constituent (U.S. EPA, 2014).

Table 7-1 lists the species for which routine measurements are generally available in 2012 and 2013. When quality assured data are available and appropriate for use, model performance for each species will be evaluated. Observational data will be obtained from the Air Quality and Meteorological Information System (AQMIS), which is a web-based source for real-time and official air quality and meteorological data (www.arb.ca.gov/airqualitytoday/). This database contains surface air quality observations from 1980-2016, with the data through 2014 having been fully quality assured and deemed official.

Table 7-1. Monitored species used in evaluating model performance.

Species	Sampling frequency
O_3	1 hour
NO	1 hour
NO_2	1 hour
NO_x	1 hour
CO	1 hour
SO_2	1 hour
Selected VOCs from the PAMS measurement	3 hours (not every day)
$PM_{2.5}$ measured using FRM[1]	24 hours (daily to one in six days)
$PM_{2.5}$ measured using FEM	Continuously
$PM_{2.5}$ Speciation sites	24 hours (not every day)
Sulfate ion	24 hours (not every day)
Nitrate ion	24 hours (not every day)
Ammonium ion	24 hours (not every day)
Organic carbon	24 hours (not every day)
Elemental carbon	24 hours (not every day)
Sea salt constituents	24 hours (not every day)

[1] Direct comparison between modeled and FRM $PM_{2.5}$ may not be appropriate because of various positive and negative biases associated with FRM measurement procedures.

These species cover the majority of pollutants of interest for evaluating model performance as recommended by the U.S. EPA. Other species such as H_2O_2, HNO_3, NH_3, and PAN are not routinely measured. During the DISCOVER-AQ field campaign, which took place in January and February 2013 in the SJV, aircraft sampling provided daytime measurements for a number of species (including HNO_3, NH_3, PAN, alkyl nitrates, and selected VOC species) that are not routinely measured. Modeled concentrations will be compared to aircraft measurements for these species, except for the gaseous HNO_3 measurements, which were contaminated by particulate nitrate (Dr. Chris Cappa, personal communication).

7.2 Statistical Evaluation

As recommended by U.S. EPA, a number of statistical metrics will be used to evaluate model performance for ozone, speciated and total $PM_{2.5}$, as well as other precursor species. These metrics may 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), correlation coefficient (R^2), mean normalized bias (MNB), and mean normalized gross error (MNGE). The formulae for estimating these metrics are given below.

$$MB = \frac{1}{N}\sum_{1}^{N}(Model - Obs) \quad (7\text{-}1)$$

$$ME = \frac{1}{N}\sum_{1}^{N}\left|Model - Obs\right| \quad (7\text{-}2)$$

$$MFB = \frac{2}{N}\sum_{1}^{N}\left(\frac{Model - Obs}{Model + Obs}\right)\times 100\%, \quad (7\text{-}3)$$

$$MFE = \frac{2}{N}\sum_{1}^{N}\left(\frac{\left|Model - Obs\right|}{Model + Obs}\right)\times 100\%, \quad (7\text{-}4)$$

$$NMB = \frac{\sum_{1}^{N}(Model - Obs)}{\sum_{1}^{N} Obs} \times 100\%, \quad (7\text{-}5)$$

$$NME = \frac{\sum_{1}^{N}| Model - Obs |}{\sum_{1}^{N} Obs} \times 100\%, \quad (7\text{-}6)$$

$$RSME = \sqrt{\frac{\sum_{1}^{N}(Model - Obs)^2}{N}} \quad (7\text{-}7)$$

$$R^2 = \left(\frac{\sum_{1}^{N}((Model - \overline{Model}) \times (Obs - \overline{Obs}))}{\sqrt{\sum_{1}^{N}(Model - \overline{Model})^2 \sum_{1}^{N}(Obs - \overline{Obs})^2}}\right)^2 \quad (7\text{-}8)$$

$$MNB = \frac{1}{N}\sum_{1}^{N}\left(\frac{Model - Obs}{Obs}\right) \times 100\%, \quad (7\text{-}9)$$

$$MNGE = \frac{1}{N}\sum_{1}^{N}\left(\frac{|Model - Obs|}{Obs}\right) \times 100\%. \quad (7\text{-}10)$$

where, “Model” is the simulated mixing ratio, “$\overline{Model}$” is the simulated mean mixing ratio, “Obs” is the observed value, “$\overline{Obs}$” is the mean observed value, and “N” is the number of observations.

In addition to the above statistics, various forms of graphics will also be created to visually examine and compare the model predictions to observations. These will include time-series plots comparing the predictions and observations, scatter plots for comparing the magnitude of the simulated and observed mixing ratios, box plots to summarize the time series data across different regions and averaging times, as well as frequency distributions. For $PM_{2.5}$ the so called "bugle plots" of MFE and MFB from Boylan and Russell (2006) will also be generated. The plots described above will be created for paired observations and predictions over time scales dictated by the averaging frequencies of observations (i.e., hourly, daily, monthly, seasonally) for the species of interest. Together, they will provide a detailed view of model performance during different time periods, in different sub-regions, and over different concentrations and mixing ratio levels.

7.3 Comparison to Previous Modeling Studies

Previous U.S. EPA modeling guidance (U.S. EPA, 1991) utilized "bright line" criteria for the performance statistics that distinguished between adequate and inadequate model performance. In the latest modeling guidance from U.S. EPA (U.S EPA, 2014) it is now recommended that model performance be evaluated in the context of similar modeling studies to ensure that the model performance approximates the quality of those studies. The work of Simon et al. (2012) summarized photochemical model performance for studies published in the peer-reviewed literature between 2006 and 2012 and this work will form the basis for evaluating the modeling utilized in the attainment demonstration.

7.4 Diagnostic Evaluation

Diagnostic evaluations are useful for investigating whether the physical and chemical processes that control ozone and $PM_{2.5}$ formation are correctly represented in the modeling. These evaluations can take many forms, such as utilizing model probing tools like process analysis, which tracks and apportions ozone mixing ratios in the model to various chemical and physical processes, or source apportionment tools that utilize model tracers to attribute ozone formation to various emissions source sectors and/or geographic regions. Sensitivity studies (either "brute-force" or the numerical Direct Decoupled Method) can also provide useful information as to the response exhibited in the modeling to changes in various input parameters, such as changes to the emissions inventory or boundary conditions. Due to the nature of this type of analysis, diagnostic evaluations can be very resource intensive and the U.S. EPA modeling guidance acknowledges that air agencies may have limited resources and time to perform such analysis under the constraints of a typical SIP modeling application. To the extent possible, some level of diagnostic evaluation will be included in the model attainment demonstration for this SIP.

In addition to the above analysis, the 2013 DISCOVER-AQ field campaign in the SJV offers a unique dataset for additional diagnostic analysis that is not available in other areas, in particular, the use of indicator ratios in determining the sensitivity of secondary $PM_{2.5}$ to its limiting precursors. As an example, the ratio between free ammonia (total ammonia – 2 x sulfate) and total nitrate (gaseous + particulate) was proposed by Ansari and Pandis (1998) as an indicator of whether ammonium nitrate formation is limited by NO_x or ammonia emissions. The DISCOVER-AQ dataset will be utilized to the extent possible to investigate $PM_{2.5}$ precursor sensitivity in the SJV as well as analysis of upper measurements and detailed ground level AMS measurements (Young et al., 2016).

8. ATTAINMENT DEMONSTRATION

The U.S. EPA modeling guidance (U.S. EPA, 2014) outlines the approach for utilizing models to predict future attainment of the 0.075 ppm 8-hour ozone standard. Consistent with the previous modeling guidance (U.S. EPA, 2007) utilized in the most recent 8-hour ozone (2007), annual $PM_{2.5}$ (2008), and 24-hour $PM_{2.5}$ (2012) SIPs, the current guidance recommends utilizing modeling in a relative sense. A detailed description of how models are applied in the attainment demonstration for both ozone and $PM_{2.5}$, as prescribed by U.S. EPA modeling guidance, is provided below.

8.1 Base Year Design Values

The starting point for the attainment demonstration is with the observational based design value (DV), which is used to determine compliance with the standard at any given monitor. The DV for a specific monitor and year represents the three-year average of the annual 4^{th} highest 8-hour ozone mixing ratio, 98^{th} percentile of the 24-hour $PM_{2.5}$ concentration, or annual average $PM_{2.5}$ concentration, depending on the standard, observed at the monitor. For example, the 8-hr O_3 DV for 2012 is the average of the observed 4^{th} highest 8-hour ozone mixing ratio from 2010, 2011, and 2012.

The U.S. EPA recommends using an average of three DVs to better account for the year-to-year variability inherent in meteorology. Since 2012 has been chosen as the base year for projecting DVs to the future, site-specific DVs will be calculated for the three three-year periods ending in 2012, 2013, and 2014 and then these three DVs will be averaged. This average DV is called a weighted DV (in the context of this SIP, the weighted DV will also be referred to as the reference year DV or DV_R). Table 8-1 illustrates how the weighted DV is calculated.

Table 8-1. Illustrates the data from each year that are utilized in the Design Value calculation for that year (DV Year), and the yearly weighting of data for the weighted Design Value calculation (or DV_R). "obs" refers to the observed metric (8-hr O_3, 24-hour $PM_{2.5}$, or annual average $PM_{2.5}$).

DV Year	Years Averaged for the Design Value (4th highest observed 8-hr O_3, 98th percentile 24-hour $PM_{2.5}$, or annual average $PM_{2.5}$)				
2012	2010	2011	2012		
2013		2011	2012	2013	
2014			2012	2013	2014
Yearly Weightings for the Weighted Design Value Calculation					
2012-2014 Average	$DV_R = \frac{obs_{2010} + (2)obs_{2011} + (3)obs_{2012} + (2)obs_{2013} + obs_{2014}}{9}$				

8.2 Base, Reference, and Future Year Simulations

Projecting the weighted DVs to the future requires three photochemical model simulations as described below:

1. ***Base Year Simulation***
   The base year simulation for 2012 or 2013 is used to assess model performance (i.e., to ensure that the model is reasonably able to reproduce the observed ozone mixing ratios). Since this simulation will be used to assess model performance, it is essential to include as much day-specific detail as possible in the emissions inventory, including, but not limited to hourly adjustments to the motor vehicle and biogenic inventories based on observed local meteorological conditions, known wildfire and agricultural burning events, and exceptional events such as the Chevron refinery fire in 2012.

2. ***Reference Year Simulation***
   The reference year simulation is 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. These include wildfires and events such as the 2012 Chevron refinery fire.

3. ***Future Year Simulation***
   The future year simulation is identical to the reference year simulation, except that the projected future year anthropogenic emission levels are 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.

The base year simulation is solely used for evaluating model performance, while the reference and future year simulations are used to project the weighted DV to the future as described in subsequent sections of this document.

8.3 Relative Response Factors

As part of the model attainment demonstration, the fractional change in ozone or $PM_{2.5}$ between the model future year and model reference year are calculated for each monitor location. These ratios, called "relative response factors" or RRFs, are calculated based on the ratio of modeled future year ozone or $PM_{2.5}$ to the corresponding modeled reference year ozone or $PM_{2.5}$ (Equation 8-1).

$$\text{RRF} = \frac{\text{average } (O_3 \text{ or } PM_{2.5})_{\text{future}}}{\text{average } (O_3 \text{ or } PM_{2.5})_{\text{reference}}} \qquad (8\text{-}1)$$

8.3.1 8-hour Ozone RRF

For 8-hour ozone, the modeled maximum daily average 8-hour (MDA8) ozone is used in calculating the RRF. These MDA8 ozone values are based on the maximum simulated ozone within a 3x3 array of cells surrounding the monitor (Figure 8-1). The future and base year ozone values used in RRF calculations are paired in space (i.e., using the future year MDA8 ozone value at the same grid cell where the MDA8 value for the reference? year is located within the 3x3 array of cells). The days used to calculate the average MDA8 for the reference and future years are inherently consistent, since the same meteorology is used to drive both simulations.

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 geared toward the days with the highest mixing ratios in any ozone season (i.e., the 4^{th} highest MDA8 ozone). Therefore, the modeled days used in the RRF calculation should also reflect days with the highest ozone levels. As a result, the current U.S. EPA guidance (U.S. EPA, 2014) suggests using the top 10 modeled days when calculating the RRF. 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 robust and stable (i.e., not overly sensitive to any single day used in the calculation).

When choosing the top 10 days, the U.S. EPA recommends beginning with all days in which the simulated reference MDA8 is >= 60 ppb and then calculating RRFs based on the top 10 high ozone days. If there are fewer than 10 days with MDA8 ozone >= 60 ppb then all days >= 60 ppb are used in the RRF calculation, as long as there are at least 5 days used in the calculation. If there are fewer than 5 days >= 60 ppb, an RRF cannot be calculated for that monitor. To ensure that only modeled days which are consistent with the observed ozone levels are used in the RRF calculation, the modeled days are further restricted to days in which the reference MDA8 ozone is within ± 20% of the observed value at the monitor location.

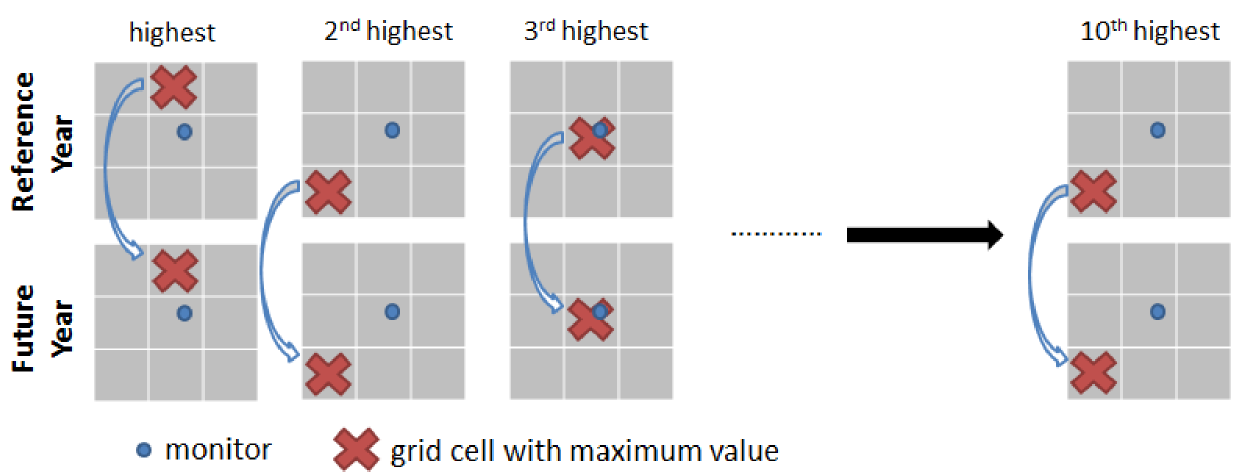

Figure 8-1. Example showing how the location of the MDA8 ozone for the top ten days in the reference and future years are chosen.

8.3.2 Annual and 24-hour $PM_{2.5}$ RRF

The U.S. EPA (2014) guidance requires RRFs for both the annual and 24-hour $PM_{2.5}$ attainment tests be calculated on a quarterly basis (January-March, April-June, July-September, and October-December) and for each $PM_{2.5}$ component (sulfate, nitrate, ammonium, organic carbon, elemental carbon, particle bound water, salt, and other primary inorganic components).

For annual $PM_{2.5}$, the quarterly RRFs are based on modeled quarterly mean concentrations for each component, where the concentrations are averaged over the 9 model grid cells within the 3x3 array of grid cells surrounding each monitor. For the 24-hour $PM_{2.5}$ attainment test, the quarterly RRFs are calculated based on the average for each component over the top 10% of modeled days (or the top nine days per quarter) with the highest total 24-hour average $PM_{2.5}$ concentration. Peak $PM_{2.5}$ values are selected and averaged using the $PM_{2.5}$ concentration simulated at the single grid cell containing the monitoring site for calculating the 24-hour $PM_{2.5}$ RRF (as opposed to the 3x3 array average used in the annual $PM_{2.5}$ RRF calculation).

8.4 Future Year Design Value Calculation

8.4.1 8-hour Ozone

For 8-hour ozone, a future year DV at each monitor is calculated by multiplying the corresponding reference year DV by the site-specific RRF from Equation 8-1 (Equation 8-2).

$$DV_F = DV_R \times RRF \quad (8\text{-}2)$$

where,
DV_F = future year design value,
DV_R = reference year design value, and
RRF = the site specific RRF from Equation 8-1

The resulting future year DVs are then compared to the 8-hour ozone NAAQS to demonstrate whether attainment will be reached under the future 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 design value does not exceed the level of the standard.

8.4.2 Annual and 24-hour $PM_{2.5}$

8.4.2.1 Sulfate, Adjusted Nitrate, Derived, Water, Inferred Carbonaceous Material Balance Approach (SANDWICH) and Potential Modifications

Federal Reference Method (FRM) $PM_{2.5}$ mass measurements provide the basis for the attainment/nonattainment designations. For this reason it is recommended that the FRM data be used to project future air quality and progress towards attainment. However, given the complex physicochemical nature of $PM_{2.5}$, it is necessary to consider individual $PM_{2.5}$ species as well. While the FRM measurements give the mass of the bulk sample, a method for apportioning this bulk mass to individual $PM_{2.5}$ components is the first step towards determining the best emissions controls strategies to reach NAAQS levels in a timely manner.

The FRM measurement protocol finds its roots in the past epidemiological studies of health effects associated with $PM_{2.5}$ exposure. It is upon these studies that the NAAQS are based. The FRM protocol is sufficiently detailed so that results might be easily reproducible and involves the measurement of filter mass before and after sampling together with equilibrating at narrowly defined conditions. Filters are equilibrated for more than 24 hours at a standard relative humidity between 30 and 40% and temperature between 20 and 23 ºC. Due to the sampler construction and a lengthy filter equilibration period, FRM measurements are subjected to a number of known positive and negative artifacts. FRM measurements do not necessarily capture the $PM_{2.5}$ concentrations in the atmosphere and can differ substantially from what is measured by speciation monitors including the Speciation Trends Network (STN) monitors (see http://www.epa.gov/ttnamti1/specgen.html for more details). Nitrate and semi-volatile organic mass can be lost from the filter during the equilibration process, and particle bound water associated with hygroscopic species like sulfate provides a positive artifact. These differences present an area for careful consideration when one attempts to utilize speciated measurements to apportion the bulk FRM mass to individual species. Given that (1) attainment status is currently dependent upon FRM measurements and (2) concentrations of individual $PM_{2.5}$ species need to be considered in order to understand the nature of and efficient ways to ameliorate the $PM_{2.5}$ problem in a given region, a method has been developed to speciate bulk FRM $PM_{2.5}$ mass with known FRM limitations in mind. This method is referred to as the measured **S**ulfate, **A**djusted **N**itrate, **D**erived **W**ater, **I**nferred **C**arbonaceous material balance approach or "SANDWICH" (Frank, 2006). SANDWICH is based on speciated measurements from other (often co-located) samplers, such as those from STN, and the known sampling artifacts of the FRM. The approach strives to provide mass closure, reconciliation between speciated and bulk mass concentration measurements, and the basis for a connection between observations, modeled $PM_{2.5}$ concentrations, and the air quality standard (U.S. EPA, 2014).

The main steps in estimating the $PM_{2.5}$ composition are as follows:

(1) Calculate the nitrate retained on the FRM filter using hourly relative humidity and temperature together with the STN nitrate measurements,

The FRM does not retain all of the semi-volatile $PM_{2.5}$ mass, and at warmer temperatures, loss of particulate nitrate from filters has been commonly observed (Chow et al., 2005). In order to estimate how much nitrate is retained on the FRM filter, simple thermodynamic equilibrium relations may be used. Necessary inputs include 24-hour average nitrate measurements and hourly temperature and relative humidity data. Frank (2006) suggests the following methodology for estimating retained nitrate. For each hour *i* of the day, calculate the dissociation constant, K_i from ambient temperature and relative humidity (RH).

For RH < 61%:

$$\ln(K_i) = 118.87 - (24084/T_i) - 6.025 \times \ln(T_i),$$

where, T_i is the hourly temperature in Kelvins and K_i is in nanobars.

For RH ≥ 61%, K_i is replaced by:

$$K_i' = [P_1 - P_2(1-a_i) + P_3(1-a_i)^2] \times (1-a_i)^{1.75} \times K_i,$$

where, a_i is "fractional" relative humidity and

$$\ln(P_1) = -135.94 + 8763/T_i + 19.12 \times \ln(T_i),$$
$$\ln(P_2) = -122.65 + 9969/T_i + 16.22 \times \ln(T_i),$$
$$\ln(P_3) = -182.61 + 13875/T_i + 24.46 \times \ln(T_i).$$

Using this information, calculate the nitrate retained on the filter as:

$$\text{Retained Nitrate} = \text{STN nitrate} - 745.7/T_R \times (\kappa - \gamma) \times \frac{1}{24}\sum_{i=1}^{24}\sqrt{K_i},$$

where, T_R is the daily average temperature for the sampled air volume in Kelvin, K_i is the dissociation constant for NH_4NO_3 at ambient temperature for hour i, and $(\kappa - \gamma)$ relates to the temperature rise of the filter and vapor depletion from the inlet surface and is assumed to have a value equal to one (Hering and Cass, 1999).

(2) Calculate quarterly averages for retained nitrate, sulfate, elemental carbon, sea salt, and ammonium,

(3) Calculate particle bound water using the concentrations of ammonium, sulfate, and nitrate, using an equilibrium model like the Aerosol Inorganic Model (AIM) or a polynomial equation derived from model output

Under the FRM filter equilibration conditions, hygroscopic aerosol will retain its particle bound water (PBW) and be included in the observed FRM $PM_{2.5}$ mass. PBW can be calculated using an equilibrium model like the Aerosol Inorganics Model (AIM). AIM requires the concentrations of ammonium, nitrate, sulfate, and estimated H^+ as inputs. In addition to inorganic concentrations, the equilibration conditions are also necessary model inputs. In this case, a temperature of 294.15 K and 35% RH is recommended. Alternatively, for simplification, a polynomial regression equation may be constructed by fitting the calculated water concentration from an equilibrium model and the concentrations of nitrate, ammonium, and sulfate. The AIM model will be used for more accurate calculation of PBW.

(4) Add 0.5 μg/m^3 as blank mass, and

(5) Calculate organic carbon mass (OCMmb) by difference, subtracting all inorganic species (including blank mass) from the $PM_{2.5}$ mass.

Other components that may be represented on the FRM filter include elemental carbon, crustal material, sea salt, and passively collected mass. Depending on location certain species may be neglected (e.g., sea salt for inland areas).

While carbonaceous aerosol may make up a large portion of airborne aerosol, speciated measurements of carbonaceous PM are considered highly uncertain. This is due to the large number of carbon compounds in the atmosphere and the measurement uncertainties associated with samplers of different configurations. In the SANDWICH approach, organic carbonaceous mass is calculated by difference. The sum of all nonorganic carbon components will be subtracted from the FRM $PM_{2.5}$ mass to estimate the mass of organic carbon.

After having calculated the species concentrations as outlined above, we will calculate the percentage contribution of each species to the measured FRM mass (minus the blank concentration of 0.5 μg/m^3) for each quarter of the years represented by the speciated data. Note that blank mass is kept constant at 0.5 μg/m^3 between the base and future years, and future year particle bound water needs to be calculated for the future year values of nitrate, ammonium, and sulfate.

8.4.2.2 Estimation of Species Concentrations at Federal Reference Method (FRM) Monitors that Lack Speciation Data

Speciation data from available STN (speciation) sites will be used to speciate the FRM mass for all FRM sites. For those sites not collocated with STN monitors, surrogate speciation sites will be determined based on proximity and evaluation of local emissions or based on similarity in speciation profiles if such data exists (e.g., such as the speciated data collected in the SJV during CRPAQS (Solomon and Magliano, 1998)).

8.4.2.3 Speciated Modeled Attainment Test (SMAT)

Following U.S. EPA modeling guidance (U.S. EPA, 2014), the model attainment test for the annual $PM_{2.5}$ standard will be performed with the following steps.

> Step 1: For each year used in the design value calculation, determine the observed quarterly mean $PM_{2.5}$ and quarterly mean composition for each monitor by multiplying the monitored quarterly mean concentration of FRM derived $PM_{2.5}$ by the fractional composition of $PM_{2.5}$ species for each quarter.
>
> Step 2: Calculate the component specific RRFs at each monitor for each quarter as described in section 8.3.2.
>
> Step 3: Apply the component specific RRFs to the quarterly mean concentrations from Step 1 to obtain projected quarterly species estimates.
>
> Step 4: Calculate future year annual average $PM_{2.5}$ estimates by summing the quarterly species estimates at each monitor and then compare to the annual $PM_{2.5}$ NAAQS. If the projected average annual arithmetic mean $PM_{2.5}$ concentration is ≤ the NAAQS, then the attainment test is passed.

For the 24-hour $PM_{2.5}$ standard, the attainment test is performed with the following steps (U.S. EPA, 2014):

> Step 1: Determine the top eight days with the highest observed 24-hour $PM_{2.5}$ concentration (FRM sites) in each quarter and year used in the design value calculation (a total of 32 days per year), and calculate the 98th percentile value for each year.
>
> Step 2: Calculate quarterly ambient species fractions on "high" $PM_{2.5}$ days for each of the major $PM_{2.5}$ component species (i.e., sulfate, nitrate, ammonium,

elemental carbon, organic carbon, particle bound water, salt, and blank mass). The "high" days are represented by the top 10% of days in each quarter. Depending on the sampling frequency, the number of days captured in the top 10% would range from three to nine. The species fractions of $PM_{2.5}$ are calculated using the "SANDWICH" approach which was described previously. These quarter-specific fractions along with the FRM $PM_{2.5}$ concentrations are then used to calculate species concentrations for each of the 32 days per year determined in Step 1.

Step 3: Apply the component and quarter specific RRF, described in Section 8.3.2, to observed daily species concentrations from Step 2 to obtain future year concentrations of sulfate, nitrate, elemental carbon, organic carbon, salt, and other primary $PM_{2.5}$.

Step 4: Calculate the future year concentrations for the remaining $PM_{2.5}$ components (i.e., ammonium, particle bound water, and blank mass). The future year ammonium is calculated based on the calculated future year sulfate and nitrate, using a constant value for the degree of neutralization of sulfate from the ambient data. The future year particle bound water is calculated from the AIM model.

Step 5: Sum the concentration of each of the species components to calculate the total $PM_{2.5}$ concentration for each of the 32 days per year and at each site. Sort the 32 days for each site and year, and calculate the 98th percentile value corresponding to each year.

Step 6: Calculate the future design value at each site based on the 98th percentile concentrations calculated in Step 5 and following the standard protocol for calculating design values (see Table 8-1). Compare the future-year 24-hour design values to the NAAQS. If the projected design value is ≤ the NAAQS, then the attainment test is passed.

8.4.2.4 Sensitivity Analyses

Model sensitivity analysis may be conducted if the model attainment demonstration does not show attainment of the applicable standard with the baseline future inventory, or for determining precursor sensitivities and inter-pollutant equivalency ratios. For both ozone and $PM_{2.5}$, the sensitivity analysis will involve domain wide fractional reductions of the appropriate anthropogenic precursor emissions using the future year baseline emissions scenario as a starting point. In the event that the model attainment demonstration does not show attainment for the applicable standard, it is important to know the precursor limitation to assess the level of emissions controls needed to attain the standard.

In order to identify what combinations of precursor emissions reductions is predicted to lead to attainment, a series of modeling sensitivity simulations with varying degrees of precursor reductions from anthropogenic sources are typically performed. These sensitivity simulations are identical to the baseline future year simulation discussed earlier except that domain-wide fractional reductions are applied to future year anthropogenic precursor emission levels and a new future year design value is calculated. The results of these sensitivity simulations are plotted on isopleth diagrams, which are also referred to as carrying capacity diagrams. The isopleths provide an estimate of the level of emissions needed to demonstrate attainment and thereby inform the development of a corresponding control strategy.

For ozone, this would likely entail reducing anthropogenic NO_x and VOC emissions in 25% increments including cross sensitivities (e.g., 0.75 x NO_x + 1.00 x VOC; 1.00 x NO_x + 0.75 x VOC; 0.75 x NO_x + 0.75 x VOC; 0.5 x NO_x + 1.00 x VOC; ….). Typically, a full set of sensitivities would include simulations for 25%, 50%, and 75% reduction in NO_x and VOC, along with the cross sensitivities (for a total of 16 simulations including the future base simulation). After design values are calculated for each new sensitivity simulation, an ozone isopleth (or carrying capacity diagram) as a function of NO_x and VOC emissions is generated and used to estimate the additional NO_x and VOC emission reductions needed to attain the standard. The approach for $PM_{2.5}$ is similar, except that additional precursor emissions must be considered. Typically, the precursors considered for $PM_{2.5}$ would include anthropogenic NO_x, SO_x, VOCs, NH_3, as well as direct $PM_{2.5}$ emissions (Chen et al., 2014). Cross sensitivities for generating $PM_{2.5}$ carrying capacity diagrams would be conducted with respect to NO_x, which would include the following precursor pairs: NO_x vs. primary $PM_{2.5}$, NO_x vs. VOC, NO_x vs. NH_3, and NO_x vs. SO_x.

In addition to the $PM_{2.5}$ carrying capacity simulations, precursor sensitivity modeling may be conducted for determining the significant precursors to $PM_{2.5}$ formation and for developing inter-pollutant equivalency ratios. These simulations would follow a similar approach to the carrying capacity simulations described above, but would involve only a single sensitivity simulation for each precursor, where emissions of that precursor are reduced between 30% and 70% from the future base year. The "effectiveness" of reducing a given species can be quantified at each FRM monitor as the change in µg $PM_{2.5}$ (i.e., change in design value) per ton of precursor emissions (corresponding to the 15% change in emissions). Equivalency ratios between $PM_{2.5}$ precursors (i.e., NO_x, SO_x, VOCs, and NH_3) and primary $PM_{2.5}$ will be determined by dividing primary $PM_{2.5}$ effectiveness by the precursors' effectiveness.

8.5 Unmonitored Area Analysis

The unmonitored area analysis is used to ensure that there are no regions outside of the existing monitoring network that could exceed the NAAQS if a monitor was present at that location (U.S. EPA, 2014). The U.S. EPA recommends combining spatially interpolated design value fields with modeled gradients for the pollutant of interest (e.g. Ozone and $PM_{2.5}$) and grid-specific RRFs in order to generate gridded future year gradient adjusted design values. The spatial Interpolation of the observed design values is done only within the geographic region constrained by the monitoring network, since extrapolating to outside of the monitoring network is inherently uncertain. This analysis can be done using the Model Attainment Test Software (MATS) (Abt, 2014); 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 (https://www.r-project.org/) developed at ARB will be utilized in this analysis. The basic steps followed in the unmonitored area analysis for 8-hour ozone and annual/24-hour $PM_{2.5}$ are described below.

8.5.1 8-hour Ozone

In this section, the specific steps followed in 8-hr ozone unmonitored area analysis are described briefly:

Step 1: At each grid cell, the top-10 modeled maximum daily average 8-hour ozone mixing ratios from the reference year simulation will be averaged, and a gradient in this top-10 day average between each grid cell and grid cells which contain a monitor will be calculated.

Step 2: A single set of spatially interpolated 8-hr ozone DV fields will be generated based on the observed 5-year weighted base year 8-hr ozone DVs from the available monitors. The interpolation is done using normalized inverse distance squared weightings for all monitors within a grid cell's Voronoi Region (calculated with the R tripack library; https://cran.r-project.org/web/packages/tripack/README), 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 8.3, except that the +/- 20% limitation on the simulated and observed maximum daily average 8-hour ozone is not applicable because observed data do not exist for grid cells in unmonitored areas.

Step 4: The future year gridded 8-hr ozone DVs are calculated by multiplying the gradient-adjusted interpolated 8-hr ozone DVs from Step 2 with the gridded RRFs from Step 3

Step 5: The future-year gridded 8-hr ozone DVs (from Step 4) are examined to determine if there are any peak values higher than those at the monitors, which could potentially cause violations of the applicable 8-hr ozone NAAQS.

8.5.2 Annual $PM_{2.5}$

The unmonitored area analysis for the annual $PM_{2.5}$ standard will include the following steps:

Step 1: At each grid cell, the quarterly average $PM_{2.5}$ (total and by species) will be calculated from the reference year simulation, and a gradient in these quarterly averages between each grid cell and grid cells which contain a monitor will be calculated.

Step 2: Interpolated spatial fields, based on the observed $PM_{2.5}$ (FRM) and each component species of $PM_{2.5}$, will be generated for each quarter using normalized inverse distance squared weightings for all monitors within a grid cell's Voronoi Region. The ambient interpolated spatial fields are then adjusted based on the gradients in predicted quarterly mean concentrations from Step 1.

Step 3: The component specific RRFs are calculated at each grid cell for each quarter as described in section 8.3.2.

Step 4: The quarterly mean concentrations from Step 2 are then multiplied by the corresponding component specific RRF (from Step 3) to obtain the corresponding projected quarterly species estimates.

Step 5: The future year annual average $PM_{2.5}$ estimates are calculated by summing the quarterly species estimates at each grid cell and then compared to the annual $PM_{2.5}$ NAAQS to determine compliance.

8.5.3 24-hour $PM_{2.5}$

The unmonitored area analysis for the 24-hour $PM_{2.5}$ standard will include the following steps:

Step 1: At each grid cell, the quarterly average of the top 10% of the modeled days for 24-hour $PM_{2.5}$ (total and by species for the same top 10% of days) will be calculated from the reference year simulation, and a gradient in these quarterly averages between each grid cell and grid cells which contain a monitor will be calculated.

Step 2: The top 8 days with observed high $PM_{2.5}$ (FRM) are identified for each quarter and for each of the five years (a total of 32 days per year), used in the base year DV calculation. The speciated $PM_{2.5}$ (FRM) values are then interpolated for each of the "high" $PM_{2.5}$ days (identified above) using normalized inverse distance squared weightings for all monitors within a grid cell's Voronoi Region. These ambient interpolated spatial fields are then adjusted based on the appropriate gradients in predicted concentrations from Step 1.

Step 3: The component specific RRFs are calculated at each grid cell for each quarter as described in section 8.3.2.

Step 4: The observed daily species concentrations from Step 2 are multiplied by the component and quarter specific RRF (from Step 3) to estimate the future year concentration of each $PM_{2.5}$ species using the method outlined in section 8.4.2.3

Step 5: The concentration of each of the component $PM_{2.5}$ species is summed to calculate the total $PM_{2.5}$ concentration for each of the 32 days per year (8 days per quarter) and at each grid cell. For each year, the 98th percentile value is calculated by the sorting the 32 days for that particular year at each grid cell.

Step 6: The future design value at each grid cell is calculated based on the 98^{th} percentile concentrations calculated in Step 5 and following the standard protocol for calculating design values (see Table 8-1). The future-year 24-hour design values are then compared to the 24-hour $PM_{2.5}$ NAAQS to determine compliance with that standard.

The R codes used in this analysis will be made available upon request.

8.6 Banded Relative Response Factors for Ozone

The “Band-RRF” approach expands upon the standard “Single-RRF” approach for 8-hour ozone to account for differences in model response to emissions controls at varying ozone levels. The most recent U.S. EPA modeling guidance (U. S. EPA, 2014) accounts for some of these differences by focusing on the top ten modeled days, but even the top ten days may contain a significant range of ozone mixing ratios. The Band-RRF approach accounts for these differences more explicitly by grouping the simulated ozone into bands of lower, medium, and higher ozone mixing ratios. Specifically, daily peak 8-hour ozone mixing ratios for all days meeting model performance criteria (+/- 20% with the observations) can be stratified into 5 ppb increments from 60 ppb upwards (bin size and mixing ratio range may vary under different applications). A separate RRF is calculated for each ozone band following a similar approach as the standard Single-RRF. A linear regression is then fit to the data resulting in an equation relating RRF to ozone band. Similar to the Single-RRF, this equation is unique to each monitor/location.

The top ten days for each monitor, based on observed 8-hour ozone, for each year that is utilized in the design value calculation (see Table 8-1) is then projected to the future using the appropriate RRF for the corresponding ozone band. The top ten future days for each year are then re-sorted, the fourth highest 8-hour ozone is selected, and the future year design value is calculated in a manner consistent with the base/reference year design value calculation. More detailed information on the Band-RRF approach can be found in Kulkarni et al. (2014) and the 2013 SJV 1-hour ozone SIP (SJVUAPCD, 2013).

9. PROCEDURAL REQUIREMENTS

9.1 How Modeling and other Analyses will be Archived, Documented, and Disseminated

The computational burden of modeling the entire state of California and its sub-regions requires a significant amount of computing power and large data storage requirements. For example, there are over half a million grid cells in total for each simulation based on the Northern CA domain (192 x 192 cells in the lateral direction and 18 vertical layers). The meteorological modeling system has roughly double the number of grid cells since it has 30 vertical layers. Archiving of all the inputs and outputs takes several terabytes (TB) of computer disk space (for comparison, one single-layer DVD can hold roughly 5 gigabytes (GB) of data, and it would require ~200 DVDs to hold one TB). Please note that this estimate is for simulated surface-level pollutant output only. If three-dimensional pollutant data are needed, it would add a few more TB to this total. Therefore, transferring the modeling inputs/outputs over the internet using file transfer protocol (FTP) is not practical.

Interested parties may send a request for model inputs/outputs to Mr. John DaMassa, Chief of the Modeling and Meteorology Branch at the following address.

> John DaMassa, Chief
> Modeling and Meteorology Branch
> Air Quality Planning and Science Division
> Air Resources Board
> California Environmental Protection Agency
> P.O. Box 2815
> Sacramento, CA 95814, USA

The requesting party will need to send an external disk drive(s) to facilitate the data transfer. The requesting party should also specify what input/output files are requested so that ARB can determine the capacity of the external disk drive(s) that the requester should send.

9.2 Specific Deliverables to U.S. EPA

The following is a list of modeling-related documents that will be provided to the U.S. EPA.

- The modeling protocol
- Emissions preparation and results
- Meteorology
  - Preparation of model inputs
  - Model performance evaluation
- Air Quality
  - Preparation of model inputs
  - Model performance evaluation
- Documentation of corroborative and weight-of-evidence analyses
- Predicted future year Design Values
- Access to input data and simulation results

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APPENDIX: Imperial County Nonattainment Area 8-Hour Ozone Plan (2017)

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ACRONYMS

ARB – Air Resources Board

DRI – Desert Research Institute

FEM – Federal Equivalent Method

FRM – Federal Reference Method

NAFTA – North America Free Trade Agreement

OC – Organic Carbon

PM – Particulate Matter

$PM_{2.5}$ – Particulate matter with aerodynamic diameter less than 2.5 µm

PM_{10} – Particulate matter with aerodynamic diameter less than 10 µm

SANDWICH – Sulfate, Adjusted Nitrate, Derived Water, Inferred Carbon Hybrid

SASS – Spiral Aerosol Speciation Sampler

SCERP – Southwest Consortium for Environmental Research and Policy

SCOS97 – South Coast Ozone Study

SIP – State Implementation Plan

SLAMS - State and Local Air Monitoring Stations

U.S. – United States

U.S. EPA – United States Environmental Protection Agency

VOC – Volatile Organic Carbon

1. TIMELINE OF THE PLAN

Table 1-1. Timeline for Completion of the Plan

Timeline	Action
December 2016	Modeling Emission Inventory Completed
January 2017	Modeling Completed
March/April 2017	District hearing to consider the Draft Plan
April/May 2017	ARB Board Hearing to consider the Imperial Adopted Plan
Summer 2017	Plan submitted to U.S. EPA

2. DESCRIPTION OF THE CONCEPTUAL MODEL FOR THE NONATTAINMENT AREA

2.1 History of Field Studies in the Region

Field studies in the border region of Imperial County and Mexicali are somewhat limited, and have primarily focused on PM_{10} episodes and emissions, rather than ozone (Table 2-1). Nevertheless, these studies can provide useful information regarding the meteorological conditions and transport patterns that lead to elevated pollution in the region. Many of these studies were conducted under the auspices of the Southwest Consortium for Environmental Research and Policy (SCERP), which was a university consortium that focused on environmental research in the U.S.-Mexican border region. SCERP was created by the U.S. Congress in 1990 and ended its operations in 2013.

One of the first ozone focused field studies in the region was the 1997 Southern California Ozone Study (SCOS97), which measured ambient VOCs in the Mexicali region and found that the main source of non-methane VOCs was from motor vehicles. More recently in 2010, the California-Mexico (Cal-Mex) field campaign was conducted along the California-Mexico border with the goal of characterizing the sources, transport, and chemistry related to emissions along the border region, which includes the formation and transport of ozone. From May 15 – June 30, 2010 the intensive field campaign was conducted and included the participation of approximately 100 scientific investigators from around 20 institutions in Mexico and the U.S. and coincided with the larger CalNex field study in California. The intensive measurement phase of Cal-Mex generated an extensive data set of trace gases and fine particles, meteorological parameters, and emission fluxes in the San Diego/Tijuana region. Subsequent analysis of the Cal-Mex measurements included supporting meteorological and photochemical modeling for the San Diego/Tijuana and Imperial/Mexicali regions, which investigated the cross-border transport of pollution.

Table 2-1. Field studies and analyses in the Imperial Valley/Mexicali region.

Year	Study	Significance
1981	The Impact of Transport from the South Coast Air Basin on Ozone Levels in the Southeast Desert Air Basin	Significant tracer concentrations were observed in the desert from SF_6 tracer releases throughout the Los Angeles air basin (Smith et al., 1983).
1997	Southern California Ozone Study (SCOS97)	Measurements of VOCs in the Mexicali region indicate that the main source of non-methane VOC is from motor vehicles (Zielinska et al., 2001).
2000-2005	Program to Improve the Air Quality of Mexicali (PROAIR)	Detailed emission inventory preparation, and Mexicali was identified as one of the most polluted city in Mexico on PM_{10}, $PM_{2.5}$ and O_3 (ERG, 2008).
2001	Compilation, Summary, and Transport Analysis of Air Quality Data Collected Along the California/Mexico Border	Light and variable wind conditions often resulted in exceedances of air quality standards. Evidence suggests that local transport of primary pollutants from Mexicali to Calexico was significant (Hyslop et al., 2001).
2001-2004	Evaluation of PM Emissions from Vehicles in the Border Region	Busses and medium-duty trucks were found to be higher PM emitters than heavy-duty trucks or passenger vehicles. Mexican trucks and buses had higher average emission factors compared to U.S. trucks and buses, but results may not be statistically significant (Kelly et al., 2004).
2003-2006	Particulate Matter Emissions from Agricultural Burns in the Mexicali/Imperial Valley Region	On days with calm winds, agricultural burning contributed as much as 15% to the total PM_{10} mass (Kelly et al., 2006)
2005-2007	Investigation of Low-Wind/High Particulate Matter Episodes in the Imperial Valley/Mexicali Region	Concluded that these episodes are relatively common during winter months and are driven by short-term (2-6 hr) peaks in PM concentrations (Kelly et al., 2007).

2006-2008	Identifying Sources of Low-Wind/High Particulate Matter Episodes in the Imperial Valley-Mexicali Region	Sources contributing to these episodes were found to be mobile, trash and biomass burning, as well as windblown dust. Relative source contributions were similar on each side of the border (Kelly et al., 2008).
2010	Cal-Mex	Collaborative research study to characterize the sources and chemistry of emissions in the California-Mexico border region.
2011-2020	Program to Improve the Air Quality of Mexicali (PROAIR 2010-2020)	Through data collection to track air quality tendencies of the criteria pollutants, and recommend the possible air pollution control strategies (Quintero-Nunez et al., 2012) .

2.2 Description of the Ambient Monitoring Network

Imperial County is located in the southeast corner of California, and covers approximately 4,500 square miles with a population of around 175,000. The majority of the population and commercial activity/farming is located and occurs within the Imperial Valley, which covers around one quarter of the county and is bordered by the Salton Sea to the north, the Santa Rosa Mountain Range to the west, the Chocolate Mountains to the east, and Mexico to the south (Figure 2-1). Within the Valley, the two most populated cities are Calexico and El Centro, with a population of around 40,000 in each city. To the south of Calexico across the U.S.-Mexico border is the Mexicali metropolitan region with a combined population of nearly one million. Mexicali is a growing metropolitan area, which has a strong agricultural and manufacturing economy, with year round agricultural activities.

Table 2-2 lists the air quality monitoring sites within Imperial County and their geographic location, as well as the corresponding gaseous pollutants measured at each site. A detailed discussion about the monitoring network and its adequacy can be found in the Valley's 2014 Ambient Air Monitoring Network Plan (https://www3.epa.gov/ttnamti1/files/networkplans/caimperial2014plan.pdf) and 2014 California Infrastructure SIP (http://www.arb.ca.gov/planning/sip/infrasip/docs/i-sip.pdf).

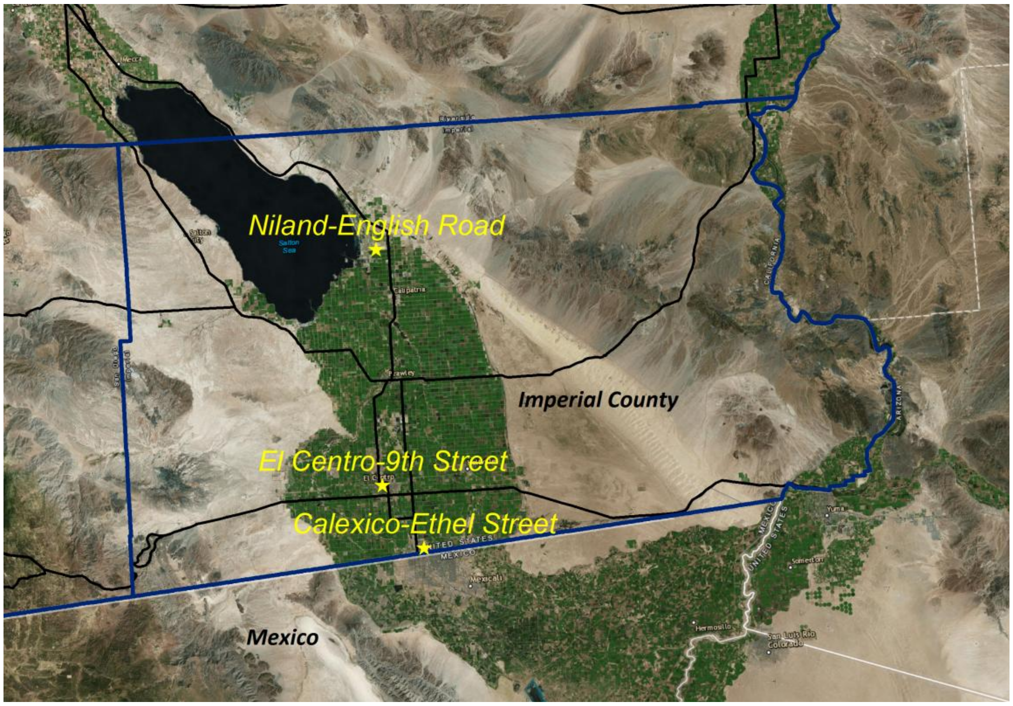

Figure 2-1. Map showing the borders of Imperial County and the locations of three Ozone monitors within the county.

Table 2-2. Imperial County monitoring sites.

Site ID (AQS/ARB)	Site	$PM_{2.5}$	Gaseous		Location	
			NO_x	Ozone	Latitude	Longitude
060254004 3186	Niland *English Road*			X	33.21349	-115.54514
060250007 3675	Brawley *Main Street*	X			32.97831	-115.53904
060251003 2551	El Centro *9th Street*	X	X	X	32.79215	-115.56299
060250005 3135	Calexico *Ethel Street*	X	X	X	32.67618	-115.48307

2.3 Daily Maximum 8-hour Ozone Air Quality Trends

Table 2-3 shows the daily maximum 8-hour ozone design values, from 2001 to 2015, at the three ozone monitors in Imperial County. Based on the most recent trends, the El Centro and Calexico monitors still have design values which exceed the 8-hour ozone standard of 0.075 ppm. Figure 2-2 shows the trend in county-wide daily max 8-hour ozone design value and the number of days above the standard (0.075 ppm) in the Valley from 2001 to 2015. Over that time, there has been an approximate 50% reduction in anthropogenic NOx emissions and a 40% reduction in anthropogenic VOC emissions in Imperial County (Figure 2-3), which resulted in a corresponding decrease in the daily max 8-hour ozone design value from 92 ppb in 2001 to 78 ppb in 2015. However, in recent years (starting around 2010), there has been little change in the county wide design value despite decreasing emissions in Imperial County (Figure 2-2). The lack of response in the design value is likely at least partially due to increases in emissions across the border in the Mexicali Metropolitan area, which has seen a growth in population of around 50,000 since 2010.

Table 2-3. Daily Maximum 8-hour Ozone Design Value (ppb) at the three ozone monitors in Imperial Valley.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Niland	*	*	79	78	72	73	74	75	76	74	73	70	71	70	70
El Centro	*	*	87	85	84	85	86	82	79	77	80	81	82	80	78
Calexico	92	87	78	68	71	74	79	80	83	78	73	75	76	78	77

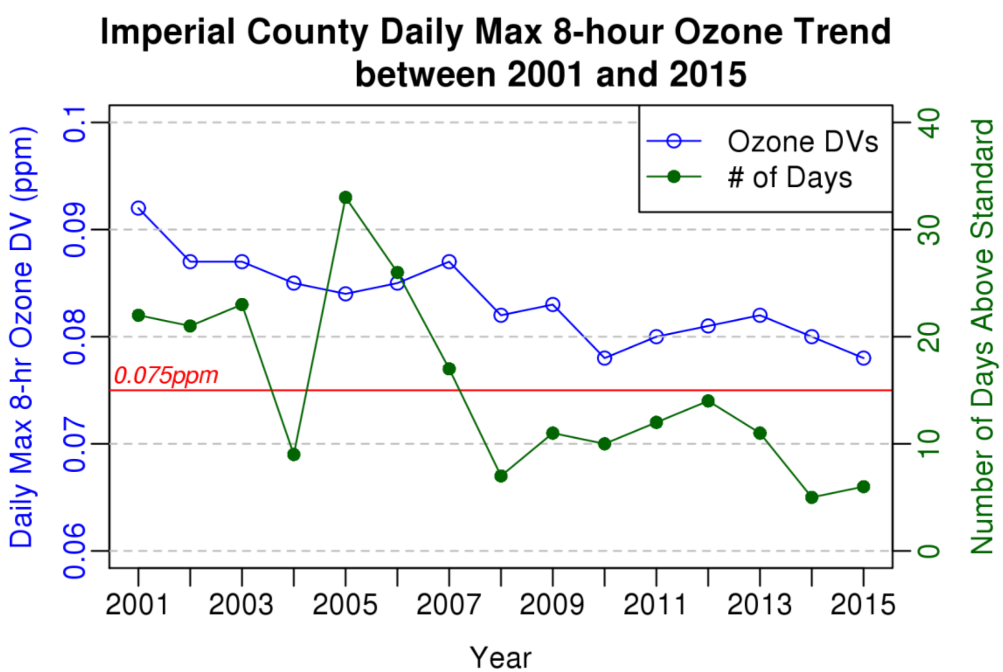

Figure 2-2. Trends in county-wide daily max 8-hour ozone design value and number of days above the 75 ppb 8-hour ozone standard (http://www.arb.ca.gov/adam/index.html).

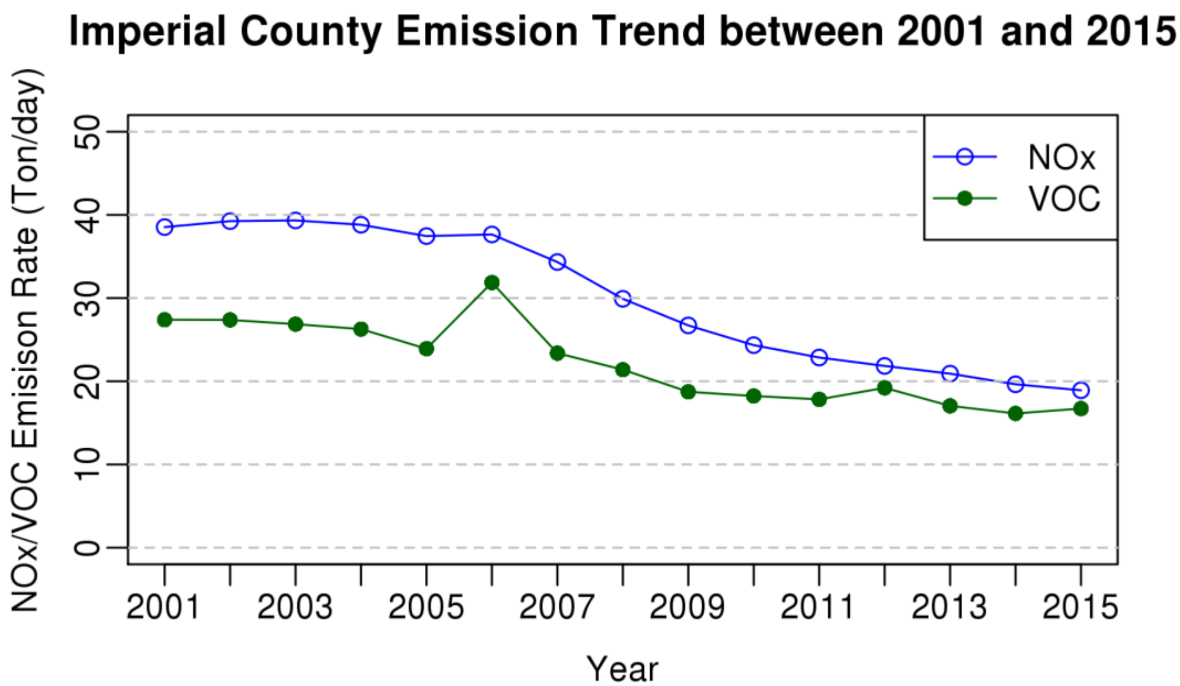

Figure 2-3. Imperial County trends in NO_x and VOC emissions (http://cefs1.arb.ca.gov/cefs/cepam_home.php).

2.4 Possible Cross Boarder Impacts from Mexicali

Since the North America Free Trade Agreement (NAFTA) was implemented in 1994, Mexicali has grown from a primarily agricultural region to an economic center that includes a wide range of agricultural activities, manufacturing plants, and food processing. Over the same period, the population within the greater Mexicali Metropolitan area has grown from around 600,000 in the early 1990's to nearly 1 million in 2015. This growth in Mexicali has also led to an increase in emissions associated with corresponding economic activities, as well as the growth in population.

The proximity of Mexicali emission sources to the Imperial Valley suggests that those emissions have the potential to adversely affect air quality in the Imperial Valley, and there is evidence to support cross-border transport between Mexicali and Imperial Valley. Shi et al. (2009) utilized photochemical modeling and back trajectory analysis to simulate ozone in the Imperial Valley-Mexicali region from June 1-4, 2006 and found that there were ozone transport pathways into Imperial Valley from both Mexico and the coastal areas of Southern California. Similarly, Li et al. (2014) utilized a coupled meteorology-chemical transport model to investigate four pollution episodes during Cal-Mex, and found that with favorable transport patterns, Mexico emissions could significantly enhance daytime ozone levels in Imperial Valley, while the opposite was generally not true.

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Appendix H
Modeling Emission Inventory for the 8-Hour Ozone State Implementation Plan in the Imperial Nonattainment Area

Modeling Emission Inventory for the 8-Hour Ozone State Implementation Plan in the Imperial Non-Attainment Area

Prepared by

California Air Resources Board

Imperial County Air Pollution Control District

Prepared for

United States Environmental Protection Agency Region IX

September 12, 2017

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1. Development of Ozone Emissions Inventories

Emission inputs for air quality modeling (commonly and interchangeably referred to as ‘modeling inventories’ or ‘gridded inventories’) have been developed by ARB and district staff. These inventories support the different SIPs across California to meet various federal standards. ARB maintains an electronic database of emissions and other useful information to generate aggregate emission estimates at the county, air basin and district level. This database is called the California Emission Inventory Development and Reporting System (CEIDARS). CEIDARS provides a foundation for the development of a more refined (hourly, grid-cell specific) set of emission inputs that are required by air quality models. The CEIDARS base year inventory is a primary input to the state’s emission forecasting system, known as the California Emission Projection Analysis Model (CEPAM). CEPAM produces the projected emissions that are then gridded and serve as the emission input for the particulate matter models.

The following sections of this document describe how base and future year emissions inventory estimates are prepared.

1.1. Inventory Coordination

The Air Resources Board convened the SIP Inventory Working Group (SIPIWG) to provide an opportunity and means for interested parties (ARB, 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 has met every four to six weeks since March 2013. Group participants included district staff from Bay Area, Butte, Eastern Kern, El Dorado, Feather River, Imperial, Northern Sierra, Placer, Sacramento, San Diego, San Joaquin, San Luis Obispo, South Coast, Ventura and Yolo-Solano.

Additionally, ARB established the SIPIWG Spatial Surrogate Sub-committee, which focused on improving input data to spatially disaggregate emissions at a more refined level needed for air quality modeling. Local air districts that participated included San Joaquin Valley APCD, South Coast AQMD, Ventura County APCD and Sacramento Metropolitan AQMD.

In addition to the two coordination groups described above, a great deal of work preceded this modeling effort through the Central California Air Quality Studies (CCAQS). CCAQS consisted of two studies: 1) the Central California Ozone Study (CCOS); and 2) the California Regional $PM_{10}/PM_{2.5}$ Air Quality Study (CRPAQS).

1.2. Background

California's emission inventory is an estimate of the amounts and types of pollutants emitted from thousands of industrial facilities, millions of motor vehicles and a myriad of emission sources such as consumer products and fireplaces. The development and maintenance of the emission inventory involves several agencies. This multi-agency effort includes: ARB, 35 local air pollution control and air quality management districts (Districts), regional transportation planning agencies (RTPAs), and the California Department of Transportation (Caltrans). The ARB 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 (Kwong, 2017) from the National Emissions Inventory (NEI) 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 are measured in terms such as the amount of product produced, solvent used, or fuel used.

The district reported or ARB estimated emissions totals are stored in the CEIDARS database for any given pollutant. Both criteria and toxic air pollutant emission inventories are stored in this complex database. These are typically annual average emissions for each county, air basin, and district. Modeling inventories for reactive organic gases (ROG) are estimated from total organic gases (TOG). Similarly, the modeling inventories for total particulate matter 10µ in diameter and smaller (PM_{10}) and total particulate matter 2.5µ in diameter and smaller ($PM_{2.5}$) are estimated from total particulate matter (PM). Details about chemical and size resolved speciation of emissions for modeling can be found in Section 2.4. Additional information on ARB emission inventories can be found at: http://www.arb.ca.gov/ei/ei.htm.

1.3. Inventory Years

The emission inventory scenarios used for air quality modeling must be consistent with U.S. EPA's Modeling guidance (U.S. EPA, 2014). Since changes in the emissions inventory can affect the calculation of the relative response factors (RRFs), 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:

1.3.1. Base Case Modeling Inventory (2012): Base case modeling is intended to evaluate model performance and demonstrate confidence in the modeling system used for the modeled attainment test. The base case modeling inventory is not used as part of the modeled attainment test itself. Model performance is assessed relative to how well model-simulated concentrations match actual measured concentrations. The modeling inputs are developed to represent (as best as possible) actual, day-specific conditions. Therefore, the base case modeling inventory for 2012 includes day-specific emissions for certain sectors. This includes, for instance, actual district-reported point source emissions information for 2012, as well as available day-specific activities and emission adjustments. The year 2012 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 ARB and the local air districts began a comprehensive review and update of the emission inventory several years ago resulting in a comprehensive emissions inventory for 2012.

1.3.2. Reference Year (or Baseline) Modeling Inventory (2012): The baseline or 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 2012 reference year inventory represents typical average conditions and emission patterns through the 2012 design value period. The baseline inventory includes temperature, relative humidity and solar insolation effects, for 2012.

1.3.3. Future Year Modeling Inventory (2017): Future year modeling inventories, along with the reference year modeling inventory, are used in the model-derived RRF calculation. These inventories maintain the “typical”, average patterns of the 2012 reference year modeling inventory. The 2017 inventory will include temperature, relative humidity, and solar insolation effects from reference year (2012) meteorology. Future year point and area source emissions are projected from the 2012 baseline emissions used in the 2012 reference year modeling inventory. Additionally, future year on-road emission inventories are used, as projected by EMFAC.

In summary and based on the definitions above, the following modeling emission inventories were developed:

1.3.4. 2012 Base Case Modeling Inventory: This day-specific inventory is used for the model performance evaluation.

1.3.5. 2012 Reference Year (Baseline) Modeling Inventory: This 2012 reference year inventory is used to determine site-specific RRFs in the modeled attainment test. The 2012 reference year modeling inventory represents typical, average conditions and emission patterns over the baseline design value period, and includes 2012 meteorological effects.

1.3.6. 2017 Future Year Modeling Inventories: These typical, average-day inventories are used to determine site-specific RRFs in the modeled attainment test. Consistent with the 2012 reference year modeling inventory, the 2017 inventory is projected from the 2012 baseline inventory and includes 2012 meteorological effects.

1.4. Spatial Extent of Emission Inventories

The emissions model-ready files that are prepared for use as an input for the air quality model conform to the definition and extent of the grids shown in Figure 1.

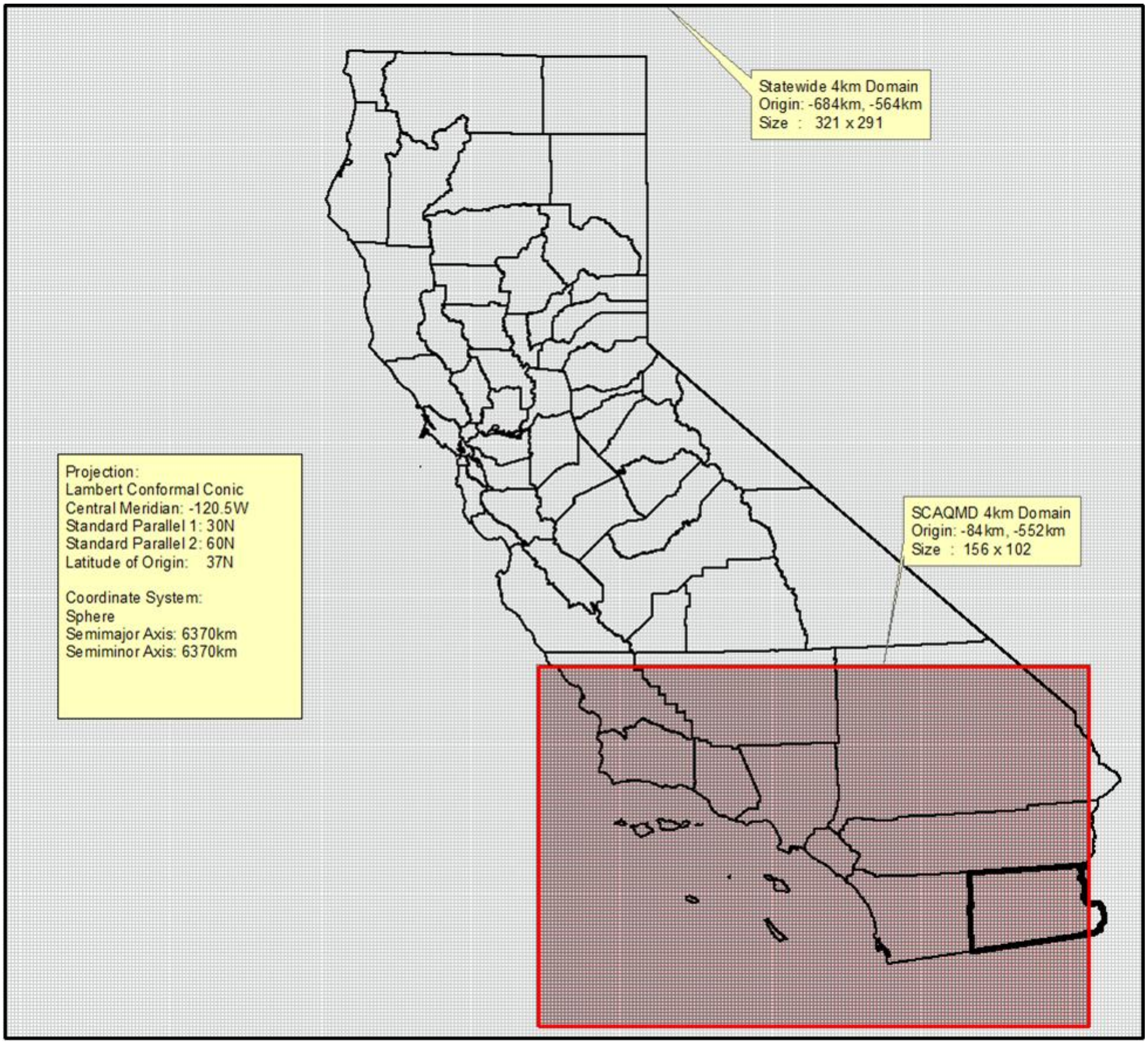

Figure 1 Spatial coverage and parameter summary of modeling domains

The domain uses a Lambert projection and assumes a spherical Earth. The emissions inventory grid uses a Lambert Conical Projection with two parallels. The parallels are at 30° and 60° N latitude, with a central meridian at 120.5° W longitude. The coordinate system origin is offset to 37° N latitude. The emissions inventory uses a grid with 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. A smaller 4km x 4km subdomain is used for the southern California region. The specifications for the statewide and southern California (SCAQMD) domains are summarized in Table 1.

Table 1 Modeling domain parameters

Parameter	Statewide domain	SCAQMD Subdomain
Map Projection	Lambert Conformal Conic	Lambert Conformal Conic
Datum	None (Clarke 1866 spheroid)	None (Clarke 1866 spheroid)
1st Standard Parallel	30.0° N	30.0° N
2nd Standard Parallel	60.0° N	60.0° N
Central Meridian	-120.5° W	-120.5° W
Latitude of projection origin	37.0° N	37.0° N
COORDINATE SYSTEM		
Units	Meters	Meters
Semi-major axis	6370 km	6370 km
Semi-minor axis	6370 km	6370 km
DEFINITION OF GRID		
Grid size	4km x 4km	4km x 4km
Number of cells	321 x 291 cells	156 x 102 cells
Lambert origin	(-684,000 m, -564,000 m)	(-84,000 m, -552,000 m)
Geographic center	-120.5° Lat and 37.0° Lon	-120.5° Lat and 37.0° Lon

2. Estimation of Baseline Year Modeling Inventory

As mentioned in Section 1.3, base case modeling is intended to demonstrate confidence in the modeling system used for the modeled attainment test. The following sections describe the temporal and spatial distribution of emissions and how the different sectors of the modeling inventories are prepared.

2.1. Terminology

The terms “point sources” and “area sources” are often confused. Traditionally, these terms have had different meanings to the developers of emissions inventories and the developers of modeling inventories. Table 2 summarizes the difference in the terms. Both sets of terms are used in this document. In modeling terminology, “point sources” traditionally refer to elevated emission sources that exit from a stack and have an associated plume rise. While the current inventory includes emissions from stacks, all emission sources reported by Imperial County APCD and other local air districts associated with a facility are treated as potential elevated sources. The emissions processor calculates plume rise if appropriate; non-elevated sources are treated as ground-level sources. Examples of non-elevated emissions sources include gas dispensing facilities and storage piles. “Area sources” refers collectively to area-wide sources, stationary-aggregated sources, and other mobile sources (including aircraft, trains, ships, and all off-road vehicles and equipment). That is, “area sources” are low-level sources from a modeling perspective.

Table 2 Inventory terms for emission source types

Modeling Term	Emission Inventory Term	Examples
Point	Stationary – Point Facilities	Stacks at Individual Facilities
Area	Off-Road Mobile	Construction Equipment, Farm Equipment, Trains, Recreational Boats
Area	Area-wide	Residential Fuel Combustion, Livestock Waste, Consumer Products, Architectural Coatings
Area	Stationary - Aggregated	Industrial Fuel Use
On-Road Motor Vehicles	On-Road Mobile	Cars and Trucks
Biogenic	Biogenic	Trees

The following sections describe in more detail the temporal, spatial and chemical disaggregation of the emissions inventory for point sources and area sources.

2.2. Temporal Distribution of Emissions

Emission inventories that are temporally and spatially resolved are needed for modeling purposes, for the base case and baseline modeling inventories as well as future year inventories. The temporal distribution of on-road emissions and biogenic emissions are discussed in Sections 3.4 and 3.5, respectively. How emissions are temporally distributed for the remaining sources (point, area and off-road mobile sources) is discussed below.

Emissions are adjusted temporally to represent variations by month, day of week and hour of day. Temporal data are stored in ARB'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. ARB or district staff also assigns temporal data for each area source category by county/air basin/district.

2.2.1. Monthly Variation: Emissions are adjusted temporally to represent variations by month. Some emission sources operate the same throughout a year. For example, a process heater at a refinery or a line haul locomotive likely operates the same month to month. Other emission categories, such as a tomato processing plant or use of recreational boats, vary significantly by season. ARB'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 in July for recreational boats of 15 results in about 1.8 times higher (15 / 8.33 = 1.8) emissions than a day with flat monthly profile.

2.2.2. Weekly Variation: Emissions are adjusted temporally to represent variations by day of 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 below shows the current DPWK codes and Table 11 in Appendix D shows additional DPWK codes used for agricultural-related emissions.

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 week days; non on Saturday and Sunday	1	1	1	1	1	0	0
6	Six days per week - Uniform activity on week days; non on Saturday and Sunday	1	1	1	1	1	1	0
7	Seven days per week – Uniform activity every day Of the week	1	1	1	1	1	1	1
20	Uniform activity on Saturday and Sunday; No activity the remainder of the week	0	0	0	0	0	1	1
21	Uniform activity on Saturday and Sunday; No activity the remainder of the week	5	5	5	5	5	10	10
22	Uniform activity on week days; Reduced activity on weekends	10	10	10	10	10	7	4
23	Uniform activity on week days; Reduced activity on weekends (For onroad motor vehicles)	10	10	10	10	10	8	8
24	Uniform activity on week days; half as much activity on Saturday. Little activity on Sunday	10	10	10	10	10	5	1
25	Uniform activity on week days; one third as much on Saturday; little on Sunday	10	10	10	10	10	3	1
26	Uniform activity on week days; little activity on Saturday; no activity on Sunday	10	10	10	10	10	3	0
27	Uniform activity on week days; half as much activity on weekends	10	10	10	10	10	5	5
28	Uniform activity on week days; Five times as much activity on weekends	2	2	2	2	2	10	10
29	Uniform activity on Monday through Thursday; increased activity on Friday, Saturday, Sunday	8	8	8	8	10	10	10

2.2.3. Daily Variation: Emissions are adjusted temporally to represent variations by hour of day. Many emission sources occur 24 hours per day, such as livestock waste or a sewage treatment plant. 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 code or HPDY. Table 4 below shows the daily variation factors or current HPDY codes. Table 12 in

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	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
2	2 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
3	3 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	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	1	1	1	1	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	1	1	1	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	1	1	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	1	0	0	0	0	0	0	0	0
8	8 HOURS PER DAY - UNIFORM ACTIVITY FROM 8 A.M. TO 4 P.M. (NORMAL WORKING SHIFT)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
9	9 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
10	10 HOURS PER DAY	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
11	11 HOURS PER DAY	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
12	12 HOURS PER DAY	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
13	13 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
14	14 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
15	15 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
16	16 HOURS PER DAY - UNIFORM ACTIVITY FROM 8 A.M. TO MIDNIGHT (2 WORKING SHIFTS)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	17 HOURS PER DAY	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	18 HOURS PER DAY	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	19 HOURS PER DAY	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
20	20 HOURS PER DAY	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
21	21 HOURS PER DAY	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
22	22 HOURS PER DAY	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
23	23 HOURS PER DAY	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
24	24 HOURS PER DAY - UNIFORM ACTIVITY DURING THE DAY	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
31	MAJOR ACTIVITY 5-9 P.M., AVERAGE DURING DAY, MINIMAL IN EARLY A.M.(GAS STATIONS)	3	1	1	1	1	1	1	5	5	5	5	5	5	5	5	5	5	10	10	10	10	7	7	3
33	MAX ACTIVITY 7-9 A.M. & 7-11 P.M.,AVERAGE DURING DAY, LOW AT NIGHT (RESIDENTIAL FUEL COMBUSTION)	2	2	2	2	2	2	2	10	10	6	6	5	5	5	5	5	5	5	5	10	10	10	10	2
34	ACTIVITY 1 TO 9 A.M.; NO ACTIVITY REMAINDER OF DAY (i.e. ORCHARD HEATERS)	0	8	8	8	8	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	MAX ACTIVITY 7 A.M. TO 1 A.M., REMAINDER IS LOW (i.e. COMMERCIAL AIRCRAFT)	10	1	1	1	1	1	1	8	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
37	ACTIVITY DURING DAYLIGHT HOURS; LESS CHANCE IN EARLY MORNING AND LATE EVENING	0	0	0	0	0	1	3	6	9	10	10	10	10	10	10	10	10	9	6	3	1	0	0	0
38	ACTIVITY DURING MEAL TIME HOURS (i.e. RESIDENTIAL COOKING)	0	0	0	0	0	2	6	6	2	2	1	2	4	4	2	1	1	3	10	8	7	6	1	0
50	PEAK ACTIVITY AT 7 A.M. & 4 P.M.; AVERAGE DURING DAY (ON-ROAD MOTOR VEHICLES)	1	1	1	1	1	1	6	10	6	5	5	5	5	5	5	6	10	8	6	4	1	1	1	1
51	ACTIVITY FROM 6 A.M. TO 12 P.M. (PETROLEUM DRY CLEANING)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
52	MAJOR ACTIVITY FROM 6 A.M.-12 P.M., LESS FROM 12-7 P.M. (PESTICIDES)	0	0	0	0	0	1	6	10	10	10	10	10	6	3	3	3	3	4	4	0	0	0	0	0
53	ACTIVITY FROM 7 A.M. TO 12 P.M. (AGRICULTURAL AIRCRAFT)	0	0	0	0	0	0	0	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0
54	UNIFORM ACTIVITY FROM 7 A.M. TO 9 P.M. (DAYTIME BIOGENICS)	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
55	UNIFORM ACTIVITY FROM 9 P.M. TO 7 A.M. (NIGHTIME BIOGENICS)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
56	MAX ACTIVITY 8 A.M. TO 5 P.M, MINIMAL AT NIGHT & EARLY MORNING(CAN&COIL/METAL PARTS COATINGS)	0	0	0	0	1	1	2	3	10	10	10	10	10	10	10	10	9	1	1	1	1	1	1	1
57	MAX ACTIVITY 7 A.M. TO 2 P.M., MINIMAL AT EVENING AND MORNING HOURS (CONSTRUCTION EQUIPMENT ON HOT	0	0	0	0	0	1	6	10	10	10	10	10	10	9	8	4	2	1	1	0	0	0	0	0
58	MAX ACTIVITY 7 A.M. TO NOON.;REDUCED ACTIVITY NOON TO 6 P.M. (AUTO REFINISHING)	0	0	0	0	0	0	0	10	10	10	10	10	8	8	8	8	8	8	0	0	0	0	0	0
59	MAXIMUM ACTIVITY FROM 7:00 AM TO 3:00 PM; REDUCED ACTIVITY FROM 3:00 TO 6:00 PM.(CONSTRUCTION	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	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

2.3. Spatial Allocation

Once the base case, baseline or future year inventories are developed, the next step of modeling inventory development is to spatially allocate the emissions. Air quality modeling attempts to replicate the physical and chemical processes that occur in an inventory domain. Therefore, it is important that the physical location of emissions be specified as accurately as possible. Ideally, the actual location of all emissions would be known exactly. In reality, however, some categories of emissions would be virtually impossible to determine – for example, the actual amount and location of consumer products (e.g. deodorant) used every day. To the extent possible, the spatial allocation of emissions in a modeling inventory approximates as closely as possible the actual location of emissions.

Spatial allocation is typically accomplished by using spatial surrogates. These spatial surrogates are processed into spatial allocation factors in order to geographically distribute county-wide area source emissions to individual grid cells. Spatial surrogates are developed based on demographic, land cover and other data that exhibit patterns which vary geographically. The spatial surrogates have been updated over the years mainly by Sonoma Technology, Inc. (STI) (Funk, et al., 2001) who created a 2000 base year and various future years. Later, STI updated the underlying spatial data and developed new surrogates (Reid, et al., 2006) completing the project in 2008. ARB and districts have continued to update and improve many of the spatial surrogates and added new ones.

Three basic types of surrogate data were used to develop the original spatial allocation factors: land use and land cover; facility location; and demographic and socioeconomic data. Land use and land cover data are associated with specific land uses, such as agricultural harvesting or recreational boats. Facility locations are used for sources such as gas stations and dry cleaners. Demographic and socioeconomic data, such as population and housing, are associated with residential, industrial, and commercial activity (e.g. residential fuel combustion). To develop spatial allocation factors of high quality and resolution, local socioeconomic and demographic data were used where available for developing base case, baseline and future year inventories. These data were available from local Metropolitan Planning Organizations (MPO) or Regional Transportation Planning Agencies (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.

Since 2008, ARB and district staffs have continued to search for more recent or improved sources of data, since the underlying data used by STI were pre-recession. ARB and district staffs have updated many of the spatial surrogates and added many new ones.

- Updates to land use categories were made using the National Land Cover Database 2011 (Homer, et al., 2015).
- Many surrogates were updated using the locations from Dun & Bradstreet's Market Insight Database (Dun and Bradstreet, 2015). The types of sources were defined by SIC (Standard Industrial Classification). Fourteen new surrogates were developed for industrial-related sources using SIC and whether manufacturing occurred at the facility.
- U.S. Census American Community Survey (FactFinder, 2011) data by census block were used to update residential fuel use.
- Sierra Research developed nine new surrogates related to agricultural activities (Anderson, et al., 2012) , some of which incorporated crop-specific factors.
- Seven new surrogates were developed using vessel traffic data, or Automatic Identification System (AIS) data, collected by the U.S. Coast Guard.
- A new surrogate was created to represent the location of construction equipment. The distribution is a combination of two sets of data: 90% change in "imperviousness" between 2006 and 2011 from NLCD 2011 and 10% road network. Impervious surfaces are mainly artificial structures such as pavements (roads, sidewalks, driveways and parking lots) that are covered by materials impenetrable to a satellite such as asphalt, concrete, brick, stone and rooftops.
- A new surrogate was compiled to distribute emissions from transport refrigeration units (TRU) from three sources: 65% distribution centers, 34% road network and 1% grocery stores / food processing facilities. Information on

distribution centers were retrieved from ARBER, the ARB Equipment Registration software for the Transport Refrigeration Unit (TRU) ATCM and the Drayage Truck Regulation.

In all, a total of 99 unique surrogates are available for use. A summary of the spatial surrogates for which spatial allocation factors were developed is shown below in Table 5.

Table 5 Spatial Surrogates

Surrogate Name	**Surrogate Definition**
AEROSPACE	Spatial distribution of businesses involved in aerospace
Airports	Spatial locations of all airports
All_PavedRds	Spatial distribution of road network (all paved roads)
AutobodyShops	Locations of autobody repair and refinishing shops
CAFO	Spatial distribution of concentrated animal feeding operations
CANCOIL	Spatial distribution of businesses involved in can and coil operations
Cemeteries	Spatial locations of cemeteries
Comm_Airports	Spatial locations of commercial airports
COMPOST	Spatial distribution of composting
CONSTRUCTION_EQUIP	Spatial distribution of where construction equipment is used
Devplnd_HiDensity	Spatial distribution of developed land - low density, medium density and high density
Devplnd_LoDensity	Spatial distribution of developed land - open space (lowest density)
DREDGE	Locations of dredging
Drycleaners	Locations of dry cleaning facilities
DryLakeBeds	Locations of dry lake beds
Elev5000ft	Topological contours – areas above 5000 feet
Employ_Roads	Spatial distribution of total employment and road density (all paved roads)
FABRIC	Spatial distribution of businesses involved in fabric manufacturing
FERRIES	Locations of ferry ports and routes
FISHING_COMM	Locations of commercial fishing
Forestland	Spatial distribution of forest land
Fugitive_Dust	Spatial distribution of barren land
GAS_DISTRIBUTION	Location of gas pipelines
GAS_SEEP	Location of natural-occurring gas seeps
GasStations	Locations of gasoline service stations
GASWELL	Locations of gas wells
GolfCourses	Spatial locations of golf courses
HE_Sqft	Computed surrogate based on housing and employment (est. ft2 / person)
Hospitals	Spatial locations of hospitals
Housing	Spatial distribution of total housing
Housing_Autobody	Spatial distribution of housing and autobody refinishing shops
Housing_Com_Emp	Spatial distribution of total housing and commercial employment
Housing_Restaurants	Spatial distribution of total housing and restaurants/bakeries
Surrogate Name	Surrogate Definition
INDUSTRIAL	Spatial distribution of industrial businesses where manufacturing occurs (SIC<4000)
Industrial_Emp	Spatial distribution of industrial employment
InlandShippingLanes	Spatial distribution of major shipping lanes within bays and inland areas
Irr_Cropland	Spatial location of agricultural cropland
Lakes_Coastline	Locations of lakes, reservoirs, and coastline
LAKES_RIVERS_RECBOAT	Locations of lakes, rivers and reservoirs where recreational boats are used
LANDFILLS	Locations of landfills
LANDPREP	Spatial distribution of dust from land preparation operations (e.g. tilling)
LINEHAUL	Spatial distribution of Class I rail network
LiveStock	Spatial distribution of cattle ranches, feedlots, dairies, and poultry farms
MARINE	Spatial distribution of businesses involved in marine

Surrogate Name	Surrogate Definition
METALFURN	Spatial distribution of businesses involved in metal furniture
METALPARTS	Spatial distribution of businesses involved in metal parts and products
Metrolink_Lines	Spatial distribution of metrolink network
MILITARY_AIRCRAFT	Locations of landing strips on military bases
MILITARY_SHIPS	Locations of military ship activity
MILITARY_TACTICAL	Military bases where tactical equipment are used
MiltaryBases	Locations of military bases
NON_PASTURE_AG	Spatial distribution of farmland
NonIrr_Pastureland	Spatial location of pasture land
NonRes_Chg	Computed surrogate based on spatial distribution of non-residential areas
OCEAN_RECBOAT	Locations of recreational boat activity that can occur on the ocean and SF Bay
OIL_SEEP	Location of naturally-occurring oil seeps
OILWELL	Locations of oil wells (both onshore and offshore)
OTHERCOAT	Spatial distribution of businesses with SIC<4000 not included in another category
PAPER	Spatial distribution of businesses involved in paper
PASTURE	Spatial distribution of grazing land
PEST_ME_BR	Spatial distribution of methyl bromide pesticides
PEST_NO_ME_BR	Spatial distribution of non-methyl bromide pesticides
PLASTIC	Spatial distribution of businesses involved in plastic
Pop_ComEmp_Hos	Spatial distribution of hospitals, population and commercial employment
Population	Spatial distribution of population
Ports	Locations of shipping ports
POTWs	Coordinate locations of POTWs
PrimaryRoads	Spatial distribution of road network (primary roads)
PRINT	Spatial distribution of print businesses
Raillines	Spatial distribution of railroad network
RailYards	Locations of rail yards
Rds_HE	Calculated surrogate based on road densities and housing/employment (est. ft2 / person)
RefinieriesTankFarms	Coordinate locations of refineries and tank farms
Res_NonRes_Chg	Computed surrogate based on spatial distribution of residential and non-residential areas
ResGasHeating	Spatial distribution of homes using gas supplied by a utility as primary source of heating
Residential_Chg	Computed surrogate based on spatial distribution of residential areas
ResLPGHeat	Spatial distribution of homes using gas (bottled, tank or LP) as primary source of heating
ResNonResChg_IndEmp	Spatial distribution of industrial employment and residential/non-residential change
ResOilHeat	Spatial distribution of homes using fuel oil or kerosene as primary source of heating
Restaurants	Locations of restaurants
ResWoodHeating	Spatial distribution of homes using wood as primary source of heating
Surrogate Name	Surrogate Definition
SandandGravelMines	Locations of sand/gravel excavation and mining
Schools	Spatial locations of schools
SecondaryPavedRds	Spatial distribution of road network (secondary roads)
SEMICONDUCT	Spatial distribution of businesses involved in semiconductors
Ser_ComEmp_Sch_GolfC_Cem	Spatial distribution of service and commercial employment, schools, cemeteries, olf courses
Service_Com_Emp	Spatial distribution of service and commercial employment
Shiplanes	Spatial distribution of major shipping lanes
SILAGE	Spatial distribution of silage operations
SingleHousingUnits	Spatial distribution of single dwelling units
TRU	Spatial distribution of transport refrigeration units
TUG_TOW	Spatial distribution of tug and tow boats
UnpavedRds	Spatial distribution of road network (unpaved roads)
Wineries	Locations of wineries
WOOD	Spatial distribution of businesses using wood
WOODFURN	Spatial distribution of businesses involved in wood furniture

The following sections describe in more detail the type of spatial disaggregation used for each sector of the emissions inventory.

2.3.1. Spatial Allocation of Area Sources: Each area source category is assigned a spatial surrogate that is used to allocate emissions to a grid cell in ARB'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.

2.3.2. Spatial Allocation of Point Sources: Each point source is allocated to grid cells using the latitude and longitude reported for each stack. If there are no stack latitude and longitude, the facility coordinates are used. There are two types of point sources: elevated and non-elevated sources. Vertical distribution of elevated sources is allocated using the plume rise algorithm in the emissions processor, SMOKE (see Section 3.3), while non-elevated are allocated to the first layer. Most stationary point sources with existing stacks are regarded as elevated sources. Those without physical stacks that provide only latitude/longitude, such as airports or landfills, are considered non-elevated.

2.3.3. Spatial Allocation of Wildfires, Prescribed Burns and Wildland Fire Use: Emissions from these sources are event and location-based. A fire event can last a few hours or span multiple days. Each fire is spatially allocated to grid cells using the extent of each fire event, while the temporal distribution also reflects the actual duration of the fire. The spatial information to allocate the fire emissions comes from a statewide interagency fire perimeters geodatabase maintained by the Fire and Resource Assessment Program (FRAP) of the California Department of Forestry and Fire Protection (CALFIRE). More details on the methodology and estimation of the wildfire emissions can be found in Section 3.6.1.

2.3.4. Spatial Allocation of Ocean going vessels (OGV): Ship emissions are allocated to the grids corresponding to the vessel traffic lanes in ARB's OGV model (ARB-PTSD, 2011) These traffic lanes were estimated from three different sources:

a. National Waterway Network
b. The Ship Traffic, Energy and Environment Model
c. Automated instrumentation system (AIS) telemetry data collected in 2007

2.3.5. Spatial Allocation of On-road Motor Vehicles: The spatial allocation of on-road motor vehicles is based on DTIM as described in Section 3.4.

2.3.6. Spatial Allocation of Biogenic Emissions: As described in Section 3.5, gridded biogenic emissions are derived using the Model of Emissions of Gases and Aerosols from Nature (MEGAN). MEGAN utilizes gridded emission factor and plant functional type data, adjusted by local meteorological conditions and satellite derived leaf area data, to estimate hourly biogenic emissions within each grid cell of the modeling domain. More details about MEGAN can be found at http://lar.wsu.edu/megan/.

2.4. Speciation Profiles

ARB's emission inventory lists the amount of pollutants discharged into the atmosphere by source in a certain geographical area during a given time period. It currently contains estimates for CO, NH_3, NOx, SOx, total organic gases (TOG) and particulate matter (PM). CO and NH3 are single species; NOx emissions are composed of NO, NO_2 and HONO; and SOx emissions are composed of SO_2 and SO_3. Emissions of TOG and PM for many sources can actually 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. ARB maintains and updates such species 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. Organic gases emitted to the atmosphere are referred to as Total Organic Gas or TOG. TOG includes all organic compounds that can become airborne (through evaporation, sublimation, as aerosols, etc.), excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates and ammonium carbonate. TOG emissions reported in the ARB'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 ARB'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 term ROG and VOC are interchangeable. Also, various regulatory uses of the term VOC, such as that for consumer products exclude specific, additional compounds from particular control requirements.

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 chemical code (a 5-digit ARB internal identifier). 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 organic gas 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 profiles, which contain the total weight fraction for $PM_{2.5}$ and PM_{10} out of total PM. The fine and coarse PM chemical compositions are characterized by applying the PM chemical speciation profiles for each source type, which contain the weight fractions of each chemical species for $PM_{2.5}$, PM_{10} and total PM. PM chemical speciation profiles may also vary for different PM size fractions even for the same emission source. PM size profiles and speciation profiles are typically generated based on source testing data. In most previous source testing studies aimed at determining PM chemical composition, filter-based sampling techniques were used to collect PM samples for chemical analyses.

The organic gas profiles and PM profiles used in the emission inventory are available for download from the ARB's web site at: http://www.arb.ca.gov/ei/speciate/speciate.htm

Each process or product category is keyed to one of the OG profiles and one of the PM profiles. Also available for download from ARB's web site 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 organic gas 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 diesel particulate filter (DPF) requirements over time. Details can be found in ARB's documentation of heavy-duty diesel vehicle exhaust PM speciation profiles (ARB, 2011).

Research studies are conducted regularly to improve ARB's speciation profiles. These profiles support ozone and PM modeling studies but are also designed to be used for aerosol and regional toxics modeling. The profiles are also used to support other health or welfare related modeling studies where the compounds of interest cannot always be anticipated. Therefore, speciation profiles need to be as complete and accurate as possible. ARB has an ongoing effort to update speciation profiles as data become available, such as the testing of emission sources or surveys of product formulations. New speciation data generally undergo technical and peer review, and updating of the profiles is coordinated with users of the data. The recent addition to ARB's speciation profiles include:

(1) Organic gas profile

- Consumer products
- Architectural coating
- Gasoline fuel and headspace vapor
- Gasoline vehicle hot soak and diurnal evaporation
- Gasoline vehicle start and running exhaust
- Silage
- Aircraft exhaust
- Compressed Natural Gas (CNG) bus running exhaust

(2) PM profile

- 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

3. Methodology for Developing Base Case and Baseline Emissions Inventories

As mentioned in Section 1, the base case and baseline inventories include temperature, humidity and solar insolation effects for some emission categories; development of these data is described in Sections 3.1 and 3.2. The remaining sections of Chapter 3 detail how the base case and baseline inventories were created for different sectors of the inventory, such as for point, area, on-road motor vehicles, biogenic and other day-specific sources.

3.1. Surface Temperature and Relative Humidity Fields

The calculation of gridded emissions for some categories of the emissions inventory is dependent on meteorological variables. More specifically, biogenic emissions are sensitive to air temperatures and solar radiation while emissions from on-road mobile sources are sensitive to air temperature and relative humidity. As a result, estimates of air temperature (T), relative humidity (RH), and solar radiation are needed for each grid cell in the modeling domain in order to take into account the effects of these meteorological variables.

Gridded temperature and humidity fields are readily available from prognostic meteorological models such as the Weather Research and Forecasting (WRF) model (http://www.wrf-model.org/index.php), which is used to prepare meteorological inputs for the air quality model. However, prognostic meteorological models can at times have difficulty capturing diurnal temperature extremes (Valade, 2009; Caldwell, 2009; Fovell, 2008). Since temperature and the corresponding relative humidity extremes can have an appreciable influence on some emissions categories, such as on-road mobile and biogenic sources, measurement based fields for these parameters are used in processing emissions. The CALMET (http://www.src.com/) diagnostic meteorological model is utilized to generate both the gridded temperature and relative humidity fields used in processing emissions. The solar radiation fields needed for biogenic emission inventory calculations were taken from the WRF prognostic model, which is also used to generate meteorology for the air quality model. The principal steps involved in generating a gridded, surface-level temperature field using CALMET include the following:

1. Compute the relative weights of each surface observation station to each grid cell (the weight is inversely proportional to the distance between the surface observation station and grid cell center).
2. Adjust all surface temperatures to sea level. In this step, a lapse rate of -0.0049 ^{o}C/m is used (this lapse rate is based on private communication with Gary Moore of Earth Tech, Inc., Concord, MA). This lapse rate (=2.7 F/1000 feet) is based on observational data.

3. Use the weights to compute a spatially-averaged sea-level temperature for each grid cell.
4. Correct all sea-level temperatures back to 10 m height above ground level (i.e. the standard height of surface temperature measurements) using the lapse rate of -0.0049 ^{o}C/m again.
5. The current version of CALMET does not generate estimates of relative humidity. As a result, a post-processing program was used to produce gridded, hourly relative humidity estimates from observed relative humidity data. The major steps needed to generate gridded, surface-level relative humidity are described as follows:
    a. Calculate actual vapor pressure from observed relative humidity and temperature at all meteorological stations. The (Mc. Rae, 1980) method is used to calculate the saturated vapor pressure from temperature;
    b. Compute the relative weights of each surface observation station to each grid in question, exactly as done by CALMET to compute the temperature field;
    c. Use the weights from step 2 to compute a spatially-averaged estimate of actual vapor pressure in each grid cell;
    d. For each grid cell, calculate relative humidity from values for actual vapor pressure and temperature for the same grid cell.

3.2. Insolation Effects

Insolation data was used in the estimation of the gridded emissions inventory and provided by the WRF meteorological fields as mentioned in Section 3.5.

3.3. 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 (Sparse Matrix Operator

Kernel Emissions) modeling system (https://www.cmascenter.org/smoke/). Improvements to SMOKE were recently implemented under ARB contract for version 4.0 of SMOKE (Baek, 2015).

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 4.1. Temporal allocation of emissions using SMOKE involves the disaggregation of annual emissions totals into monthly, day of week, and hour of day emissions totals. The temporal codes from Table 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 2.4, and emissions source cross-reference files used as inputs for SMOKE are developed by ARB staff. SMOKE uses the files for the chemical speciation of NOx, SOx, TOG and PM to species needed by photochemical air quality models.

Emissions for area sources are allocated to grid cells as defined by the modeling grid domain defined in Section 1.4. Emissions are spatially disaggregated by the use of spatial surrogates as described in Section 2.3. These spatial surrogates are converted to a SMOKE-ready format as described in the SMOKE user's manual. Emissions for point sources are allocated to grid cells by SMOKE using the latitude and longitude coordinates reported for each stack.

3.4. Estimation of On-road Motor Vehicle Emissions

The EMFAC emissions model is used by ARB to assess emissions from on-road vehicles including cars, trucks, and buses in California, and to support air quality planning efforts to meet the Federal Highway Administration's transportation planning requirements. EMFAC is designed to produce county-level, average-day estimates. As a result, these estimates must be disaggregated spatially and temporally into gridded, hourly estimates for air quality modeling.

The general methodology used to disaggregate EMFAC emission estimates is a two-step approach. The first step uses the Direct Travel Impact Model (DTIM4) (Systems Applications Inc., 2001) to produce gridded, hourly emission estimates. The second step distributes EMFAC emissions according to the spatiotemporal output from DTIM. This methodology has been peer reviewed by the Institute of Transportation Studies at the University of California, Irvine, under CCOS contract 11-4CCOS.

The spatiotemporal allocation of emissions from DTIM does not vary dramatically with small changes in meteorological data (T/RH), resulting in a negligible monthly variation of the spatial surrogate. However, differences in DTIM's winter versus summer spatiotemporal allocation are slightly appreciable. Therefore, spatial surrogates are created for a winter and a summer day.

The most recent version of EMFAC, EMFAC2014, has three separate modules that are relevant for the preparation of the on-road emissions gridded inventory: one that estimates emissions, one that estimates emission rates, and one that estimates activity data. The emissions module is run for every county and every day of the modeled year using day-specific temperature and relative humidity. On a less granular level, the emissions rates module is run for every county for a summer day and a winter day. Lastly, the activity module is run once to estimates vehicle miles traveled (VMT), number of vehicle trips, fuel consumption, and the number of vehicles in use.

3.4.1. General Methodology: Mobile source emissions are sensitive to ambient temperature and humidity. Both EMFAC and DTIM account for meteorological effects using day-specific inputs. For EMFAC, hourly gridded temperature and humidity fields are averaged by county using a gridded VMT weighted average (i.e. weighted proportional to the VMT per grid cell in a county). DTIM accepts gridded, hourly data directly (CALMET formatted data). See Section 3.1 for more information.

EMFAC provides vehicle-class-specific emissions estimates for: exhaust, evaporative, tire wear, and brake wear emissions. EMFAC also produces estimates of: VMT, number of vehicle trips, fuel consumption, and the number of vehicles in use. More information on EMFAC can be found at (ARB-MSEI, 2015) . The vehicle activity is the most important input for spatiotemporal distribution of emissions. DTIM uses hourly vehicle miles traveled on each highway link and each of the vehicle trips in the modeling domain. The detailed vehicle activity data is obtained from ARB's Integrated Transportation Network (dtiv3) database.

The overall processing of on-road emissions to create the gridded emissions inventory can be seen in Figure 2. Activity data from the ITN (see Section3.4.2) is developed for the thirteen EMFAC 2007 vehicle types, but activity is split for gas and diesel, resulting in a total of 26 vehicle types as shown in the block diagram. The forecasted on-road modeling inventories are developed using the same methodology as the baseline year, where future year emissions are based on running EMFAC 2014 in Emissions Mode for the associated future year.

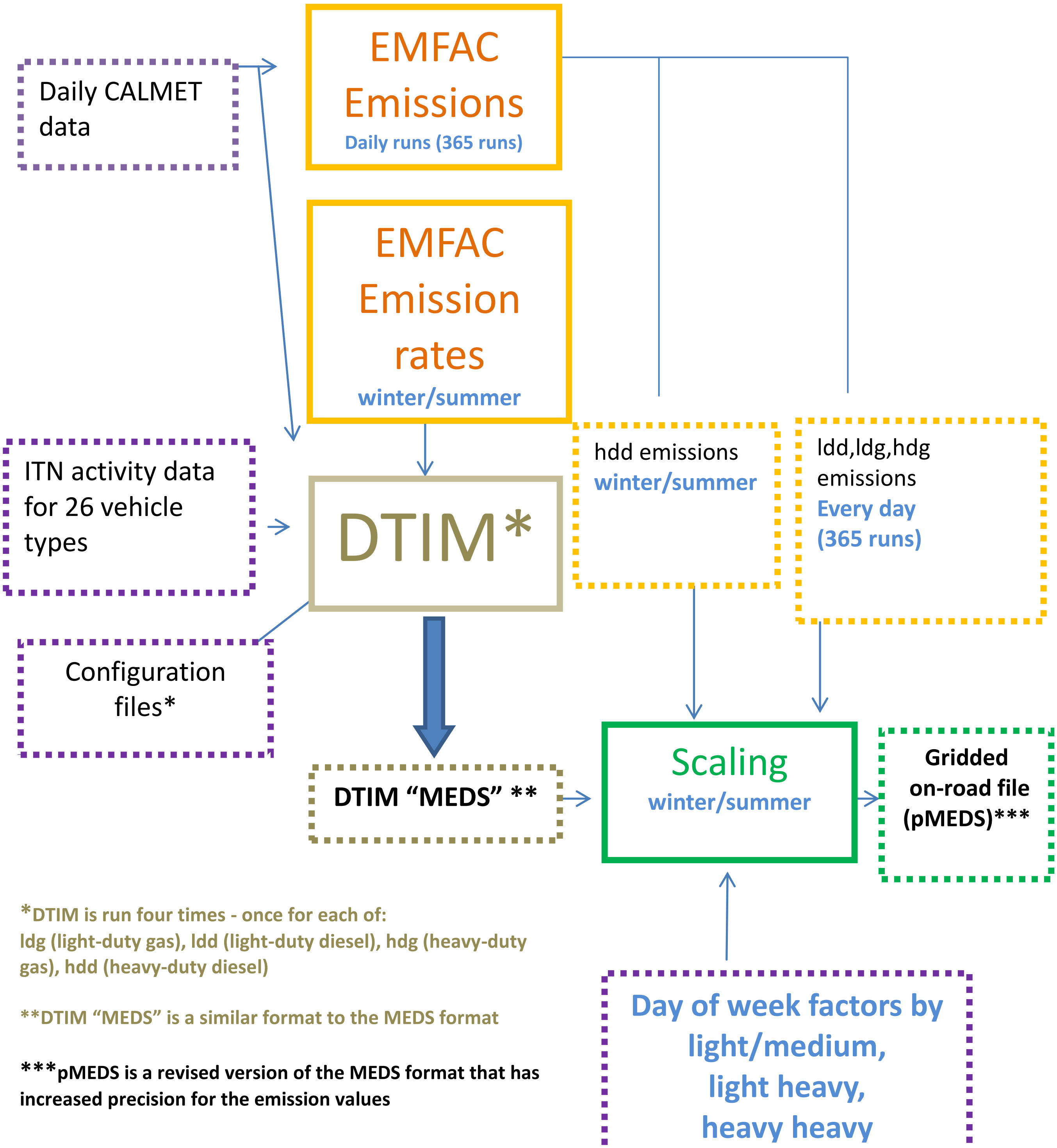

Figure 2 Block diagram for on-road processing

3.4.2. ITN Activity Data: The ITN is a database which is populated with link-based and Traffic Analysis Zone (TAZ)-based travel activity from travel demand models provided by different metropolitan planning organizations (MPOs), California Department of Transportation (Caltrans) and other California regional transportation planning agencies. The vintage and types of data used in the current version of the ITN are shown in Table 6. Different types of quality control parameters like vehicle mix, hourly distributions and post-mile coverage are obtained from default EMFAC and Caltrans databases. After these various pieces of data are imported to the database, the data can be examined for quality assurance. These input data sets are later moved into consolidated and geographically referenced master tables of link and TAZ activity data. Finally, these master tables are processed to produce hourly tables and hourly activity data input files for DTIM.

Table 6 Vintage of travel demand models for link based and traffic analysis zone

Metropolitan Planning Organizations	TDM Version Base year	Data types received	Data received on
AMBAG	2010	Links, Trips	06/15/2015
BCAG	2010	Links, Trips	05/13/2015
FCOG	2008	Links†	06/11/2015
CALTRANS	2010	Links, Trips	12/09/2014
KCOG	2010	Links†	06/11/2015
KCAG	2010	Links†	06/11/2015
MTC	2010	Links, Trips	03/23/2015
MCTC	2010	Links†	06/11/2015
MCAG	2010	Links, Trips	06/11/2015
SACOG	2010	Links, Trips	05/08/2014
SANDAG	2008	Links, Trips	12/09/2014
SBCAG	2010	Links, Trips	04/06/2015
SCAG	2008	Links, Trips	01/23/2014
SJCOG	2010	Links, Trips	06/11/2015
SLOCOG	2010	Links, Trips	12/19/2014
StanCOG	2010	Links, Trips	06/11/2015
SCRTPA	2010	Links, Trips	07/13/2015
TCAG	2010	Links†	06/11/2015
TMPO	2010	Links, Trips	04/02/2015

† Trips data from Caltrans Statewide Travel Demand model were used

3.4.3. Spatial Adjustment: The spatial allocation of county-wide EMFAC emissions is accomplished using gridded, hourly emission estimates from DTIM normalized by county. DTIM uses emission rates from EMFAC along with activity data, digitized roadway segments (links) and traffic analysis zone centroids to calculate gridded, hourly emissions for travel and trip ends. DTIM considers fewer vehicle categories than EMFAC outputs; therefore a mapping between EMFAC and DTIM vehicle categories is necessary. Categories of emissions after running DTIM are presented in Table 7. The categories are represented by the listed source classification codes (SCC) developed by ARB and depend on vehicle type, technology, and whether the vehicle is catalyst, non-catalyst, or diesel. Light- and medium-duty vehicles are separated from heavy-duty vehicles to allow for separate reporting and control strategy applications.

Table 7 DTIM Emission Categories

SCC for light and medium duty gas vehicles	SCC for heavy-duty gas vehicles	SCC for light-duty and medium-duty diesel vehicles	SCC for heavy-duty diesel vehicles	Description
202	302			Catalyst Start Exhaust
203	303			Catalyst Running Exhaust
204	304			Non-catalyst Start
205	305			Non-catalyst Running
206	306			Hot Soak
207	307			Diurnal Evaporatives
		808	408, 508	Diesel Exhaust
209	309			Running Evaporatives
210	310			Resting Evaporatives
211	311			Multi-Day Resting
212	312			Multi-Day Diurnal
213	313	813	413, 513, 613,	PM Tire Wear
214	314	814	414, 514, 614,	PM Brake Wear
215	315			Catalyst Buses
216	316			Non-catalyst Buses
		817	617, 717	Diesel Bus
218	318			Catalyst Idle
219	319			Non-catalyst Idle
		820	420, 520, 620,	Diesel Idle
221	321			PM Road Dust

DTIM and EMFAC2014 are both run using the 13 vehicle types shown in Table 8. In order to obtain better resolved spatiotemporal surrogates, the DTIM runs are split by light-duty (LDA, LDT1, LDT2, MDV, LHDT1, LHDT2, Urban Bus, MH, MCY) and heavy-duty (T6/T7 HHDT, SBUS, Other BUS) vehicle classes, and also by fuel type (gas, diesel). Each DTIM run outputs emissions for categories from 1-13; therefore, the mapping from Table 8 is used to preserve the spatial surrogates for each of the four DTIM runs. These codes depend on vehicle type, technology, and whether the vehicle is catalyst, non-catalyst, or diesel.

Table 8 Vehicle classification and type of adjustment

DTIM Category	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

3.4.4. Temporal Adjustment (Day-of-Week adjustments to EMFAC daily totals): EMFAC2014 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 ARB is a system that fuses available data sources to produce a “best estimate” of vehicle activity by class. The CalVAD data set includes actual daily measurements of VMT on the road network for 43 of the 58 counties in California. However, there are seven counties that 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 for each of the missing counties. The CalVAD fractions were developed for three categories of vehicles: passenger cars (LD), light- and medium-duty trucks (LM), and heavy-heavy duty trucks (HHDT). Table 8 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 work day. 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 week day. Thus, in the end, there are six daily fractions for each of the three vehicle classes, for all 58 counties. The DOW factors and vehicle type can be found in Appendix A: Day of week redistribution factors by vehicle type and county.

3.4.5. Temporal Adjustment (Hour-of-Day re-distribution of hourly travel network volumes): The travel networks provided by local transportation agencies and used with DTIM represent an hourly distribution for an average day. As for EMFAC, it is assumed that these average day-of-week hourly distributions represent hourly mid-week activities (i.e. for Tuesday, Wednesday, and Thursday). As such, they lack the temporal variations that are known to occur on other days of the week. To rectify this, the CalVAD data were used to develop hour-of-day profiles for Friday through Monday and a typical holiday. In a similar manner as the DOW factors, these hour-of-day profiles are used to re-allocate the hourly travel network distributions used in DTIM to Friday through Monday and a typical holiday. The hour-of-day profiles can be found in Appendix B: Hour of Day Profiles by vehicle type and county.

3.4.6. Summary of On-road Emissions Processing Steps: Eight general steps are used to spatially and temporally allocate EMFAC emissions by hour and grid cell:

1. Activity Data
   a. EMFAC is run in default mode for a single day to generate hourly activity data for each vehicle type and county: VMT, vehicle population, and number of vehicle trips. This is a single day's run, as EMFAC2014 yields the same hourly activity data for every day of the year.
   b. The activity data are used to generate various input files for ITN and DTIM, the general goal being to determine how much each activity belongs to each vehicle type through the day.

2. Road Network
   a. Pull a full copy of the California road network from the ITN database, using MPO inputs.
   b. Convert the ITN results to a form readable by DTIM.
   c. Apply travel network volumes by county hourly DOW fractions.

3. Meteorological Input Data
   a. Gridded, hourly temperature (T) and relative humidity (RH) are modeled using CALMET. Section 3.1 describes the development of these meteorological (met) data in more detail.
   b. Daily met files are prepared in formats readable by both EMFAC2014 and DTIM4.

4. EMFAC Emission Rates
   a. EMFAC is run in emissions rates mode (using monthly-average T and RH) to generate a look-up table of on-road mobile source emission rates by speed, temperature, and relative humidity for each county. These results are created on a monthly-average basis to save processing time.
   b. The emissions rates are pulled from the EMFAC database and reformatted in the DTIM-ready IRS file format.

5. EMFAC Emissions
   a. EMFAC is run in emissions mode (using day-specific T and RH) to provide county-wide on-road mobile source emission estimates by day and hour for EMFAC categories.
   b. These results are saved for later use.

6. DTIM
   a. DTIM is run for one week (five representative days since Tuesday, Wednesday and Thursday are treated as a single day) and one holiday in the summer and in the winter.
   b. Convert the DTIM output results into MEDS format for further processing.

More details on the DTIM and scaling processing can be found in the Appendix C.

7. Scale EMFAC Emissions Using DTIM
   a. For each day of EMFAC emissions, the closest day-of-week matching DTIM file is chosen for scaling.
   b. The daily, county-wide EMFAC emissions are distributed spatially and temporally using the DTIM MEDS files as surrogates, as shown by the equation:

$$E_{P,ij,hr,cat} = \frac{EF_{P,cat} \times DTIM_{P,ij,hr,cat}}{DTIM_{P,daily,cat,cnty}}$$

where:

E = grid cell emissions
EF = EMFAC emissions
DTIM = DTIM emissions
p = pollutant
i,j = grid cell
hr = hourly emissions
cat = emission category
daily = daily emissions
cnty = county

   c. Finally, the Caltrans day-of-week factors are applied to the gridded, hourly emissions to better match traffic patterns.

8. Final Formatting
   a. The final step of on-road emissions processing is to convert the gridded, hourly emissions data to a NetCDF file usable by the CMAQ (U.S. EPA, 2015) photochemical model.

3.5. Estimation of Gridded Biogenic Emissions

Biogenic emissions were estimated using the Model of Emissions of Gases and Aerosols from Nature (MEGAN) version 2.04 (Guenther, et al., 2006). MEGAN estimates biogenic emissions as a function of normalized emission rates (i.e. emission rates at standard conditions), which are adjusted to reflect variations in temperature, light, leaf area index (LAI), and leaf age (estimated from changes in LAI). The default MEGAN input databases for emission factors (EFs), plant functional types (PFTs), and LAI are not used in the application of MEGAN in California. Instead, California-specific emission factor and PFT databases were translated from those used in the Biogenic Emission Inventory GIS (BEIGIS) system (Scott & Benjamin, 2003) to improve emission estimates and to maintain consistency with previous California biogenic emission inventories. LAI data were derived from the MODIS 8-day LAI satellite product. Hourly surface temperatures were from observations gridded with the CALMET meteorological model and insolation data was provided by the WRF meteorological fields, as discussed in Section 3.1. Emissions of isoprene, monoterpenes, and methylbutenol were estimated from California-specific gridded emission factor data, while emissions of sesquiterpenes, methanol, and other volatile organic compounds were estimated from California-specific PFT data and PFT-derived emission rates.

MEGAN emissions estimates for California were evaluated during the California Airborne BVOC Emission Research in Natural Ecosystems Transects (CABERNET) field campaign in 2011 (Karl, et al., 2013), (Misztal, et al., 2014) and were shown to agree to within +/-20% of the measured fluxes (Misztal, et al., 2015), which is well within the stated model uncertainty of 50%.

3.6. Estimation of Other Day-Specific Sources

Day-specific data were used for preparing base case inventories when data were available. ARB and district staffs were able to gather hourly/daily emission information for 1) wildfires and prescribed burns and 2) agricultural burns in six districts. Additionally, emissions in future years were removed for facilities that have closed after 2012.

For the reference and future year inventories, which are used to calculate Relative Response Factors (RRFs), day-specific emissions for wildfires, prescribed burns, and wildland fires use (WFU) are left out of the inventory. All other day-specific data are included in both reference and future year modeling inventories.

3.6.1. Wildfires and Prescribed Burns: Day-specific, base case estimates of emissions from wildfires and prescribed fires were developed in a two-part process. The first part consisted of estimating micro-scale, fire-specific emissions (i.e. at the fire polygon scale, which can be at a smaller spatial scale than the grid cells used in air quality modeling). The second part consisted of several steps of post-processing fire polygon emission estimates into gridded, hourly emission estimates that were formatted for use in air quality modeling.

Fire event-specific emissions were estimated using a combination of geospatial databases and a federal wildland fire emission model, first described in (Clinton, et al., 2006). A series of pre-processing steps were performed using a Geographic Information System (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 (fire12_1.gdb, downloaded June 4, 2013) maintained by the Fire and Resource Assessment Program (FRAP) of the California Department of Forestry and Fire Protection (CALFIRE) provided georeferenced information on the location, size (area), spatial shape, and timing of wildfires and prescribed burns. (Under interagency Memorandums of Understanding, federal, state, and local agencies report California wildfire and prescribed burning activity data to FRAP.) Using GIS software, fire polygons were overlaid upon a vegetation fuels raster dataset called the Fuel Characteristic Classification System (FCCS) (Ottmar, et al., 2007). The FCCS maps vegetation fuels at a 30 meter spatial resolution, and is maintained and distributed by LANDFIRE.GOV, a state and federal consortium of wildland fire and natural resource management agencies. With spatial overlay of fire polygons upon the FCCS raster, fuel model codes were retrieved and component areas within each fire footprint tabulated. For each fuel code, loadings (tons/acre) for fuel categories were retrieved from a FOFEM look-up table. Fuel categories included dead woody fuel size classes, overstory live tree crown, understory trees, shrubs, herbaceous vegetation, litter and duff. Fuel moisture values for each fire were estimated by overlaying fire polygons on year- and month-specific 1 km spatial resolution fuel moisture raster files generated from the national Wildland Fire Assessment System (WFAS.net) and retrieving moisture values from fire polygon centroids. Fire event-specific fuel loads and fuel moisture values were compiled and formatted to a batch input file and run through FOFEM.

A series of post-processing steps were performed on the FOFEM batch output to include emission estimates (pounds/acre) for three supplemental pollutant species (NH_3, TNMHC and N_2O) in addition to the seven species native to FOFEM (CO, CO_2, $PM_{2.5}$, PM_{10}, CH_4, NO_x, SO_2), and to calculate total emissions (tons) by pollutant species for each fire. Emission estimates for NH_3, TNMHC and N_2O were based on mass ratios to emitted CO and CO_2 (Gong, et al., 2003)

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

Another set of post-processing steps were applied to allocate fire polygon emissions by date and hour of the day. Fire polygon emissions were allocated evenly between fire start and end dates, taken from the fire perimeters geodatabase. Daily emissions were then allocated to hour of day and to the model grid cells and distributed vertically using a method developed by the Western Regional Air Partnership (WRAP), which specifies a pre-defined diurnal temporal profile, plume bottom and plume top for each fire. (WRAP, 2005)

3.6.2. Agricultural Burning: Agricultural burning day-specific emission estimations were incorporated into the inventory for the following areas:

Imperial

Imperial County Air Pollution Control District provided information needed to calculate emissions from agricultural and prescribed burning for each day of 2012 when agricultural burning occurred. Using the same methodology as San Joaquin Valley, emissions were estimated for the burning of field crops and weed abatement. The location of each burn was converted to latitude/longitude based on the nearest crossroads provided by the burn permit holder, then ultimately to grid cell. Burning was assumed to occur over four hours from 11:00 a.m. to 3:00 p.m.

San Joaquin Valley

The San Joaquin Valley Air Pollution Control District estimated emissions for each day of 2012 when agricultural burning occurred. Emissions were estimated for the burning of prunings, field crops, weed abatement and other solid fuels. Information needed to estimate emissions came from the district's Smoke Management System, which stores information on burn permits issued by the district. In order to obtain a daily burn authorization, the person requesting the burn provides information to the district, including the acres and type of material to be burned, the specific location of the burn and the date of the burn. Acres are converted to tons of fuel burned using a fuel loading factor based on the specific crop to be burned. Emissions are calculated by multiplying the tons of fuel burned by a crop-specific emission factor. More information can be found in (ARB-Miscellaneous Methodologies, 2013).

To determine the location of the burn, district staff created spatial allocation factors for each 4 kilometer grid cell used in modeling. These factors were developed for "burn zones" in the San Joaquin Valley based on the agricultural land coverage. Daily emissions in each "agricultural burn zone" were then distributed across the zone/grid cell combinations using the spatial allocation factors. Emissions were summarized by grid cell and day.

Burning was assumed to occur over three hours from 10:00 a.m. to 1:00 p.m., except for two categories. Orchard removals were assumed to burn over eight hours from 10:00 a.m. to 6:00 p.m. Vineyard removals were assumed to burn over five hours from 10:00 a.m. to 3:00 p.m.

Ventura

Ventura County Air Pollution Control District provided emissions in Ventura County from agricultural burning for each day of 2012 when agricultural burning occurred. Using the same methodology as San Joaquin Valley, emissions were estimated for the burning of prunings, field crops, weed abatement, range improvement and prescribed burns not included in the wildfires / prescribed burns discussed in the San Joaquin Valley portion of Section 3.6.4. Information needed to estimate emissions came from burn permits issued by the district. In order to obtain a burn permit, the person requesting the burn provides information to the district, including the acres to be burned, the specific location of the burn and the date of the burn. Acres are converted to tons of fuel burned using a fuel loading factor based on the specific crop to be burned. Emissions are calculated by multiplying the tons of fuel burned by a crop-specific emission factor. The location of the burn was converted to latitude/longitude based on the address or description of location provided by the burn permit holder, then ultimately to grid cell. Burning was assumed to occur over three hours from 9:00 a.m. to 12:00 p.m.

3.6.3. Closed Facilities: Emissions in future years were removed for facilities that have closed beyond the baseline year. In other words, the emissions were removed from future year inventories for a facility that was included in the 2012 inventory but stopped operating after 2012. Local air district staffs provided the lists of facilities.

4. Quality Assurance of Modeling Inventories

As mentioned in Section 1.3, base case modeling is intended to demonstrate confidence in the modeling system. Quality assurance of the data is fundamental in order to detect any possible outliers and potential problems with emission estimates.

The most important quality assurance checks of the modeling emissions inventory are summarized in the following sections.

4.1. Area and Point Sources

Before utilizing SMOKE to process the annual emissions totals into temporally, chemically, and spatially-resolved emissions inventories for photochemical modeling, all SMOKE inputs are subject to extensive quality assurance procedures performed by ARB staff. Annual and forecasted emissions are carefully reviewed before input into SMOKE. ARB and district staff review data used to calculate emissions along with other associated data, such as the location of facilities and assignment of SCC to each process. Growth and control information are reviewed and updated as needed.

The next check is to compare annual average emissions from CEPAM with planning inventory totals to ensure data integrity. The planning and modeling inventories start with the same annual average emissions. The planning inventory is developed for an average summer day and an average winter day, whereas the modeling inventory is developed by month. Both inventory types use the same temporal data described in Section 2.2. The summer planning inventory uses the monthly throughputs from May through October. Similarly, the winter planning inventory uses the monthly throughputs from November through April. The modeling inventory produces emissions for a weekday, Saturday and Sunday for each month.

Annual emissions totals are plotted using the same gridding inputs as used in SMOKE in order to visually inspect and analyze the spatial allocation of emissions independent of temporal allocation and chemical speciation. Spatial plots by source category like the one shown in Figure 3 are carefully screened for proper spatial distribution of emissions.

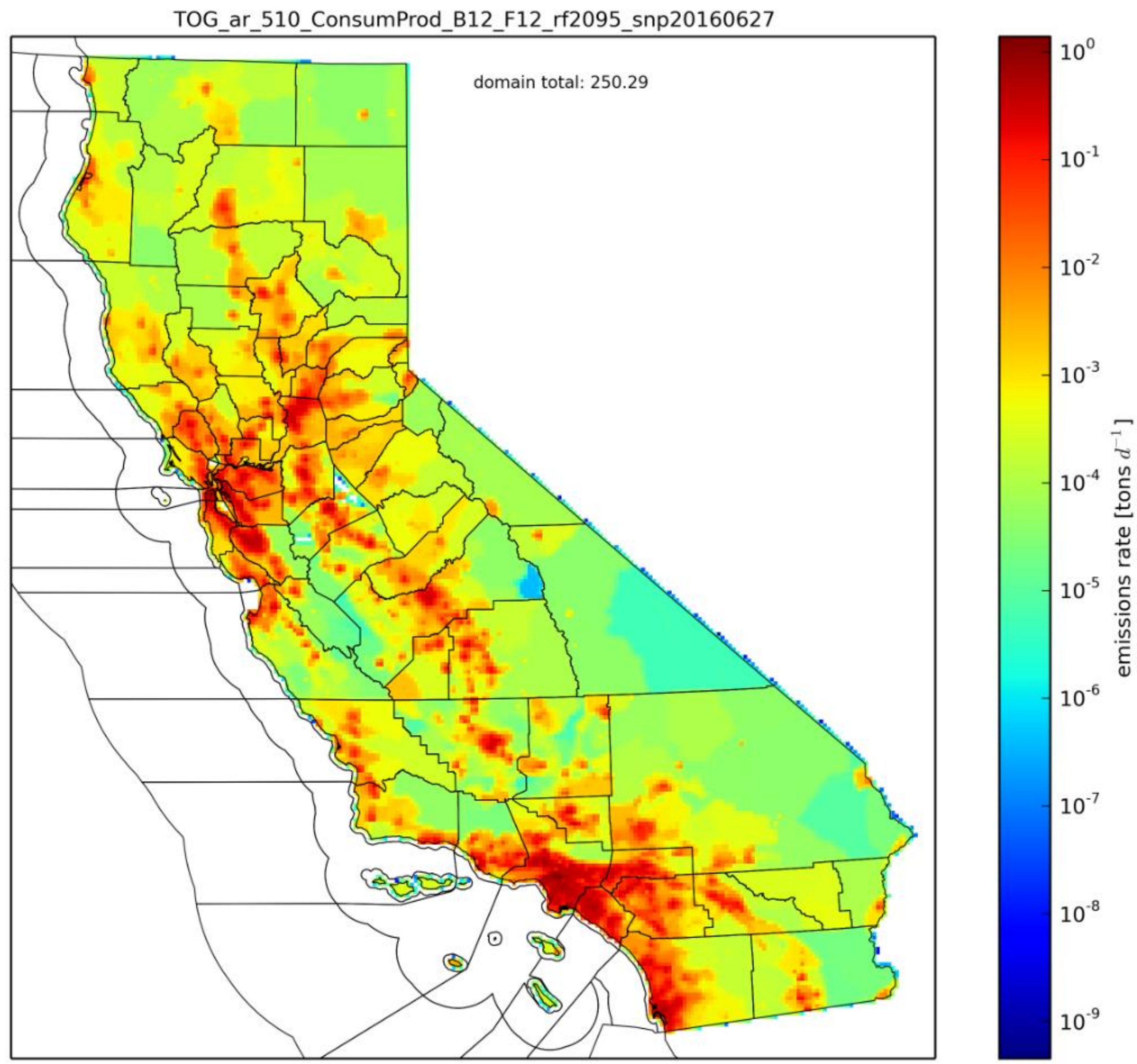

Figure 3 Example of a spatial plot by source category

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. ARB staff utilize the SMOKE reports by checking emissions totals by source category and region, creating and analyzing time series plots, and comparing aggregate emissions totals with the pre-SMOKE emissions totals obtained from CEPAM. A screenshot capture of a portion of such report can be seen in Figure 4.

```
# Processed as Area sources
# Base inventory year      2012
# No gridding matrix applied
# No speciation matrix applied
# Temporal factors applied for episode from
#      Wednesday Aug. 8, 2012   at 080000 to
#      Thursday Aug. 9, 2012   at 080000
# Annual total data basis in report
#          ,             ,                     , [tons/day]    , [tons/day]    , [tons/day]    , [tons/day]    , [tons/day]    , [tons/day]
#Date      , Region      , SCC                 , CO            , NOX           , TOG           , NH3           , SOX           , PM
 08/09/2012, 0LC006017LAK, 00000005204212000010,    0.19098E-01,   0.46288E-01,   0.44956E-02,   0.00000E+00,   0.16055E-03,   0.16051E-02
 08/09/2012, 0LC006017LAK, 00000005204212000011,    0.94908E-02,   0.21052E-01,   0.30532E-02,   0.00000E+00,   0.00000E+00,   0.11252E-02
 08/09/2012, 0LC006017LAK, 00000011011003000000,    0.00000E+00,   0.00000E+00,   0.00000E+00,   0.63987E-03,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000012012202420000,    0.00000E+00,   0.00000E+00,   0.00000E+00,   0.29915E-01,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000019917002400000,    0.00000E+00,   0.00000E+00,   0.00000E+00,   0.13904E-01,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000021020033000000,    0.00000E+00,   0.00000E+00,   0.13736E-01,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000021020081500000,    0.00000E+00,   0.00000E+00,   0.31439E-02,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000022020405000000,    0.00000E+00,   0.00000E+00,   0.31245E-01,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000022020430220000,    0.00000E+00,   0.00000E+00,   0.72951E-03,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000022020430830000,    0.00000E+00,   0.00000E+00,   0.36475E-03,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000022020432040000,    0.00000E+00,   0.00000E+00,   0.36475E-03,   0.00000E+00,   0.00000E+00,   0.00000E+00
```

Figure 4 Screen capture of a SMOKE-generated QA report

4.1.1. Area and Point Sources Temporal Profiles: Checks for missing or invalid temporal assignments are conducted to ensure accurate temporal allocation of emissions. Special attention is paid to checking monthly throughputs and appropriate monthly temporal distribution of emissions for each source category. In addition, checks for time-invariant temporal assignments are done for certain source categories and suitable alternate temporal assignments are determined and applied. For the agricultural source sector (e.g. agricultural pesticides/fertilizers, farming operations, fugitive windblown dust, managed burning and disposal, and farm equipment), replacement temporal assignments are extracted from the Agricultural Emissions Temporal and Spatial Allocation Tool (AgTool). (Anderson, et al., 2012). The AgTool is a database management system capable of temporally and spatially allocating emissions from the agricultural source sector. It was developed by Sierra Research, Inc. and its subcontractor Alpine Geophysics, LLC along with collaboration from ARB and the San Joaquin Valley Air Pollution Control District (SJVAPCD). Temporal allocation data outputs from the AgTool, were compiled using input data provided by the UC Cooperative Extension, U.S. Department of Agriculture (USDA), and the CA Department of Pesticide Regulation (DPR).

Further improvements to temporal profiles used in the allocation of area source emissions are performed using suitable alternate temporal assignments determined by ARB 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.

4.2. On-road Emissions

There are several processes to conduct quality assurance of the on-road mobile source modeling inventory at various stages of the inventory processing. The specific steps taken are described below:

1. Generate an ITN spatial plot to check if there were any missing network activities.
2. Generate a time series plot for each county to check the diurnal pattern of network activities.
3. Generate time series plots for the DTIM output files by county and by SCC to check the diurnal pattern.
4. Generate time series plots for the on-road mobile source files after scaling to EMFAC 2014 emissions (MEDS files) by county and SCC to check the diurnal pattern.
5. Compare the statewide daily total emissions for the MEDS files and the EMFAC 2014 emissions files to ensure that the emissions are the same.
6. Generate the spatial plot for the MEDS file to check if there were any missing emissions.
7. Generate time series and spatial plots again to check the final MEDS files.

4.3. Day-specific Sources

4.3.1. Wildfires and Prescribed Burns: To check for potential wildfire activity data gaps in the CALFIRE interagency fire perimeters geodatabase, staff examined geospatial fire activity data reported in the national Geospatial Multi-Agency Coordination (www.geomac.gov) wildland fire geodatabase. California wildfires reported to GeoMAC were accounted for in the CALFIRE geodatabase.

Prescribed burns are performed by land and fire management agencies primarily to reduce wildfire risk to local communities associated with high loads of vegetation fuels in adjacent wildlands. Vegetation is burned during winter, in-situ or in piles following mechanical treatment. Public land management agencies also perform prescribed burning to restore the natural role of fire in selected ecosystems. To check for potential prescribed burn activity data gaps in the CALFIRE interagency fire perimeters geodatabase, staff queried data for calendar year 2012 reported to ARB's Prescribed Fire Information Reporting System (PFIRS) (https://ssl.arb.ca.gov/pfirs/index.php). Staff discovered that CALFIRE data accounted for 38 prescribed burn projects, while PFIRS reported 453 projects. Only one burn project was accounted for in both datasets. Burn project area for CALFIRE data totaled approximately 3,780 acres, while burned acres reported to PFIRS totaled 9,097 acres. Burn projects reported to PFIRS were located in the Sierra Nevada Mountains and northern Coast Range.

Records for 651 prescribed wildland burn events reported for 2012 were downloaded from PFIRS and imported to a geodatabase. Data fields included event ("Unit") name, burned area, latitude/longitude, start and end dates. A series of geoprocessing steps were used to map and overlay prescribed burns as points on the statewide vegetation fuels (FCCS) and moisture raster datasets, to retrieve associated fuel loadings and moisture values for use as input to FOFEM. Prescribed burn points were also overlayed on the statewide 4-km modeling grid to assign grid cell IDs to each burn. Emission estimates for each prescribed burn event were generated by FOFEM and summarized in an Access database.

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

4.4. Additional QA

In addition to the QA 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 3.4; since weekend travel is generally less than weekday travel, modeling inventory emissions are usually lower when compared to annual average inventories from CEPAM. Figure 5 provides a screen capture of a report that summarizes different emission categories for San Luis Obispo County. Please note that this table is only an example since emissions have been updated from what is displayed here.

County:***40*** Spec:***NOx***

EIC	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	CEPAM	Difference
10	electric utilities	0.12	0.11	0.1	0.06	0.09	0.13	0.13	0.16	0.14	0.16	0.14	0.13	0.12	0.12	0.00
20	cogeneration	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.00
30	oil and gas production (combustion)	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.00
40	petroleum refining (combustion)	0.3	0.3	0.26	0.3	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.26	0.31	0.31	0.00
50	manufacturing and industrial	0.06	0.06	0.06	0.06	0.07	0.06	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.00
52	food and agricultural processing	0.19	0.19	0.19	0.34	0.34	0.34	0.38	0.38	0.38	0.18	0.18	0.18	0.27	0.27	0.00
60	service and commercial	0.91	0.92	0.92	0.92	0.92	0.9	0.9	0.91	0.91	0.91	0.92	0.91	0.91	0.91	0.00
99	other (fuel combustion)	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.00
110	sewage treatment	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
120	landfills	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
130	incinerators	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
140	soil remediation	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
199	other (waste disposal)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
210	laundering	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
220	degreasing	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
230	coatings and related process solvents	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
240	printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
250	adhesives and sealants	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
299	other (cleaning and surface coatings)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
310	oil and gas production	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
320	petroleum refining	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
330	petroleum marketing	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
399	other (petroleum production and marketing)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
410	chemical	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
420	food and agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
430	mineral processes	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.00
440	metal processes	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
450	wood and paper	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
460	glass and related products	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
470	electronics	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
499	other (industrial processes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
510	consumer products	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
520	architectural coatings and related process sol	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
530	pesticides/fertilizers	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
540	asphalt paving / roofing	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
610	residential fuel combustion	0.73	0.73	0.68	0.65	0.57	0.57	0.57	0.57	0.57	0.65	0.7	0.73	0.64	0.64	0.00
620	farming operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
630	construction and demolition	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
640	paved road dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
645	unpaved road dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
650	fugitive windblown dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
660	fires	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
670	managed burning and disposal	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00
690	cooking	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
699	other (miscellaneous processes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
700	on-road vehicles	9.34	9.32	9.36	9.17	9.06	8.81	8.69	8.77	8.63	8.79	9.3	9.23	9.04	9.60	0.56
810	aircraft	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00
820	trains	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.93	0.74
830	ships and commercial boats	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
833	ocean going vessels	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.52	0.29
835	commercial harbor craft	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	0.83	-0.29
840	recreational boats	0.05	0.05	0.17	0.18	0.16	0.47	0.46	0.43	0.12	0.11	0.11	0.06	0.2	0.20	0.00
850	off-road recreational vehicles	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.00
860	off-road equipment	1.08	1.24	1.21	1.24	1.25	1.28	1.25	1.25	1.28	1.21	1.19	1.12	1.21	1.21	0.00
870	farm equipment	1.08	1.22	1.72	1.77	2.21	2.21	2.16	2.21	2.17	1.52	1.14	1.06	1.71	1.71	0.00
890	fuel storage and handling	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
920	geogenic sources	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
***	Total	26.78	27.05	27.59	27.61	27.93	28.05	27.88	28.01	27.55	26.87	27.01	26.67	27.42	28.73	1.31

Notes:

CEPAM refers to annual average emissions from 2016 SIP Baseline Emission Inventory Tool with external adjustments: http://outapp.arb.ca.gov/cefs/2016oz

Monthly gridded emissions comes from GeoVAST mo-yr/avg tabular summary - gid 319

On-road vehicles: The modeling inventory adjusts on-road by day of week as well as day-specific temperatures and relative humidity - Fridays are higher wit
time series plots shows weekdays are ~9-10 tpd

Trains: The modeling inventory reflects the revised locomotive emissions; the planning inventory reflects the previous emission estimates

OGV model produces gridded OGV emissions, which can vary from planning inventory (these emissions include OC1 and OC2 offshore air basins)

CHC The modeling inventory reflects the revised commercial harbor craft emissions; the planning inventory reflects the previous emission estimates

Figure 5 Screenshot of comparison of inventories report

Staff also review how modeling emissions vary over a year. Figure 6 provides an example of a modeling inventory time series plot for San Luis Obispo County for area-wide sources, on-road sources and off-road sources. Again, this figure is <u>only an example</u>.

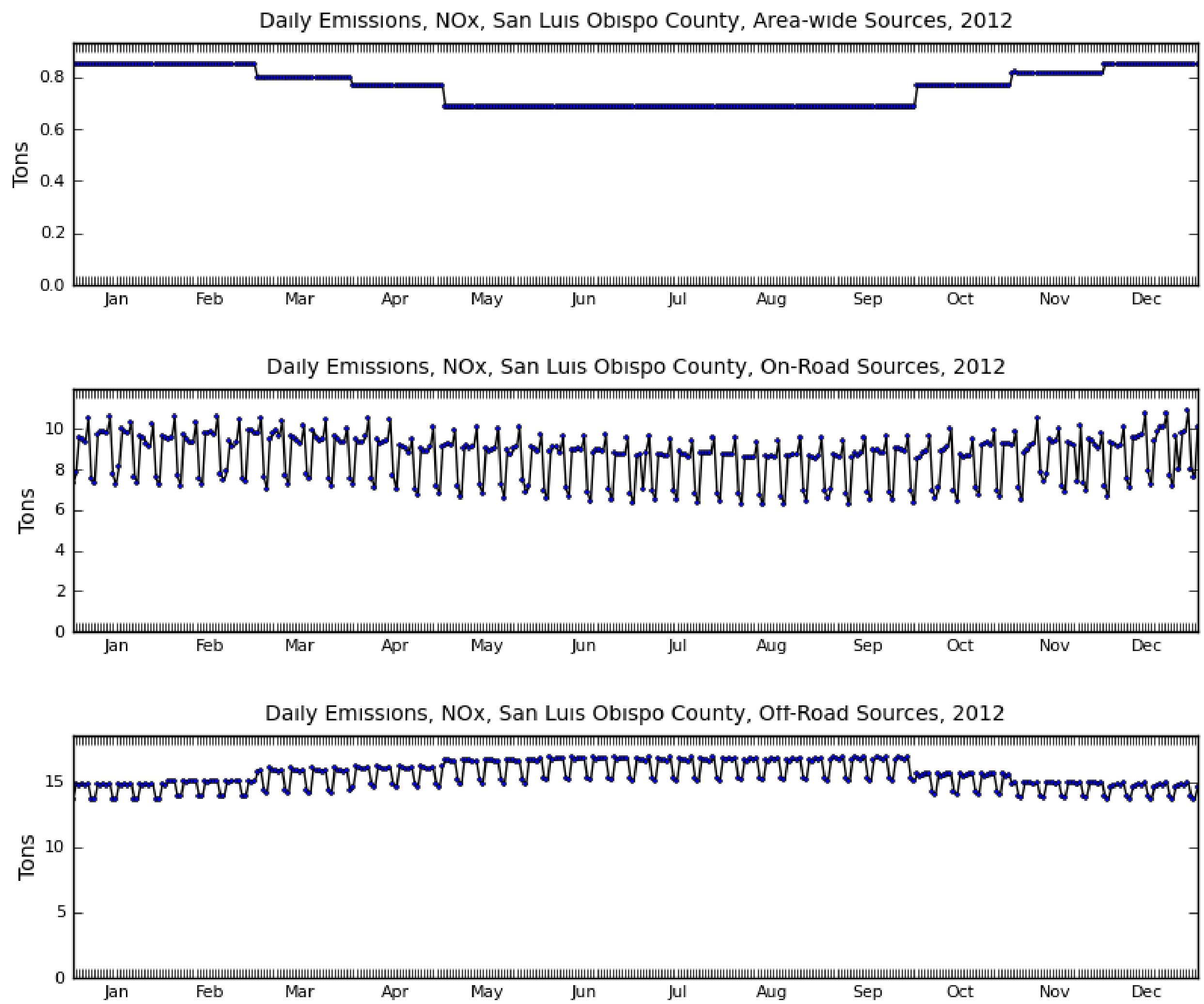

Figure 6 Daily variation of NOx emissions for mobile sources for San Luis Obispo

4.5. Model ready files QA

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 ARB staff on the intermediate emissions files (e.g. MEDS, SMOKE-generated reports), however, further checks are needed to ensure data integrity is preserved when the model-ready emissions files are generated from those intermediate emissions files.

Comparisons of the totals for both the intermediate and model-ready emissions files are made. Emissions totals are aggregated spatially, temporally, and chemically to single-layer, statewide, daily values by inventory pollutant. Spatial plots are also generated for both the intermediate and model-ready emissions files using the same graphical utilities and aggregated to the same spatial, temporal, and chemical resolution to allow equal comparison of emissions. Any discrepancies in the emissions totals are reconciled before proceeding with the development of the model-ready inventory emissions files.

Before combining the model-ready emissions files of the individual source category inventories into a single model-ready inventory, they are checked for completeness. Day-specific source inventories (when necessary) should have emissions for every day in the modeling period. Likewise, source inventories with emissions files that use averaged temporal allocation (e.g. day-of-week, weekday/weekend, monthly) should have model-ready emissions files to represent every day in the modeling period. In particular, it is important that during these checks source inventories with missing files are identified and resolved. Once all constituent source inventories are complete, they are used to develop the model-ready inventory used in photochemical modeling. When the modeling inventory files are generated, log files are also generated documenting what each daily model-ready emissions file is comprised of as an additional means of verifying that each daily model-ready inventory is complete.

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Appendix A: Day of week redistribution factors by vehicle type and county

The factors shown in Table 9 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 9 Day of week adjustment by vehicle class and county

County	Day of Week	LD	LM	HH
Alameda	Sunday	0.797	0.496	0.324
Alameda	Monday	0.948	0.919	0.893
Alameda	Tues/Wed/Thurs	1	1	1
Alameda	Friday	1.051	1.014	0.959
Alameda	Saturday	0.929	0.618	0.369
Alameda	Holiday	0.797	0.866	0.829
Alpine	Sunday	1.201	0.821	0.415
Alpine	Monday	1.007	0.945	0.908
Alpine	Tues/Wed/Thurs	1	1	1
Alpine	Friday	1.247	1.082	1.007
Alpine	Saturday	1.219	0.803	0.442
Alpine	Holiday	1.118	0.935	0.832
Amador	Sunday	1.201	0.821	0.415
Amador	Monday	1.007	0.945	0.908
Amador	Tues/Wed/Thurs	1	1	1
Amador	Friday	1.247	1.082	1.007
Amador	Saturday	1.219	0.803	0.442
Amador	Holiday	1.118	0.935	0.832
Butte	Sunday	0.651	0.442	0.41
Butte	Monday	0.964	0.96	0.871
Butte	Tues/Wed/Thurs	1	1	1
Butte	Friday	1.008	1.015	0.962
Butte	Saturday	0.771	0.604	0.503
Butte	Holiday	0.73	0.657	0.606
Calaveras	Sunday	1.201	0.821	0.415
Calaveras	Monday	1.007	0.945	0.908
Calaveras	Tues/Wed/Thurs	1	1	1
Calaveras	Friday	1.247	1.082	1.007
Calaveras	Saturday	1.219	0.803	0.442
Calaveras	Holiday	1.118	0.935	0.832
Colusa	Sunday	0.651	0.442	0.41
Colusa	Monday	0.964	0.96	0.871
Colusa	Tues/Wed/Thurs	1	1	1
Colusa	Friday	1.008	1.015	0.962
Colusa	Saturday	0.771	0.604	0.503
Colusa	Holiday	0.73	0.657	0.606
Contra Costa	Sunday	0.779	0.519	0.376
Contra Costa	Monday	0.943	0.927	0.873
Contra Costa	Tues/Wed/Thurs	1	1	1
Contra Costa	Friday	1.048	1.023	0.982
Contra Costa	Saturday	0.924	0.665	0.471
Contra Costa	Holiday	0.788	0.827	0.799
Del Norte	Sunday	0.85	0.493	0.326
Del Norte	Monday	0.961	0.95	0.915
Del Norte	Tues/Wed/Thurs	1	1	1
Del Norte	Friday	1.031	1.004	0.932
Del Norte	Saturday	0.924	0.619	0.376
Del Norte	Holiday	0.77	0.619	0.527
El Dorado	Sunday	0.972	0.668	0.602
El Dorado	Monday	0.988	0.977	0.943
El Dorado	Tues/Wed/Thurs	1	1	1
El Dorado	Friday	1.178	1.101	0.963
El Dorado	Saturday	1.037	0.786	0.575
El Dorado	Holiday	0.971	0.933	0.921
Fresno	Sunday	0.851	0.443	0.396
Fresno	Monday	1.016	0.934	0.878
Fresno	Tues/Wed/Thurs	1	1	1
Fresno	Friday	1.155	1.026	0.927

County	Day of Week	LD	LM	HH
Fresno	Saturday	0.946	0.563	0.478
Fresno	Holiday	0.799	0.774	0.784
Glenn	Sunday	0.651	0.442	0.41
Glenn	Monday	0.964	0.96	0.871
Glenn	Tues/Wed/Thurs	1	1	1
Glenn	Friday	1.008	1.015	0.962
Glenn	Saturday	0.771	0.604	0.503
Glenn	Holiday	0.73	0.657	0.606
Humboldt	Sunday	0.85	0.493	0.326
Humboldt	Monday	0.961	0.95	0.915
Humboldt	Tues/Wed/Thurs	1	1	1
Humboldt	Friday	1.031	1.004	0.932
Humboldt	Saturday	0.924	0.619	0.376
Humboldt	Holiday	0.77	0.619	0.527
Imperial	Sunday	1.082	0.608	0.396
Imperial	Monday	1.004	0.931	0.948
Imperial	Tues/Wed/Thurs	1	1	1
Imperial	Friday	1.109	1.161	0.983
Imperial	Saturday	1.065	0.687	0.522
Imperial	Holiday	1.024	0.814	0.673
Inyo	Sunday	1.201	0.821	0.415
Inyo	Monday	1.007	0.945	0.908
Inyo	Tues/Wed/Thurs	1	1	1
Inyo	Friday	1.247	1.082	1.007
Inyo	Saturday	1.219	0.803	0.442
Inyo	Holiday	1.118	0.935	0.832
Kern	Sunday	1.114	0.63	0.416
Kern	Monday	1.061	0.942	0.849
Kern	Tues/Wed/Thurs	1	1	1
Kern	Friday	1.253	1.044	0.9
Kern	Saturday	1.1	0.734	0.535
Kern	Holiday	0.986	0.911	0.837
Kings	Sunday	0.663	0.358	0.355
Kings	Monday	0.961	0.909	0.89
Kings	Tues/Wed/Thurs	1	1	1
Kings	Friday	1.045	0.982	0.947
Kings	Saturday	0.807	0.52	0.454
Kings	Holiday	0.669	0.665	0.758
Lake	Sunday	0.85	0.493	0.326
Lake	Monday	0.961	0.95	0.915
Lake	Tues/Wed/Thurs	1	1	1
Lake	Friday	1.031	1.004	0.932
Lake	Saturday	0.924	0.619	0.376
Lake	Holiday	0.77	0.619	0.527
Lassen	Sunday	0.941	0.703	0.587
Lassen	Monday	0.993	0.942	0.798
Lassen	Tues/Wed/Thurs	1	1	1
Lassen	Friday	1.094	1.07	0.882
Lassen	Saturday	0.962	0.766	0.658
Lassen	Holiday	0.968	0.744	0.608
Los Angeles	Sunday	0.858	0.489	0.398
Los Angeles	Monday	0.973	0.936	0.878
Los Angeles	Tues/Wed/Thurs	1	1	1
Los Angeles	Friday	1.047	1.005	0.918
Los Angeles	Saturday	0.979	0.641	0.509
Los Angeles	Holiday	0.863	0.808	0.801
Madera	Sunday	1.017	0.478	0.4
Madera	Monday	1.024	0.942	0.902
Madera	Tues/Wed/Thurs	1	1	1
Madera	Friday	1.176	1.022	0.96
Madera	Saturday	1.105	0.602	0.476
Madera	Holiday	0.866	0.833	0.832
Marin	Sunday	0.779	0.519	0.376
Marin	Monday	0.943	0.927	0.873
Marin	Tues/Wed/Thurs	1	1	1
Marin	Friday	1.048	1.023	0.982
Marin	Saturday	0.924	0.665	0.471
Marin	Holiday	0.788	0.827	0.799
Mariposa	Sunday	1.201	0.821	0.415
Mariposa	Monday	1.007	0.945	0.908
Mariposa	Tues/Wed/Thurs	1	1	1
Mariposa	Friday	1.247	1.082	1.007
Mariposa	Saturday	1.219	0.803	0.442
Mariposa	Holiday	1.118	0.935	0.832

County	Day of Week	LD	LM	HH
Mendocino	Sunday	0.85	0.493	0.326
Mendocino	Monday	0.961	0.95	0.915
Mendocino	Tues/Wed/Thurs	1	1	1
Mendocino	Friday	1.031	1.004	0.932
Mendocino	Saturday	0.924	0.619	0.376
Mendocino	Holiday	0.77	0.619	0.527
Merced	Sunday	1.002	0.593	0.421
Merced	Monday	1.009	0.958	0.904
Merced	Tues/Wed/Thurs	1	1	1
Merced	Friday	1.185	1.103	0.97
Merced	Saturday	1.055	0.713	0.477
Merced	Holiday	0.977	0.897	0.797
Modoc	Sunday	1.133	0.801	0.638
Modoc	Monday	1.159	0.961	0.634
Modoc	Tues/Wed/Thurs	1	1	1
Modoc	Friday	1.202	1.109	0.767
Modoc	Saturday	1.041	0.819	0.745
Modoc	Holiday	1.087	0.992	0.704
Mono	Sunday	1.201	0.821	0.415
Mono	Monday	1.007	0.945	0.908
Mono	Tues/Wed/Thurs	1	1	1
Mono	Friday	1.247	1.082	1.007
Mono	Saturday	1.219	0.803	0.442
Mono	Holiday	1.118	0.935	0.832
Monterey	Sunday	1.2	0.603	0.342
Monterey	Monday	1.106	0.988	0.876
Monterey	Tues/Wed/Thurs	1	1	1
Monterey	Friday	1.116	1.093	0.995
Monterey	Saturday	1.023	0.724	0.7
Monterey	Holiday	1.083	0.755	0.607
Napa	Sunday	1.028	0.624	0.392
Napa	Monday	0.989	0.95	0.895
Napa	Tues/Wed/Thurs	1	1	1
Napa	Friday	1.126	1.041	0.988
Napa	Saturday	1.118	0.743	0.44
Napa	Holiday	0.952	0.905	0.847
Nevada	Sunday	0.972	0.668	0.602
Nevada	Monday	0.988	0.977	0.943
Nevada	Tues/Wed/Thurs	1	1	1
Nevada	Friday	1.178	1.101	0.963
Nevada	Saturday	1.037	0.786	0.575
Nevada	Holiday	0.971	0.933	0.921
Orange	Sunday	0.808	0.415	0.327
Orange	Monday	0.962	0.92	0.891
Orange	Tues/Wed/Thurs	1	1	1
Orange	Friday	1.038	1.025	0.988
Orange	Saturday	0.94	0.587	0.433
Orange	Holiday	0.831	0.774	0.796
Placer	Sunday	0.972	0.668	0.602
Placer	Monday	0.988	0.977	0.943
Placer	Tues/Wed/Thurs	1	1	1
Placer	Friday	1.178	1.101	0.963
Placer	Saturday	1.037	0.786	0.575
Placer	Holiday	0.971	0.933	0.921
Plumas	Sunday	0.651	0.442	0.41
Plumas	Monday	0.964	0.96	0.871
Plumas	Tues/Wed/Thurs	1	1	1
Plumas	Friday	1.008	1.015	0.962
Plumas	Saturday	0.771	0.604	0.503
Plumas	Holiday	0.73	0.657	0.606
Riverside	Sunday	0.894	0.489	0.383
Riverside	Monday	0.974	0.941	0.887
Riverside	Tues/Wed/Thurs	1	1	1
Riverside	Friday	1.085	1.028	0.977
Riverside	Saturday	1.011	0.629	0.491
Riverside	Holiday	0.933	0.848	0.844
Sacramento	Sunday	0.774	0.49	0.431
Sacramento	Monday	0.963	0.954	0.913
Sacramento	Tues/Wed/Thurs	1	1	1
Sacramento	Friday	1.065	1.039	0.973
Sacramento	Saturday	0.884	0.622	0.502
Sacramento	Holiday	0.809	0.832	0.852
San Benito	Sunday	1.2	0.603	0.342
San Benito	Monday	1.106	0.988	0.876

County	Day of Week	LD	LM	HH
San Benito	Tues/Wed/Thurs	1	1	1
San Benito	Friday	1.116	1.093	0.995
San Benito	Saturday	1.023	0.724	0.7
San Benito	Holiday	1.083	0.755	0.607
San Bernardino	Sunday	0.89	0.56	0.532
San Bernardino	Monday	0.988	0.931	0.913
San Bernardino	Tues/Wed/Thurs	1	1	1
San Bernardino	Friday	1.094	1.069	1.012
San Bernardino	Saturday	0.97	0.743	0.634
San Bernardino	Holiday	0.942	0.818	0.831
San Diego	Sunday	0.796	0.532	0.341
San Diego	Monday	0.963	0.928	0.882
San Diego	Tues/Wed/Thurs	1	1	1
San Diego	Friday	1.067	1.022	0.982
San Diego	Saturday	0.928	0.665	0.446
San Diego	Holiday	0.808	0.785	0.785
San Francisco	Sunday	0.852	0.522	0.39
San Francisco	Monday	0.928	0.897	0.888
San Francisco	Tues/Wed/Thurs	1	1	1
San Francisco	Friday	1.05	1.002	0.98
San Francisco	Saturday	0.957	0.639	0.452
San Francisco	Holiday	0.783	0.811	0.84
San Joaquin	Sunday	0.933	0.5	0.393
San Joaquin	Monday	0.984	0.918	0.908
San Joaquin	Tues/Wed/Thurs	1	1	1
San Joaquin	Friday	1.128	1.086	0.976
San Joaquin	Saturday	1.035	0.657	0.466
San Joaquin	Holiday	0.907	0.77	0.757
San Luis Obispo	Sunday	1.038	0.629	0.413
San Luis Obispo	Monday	1.064	0.97	0.935
San Luis Obispo	Tues/Wed/Thurs	1	1	1
San Luis Obispo	Friday	1.113	1.094	1.047
San Luis Obispo	Saturday	0.99	0.725	0.563
San Luis Obispo	Holiday	0.967	0.714	0.669
San Mateo	Sunday	0.714	0.439	0.324
San Mateo	Monday	0.926	0.89	0.887
San Mateo	Tues/Wed/Thurs	1	1	1
San Mateo	Friday	1.02	0.983	0.978
San Mateo	Saturday	0.835	0.55	0.402
San Mateo	Holiday	0.78	0.742	0.767
Santa Barbara	Sunday	0.81	0.388	0.301
Santa Barbara	Monday	1.044	0.952	0.912
Santa Barbara	Tues/Wed/Thurs	1	1	1
Santa Barbara	Friday	1.08	1.011	0.996
Santa Barbara	Saturday	0.829	0.542	0.562
Santa Barbara	Holiday	0.811	0.535	0.545
Santa Clara	Sunday	0.734	0.489	0.343
Santa Clara	Monday	0.954	0.909	0.906
Santa Clara	Tues/Wed/Thurs	1	1	1
Santa Clara	Friday	1.042	1.004	0.953
Santa Clara	Saturday	0.853	0.614	0.4
Santa Clara	Holiday	0.765	0.834	0.807
Santa Cruz	Sunday	0.846	0.526	0.468
Santa Cruz	Monday	0.935	0.923	0.947
Santa Cruz	Tues/Wed/Thurs	1	1	1
Santa Cruz	Friday	1.027	1.012	1.036
Santa Cruz	Saturday	0.935	0.652	0.541
Santa Cruz	Holiday	0.9	0.896	0.875
Shasta	Sunday	1.076	0.823	0.627
Shasta	Monday	0.939	1.007	0.66
Shasta	Tues/Wed/Thurs	1	1	1
Shasta	Friday	1.078	1.156	0.774
Shasta	Saturday	1.117	0.863	0.719
Shasta	Holiday	0.902	0.837	0.602
Sierra	Sunday	0.972	0.668	0.602
Sierra	Monday	0.988	0.977	0.943
Sierra	Tues/Wed/Thurs	1	1	1
Sierra	Friday	1.178	1.101	0.963
Sierra	Saturday	1.037	0.786	0.575
Sierra	Holiday	0.971	0.933	0.921
Siskiyou	Sunday	1.133	0.801	0.638
Siskiyou	Monday	1.159	0.961	0.634
Siskiyou	Tues/Wed/Thurs	1	1	1
Siskiyou	Friday	1.202	1.109	0.767

County	Day of Week	LD	LM	HH
Siskiyou	Saturday	1.041	0.819	0.745
Siskiyou	Holiday	1.087	0.992	0.704
Solano	Sunday	1.008	0.589	0.36
Solano	Monday	0.979	0.948	0.887
Solano	Tues/Wed/Thurs	1	1	1
Solano	Friday	1.13	1.033	0.969
Solano	Saturday	1.091	0.719	0.416
Solano	Holiday	0.909	0.896	0.844
Sonoma	Sunday	0.779	0.519	0.376
Sonoma	Monday	0.943	0.927	0.873
Sonoma	Tues/Wed/Thurs	1	1	1
Sonoma	Friday	1.048	1.023	0.982
Sonoma	Saturday	0.924	0.665	0.471
Sonoma	Holiday	0.788	0.827	0.799
Stanislaus	Sunday	1.002	0.593	0.421
Stanislaus	Monday	1.009	0.958	0.904
Stanislaus	Tues/Wed/Thurs	1	1	1
Stanislaus	Friday	1.185	1.103	0.97
Stanislaus	Saturday	1.055	0.713	0.477
Stanislaus	Holiday	0.977	0.897	0.797
Sutter	Sunday	0.972	0.668	0.602
Sutter	Monday	0.988	0.977	0.943
Sutter	Tues/Wed/Thurs	1	1	1
Sutter	Friday	1.178	1.101	0.963
Sutter	Saturday	1.037	0.786	0.575
Sutter	Holiday	0.971	0.933	0.921
Tehama	Sunday	1.076	0.823	0.627
Tehama	Monday	0.939	1.007	0.66
Tehama	Tues/Wed/Thurs	1	1	1
Tehama	Friday	1.078	1.156	0.774
Tehama	Saturday	1.117	0.863	0.719
Tehama	Holiday	0.902	0.837	0.602
Trinity	Sunday	1.133	0.801	0.638
Trinity	Monday	1.159	0.961	0.634
Trinity	Tues/Wed/Thurs	1	1	1
Trinity	Friday	1.202	1.109	0.767
Trinity	Saturday	1.041	0.819	0.745
Trinity	Holiday	1.087	0.992	0.704
Tulare	Sunday	1.029	0.429	0.185
Tulare	Monday	1.052	0.936	0.912
Tulare	Tues/Wed/Thurs	1	1	1
Tulare	Friday	1.099	1.02	0.97
Tulare	Saturday	0.993	0.67	0.503
Tulare	Holiday	0.942	0.585	0.567
Tuolumne	Sunday	1.201	0.821	0.415
Tuolumne	Monday	1.007	0.945	0.908
Tuolumne	Tues/Wed/Thurs	1	1	1
Tuolumne	Friday	1.247	1.082	1.007
Tuolumne	Saturday	1.219	0.803	0.442
Tuolumne	Holiday	1.118	0.935	0.832
Ventura	Sunday	0.772	0.406	0.491
Ventura	Monday	0.956	0.924	0.932
Ventura	Tues/Wed/Thurs	1	1	1
Ventura	Friday	1.036	0.992	1.004
Ventura	Saturday	0.888	0.554	0.637
Ventura	Holiday	0.817	0.785	0.863
Yolo	Sunday	0.902	0.563	0.357
Yolo	Monday	0.972	0.954	0.932
Yolo	Tues/Wed/Thurs	1	1	1
Yolo	Friday	1.099	1.045	0.973
Yolo	Saturday	0.992	0.669	0.426
Yolo	Holiday	0.895	0.883	0.861
Yuba	Sunday	0.972	0.668	0.602
Yuba	Monday	0.988	0.977	0.943
Yuba	Tues/Wed/Thurs	1	1	1
Yuba	Friday	1.178	1.101	0.963
Yuba	Saturday	1.037	0.786	0.575
Yuba	Holiday	0.971	0.933	0.921

Appendix B: Hour of Day Profiles by vehicle type and county

The factors shown in Table 10 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 10 Hour of Day Profiles by vehicle type and county

		Alameda			Alpine			Amador			Butte			Calaveras			Colusa			Contra Costa		
Day of Week	Hour	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Sunday	0	0.020	0.041	0.061	0.010	0.014	0.032	0.010	0.014	0.032	0.015	0.010	0.015	0.010	0.014	0.032	0.015	0.010	0.015	0.019	0.038	0.053
Sunday	1	0.013	0.039	0.056	0.007	0.011	0.024	0.007	0.011	0.024	0.010	0.006	0.011	0.007	0.011	0.024	0.010	0.006	0.011	0.012	0.034	0.047
Sunday	2	0.010	0.039	0.052	0.005	0.011	0.022	0.005	0.011	0.022	0.007	0.004	0.012	0.005	0.011	0.022	0.007	0.004	0.012	0.008	0.031	0.043
Sunday	3	0.007	0.038	0.049	0.004	0.010	0.021	0.004	0.010	0.021	0.006	0.004	0.012	0.004	0.010	0.021	0.006	0.004	0.012	0.006	0.030	0.040
Sunday	4	0.007	0.037	0.046	0.004	0.010	0.020	0.004	0.010	0.020	0.006	0.005	0.017	0.004	0.010	0.020	0.006	0.005	0.017	0.006	0.029	0.038
Sunday	5	0.010	0.038	0.044	0.007	0.013	0.021	0.007	0.013	0.021	0.010	0.011	0.029	0.007	0.013	0.021	0.010	0.011	0.029	0.010	0.031	0.038
Sunday	6	0.016	0.038	0.043	0.012	0.019	0.026	0.012	0.019	0.026	0.016	0.017	0.037	0.012	0.019	0.026	0.016	0.017	0.037	0.016	0.033	0.039
Sunday	7	0.022	0.039	0.042	0.019	0.023	0.029	0.019	0.023	0.029	0.023	0.029	0.051	0.019	0.023	0.029	0.023	0.029	0.051	0.023	0.036	0.040
Sunday	8	0.032	0.040	0.041	0.032	0.035	0.038	0.032	0.035	0.038	0.033	0.043	0.071	0.032	0.035	0.038	0.033	0.043	0.071	0.033	0.040	0.042
Sunday	9	0.046	0.043	0.041	0.051	0.051	0.053	0.051	0.051	0.053	0.047	0.063	0.091	0.051	0.051	0.053	0.047	0.063	0.091	0.048	0.046	0.044
Sunday	10	0.059	0.046	0.041	0.067	0.067	0.071	0.067	0.067	0.071	0.057	0.075	0.084	0.067	0.067	0.071	0.057	0.075	0.084	0.062	0.051	0.045
Sunday	11	0.065	0.047	0.039	0.080	0.081	0.085	0.080	0.081	0.085	0.067	0.083	0.079	0.080	0.081	0.085	0.067	0.083	0.079	0.067	0.053	0.046
Sunday	12	0.069	0.048	0.038	0.083	0.081	0.076	0.083	0.081	0.076	0.074	0.090	0.070	0.083	0.081	0.076	0.074	0.090	0.070	0.070	0.054	0.046
Sunday	13	0.071	0.049	0.036	0.085	0.082	0.074	0.085	0.082	0.074	0.078	0.089	0.061	0.085	0.082	0.074	0.078	0.089	0.061	0.073	0.055	0.050
Sunday	14	0.072	0.049	0.035	0.085	0.083	0.069	0.085	0.083	0.069	0.079	0.081	0.057	0.085	0.083	0.069	0.079	0.081	0.057	0.073	0.055	0.047
Sunday	15	0.071	0.049	0.034	0.084	0.081	0.066	0.084	0.081	0.066	0.080	0.079	0.053	0.084	0.081	0.066	0.080	0.079	0.053	0.073	0.053	0.041
Sunday	16	0.070	0.048	0.033	0.082	0.079	0.060	0.082	0.079	0.060	0.079	0.075	0.045	0.082	0.079	0.060	0.079	0.075	0.045	0.072	0.052	0.039
Sunday	17	0.069	0.048	0.034	0.076	0.070	0.053	0.076	0.070	0.053	0.075	0.066	0.043	0.076	0.070	0.053	0.075	0.066	0.043	0.070	0.050	0.038
Sunday	18	0.063	0.045	0.033	0.064	0.056	0.043	0.064	0.056	0.043	0.066	0.054	0.039	0.064	0.056	0.043	0.066	0.054	0.039	0.063	0.047	0.036
Sunday	19	0.057	0.043	0.035	0.049	0.043	0.035	0.049	0.043	0.035	0.055	0.042	0.037	0.049	0.043	0.035	0.055	0.042	0.037	0.056	0.044	0.035
Sunday	20	0.052	0.041	0.036	0.038	0.033	0.024	0.038	0.033	0.024	0.045	0.031	0.030	0.038	0.033	0.024	0.045	0.031	0.030	0.051	0.041	0.036
Sunday	21	0.045	0.037	0.039	0.026	0.022	0.020	0.026	0.022	0.020	0.035	0.022	0.024	0.026	0.022	0.020	0.035	0.022	0.024	0.042	0.038	0.037
Sunday	22	0.033	0.032	0.043	0.017	0.014	0.017	0.017	0.014	0.017	0.023	0.013	0.018	0.017	0.014	0.017	0.023	0.013	0.018	0.030	0.032	0.039
Sunday	23	0.021	0.027	0.049	0.010	0.010	0.020	0.010	0.010	0.020	0.014	0.008	0.015	0.010	0.010	0.020	0.014	0.008	0.015	0.019	0.027	0.043
Monday	0	0.009	0.026	0.032	0.006	0.010	0.017	0.006	0.010	0.017	0.006	0.002	0.006	0.006	0.010	0.017	0.006	0.002	0.006	0.007	0.023	0.029
Monday	1	0.004	0.027	0.032	0.004	0.009	0.016	0.004	0.009	0.016	0.004	0.002	0.007	0.004	0.009	0.016	0.004	0.002	0.007	0.003	0.022	0.028
Monday	2	0.003	0.028	0.033	0.003	0.009	0.016	0.003	0.009	0.016	0.003	0.002	0.010	0.003	0.009	0.016	0.003	0.002	0.010	0.002	0.022	0.029
Monday	3	0.005	0.030	0.035	0.005	0.011	0.019	0.005	0.011	0.019	0.003	0.004	0.012	0.005	0.011	0.019	0.003	0.004	0.012	0.003	0.023	0.030
Monday	4	0.014	0.033	0.039	0.008	0.017	0.024	0.008	0.017	0.024	0.007	0.009	0.021	0.008	0.017	0.024	0.007	0.009	0.021	0.012	0.028	0.035
Monday	5	0.034	0.039	0.044	0.019	0.028	0.036	0.019	0.028	0.036	0.018	0.024	0.037	0.019	0.028	0.036	0.018	0.024	0.037	0.033	0.041	0.042
Monday	6	0.051	0.046	0.048	0.036	0.041	0.050	0.036	0.041	0.050	0.041	0.051	0.055	0.036	0.041	0.050	0.041	0.051	0.055	0.054	0.051	0.048
Monday	7	0.064	0.053	0.052	0.051	0.044	0.065	0.051	0.044	0.065	0.078	0.069	0.066	0.051	0.044	0.065	0.078	0.069	0.066	0.066	0.058	0.053
Monday	8	0.064	0.055	0.053	0.053	0.056	0.068	0.053	0.056	0.068	0.067	0.077	0.077	0.053	0.056	0.068	0.067	0.077	0.077	0.062	0.060	0.055
Monday	9	0.058	0.054	0.054	0.059	0.065	0.080	0.059	0.065	0.080	0.057	0.071	0.080	0.059	0.065	0.080	0.057	0.071	0.080	0.055	0.056	0.054
Monday	10	0.053	0.053	0.054	0.067	0.074	0.087	0.067	0.074	0.087	0.057	0.071	0.077	0.067	0.074	0.087	0.057	0.071	0.077	0.052	0.054	0.053
Monday	11	0.051	0.054	0.054	0.071	0.075	0.082	0.071	0.075	0.082	0.060	0.074	0.073	0.071	0.075	0.082	0.060	0.074	0.073	0.053	0.055	0.054
Monday	12	0.052	0.056	0.054	0.074	0.074	0.080	0.074	0.074	0.080	0.063	0.072	0.071	0.074	0.074	0.080	0.063	0.072	0.071	0.054	0.056	0.054

		Alameda			Alpine			Amador			Butte			Calaveras			Colusa			Contra Costa		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Monday	13	0.054	0.057	0.054	0.074	0.075	0.075	0.074	0.075	0.075	0.063	0.072	0.068	0.074	0.075	0.075	0.063	0.072	0.068	0.056	0.056	0.054
Monday	14	0.061	0.059	0.053	0.077	0.076	0.065	0.077	0.076	0.065	0.067	0.077	0.064	0.077	0.076	0.065	0.067	0.077	0.064	0.063	0.059	0.056
Monday	15	0.066	0.059	0.051	0.082	0.076	0.058	0.082	0.076	0.058	0.078	0.080	0.056	0.082	0.076	0.058	0.078	0.080	0.056	0.069	0.063	0.058
Monday	16	0.069	0.057	0.048	0.081	0.073	0.045	0.081	0.073	0.045	0.086	0.077	0.049	0.081	0.073	0.045	0.086	0.077	0.049	0.072	0.060	0.052
Monday	17	0.070	0.053	0.044	0.071	0.059	0.035	0.071	0.059	0.035	0.087	0.062	0.041	0.071	0.059	0.035	0.087	0.062	0.041	0.073	0.056	0.047
Monday	18	0.062	0.045	0.037	0.052	0.042	0.023	0.052	0.042	0.023	0.051	0.038	0.030	0.052	0.042	0.023	0.051	0.038	0.030	0.061	0.045	0.039
Monday	19	0.048	0.035	0.031	0.037	0.030	0.017	0.037	0.030	0.017	0.036	0.024	0.024	0.037	0.030	0.017	0.036	0.024	0.024	0.045	0.033	0.031
Monday	20	0.036	0.028	0.026	0.027	0.022	0.013	0.027	0.022	0.013	0.026	0.018	0.023	0.027	0.022	0.013	0.026	0.018	0.023	0.035	0.026	0.026
Monday	21	0.031	0.022	0.023	0.020	0.016	0.010	0.020	0.016	0.010	0.020	0.012	0.021	0.020	0.016	0.010	0.020	0.012	0.021	0.031	0.022	0.024
Monday	22	0.024	0.018	0.023	0.015	0.012	0.009	0.015	0.012	0.009	0.013	0.007	0.017	0.015	0.012	0.009	0.013	0.007	0.017	0.023	0.017	0.023
Monday	23	0.016	0.015	0.025	0.009	0.007	0.010	0.009	0.007	0.010	0.008	0.004	0.015	0.009	0.007	0.010	0.008	0.004	0.015	0.014	0.014	0.025
Tues/Wed/Thurs	0	0.008	0.026	0.034	0.005	0.009	0.017	0.005	0.009	0.017	0.006	0.003	0.010	0.005	0.009	0.017	0.006	0.003	0.010	0.006	0.022	0.031
Tues/Wed/Thurs	1	0.004	0.027	0.034	0.003	0.008	0.017	0.003	0.008	0.017	0.003	0.002	0.011	0.003	0.008	0.017	0.003	0.002	0.011	0.003	0.021	0.030
Tues/Wed/Thurs	2	0.003	0.028	0.035	0.002	0.009	0.017	0.002	0.009	0.017	0.003	0.002	0.013	0.002	0.009	0.017	0.003	0.002	0.013	0.002	0.021	0.030
Tues/Wed/Thurs	3	0.005	0.030	0.037	0.003	0.010	0.022	0.003	0.010	0.022	0.003	0.003	0.015	0.003	0.010	0.022	0.003	0.003	0.015	0.003	0.023	0.031
Tues/Wed/Thurs	4	0.014	0.034	0.041	0.006	0.014	0.025	0.006	0.014	0.025	0.006	0.008	0.022	0.006	0.014	0.025	0.006	0.008	0.022	0.011	0.028	0.036
Tues/Wed/Thurs	5	0.035	0.040	0.046	0.018	0.027	0.039	0.018	0.027	0.039	0.017	0.024	0.037	0.018	0.027	0.039	0.017	0.024	0.037	0.034	0.040	0.044
Tues/Wed/Thurs	6	0.055	0.047	0.050	0.037	0.042	0.052	0.037	0.042	0.052	0.041	0.053	0.054	0.037	0.042	0.052	0.041	0.053	0.054	0.056	0.052	0.049
Tues/Wed/Thurs	7	0.067	0.054	0.053	0.053	0.047	0.064	0.053	0.047	0.064	0.077	0.069	0.066	0.053	0.047	0.064	0.077	0.069	0.066	0.068	0.059	0.054
Tues/Wed/Thurs	8	0.064	0.056	0.054	0.054	0.056	0.070	0.054	0.056	0.070	0.066	0.077	0.077	0.054	0.056	0.070	0.066	0.077	0.077	0.063	0.060	0.056
Tues/Wed/Thurs	9	0.057	0.054	0.055	0.059	0.068	0.083	0.059	0.068	0.083	0.057	0.071	0.080	0.059	0.068	0.083	0.057	0.071	0.080	0.055	0.055	0.053
Tues/Wed/Thurs	10	0.051	0.053	0.054	0.064	0.069	0.081	0.064	0.069	0.081	0.056	0.071	0.077	0.064	0.069	0.081	0.056	0.071	0.077	0.051	0.053	0.052
Tues/Wed/Thurs	11	0.049	0.054	0.054	0.068	0.069	0.077	0.068	0.069	0.077	0.058	0.071	0.074	0.068	0.069	0.077	0.058	0.071	0.074	0.050	0.054	0.052
Tues/Wed/Thurs	12	0.050	0.055	0.054	0.069	0.071	0.074	0.069	0.071	0.074	0.062	0.070	0.069	0.069	0.071	0.074	0.062	0.070	0.069	0.052	0.055	0.053
Tues/Wed/Thurs	13	0.053	0.056	0.053	0.072	0.073	0.074	0.072	0.073	0.074	0.063	0.073	0.067	0.072	0.073	0.074	0.063	0.073	0.067	0.054	0.056	0.054
Tues/Wed/Thurs	14	0.060	0.058	0.052	0.077	0.076	0.067	0.077	0.076	0.067	0.066	0.076	0.063	0.077	0.076	0.067	0.066	0.076	0.063	0.062	0.059	0.054
Tues/Wed/Thurs	15	0.064	0.058	0.050	0.084	0.078	0.058	0.084	0.078	0.058	0.079	0.080	0.056	0.084	0.078	0.058	0.079	0.080	0.056	0.067	0.063	0.056
Tues/Wed/Thurs	16	0.067	0.056	0.047	0.082	0.074	0.048	0.082	0.074	0.048	0.087	0.076	0.045	0.082	0.074	0.048	0.087	0.076	0.045	0.070	0.060	0.051
Tues/Wed/Thurs	17	0.067	0.052	0.042	0.074	0.061	0.036	0.074	0.061	0.036	0.088	0.062	0.040	0.074	0.061	0.036	0.088	0.062	0.040	0.071	0.057	0.046
Tues/Wed/Thurs	18	0.061	0.044	0.036	0.053	0.044	0.023	0.053	0.044	0.023	0.054	0.039	0.031	0.053	0.044	0.023	0.054	0.039	0.031	0.062	0.047	0.039
Tues/Wed/Thurs	19	0.050	0.035	0.030	0.038	0.031	0.016	0.038	0.031	0.016	0.036	0.026	0.023	0.038	0.031	0.016	0.036	0.026	0.023	0.048	0.035	0.031
Tues/Wed/Thurs	20	0.038	0.027	0.025	0.030	0.025	0.012	0.030	0.025	0.012	0.028	0.019	0.021	0.030	0.025	0.012	0.028	0.019	0.021	0.038	0.027	0.026
Tues/Wed/Thurs	21	0.033	0.022	0.022	0.023	0.018	0.010	0.023	0.018	0.010	0.021	0.013	0.020	0.023	0.018	0.010	0.021	0.013	0.020	0.033	0.022	0.024
Tues/Wed/Thurs	22	0.026	0.017	0.022	0.017	0.013	0.010	0.017	0.013	0.010	0.014	0.007	0.016	0.017	0.013	0.010	0.014	0.007	0.016	0.024	0.017	0.022
Tues/Wed/Thurs	23	0.016	0.014	0.023	0.010	0.008	0.010	0.010	0.008	0.010	0.009	0.004	0.013	0.010	0.008	0.010	0.009	0.004	0.013	0.015	0.013	0.024
Friday	0	0.009	0.027	0.036	0.005	0.009	0.019	0.005	0.009	0.019	0.007	0.003	0.011	0.005	0.009	0.019	0.007	0.003	0.011	0.008	0.022	0.033
Friday	1	0.005	0.028	0.037	0.003	0.008	0.019	0.003	0.008	0.019	0.004	0.003	0.012	0.003	0.008	0.019	0.004	0.003	0.012	0.004	0.021	0.031
Friday	2	0.004	0.029	0.038	0.002	0.008	0.019	0.002	0.008	0.019	0.004	0.003	0.015	0.002	0.008	0.019	0.004	0.003	0.015	0.003	0.022	0.032
Friday	3	0.005	0.031	0.039	0.002	0.008	0.021	0.002	0.008	0.021	0.004	0.004	0.017	0.002	0.008	0.021	0.004	0.004	0.017	0.004	0.023	0.033
Friday	4	0.013	0.034	0.043	0.005	0.013	0.024	0.005	0.013	0.024	0.006	0.007	0.024	0.005	0.013	0.024	0.006	0.007	0.024	0.010	0.028	0.036
Friday	5	0.032	0.040	0.048	0.013	0.023	0.037	0.013	0.023	0.037	0.015	0.022	0.039	0.013	0.023	0.037	0.015	0.022	0.039	0.030	0.039	0.044
Friday	6	0.049	0.046	0.052	0.026	0.035	0.049	0.026	0.035	0.049	0.035	0.045	0.055	0.026	0.035	0.049	0.035	0.045	0.055	0.050	0.049	0.050
Friday	7	0.060	0.052	0.055	0.039	0.040	0.060	0.039	0.040	0.060	0.063	0.063	0.064	0.039	0.040	0.060	0.063	0.063	0.064	0.063	0.057	0.055
Friday	8	0.059	0.054	0.056	0.043	0.049	0.068	0.043	0.049	0.068	0.058	0.072	0.074	0.043	0.049	0.068	0.058	0.072	0.074	0.059	0.057	0.056
Friday	9	0.054	0.053	0.056	0.049	0.057	0.073	0.049	0.057	0.073	0.052	0.068	0.075	0.049	0.057	0.073	0.052	0.068	0.075	0.053	0.054	0.054
Friday	10	0.051	0.053	0.056	0.058	0.063	0.078	0.058	0.063	0.078	0.055	0.071	0.074	0.058	0.063	0.078	0.055	0.071	0.074	0.051	0.053	0.053
Friday	11	0.052	0.055	0.055	0.064	0.069	0.077	0.064	0.069	0.077	0.060	0.074	0.074	0.064	0.069	0.077	0.060	0.074	0.074	0.053	0.055	0.054
Friday	12	0.054	0.056	0.055	0.066	0.071	0.076	0.066	0.071	0.076	0.063	0.072	0.069	0.066	0.071	0.076	0.063	0.072	0.069	0.056	0.057	0.055
Friday	13	0.056	0.057	0.054	0.071	0.074	0.077	0.071	0.074	0.077	0.065	0.076	0.069	0.071	0.074	0.077	0.065	0.076	0.069	0.058	0.058	0.056
Friday	14	0.061	0.058	0.052	0.076	0.077	0.070	0.076	0.077	0.070	0.069	0.078	0.063	0.076	0.077	0.070	0.069	0.078	0.063	0.064	0.059	0.056
Friday	15	0.063	0.058	0.049	0.083	0.079	0.060	0.083	0.079	0.060	0.078	0.080	0.055	0.083	0.079	0.060	0.078	0.080	0.055	0.066	0.062	0.056
Friday	16	0.064	0.055	0.045	0.083	0.077	0.050	0.083	0.077	0.050	0.085	0.075	0.047	0.083	0.077	0.050	0.085	0.075	0.047	0.067	0.059	0.050

		Alameda			Alpine			Amador			Butte			Calaveras			Colusa			Contra Costa		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Friday	17	0.064	0.051	0.040	0.075	0.064	0.038	0.075	0.064	0.038	0.082	0.061	0.039	0.075	0.064	0.038	0.082	0.061	0.039	0.067	0.055	0.046
Friday	18	0.059	0.044	0.034	0.062	0.051	0.025	0.062	0.051	0.025	0.059	0.041	0.029	0.062	0.051	0.025	0.059	0.041	0.029	0.060	0.047	0.039
Friday	19	0.052	0.035	0.027	0.050	0.039	0.018	0.050	0.039	0.018	0.042	0.028	0.024	0.050	0.039	0.018	0.042	0.028	0.024	0.049	0.036	0.030
Friday	20	0.042	0.028	0.022	0.041	0.030	0.013	0.041	0.030	0.013	0.032	0.021	0.021	0.041	0.030	0.013	0.032	0.021	0.021	0.040	0.029	0.023
Friday	21	0.036	0.023	0.019	0.036	0.025	0.010	0.036	0.025	0.010	0.027	0.015	0.020	0.036	0.025	0.010	0.027	0.015	0.020	0.035	0.023	0.020
Friday	22	0.032	0.019	0.017	0.030	0.019	0.011	0.030	0.019	0.011	0.021	0.011	0.016	0.030	0.019	0.011	0.021	0.011	0.016	0.030	0.019	0.019
Friday	23	0.023	0.015	0.018	0.018	0.012	0.009	0.018	0.012	0.009	0.014	0.007	0.015	0.018	0.012	0.009	0.014	0.007	0.015	0.022	0.015	0.020
Saturday	0	0.016	0.033	0.052	0.010	0.015	0.027	0.010	0.015	0.027	0.012	0.007	0.021	0.010	0.015	0.027	0.012	0.007	0.021	0.015	0.030	0.044
Saturday	1	0.010	0.033	0.051	0.007	0.012	0.023	0.007	0.012	0.023	0.008	0.005	0.016	0.007	0.012	0.023	0.008	0.005	0.016	0.009	0.027	0.040
Saturday	2	0.008	0.033	0.049	0.005	0.011	0.022	0.005	0.011	0.022	0.006	0.004	0.020	0.005	0.011	0.022	0.006	0.004	0.020	0.006	0.026	0.039
Saturday	3	0.006	0.034	0.048	0.004	0.010	0.025	0.004	0.010	0.025	0.005	0.004	0.022	0.004	0.010	0.025	0.005	0.004	0.022	0.005	0.025	0.037
Saturday	4	0.008	0.035	0.048	0.005	0.013	0.028	0.005	0.013	0.028	0.006	0.008	0.024	0.005	0.013	0.028	0.006	0.008	0.024	0.006	0.027	0.037
Saturday	5	0.014	0.037	0.049	0.010	0.021	0.034	0.010	0.021	0.034	0.012	0.017	0.039	0.010	0.021	0.034	0.012	0.017	0.039	0.013	0.030	0.040
Saturday	6	0.023	0.039	0.050	0.017	0.028	0.039	0.017	0.028	0.039	0.021	0.028	0.049	0.017	0.028	0.039	0.021	0.028	0.049	0.023	0.035	0.042
Saturday	7	0.033	0.041	0.051	0.029	0.036	0.053	0.029	0.036	0.053	0.034	0.041	0.058	0.029	0.036	0.053	0.034	0.041	0.058	0.034	0.041	0.047
Saturday	8	0.045	0.044	0.052	0.044	0.045	0.060	0.044	0.045	0.060	0.045	0.057	0.067	0.044	0.045	0.060	0.045	0.057	0.067	0.046	0.047	0.049
Saturday	9	0.054	0.047	0.052	0.059	0.061	0.071	0.059	0.061	0.071	0.054	0.068	0.074	0.059	0.061	0.071	0.054	0.068	0.074	0.055	0.051	0.050
Saturday	10	0.060	0.050	0.051	0.073	0.074	0.078	0.073	0.074	0.078	0.063	0.080	0.073	0.073	0.074	0.078	0.063	0.080	0.073	0.061	0.054	0.051
Saturday	11	0.064	0.052	0.050	0.081	0.077	0.083	0.081	0.077	0.083	0.068	0.082	0.071	0.081	0.077	0.083	0.068	0.082	0.071	0.065	0.056	0.052
Saturday	12	0.066	0.053	0.048	0.078	0.077	0.075	0.078	0.077	0.075	0.074	0.083	0.068	0.078	0.077	0.075	0.074	0.083	0.068	0.066	0.058	0.055
Saturday	13	0.066	0.053	0.045	0.075	0.072	0.060	0.075	0.072	0.060	0.074	0.079	0.062	0.075	0.072	0.060	0.074	0.079	0.062	0.067	0.059	0.058
Saturday	14	0.066	0.053	0.042	0.075	0.068	0.055	0.075	0.068	0.055	0.074	0.076	0.057	0.075	0.068	0.055	0.074	0.076	0.057	0.067	0.058	0.057
Saturday	15	0.066	0.053	0.040	0.075	0.068	0.052	0.075	0.068	0.052	0.073	0.074	0.052	0.075	0.068	0.052	0.073	0.074	0.052	0.068	0.057	0.051
Saturday	16	0.065	0.051	0.037	0.072	0.070	0.047	0.072	0.070	0.047	0.073	0.067	0.045	0.072	0.070	0.047	0.073	0.067	0.045	0.068	0.056	0.047
Saturday	17	0.065	0.050	0.034	0.066	0.063	0.040	0.066	0.063	0.040	0.069	0.058	0.039	0.066	0.063	0.040	0.069	0.058	0.039	0.067	0.054	0.044
Saturday	18	0.060	0.046	0.031	0.058	0.052	0.031	0.058	0.052	0.031	0.058	0.047	0.034	0.058	0.052	0.031	0.058	0.047	0.034	0.060	0.048	0.036
Saturday	19	0.050	0.041	0.028	0.047	0.041	0.026	0.047	0.041	0.026	0.046	0.036	0.029	0.047	0.041	0.026	0.046	0.036	0.029	0.049	0.041	0.029
Saturday	20	0.043	0.036	0.025	0.038	0.031	0.020	0.038	0.031	0.020	0.040	0.028	0.024	0.038	0.031	0.020	0.040	0.028	0.024	0.043	0.036	0.025
Saturday	21	0.042	0.033	0.024	0.031	0.025	0.016	0.031	0.025	0.016	0.036	0.022	0.023	0.031	0.025	0.016	0.036	0.022	0.023	0.041	0.033	0.024
Saturday	22	0.039	0.029	0.023	0.025	0.020	0.018	0.025	0.020	0.018	0.029	0.016	0.017	0.025	0.020	0.018	0.029	0.016	0.017	0.037	0.029	0.023
Saturday	23	0.029	0.025	0.023	0.016	0.013	0.018	0.016	0.013	0.018	0.020	0.011	0.017	0.016	0.013	0.018	0.020	0.011	0.017	0.028	0.024	0.022
Holiday	0	0.015	0.028	0.035	0.008	0.011	0.020	0.008	0.011	0.020	0.010	0.004	0.012	0.008	0.011	0.020	0.010	0.004	0.012	0.013	0.027	0.034
Holiday	1	0.008	0.029	0.035	0.005	0.009	0.018	0.005	0.009	0.018	0.006	0.004	0.011	0.005	0.009	0.018	0.006	0.004	0.011	0.007	0.026	0.033
Holiday	2	0.006	0.031	0.036	0.003	0.010	0.018	0.003	0.010	0.018	0.004	0.003	0.012	0.003	0.010	0.018	0.004	0.003	0.012	0.004	0.025	0.033
Holiday	3	0.005	0.032	0.037	0.004	0.010	0.021	0.004	0.010	0.021	0.004	0.005	0.015	0.004	0.010	0.021	0.004	0.005	0.015	0.003	0.025	0.033
Holiday	4	0.009	0.035	0.040	0.005	0.012	0.020	0.005	0.012	0.020	0.007	0.009	0.024	0.005	0.012	0.020	0.007	0.009	0.024	0.007	0.029	0.035
Holiday	5	0.019	0.037	0.043	0.009	0.018	0.031	0.009	0.018	0.031	0.014	0.020	0.037	0.009	0.018	0.031	0.014	0.020	0.037	0.017	0.034	0.039
Holiday	6	0.029	0.042	0.045	0.018	0.023	0.038	0.018	0.023	0.038	0.030	0.036	0.047	0.018	0.023	0.038	0.030	0.036	0.047	0.029	0.040	0.044
Holiday	7	0.038	0.046	0.048	0.029	0.031	0.043	0.029	0.031	0.043	0.044	0.052	0.061	0.029	0.031	0.043	0.044	0.052	0.061	0.038	0.045	0.047
Holiday	8	0.046	0.049	0.051	0.041	0.044	0.056	0.041	0.044	0.056	0.052	0.066	0.075	0.041	0.044	0.056	0.052	0.066	0.075	0.045	0.050	0.051
Holiday	9	0.049	0.050	0.052	0.058	0.057	0.075	0.058	0.057	0.075	0.053	0.071	0.081	0.058	0.057	0.075	0.053	0.071	0.081	0.049	0.053	0.052
Holiday	10	0.055	0.053	0.053	0.076	0.083	0.087	0.076	0.083	0.087	0.059	0.076	0.081	0.076	0.083	0.087	0.059	0.076	0.081	0.056	0.056	0.053
Holiday	11	0.060	0.056	0.054	0.084	0.086	0.088	0.084	0.086	0.088	0.066	0.076	0.071	0.084	0.086	0.088	0.066	0.076	0.071	0.062	0.059	0.055
Holiday	12	0.064	0.058	0.055	0.085	0.087	0.089	0.085	0.087	0.089	0.071	0.078	0.074	0.085	0.087	0.089	0.071	0.078	0.074	0.067	0.061	0.056
Holiday	13	0.066	0.059	0.054	0.083	0.081	0.078	0.083	0.081	0.078	0.071	0.076	0.065	0.083	0.081	0.078	0.071	0.076	0.065	0.070	0.062	0.056
Holiday	14	0.069	0.060	0.053	0.080	0.074	0.068	0.080	0.074	0.068	0.070	0.078	0.060	0.080	0.074	0.068	0.070	0.078	0.060	0.073	0.062	0.057
Holiday	15	0.069	0.058	0.051	0.078	0.074	0.060	0.078	0.074	0.060	0.075	0.075	0.053	0.078	0.074	0.060	0.075	0.075	0.053	0.071	0.061	0.054
Holiday	16	0.068	0.056	0.047	0.078	0.072	0.049	0.078	0.072	0.049	0.079	0.070	0.044	0.078	0.072	0.049	0.079	0.070	0.044	0.070	0.057	0.050
Holiday	17	0.066	0.051	0.043	0.071	0.066	0.041	0.071	0.066	0.041	0.074	0.064	0.041	0.071	0.066	0.041	0.074	0.064	0.041	0.067	0.053	0.044
Holiday	18	0.060	0.044	0.037	0.057	0.049	0.033	0.057	0.049	0.033	0.058	0.044	0.034	0.057	0.049	0.033	0.058	0.044	0.034	0.059	0.045	0.038
Holiday	19	0.052	0.036	0.031	0.043	0.040	0.022	0.043	0.040	0.022	0.047	0.033	0.026	0.043	0.040	0.022	0.047	0.033	0.026	0.051	0.036	0.031
Holiday	20	0.046	0.030	0.027	0.033	0.026	0.013	0.033	0.026	0.013	0.038	0.025	0.025	0.033	0.026	0.013	0.038	0.025	0.025	0.046	0.031	0.028

		Alameda			Alpine			Amador			Butte			Calaveras			Colusa			Contra Costa		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Holiday	21	0.042	0.025	0.024	0.024	0.018	0.011	0.024	0.018	0.011	0.030	0.018	0.021	0.024	0.018	0.011	0.030	0.018	0.021	0.041	0.026	0.026
Holiday	22	0.035	0.020	0.024	0.017	0.012	0.009	0.017	0.012	0.009	0.024	0.011	0.017	0.017	0.012	0.009	0.024	0.011	0.017	0.033	0.021	0.025
Holiday	23	0.024	0.016	0.026	0.010	0.008	0.010	0.010	0.008	0.010	0.014	0.007	0.014	0.010	0.008	0.010	0.014	0.007	0.014	0.021	0.017	0.026

		Del Norte			El Dorado			Fresno			Glenn			Humboldt			Imperial			Inyo		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Sunday	0	0.013	0.011	0.008	0.013	0.020	0.031	0.015	0.033	0.043	0.015	0.010	0.015	0.013	0.011	0.008	0.026	0.015	0.017	0.010	0.014	0.032
Sunday	1	0.013	0.008	0.010	0.008	0.016	0.028	0.010	0.030	0.040	0.010	0.006	0.011	0.013	0.008	0.010	0.026	0.013	0.016	0.007	0.011	0.024
Sunday	2	0.012	0.006	0.008	0.006	0.013	0.026	0.008	0.027	0.037	0.007	0.004	0.012	0.012	0.006	0.008	0.025	0.009	0.014	0.005	0.011	0.022
Sunday	3	0.014	0.005	0.007	0.005	0.012	0.025	0.005	0.025	0.034	0.006	0.004	0.012	0.014	0.005	0.007	0.025	0.008	0.015	0.004	0.010	0.021
Sunday	4	0.014	0.004	0.011	0.005	0.012	0.025	0.006	0.024	0.034	0.006	0.005	0.017	0.014	0.004	0.011	0.027	0.010	0.015	0.004	0.010	0.020
Sunday	5	0.017	0.009	0.019	0.008	0.015	0.027	0.010	0.026	0.034	0.010	0.011	0.029	0.017	0.009	0.019	0.030	0.015	0.017	0.007	0.013	0.021
Sunday	6	0.021	0.014	0.028	0.013	0.020	0.030	0.017	0.029	0.036	0.016	0.017	0.037	0.021	0.014	0.028	0.032	0.019	0.021	0.012	0.019	0.026
Sunday	7	0.026	0.020	0.036	0.022	0.028	0.034	0.022	0.032	0.037	0.023	0.029	0.051	0.026	0.020	0.036	0.033	0.026	0.029	0.019	0.023	0.029
Sunday	8	0.031	0.032	0.043	0.034	0.041	0.040	0.032	0.038	0.040	0.033	0.043	0.071	0.031	0.032	0.043	0.037	0.039	0.035	0.032	0.035	0.038
Sunday	9	0.040	0.050	0.054	0.048	0.055	0.046	0.044	0.046	0.044	0.047	0.063	0.091	0.040	0.050	0.054	0.040	0.053	0.047	0.051	0.051	0.053
Sunday	10	0.047	0.064	0.067	0.064	0.068	0.052	0.055	0.052	0.046	0.057	0.075	0.084	0.047	0.064	0.067	0.043	0.063	0.057	0.067	0.067	0.071
Sunday	11	0.055	0.079	0.062	0.075	0.075	0.055	0.063	0.057	0.047	0.067	0.083	0.079	0.055	0.079	0.062	0.046	0.071	0.065	0.080	0.081	0.085
Sunday	12	0.061	0.087	0.065	0.082	0.079	0.058	0.071	0.062	0.049	0.074	0.090	0.070	0.061	0.087	0.065	0.048	0.075	0.068	0.083	0.081	0.076
Sunday	13	0.065	0.092	0.064	0.084	0.079	0.058	0.076	0.064	0.049	0.078	0.089	0.061	0.065	0.092	0.064	0.052	0.078	0.068	0.085	0.082	0.074
Sunday	14	0.067	0.087	0.065	0.084	0.077	0.057	0.077	0.063	0.048	0.079	0.081	0.057	0.067	0.087	0.065	0.053	0.074	0.065	0.085	0.083	0.069
Sunday	15	0.072	0.086	0.067	0.082	0.073	0.057	0.077	0.061	0.047	0.080	0.079	0.053	0.072	0.086	0.067	0.056	0.071	0.061	0.084	0.081	0.066
Sunday	16	0.077	0.086	0.072	0.079	0.068	0.055	0.075	0.059	0.046	0.079	0.075	0.045	0.077	0.086	0.072	0.056	0.068	0.058	0.082	0.079	0.060
Sunday	17	0.070	0.075	0.058	0.072	0.062	0.053	0.073	0.056	0.045	0.075	0.066	0.043	0.070	0.075	0.058	0.059	0.067	0.055	0.076	0.070	0.053
Sunday	18	0.067	0.059	0.054	0.060	0.052	0.049	0.066	0.050	0.044	0.066	0.054	0.039	0.067	0.059	0.054	0.059	0.062	0.055	0.064	0.056	0.043
Sunday	19	0.062	0.045	0.050	0.050	0.043	0.045	0.057	0.044	0.042	0.055	0.042	0.037	0.062	0.045	0.050	0.057	0.051	0.051	0.049	0.043	0.035
Sunday	20	0.054	0.035	0.047	0.041	0.035	0.042	0.050	0.038	0.041	0.045	0.031	0.030	0.054	0.035	0.047	0.052	0.041	0.049	0.038	0.033	0.024
Sunday	21	0.045	0.024	0.039	0.031	0.026	0.039	0.040	0.033	0.040	0.035	0.022	0.024	0.045	0.024	0.039	0.047	0.032	0.044	0.026	0.022	0.020
Sunday	22	0.033	0.015	0.033	0.021	0.019	0.036	0.030	0.028	0.040	0.023	0.013	0.018	0.033	0.015	0.033	0.039	0.023	0.042	0.017	0.014	0.017
Sunday	23	0.022	0.009	0.032	0.013	0.015	0.033	0.020	0.023	0.039	0.014	0.008	0.015	0.022	0.009	0.032	0.031	0.018	0.038	0.010	0.010	0.020
Monday	0	0.010	0.003	0.007	0.008	0.014	0.027	0.009	0.019	0.024	0.006	0.002	0.006	0.010	0.003	0.007	0.025	0.010	0.016	0.006	0.010	0.017
Monday	1	0.009	0.002	0.007	0.005	0.012	0.025	0.005	0.018	0.023	0.004	0.002	0.007	0.009	0.002	0.007	0.025	0.008	0.016	0.004	0.009	0.016
Monday	2	0.010	0.003	0.010	0.004	0.012	0.025	0.004	0.018	0.023	0.003	0.002	0.010	0.010	0.003	0.010	0.024	0.008	0.017	0.003	0.009	0.016
Monday	3	0.012	0.006	0.012	0.006	0.014	0.027	0.005	0.020	0.025	0.003	0.004	0.012	0.012	0.006	0.012	0.030	0.014	0.019	0.005	0.011	0.019
Monday	4	0.014	0.009	0.013	0.011	0.019	0.030	0.011	0.023	0.027	0.007	0.009	0.021	0.014	0.009	0.013	0.030	0.022	0.025	0.008	0.017	0.024
Monday	5	0.022	0.022	0.026	0.023	0.030	0.036	0.024	0.034	0.033	0.018	0.024	0.037	0.022	0.022	0.026	0.034	0.036	0.031	0.019	0.028	0.036
Monday	6	0.037	0.047	0.044	0.042	0.047	0.043	0.044	0.047	0.041	0.041	0.051	0.055	0.037	0.047	0.044	0.036	0.043	0.034	0.036	0.041	0.050
Monday	7	0.045	0.058	0.058	0.060	0.061	0.048	0.069	0.064	0.048	0.078	0.069	0.066	0.045	0.058	0.058	0.040	0.056	0.039	0.051	0.044	0.065
Monday	8	0.047	0.062	0.067	0.059	0.062	0.050	0.063	0.062	0.049	0.067	0.077	0.077	0.047	0.062	0.067	0.041	0.065	0.045	0.053	0.056	0.068
Monday	9	0.050	0.065	0.078	0.056	0.061	0.050	0.055	0.056	0.047	0.057	0.071	0.080	0.050	0.065	0.078	0.043	0.064	0.051	0.059	0.065	0.080
Monday	10	0.051	0.065	0.080	0.058	0.064	0.051	0.055	0.056	0.048	0.057	0.071	0.077	0.051	0.065	0.080	0.044	0.069	0.058	0.067	0.074	0.087
Monday	11	0.056	0.067	0.083	0.062	0.066	0.053	0.057	0.059	0.050	0.060	0.074	0.073	0.056	0.067	0.083	0.047	0.071	0.066	0.071	0.075	0.082
Monday	12	0.058	0.069	0.081	0.066	0.068	0.054	0.061	0.061	0.052	0.063	0.072	0.071	0.058	0.069	0.081	0.048	0.068	0.067	0.074	0.074	0.080
Monday	13	0.063	0.074	0.076	0.067	0.067	0.054	0.063	0.062	0.054	0.063	0.072	0.068	0.063	0.074	0.076	0.050	0.070	0.067	0.074	0.075	0.075
Monday	14	0.067	0.076	0.074	0.070	0.069	0.055	0.069	0.065	0.056	0.067	0.077	0.064	0.067	0.076	0.074	0.051	0.069	0.066	0.077	0.076	0.065
Monday	15	0.073	0.087	0.062	0.073	0.069	0.055	0.074	0.068	0.058	0.078	0.080	0.056	0.073	0.087	0.062	0.057	0.072	0.062	0.082	0.076	0.058
Monday	16	0.076	0.084	0.053	0.075	0.067	0.054	0.079	0.068	0.059	0.086	0.077	0.049	0.076	0.084	0.053	0.054	0.063	0.061	0.081	0.073	0.045
Monday	17	0.075	0.075	0.040	0.073	0.061	0.052	0.076	0.062	0.057	0.087	0.062	0.041	0.075	0.075	0.040	0.057	0.054	0.055	0.071	0.059	0.035

		Del Norte			El Dorado			Fresno			Glenn			Humboldt			Imperial			Inyo		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Monday	18	0.057	0.047	0.032	0.056	0.046	0.045	0.053	0.043	0.050	0.051	0.038	0.030	0.057	0.047	0.032	0.054	0.040	0.047	0.052	0.042	0.023
Monday	19	0.050	0.031	0.029	0.040	0.031	0.039	0.037	0.030	0.043	0.036	0.024	0.024	0.050	0.031	0.029	0.052	0.032	0.041	0.037	0.030	0.017
Monday	20	0.043	0.020	0.021	0.031	0.022	0.035	0.030	0.023	0.039	0.026	0.018	0.023	0.043	0.020	0.021	0.047	0.022	0.037	0.027	0.022	0.013
Monday	21	0.035	0.015	0.020	0.025	0.017	0.032	0.024	0.018	0.035	0.020	0.012	0.021	0.035	0.015	0.020	0.045	0.018	0.031	0.020	0.016	0.010
Monday	22	0.025	0.009	0.014	0.017	0.012	0.030	0.018	0.013	0.032	0.013	0.007	0.017	0.025	0.009	0.014	0.038	0.013	0.026	0.015	0.012	0.009
Monday	23	0.016	0.005	0.013	0.012	0.009	0.030	0.012	0.010	0.029	0.008	0.004	0.015	0.016	0.005	0.013	0.030	0.014	0.025	0.009	0.007	0.010
Tues/Wed/Thurs	0	0.010	0.004	0.008	0.008	0.014	0.029	0.007	0.018	0.027	0.006	0.003	0.010	0.010	0.004	0.008	0.024	0.011	0.023	0.005	0.009	0.017
Tues/Wed/Thurs	1	0.009	0.003	0.008	0.004	0.011	0.027	0.004	0.017	0.027	0.003	0.002	0.011	0.009	0.003	0.008	0.025	0.009	0.020	0.003	0.008	0.017
Tues/Wed/Thurs	2	0.010	0.002	0.012	0.004	0.011	0.027	0.003	0.017	0.027	0.003	0.002	0.013	0.010	0.002	0.012	0.026	0.008	0.020	0.002	0.009	0.017
Tues/Wed/Thurs	3	0.011	0.005	0.014	0.005	0.013	0.029	0.004	0.019	0.028	0.003	0.003	0.015	0.011	0.005	0.014	0.027	0.012	0.022	0.003	0.010	0.022
Tues/Wed/Thurs	4	0.015	0.010	0.021	0.010	0.018	0.031	0.009	0.023	0.031	0.006	0.008	0.022	0.015	0.010	0.021	0.029	0.018	0.025	0.006	0.014	0.025
Tues/Wed/Thurs	5	0.024	0.024	0.035	0.022	0.029	0.037	0.024	0.032	0.036	0.017	0.024	0.037	0.024	0.024	0.035	0.034	0.036	0.032	0.018	0.027	0.039
Tues/Wed/Thurs	6	0.037	0.048	0.048	0.042	0.047	0.044	0.044	0.047	0.044	0.041	0.053	0.054	0.037	0.048	0.048	0.036	0.046	0.039	0.037	0.042	0.052
Tues/Wed/Thurs	7	0.045	0.059	0.065	0.060	0.061	0.050	0.070	0.064	0.051	0.077	0.069	0.066	0.045	0.059	0.065	0.040	0.057	0.044	0.053	0.047	0.064
Tues/Wed/Thurs	8	0.047	0.063	0.069	0.060	0.062	0.051	0.065	0.063	0.051	0.066	0.077	0.077	0.047	0.063	0.069	0.041	0.065	0.048	0.054	0.056	0.070
Tues/Wed/Thurs	9	0.050	0.064	0.074	0.055	0.060	0.050	0.055	0.057	0.049	0.057	0.071	0.080	0.050	0.064	0.074	0.041	0.062	0.053	0.059	0.068	0.083
Tues/Wed/Thurs	10	0.051	0.065	0.075	0.056	0.061	0.051	0.054	0.056	0.050	0.056	0.071	0.077	0.051	0.065	0.075	0.044	0.066	0.057	0.064	0.069	0.081
Tues/Wed/Thurs	11	0.055	0.065	0.076	0.059	0.064	0.052	0.055	0.058	0.051	0.058	0.071	0.074	0.055	0.065	0.076	0.046	0.067	0.061	0.068	0.069	0.077
Tues/Wed/Thurs	12	0.057	0.068	0.076	0.061	0.065	0.053	0.058	0.060	0.051	0.062	0.070	0.069	0.057	0.068	0.076	0.048	0.067	0.064	0.069	0.071	0.074
Tues/Wed/Thurs	13	0.061	0.070	0.071	0.064	0.066	0.053	0.061	0.062	0.053	0.063	0.073	0.067	0.061	0.070	0.071	0.049	0.069	0.063	0.072	0.073	0.074
Tues/Wed/Thurs	14	0.066	0.074	0.068	0.068	0.068	0.053	0.068	0.065	0.054	0.066	0.076	0.063	0.066	0.074	0.068	0.052	0.069	0.061	0.077	0.076	0.067
Tues/Wed/Thurs	15	0.073	0.084	0.062	0.073	0.069	0.053	0.074	0.067	0.056	0.079	0.080	0.056	0.073	0.084	0.062	0.055	0.071	0.057	0.084	0.078	0.058
Tues/Wed/Thurs	16	0.078	0.086	0.053	0.075	0.067	0.052	0.080	0.067	0.056	0.087	0.076	0.045	0.078	0.086	0.053	0.057	0.065	0.056	0.082	0.074	0.048
Tues/Wed/Thurs	17	0.077	0.078	0.041	0.074	0.063	0.050	0.078	0.063	0.054	0.088	0.062	0.040	0.077	0.078	0.041	0.056	0.054	0.051	0.074	0.061	0.036
Tues/Wed/Thurs	18	0.059	0.047	0.030	0.059	0.048	0.044	0.055	0.045	0.047	0.054	0.039	0.031	0.059	0.047	0.030	0.053	0.041	0.045	0.053	0.044	0.023
Tues/Wed/Thurs	19	0.048	0.031	0.027	0.043	0.034	0.038	0.039	0.032	0.040	0.036	0.026	0.023	0.048	0.031	0.027	0.052	0.032	0.039	0.038	0.031	0.016
Tues/Wed/Thurs	20	0.041	0.021	0.020	0.035	0.025	0.034	0.032	0.024	0.035	0.028	0.019	0.021	0.041	0.021	0.020	0.050	0.024	0.036	0.030	0.025	0.012
Tues/Wed/Thurs	21	0.036	0.017	0.020	0.029	0.019	0.031	0.027	0.019	0.032	0.021	0.013	0.020	0.036	0.017	0.020	0.045	0.021	0.030	0.023	0.018	0.010
Tues/Wed/Thurs	22	0.025	0.009	0.014	0.020	0.013	0.029	0.020	0.014	0.028	0.014	0.007	0.016	0.025	0.009	0.014	0.039	0.016	0.027	0.017	0.013	0.010
Tues/Wed/Thurs	23	0.017	0.005	0.012	0.013	0.009	0.028	0.013	0.010	0.025	0.009	0.004	0.013	0.017	0.005	0.012	0.031	0.013	0.025	0.010	0.008	0.010
Friday	0	0.009	0.004	0.008	0.007	0.014	0.032	0.007	0.019	0.030	0.007	0.003	0.011	0.009	0.004	0.008	0.023	0.009	0.025	0.005	0.009	0.019
Friday	1	0.009	0.003	0.009	0.005	0.011	0.030	0.004	0.018	0.030	0.004	0.003	0.012	0.009	0.003	0.009	0.024	0.009	0.022	0.003	0.008	0.019
Friday	2	0.009	0.003	0.011	0.004	0.011	0.030	0.003	0.017	0.029	0.004	0.003	0.015	0.009	0.003	0.011	0.024	0.009	0.021	0.002	0.008	0.019
Friday	3	0.011	0.005	0.016	0.005	0.012	0.030	0.004	0.019	0.031	0.004	0.004	0.017	0.011	0.005	0.016	0.026	0.011	0.023	0.002	0.008	0.021
Friday	4	0.013	0.009	0.022	0.008	0.016	0.033	0.009	0.023	0.034	0.006	0.007	0.024	0.013	0.009	0.022	0.028	0.017	0.027	0.005	0.013	0.024
Friday	5	0.021	0.021	0.039	0.017	0.026	0.038	0.020	0.032	0.039	0.015	0.022	0.039	0.021	0.021	0.039	0.032	0.031	0.034	0.013	0.023	0.037
Friday	6	0.033	0.041	0.054	0.033	0.040	0.045	0.037	0.044	0.046	0.035	0.045	0.055	0.033	0.041	0.054	0.034	0.040	0.040	0.026	0.035	0.049
Friday	7	0.039	0.052	0.065	0.049	0.054	0.050	0.059	0.060	0.053	0.063	0.063	0.064	0.039	0.052	0.065	0.036	0.052	0.049	0.039	0.040	0.060
Friday	8	0.044	0.059	0.074	0.051	0.057	0.052	0.057	0.059	0.053	0.058	0.072	0.074	0.044	0.059	0.074	0.039	0.058	0.051	0.043	0.049	0.068
Friday	9	0.047	0.060	0.078	0.050	0.057	0.052	0.052	0.056	0.052	0.052	0.068	0.075	0.047	0.060	0.078	0.040	0.059	0.056	0.049	0.057	0.073
Friday	10	0.048	0.067	0.075	0.054	0.061	0.054	0.053	0.057	0.052	0.055	0.071	0.074	0.048	0.067	0.075	0.043	0.063	0.060	0.058	0.063	0.078
Friday	11	0.054	0.068	0.077	0.060	0.066	0.055	0.056	0.059	0.053	0.060	0.074	0.074	0.054	0.068	0.077	0.045	0.066	0.064	0.064	0.069	0.077
Friday	12	0.060	0.072	0.079	0.063	0.067	0.055	0.059	0.061	0.053	0.063	0.072	0.069	0.060	0.072	0.079	0.046	0.063	0.065	0.066	0.071	0.076
Friday	13	0.063	0.075	0.072	0.066	0.068	0.054	0.062	0.063	0.054	0.065	0.076	0.069	0.063	0.075	0.072	0.049	0.066	0.063	0.071	0.074	0.077
Friday	14	0.068	0.078	0.067	0.070	0.070	0.054	0.068	0.066	0.055	0.069	0.078	0.063	0.068	0.078	0.067	0.051	0.067	0.059	0.076	0.077	0.070
Friday	15	0.073	0.083	0.060	0.073	0.070	0.052	0.073	0.067	0.055	0.078	0.080	0.055	0.073	0.083	0.060	0.054	0.069	0.057	0.083	0.079	0.060
Friday	16	0.076	0.082	0.049	0.074	0.067	0.050	0.077	0.067	0.053	0.085	0.075	0.047	0.076	0.082	0.049	0.056	0.067	0.053	0.083	0.077	0.050
Friday	17	0.074	0.072	0.038	0.072	0.063	0.047	0.074	0.061	0.050	0.082	0.061	0.039	0.074	0.072	0.038	0.058	0.060	0.048	0.075	0.064	0.038
Friday	18	0.060	0.050	0.026	0.063	0.051	0.042	0.060	0.047	0.043	0.059	0.041	0.029	0.060	0.050	0.026	0.057	0.051	0.042	0.062	0.051	0.025
Friday	19	0.052	0.034	0.024	0.050	0.039	0.035	0.046	0.034	0.036	0.042	0.028	0.024	0.052	0.034	0.024	0.057	0.043	0.038	0.050	0.039	0.018
Friday	20	0.043	0.022	0.017	0.041	0.029	0.030	0.038	0.026	0.030	0.032	0.021	0.021	0.043	0.022	0.017	0.053	0.033	0.033	0.041	0.030	0.013
Friday	21	0.040	0.018	0.016	0.037	0.023	0.028	0.034	0.020	0.026	0.027	0.015	0.020	0.040	0.018	0.016	0.049	0.025	0.027	0.036	0.025	0.010

		Del Norte			El Dorado			Fresno			Glenn			Humboldt			Imperial			Inyo		
Day of Week	Hour	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Friday	22	0.031	0.012	0.011	0.030	0.017	0.026	0.028	0.015	0.023	0.021	0.011	0.016	0.031	0.012	0.011	0.042	0.017	0.023	0.030	0.019	0.011
Friday	23	0.022	0.007	0.012	0.019	0.011	0.024	0.020	0.011	0.020	0.014	0.007	0.015	0.022	0.007	0.012	0.034	0.014	0.020	0.018	0.012	0.009
Saturday	0	0.012	0.008	0.014	0.013	0.019	0.038	0.015	0.028	0.041	0.012	0.007	0.021	0.012	0.008	0.014	0.025	0.018	0.036	0.010	0.015	0.027
Saturday	1	0.013	0.006	0.014	0.008	0.015	0.034	0.010	0.025	0.038	0.008	0.005	0.016	0.013	0.006	0.014	0.027	0.015	0.030	0.007	0.012	0.023
Saturday	2	0.013	0.004	0.011	0.006	0.014	0.032	0.008	0.024	0.037	0.006	0.004	0.020	0.013	0.004	0.011	0.027	0.012	0.024	0.005	0.011	0.022
Saturday	3	0.012	0.004	0.014	0.006	0.013	0.031	0.006	0.023	0.036	0.005	0.004	0.022	0.012	0.004	0.014	0.028	0.015	0.027	0.004	0.010	0.025
Saturday	4	0.014	0.008	0.020	0.007	0.014	0.032	0.009	0.024	0.037	0.006	0.008	0.024	0.014	0.008	0.020	0.031	0.019	0.030	0.005	0.013	0.028
Saturday	5	0.020	0.016	0.034	0.011	0.018	0.034	0.016	0.029	0.040	0.012	0.017	0.039	0.020	0.016	0.034	0.034	0.035	0.037	0.010	0.021	0.034
Saturday	6	0.025	0.025	0.043	0.019	0.026	0.039	0.026	0.036	0.045	0.021	0.028	0.049	0.025	0.025	0.043	0.035	0.038	0.043	0.017	0.028	0.039
Saturday	7	0.030	0.031	0.058	0.032	0.038	0.046	0.036	0.043	0.049	0.034	0.041	0.058	0.030	0.031	0.058	0.038	0.050	0.050	0.029	0.036	0.053
Saturday	8	0.036	0.041	0.070	0.045	0.051	0.052	0.045	0.050	0.052	0.045	0.057	0.067	0.036	0.041	0.070	0.040	0.057	0.055	0.044	0.045	0.060
Saturday	9	0.043	0.053	0.079	0.057	0.062	0.056	0.053	0.055	0.054	0.054	0.068	0.074	0.043	0.053	0.079	0.043	0.064	0.058	0.059	0.061	0.071
Saturday	10	0.052	0.069	0.082	0.067	0.071	0.060	0.060	0.061	0.056	0.063	0.080	0.073	0.052	0.069	0.082	0.044	0.066	0.064	0.073	0.074	0.078
Saturday	11	0.054	0.076	0.075	0.074	0.076	0.061	0.066	0.064	0.056	0.068	0.082	0.071	0.054	0.076	0.075	0.045	0.064	0.069	0.081	0.077	0.083
Saturday	12	0.061	0.080	0.070	0.075	0.075	0.060	0.069	0.065	0.056	0.074	0.083	0.068	0.061	0.080	0.070	0.046	0.063	0.066	0.078	0.077	0.075
Saturday	13	0.063	0.082	0.064	0.075	0.074	0.057	0.069	0.063	0.054	0.074	0.079	0.062	0.063	0.082	0.064	0.049	0.063	0.063	0.075	0.072	0.060
Saturday	14	0.065	0.081	0.062	0.074	0.071	0.055	0.070	0.063	0.053	0.074	0.076	0.057	0.065	0.081	0.062	0.051	0.062	0.059	0.075	0.068	0.055
Saturday	15	0.067	0.080	0.054	0.072	0.068	0.051	0.069	0.060	0.049	0.073	0.074	0.052	0.067	0.080	0.054	0.053	0.062	0.053	0.075	0.068	0.052
Saturday	16	0.071	0.081	0.051	0.070	0.064	0.048	0.067	0.057	0.046	0.073	0.067	0.045	0.071	0.081	0.051	0.053	0.057	0.047	0.072	0.070	0.047
Saturday	17	0.068	0.072	0.037	0.066	0.057	0.044	0.063	0.051	0.042	0.069	0.058	0.039	0.068	0.072	0.037	0.054	0.054	0.039	0.066	0.063	0.040
Saturday	18	0.062	0.053	0.032	0.056	0.047	0.038	0.056	0.044	0.036	0.058	0.047	0.034	0.062	0.053	0.032	0.055	0.048	0.034	0.058	0.052	0.031
Saturday	19	0.059	0.040	0.029	0.046	0.037	0.033	0.047	0.036	0.031	0.046	0.036	0.029	0.059	0.040	0.029	0.052	0.040	0.030	0.047	0.041	0.026
Saturday	20	0.051	0.032	0.021	0.040	0.030	0.028	0.041	0.031	0.027	0.040	0.028	0.024	0.051	0.032	0.021	0.049	0.032	0.026	0.038	0.031	0.020
Saturday	21	0.047	0.026	0.023	0.035	0.025	0.025	0.038	0.027	0.023	0.036	0.022	0.023	0.047	0.026	0.023	0.045	0.025	0.023	0.031	0.025	0.016
Saturday	22	0.037	0.019	0.020	0.028	0.019	0.023	0.034	0.024	0.021	0.029	0.016	0.017	0.037	0.019	0.020	0.040	0.020	0.020	0.025	0.020	0.018
Saturday	23	0.028	0.014	0.021	0.020	0.014	0.021	0.024	0.019	0.019	0.020	0.011	0.017	0.028	0.014	0.021	0.036	0.018	0.016	0.016	0.013	0.018
Holiday	0	0.010	0.004	0.009	0.010	0.016	0.028	0.013	0.023	0.029	0.010	0.004	0.012	0.010	0.004	0.009	0.027	0.013	0.019	0.008	0.011	0.020
Holiday	1	0.014	0.004	0.008	0.006	0.013	0.027	0.007	0.022	0.027	0.006	0.004	0.011	0.014	0.004	0.008	0.028	0.009	0.017	0.005	0.009	0.018
Holiday	2	0.010	0.003	0.014	0.004	0.012	0.026	0.005	0.022	0.027	0.004	0.003	0.012	0.010	0.003	0.014	0.026	0.008	0.018	0.003	0.010	0.018
Holiday	3	0.014	0.005	0.012	0.005	0.013	0.027	0.004	0.021	0.028	0.004	0.005	0.015	0.014	0.005	0.012	0.027	0.010	0.018	0.004	0.010	0.021
Holiday	4	0.014	0.006	0.017	0.008	0.016	0.029	0.008	0.024	0.030	0.007	0.009	0.024	0.014	0.006	0.017	0.030	0.016	0.022	0.005	0.012	0.020
Holiday	5	0.019	0.018	0.028	0.014	0.023	0.032	0.016	0.031	0.034	0.014	0.020	0.037	0.019	0.018	0.028	0.030	0.026	0.029	0.009	0.018	0.031
Holiday	6	0.028	0.034	0.042	0.025	0.033	0.036	0.028	0.039	0.038	0.030	0.036	0.047	0.028	0.034	0.042	0.032	0.032	0.031	0.018	0.023	0.038
Holiday	7	0.039	0.045	0.052	0.036	0.044	0.042	0.040	0.046	0.041	0.044	0.052	0.061	0.039	0.045	0.052	0.036	0.042	0.037	0.029	0.031	0.043
Holiday	8	0.041	0.051	0.059	0.046	0.053	0.048	0.045	0.049	0.043	0.052	0.066	0.075	0.041	0.051	0.059	0.040	0.055	0.044	0.041	0.044	0.056
Holiday	9	0.044	0.057	0.066	0.054	0.059	0.050	0.049	0.052	0.047	0.053	0.071	0.081	0.044	0.057	0.066	0.042	0.061	0.054	0.058	0.057	0.075
Holiday	10	0.050	0.069	0.075	0.065	0.069	0.053	0.057	0.059	0.049	0.059	0.076	0.081	0.050	0.069	0.075	0.045	0.067	0.060	0.076	0.083	0.087
Holiday	11	0.056	0.072	0.077	0.074	0.074	0.057	0.065	0.063	0.051	0.066	0.076	0.071	0.056	0.072	0.077	0.047	0.070	0.068	0.084	0.086	0.088
Holiday	12	0.058	0.080	0.078	0.077	0.074	0.056	0.070	0.067	0.054	0.071	0.078	0.074	0.058	0.080	0.078	0.046	0.069	0.070	0.085	0.087	0.089
Holiday	13	0.063	0.077	0.069	0.076	0.074	0.058	0.072	0.067	0.056	0.071	0.076	0.065	0.063	0.077	0.069	0.053	0.080	0.070	0.083	0.081	0.078
Holiday	14	0.068	0.083	0.067	0.075	0.073	0.056	0.074	0.066	0.055	0.070	0.078	0.060	0.068	0.083	0.067	0.051	0.075	0.068	0.080	0.074	0.068
Holiday	15	0.071	0.082	0.064	0.074	0.070	0.055	0.076	0.067	0.056	0.075	0.075	0.053	0.071	0.082	0.064	0.054	0.067	0.062	0.078	0.074	0.060
Holiday	16	0.075	0.083	0.061	0.072	0.066	0.054	0.076	0.064	0.055	0.079	0.070	0.044	0.075	0.083	0.061	0.056	0.066	0.057	0.078	0.072	0.049
Holiday	17	0.072	0.076	0.044	0.068	0.059	0.051	0.072	0.058	0.052	0.074	0.064	0.041	0.072	0.076	0.044	0.056	0.061	0.054	0.071	0.066	0.041
Holiday	18	0.054	0.048	0.040	0.057	0.049	0.045	0.058	0.046	0.049	0.058	0.044	0.034	0.054	0.048	0.040	0.052	0.047	0.045	0.057	0.049	0.033
Holiday	19	0.056	0.036	0.029	0.047	0.036	0.041	0.047	0.035	0.043	0.047	0.033	0.026	0.056	0.036	0.029	0.053	0.039	0.040	0.043	0.040	0.022
Holiday	20	0.049	0.025	0.029	0.039	0.029	0.037	0.039	0.028	0.040	0.038	0.025	0.025	0.049	0.025	0.029	0.049	0.029	0.035	0.033	0.026	0.013
Holiday	21	0.040	0.019	0.023	0.030	0.020	0.033	0.032	0.022	0.036	0.030	0.018	0.021	0.040	0.019	0.023	0.046	0.022	0.030	0.024	0.018	0.011
Holiday	22	0.029	0.012	0.018	0.023	0.015	0.031	0.026	0.017	0.032	0.024	0.011	0.017	0.029	0.012	0.018	0.042	0.020	0.027	0.017	0.012	0.009
Holiday	23	0.025	0.010	0.019	0.015	0.010	0.029	0.018	0.013	0.029	0.014	0.007	0.014	0.025	0.010	0.019	0.032	0.019	0.025	0.010	0.008	0.010

		Kern			Kings			Lake			Lassen			Los Angeles			Madera			Marin		
Day of Week	Hour	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Sunday	0	0.014	0.028	0.041	0.016	0.031	0.042	0.013	0.011	0.008	0.020	0.007	0.015	0.025	0.043	0.051	0.014	0.037	0.044	0.019	0.038	0.053
Sunday	1	0.010	0.024	0.038	0.010	0.025	0.038	0.013	0.008	0.010	0.020	0.005	0.014	0.018	0.033	0.044	0.008	0.032	0.040	0.012	0.034	0.047
Sunday	2	0.007	0.022	0.034	0.007	0.026	0.036	0.012	0.006	0.008	0.020	0.003	0.012	0.014	0.028	0.040	0.005	0.028	0.037	0.008	0.031	0.043
Sunday	3	0.006	0.020	0.033	0.005	0.022	0.031	0.014	0.005	0.007	0.021	0.004	0.011	0.009	0.022	0.035	0.004	0.026	0.035	0.006	0.030	0.040
Sunday	4	0.007	0.021	0.033	0.004	0.020	0.031	0.014	0.004	0.011	0.024	0.007	0.011	0.008	0.021	0.034	0.004	0.025	0.034	0.006	0.029	0.038
Sunday	5	0.012	0.024	0.033	0.008	0.023	0.031	0.017	0.009	0.019	0.028	0.012	0.015	0.012	0.024	0.035	0.009	0.027	0.034	0.010	0.031	0.038
Sunday	6	0.016	0.027	0.034	0.018	0.029	0.036	0.021	0.014	0.028	0.030	0.017	0.026	0.018	0.029	0.037	0.016	0.030	0.036	0.016	0.033	0.039
Sunday	7	0.024	0.032	0.035	0.023	0.030	0.035	0.026	0.020	0.036	0.034	0.032	0.037	0.025	0.034	0.039	0.022	0.033	0.036	0.023	0.036	0.040
Sunday	8	0.032	0.039	0.038	0.034	0.040	0.040	0.031	0.032	0.043	0.037	0.045	0.053	0.035	0.040	0.042	0.033	0.039	0.040	0.033	0.040	0.042
Sunday	9	0.042	0.045	0.040	0.048	0.049	0.046	0.040	0.050	0.054	0.044	0.064	0.064	0.047	0.050	0.045	0.046	0.047	0.044	0.048	0.046	0.044
Sunday	10	0.051	0.051	0.042	0.059	0.057	0.049	0.047	0.064	0.067	0.046	0.076	0.072	0.057	0.056	0.047	0.056	0.052	0.046	0.062	0.051	0.045
Sunday	11	0.059	0.056	0.045	0.071	0.064	0.052	0.055	0.079	0.062	0.050	0.083	0.079	0.062	0.059	0.047	0.065	0.057	0.048	0.067	0.053	0.046
Sunday	12	0.066	0.060	0.046	0.084	0.077	0.057	0.061	0.087	0.065	0.053	0.088	0.075	0.065	0.060	0.047	0.071	0.059	0.049	0.070	0.054	0.046
Sunday	13	0.071	0.063	0.047	0.083	0.077	0.056	0.065	0.092	0.064	0.054	0.082	0.069	0.068	0.060	0.046	0.073	0.059	0.049	0.073	0.055	0.050
Sunday	14	0.075	0.065	0.047	0.080	0.072	0.055	0.067	0.087	0.065	0.059	0.075	0.067	0.068	0.058	0.044	0.076	0.059	0.048	0.073	0.055	0.047
Sunday	15	0.078	0.064	0.048	0.076	0.065	0.052	0.072	0.086	0.067	0.060	0.076	0.064	0.067	0.055	0.043	0.076	0.058	0.047	0.073	0.053	0.041
Sunday	16	0.077	0.063	0.048	0.074	0.062	0.050	0.077	0.086	0.072	0.063	0.074	0.058	0.065	0.052	0.042	0.077	0.058	0.047	0.072	0.052	0.039
Sunday	17	0.074	0.060	0.047	0.068	0.056	0.046	0.070	0.075	0.058	0.063	0.063	0.058	0.063	0.049	0.040	0.074	0.055	0.046	0.070	0.050	0.038
Sunday	18	0.069	0.055	0.046	0.059	0.044	0.042	0.067	0.059	0.054	0.061	0.053	0.050	0.059	0.045	0.040	0.068	0.048	0.043	0.063	0.047	0.036
Sunday	19	0.061	0.049	0.046	0.050	0.037	0.037	0.062	0.045	0.050	0.059	0.051	0.041	0.056	0.042	0.039	0.060	0.043	0.041	0.056	0.044	0.035
Sunday	20	0.053	0.042	0.045	0.043	0.032	0.037	0.054	0.035	0.047	0.051	0.034	0.036	0.052	0.040	0.040	0.052	0.039	0.040	0.051	0.041	0.036
Sunday	21	0.042	0.035	0.044	0.036	0.028	0.035	0.045	0.024	0.039	0.044	0.025	0.031	0.047	0.038	0.041	0.042	0.034	0.039	0.042	0.038	0.037
Sunday	22	0.032	0.030	0.045	0.028	0.022	0.034	0.033	0.015	0.033	0.035	0.016	0.024	0.036	0.034	0.042	0.031	0.028	0.038	0.030	0.032	0.039
Sunday	23	0.021	0.025	0.046	0.015	0.015	0.033	0.022	0.009	0.032	0.024	0.009	0.018	0.024	0.029	0.042	0.018	0.023	0.037	0.019	0.027	0.043
Monday	0	0.013	0.022	0.025	0.005	0.013	0.019	0.010	0.003	0.007	0.020	0.005	0.012	0.012	0.018	0.025	0.007	0.021	0.024	0.007	0.023	0.029
Monday	1	0.009	0.019	0.024	0.002	0.012	0.019	0.009	0.002	0.007	0.021	0.003	0.010	0.007	0.015	0.023	0.003	0.020	0.024	0.003	0.022	0.028
Monday	2	0.008	0.019	0.024	0.001	0.014	0.020	0.010	0.003	0.010	0.022	0.003	0.012	0.006	0.015	0.023	0.002	0.020	0.024	0.002	0.022	0.029
Monday	3	0.011	0.022	0.026	0.001	0.012	0.019	0.012	0.006	0.012	0.023	0.004	0.012	0.007	0.017	0.024	0.004	0.023	0.026	0.003	0.023	0.030
Monday	4	0.021	0.029	0.028	0.003	0.015	0.021	0.014	0.009	0.013	0.026	0.011	0.013	0.016	0.024	0.030	0.012	0.028	0.029	0.012	0.028	0.035
Monday	5	0.040	0.041	0.033	0.012	0.021	0.027	0.022	0.022	0.026	0.037	0.047	0.021	0.038	0.042	0.038	0.029	0.039	0.036	0.033	0.041	0.042
Monday	6	0.047	0.046	0.034	0.034	0.040	0.038	0.037	0.047	0.044	0.038	0.049	0.030	0.054	0.056	0.044	0.050	0.051	0.044	0.054	0.051	0.048
Monday	7	0.056	0.054	0.038	0.070	0.071	0.056	0.045	0.058	0.058	0.041	0.051	0.035	0.061	0.062	0.049	0.072	0.063	0.051	0.066	0.058	0.053
Monday	8	0.050	0.052	0.038	0.073	0.071	0.056	0.047	0.062	0.067	0.043	0.058	0.047	0.059	0.061	0.049	0.063	0.059	0.049	0.062	0.060	0.055
Monday	9	0.049	0.052	0.039	0.061	0.062	0.053	0.050	0.065	0.078	0.045	0.073	0.058	0.054	0.058	0.049	0.058	0.056	0.049	0.055	0.056	0.054
Monday	10	0.052	0.053	0.042	0.059	0.062	0.054	0.051	0.065	0.080	0.047	0.076	0.068	0.052	0.057	0.050	0.057	0.057	0.051	0.052	0.054	0.053
Monday	11	0.057	0.056	0.044	0.059	0.063	0.056	0.056	0.067	0.083	0.052	0.073	0.077	0.052	0.058	0.051	0.059	0.059	0.053	0.053	0.055	0.054
Monday	12	0.061	0.059	0.046	0.062	0.064	0.056	0.058	0.069	0.081	0.053	0.068	0.073	0.054	0.058	0.052	0.060	0.062	0.055	0.054	0.056	0.054
Monday	13	0.064	0.060	0.049	0.064	0.067	0.058	0.063	0.074	0.076	0.056	0.065	0.066	0.055	0.058	0.052	0.061	0.061	0.054	0.056	0.056	0.054
Monday	14	0.068	0.063	0.052	0.073	0.071	0.064	0.067	0.076	0.074	0.058	0.072	0.066	0.059	0.060	0.052	0.066	0.062	0.057	0.063	0.059	0.056
Monday	15	0.074	0.067	0.057	0.078	0.072	0.064	0.073	0.087	0.062	0.059	0.079	0.061	0.062	0.060	0.052	0.071	0.064	0.058	0.069	0.063	0.058
Monday	16	0.073	0.065	0.058	0.086	0.073	0.062	0.076	0.084	0.053	0.061	0.069	0.053	0.063	0.058	0.051	0.075	0.062	0.057	0.072	0.060	0.052
Monday	17	0.067	0.058	0.057	0.087	0.070	0.062	0.075	0.075	0.040	0.059	0.067	0.054	0.064	0.055	0.050	0.074	0.058	0.055	0.073	0.056	0.047
Monday	18	0.050	0.044	0.053	0.056	0.046	0.053	0.057	0.047	0.032	0.056	0.043	0.048	0.059	0.047	0.047	0.052	0.041	0.047	0.061	0.045	0.039
Monday	19	0.037	0.034	0.049	0.037	0.028	0.038	0.050	0.031	0.029	0.050	0.030	0.044	0.049	0.036	0.042	0.037	0.030	0.039	0.045	0.033	0.031
Monday	20	0.032	0.028	0.048	0.029	0.021	0.033	0.043	0.020	0.021	0.043	0.021	0.036	0.039	0.028	0.038	0.030	0.022	0.034	0.035	0.026	0.026
Monday	21	0.026	0.023	0.048	0.023	0.015	0.029	0.035	0.015	0.020	0.040	0.016	0.037	0.034	0.023	0.037	0.025	0.017	0.031	0.031	0.022	0.024
Monday	22	0.021	0.018	0.044	0.016	0.010	0.024	0.025	0.009	0.014	0.030	0.009	0.035	0.027	0.020	0.036	0.019	0.014	0.027	0.023	0.017	0.023
Monday	23	0.014	0.015	0.042	0.009	0.007	0.021	0.016	0.005	0.013	0.022	0.006	0.030	0.017	0.016	0.035	0.012	0.011	0.024	0.014	0.014	0.025

		Kern			Kings			Lake			Lassen			Los Angeles			Madera			Marin		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Tues/Wed/Thurs	0	0.010	0.021	0.032	0.004	0.013	0.022	0.010	0.004	0.008	0.022	0.004	0.024	0.011	0.019	0.029	0.005	0.020	0.027	0.006	0.022	0.031
Tues/Wed/Thurs	1	0.006	0.019	0.031	0.002	0.012	0.021	0.009	0.003	0.008	0.022	0.004	0.016	0.006	0.016	0.028	0.001	0.019	0.026	0.003	0.021	0.030
Tues/Wed/Thurs	2	0.006	0.019	0.031	0.000	0.011	0.021	0.010	0.002	0.012	0.024	0.003	0.012	0.005	0.016	0.027	0.001	0.019	0.027	0.002	0.021	0.030
Tues/Wed/Thurs	3	0.009	0.022	0.031	0.000	0.012	0.021	0.011	0.005	0.014	0.025	0.005	0.016	0.007	0.017	0.028	0.002	0.022	0.028	0.003	0.023	0.031
Tues/Wed/Thurs	4	0.019	0.029	0.034	0.003	0.014	0.023	0.015	0.010	0.021	0.028	0.011	0.025	0.015	0.025	0.033	0.010	0.027	0.032	0.011	0.028	0.036
Tues/Wed/Thurs	5	0.039	0.041	0.037	0.012	0.021	0.029	0.024	0.024	0.035	0.039	0.045	0.028	0.037	0.042	0.041	0.027	0.037	0.039	0.034	0.040	0.044
Tues/Wed/Thurs	6	0.048	0.046	0.039	0.035	0.040	0.042	0.037	0.048	0.048	0.041	0.045	0.035	0.054	0.056	0.047	0.050	0.050	0.047	0.056	0.052	0.049
Tues/Wed/Thurs	7	0.058	0.053	0.042	0.070	0.066	0.055	0.045	0.059	0.065	0.041	0.054	0.046	0.061	0.062	0.051	0.074	0.063	0.054	0.068	0.059	0.054
Tues/Wed/Thurs	8	0.052	0.052	0.042	0.073	0.071	0.058	0.047	0.063	0.069	0.044	0.061	0.053	0.059	0.062	0.051	0.065	0.059	0.052	0.063	0.060	0.056
Tues/Wed/Thurs	9	0.049	0.050	0.041	0.060	0.062	0.054	0.050	0.064	0.074	0.046	0.067	0.059	0.054	0.058	0.050	0.057	0.057	0.051	0.055	0.055	0.053
Tues/Wed/Thurs	10	0.050	0.051	0.042	0.057	0.060	0.054	0.051	0.065	0.075	0.048	0.069	0.067	0.052	0.057	0.051	0.055	0.057	0.052	0.051	0.053	0.052
Tues/Wed/Thurs	11	0.054	0.054	0.044	0.058	0.063	0.056	0.055	0.065	0.076	0.049	0.069	0.074	0.052	0.057	0.051	0.056	0.058	0.052	0.050	0.054	0.052
Tues/Wed/Thurs	12	0.059	0.056	0.046	0.060	0.064	0.056	0.057	0.068	0.076	0.051	0.069	0.070	0.053	0.057	0.051	0.057	0.059	0.053	0.052	0.055	0.053
Tues/Wed/Thurs	13	0.062	0.058	0.047	0.061	0.064	0.057	0.061	0.070	0.071	0.054	0.071	0.064	0.055	0.058	0.050	0.059	0.060	0.054	0.054	0.056	0.054
Tues/Wed/Thurs	14	0.068	0.062	0.050	0.071	0.070	0.059	0.066	0.074	0.068	0.056	0.072	0.062	0.059	0.059	0.050	0.065	0.063	0.055	0.062	0.059	0.054
Tues/Wed/Thurs	15	0.075	0.067	0.053	0.077	0.072	0.062	0.073	0.084	0.062	0.058	0.073	0.059	0.060	0.058	0.049	0.072	0.064	0.056	0.067	0.063	0.056
Tues/Wed/Thurs	16	0.075	0.066	0.054	0.086	0.073	0.060	0.078	0.086	0.053	0.058	0.070	0.053	0.062	0.056	0.048	0.078	0.064	0.055	0.070	0.060	0.051
Tues/Wed/Thurs	17	0.070	0.060	0.053	0.087	0.072	0.060	0.077	0.078	0.041	0.060	0.071	0.048	0.062	0.053	0.046	0.079	0.061	0.053	0.071	0.057	0.046
Tues/Wed/Thurs	18	0.052	0.046	0.048	0.059	0.051	0.051	0.059	0.047	0.030	0.053	0.043	0.043	0.058	0.046	0.043	0.055	0.043	0.044	0.062	0.047	0.039
Tues/Wed/Thurs	19	0.039	0.036	0.044	0.039	0.032	0.038	0.048	0.031	0.027	0.049	0.034	0.038	0.051	0.036	0.039	0.040	0.031	0.036	0.048	0.035	0.031
Tues/Wed/Thurs	20	0.033	0.030	0.042	0.032	0.023	0.032	0.041	0.021	0.020	0.044	0.025	0.030	0.042	0.028	0.036	0.033	0.024	0.032	0.038	0.027	0.026
Tues/Wed/Thurs	21	0.029	0.025	0.041	0.026	0.017	0.028	0.036	0.017	0.020	0.038	0.018	0.029	0.037	0.024	0.034	0.028	0.019	0.028	0.033	0.022	0.024
Tues/Wed/Thurs	22	0.023	0.020	0.039	0.018	0.011	0.023	0.025	0.009	0.014	0.029	0.011	0.026	0.030	0.020	0.033	0.021	0.014	0.025	0.024	0.017	0.022
Tues/Wed/Thurs	23	0.015	0.017	0.038	0.010	0.007	0.019	0.017	0.005	0.012	0.022	0.006	0.024	0.019	0.016	0.032	0.013	0.011	0.023	0.015	0.013	0.024
Friday	0	0.009	0.021	0.035	0.006	0.014	0.024	0.009	0.004	0.008	0.021	0.005	0.023	0.012	0.021	0.032	0.005	0.020	0.029	0.008	0.022	0.033
Friday	1	0.007	0.019	0.034	0.002	0.012	0.024	0.009	0.003	0.009	0.022	0.004	0.015	0.008	0.017	0.030	0.002	0.019	0.029	0.004	0.021	0.031
Friday	2	0.006	0.019	0.034	0.001	0.011	0.022	0.009	0.003	0.011	0.023	0.003	0.011	0.007	0.017	0.030	0.001	0.019	0.029	0.003	0.022	0.032
Friday	3	0.008	0.021	0.035	0.001	0.013	0.024	0.011	0.005	0.016	0.024	0.004	0.016	0.007	0.018	0.031	0.003	0.021	0.030	0.004	0.023	0.033
Friday	4	0.015	0.027	0.037	0.002	0.015	0.025	0.013	0.009	0.022	0.025	0.007	0.025	0.014	0.025	0.035	0.008	0.026	0.034	0.010	0.028	0.036
Friday	5	0.031	0.037	0.040	0.011	0.021	0.031	0.021	0.021	0.039	0.033	0.027	0.029	0.033	0.040	0.044	0.022	0.036	0.040	0.030	0.039	0.044
Friday	6	0.039	0.043	0.043	0.031	0.039	0.043	0.033	0.041	0.054	0.035	0.034	0.035	0.049	0.054	0.050	0.039	0.047	0.048	0.050	0.049	0.050
Friday	7	0.048	0.050	0.045	0.063	0.064	0.057	0.039	0.052	0.065	0.040	0.046	0.049	0.057	0.060	0.053	0.059	0.058	0.054	0.063	0.057	0.055
Friday	8	0.045	0.050	0.045	0.067	0.069	0.059	0.044	0.059	0.074	0.044	0.061	0.056	0.056	0.060	0.054	0.054	0.058	0.054	0.059	0.057	0.056
Friday	9	0.045	0.049	0.046	0.057	0.062	0.057	0.047	0.060	0.078	0.047	0.068	0.060	0.052	0.058	0.054	0.051	0.056	0.054	0.053	0.054	0.054
Friday	10	0.049	0.053	0.047	0.057	0.063	0.056	0.048	0.067	0.075	0.046	0.068	0.071	0.052	0.058	0.054	0.052	0.057	0.054	0.051	0.053	0.053
Friday	11	0.054	0.055	0.048	0.059	0.065	0.058	0.054	0.068	0.077	0.049	0.075	0.077	0.053	0.059	0.054	0.054	0.059	0.054	0.053	0.055	0.054
Friday	12	0.058	0.057	0.049	0.061	0.064	0.058	0.060	0.072	0.079	0.051	0.071	0.070	0.054	0.059	0.054	0.056	0.060	0.055	0.056	0.057	0.055
Friday	13	0.063	0.060	0.050	0.062	0.066	0.058	0.063	0.075	0.072	0.056	0.074	0.065	0.056	0.059	0.052	0.059	0.062	0.055	0.058	0.058	0.056
Friday	14	0.068	0.063	0.051	0.070	0.069	0.058	0.068	0.078	0.067	0.056	0.074	0.060	0.057	0.059	0.051	0.065	0.063	0.055	0.064	0.059	0.056
Friday	15	0.072	0.067	0.053	0.073	0.069	0.060	0.073	0.083	0.060	0.059	0.074	0.055	0.058	0.057	0.049	0.071	0.064	0.056	0.066	0.062	0.056
Friday	16	0.073	0.064	0.052	0.079	0.073	0.060	0.076	0.082	0.049	0.061	0.072	0.054	0.059	0.055	0.046	0.077	0.062	0.053	0.067	0.059	0.050
Friday	17	0.070	0.059	0.050	0.079	0.065	0.055	0.074	0.072	0.038	0.058	0.066	0.046	0.059	0.051	0.044	0.076	0.057	0.049	0.067	0.055	0.046
Friday	18	0.060	0.048	0.044	0.061	0.050	0.047	0.060	0.050	0.026	0.056	0.051	0.043	0.057	0.045	0.040	0.063	0.046	0.042	0.060	0.047	0.039
Friday	19	0.049	0.039	0.039	0.045	0.034	0.036	0.052	0.034	0.024	0.052	0.043	0.036	0.051	0.037	0.035	0.050	0.035	0.035	0.049	0.036	0.030
Friday	20	0.042	0.032	0.035	0.036	0.023	0.028	0.043	0.022	0.017	0.046	0.032	0.028	0.045	0.029	0.030	0.042	0.026	0.029	0.040	0.029	0.023
Friday	21	0.037	0.027	0.032	0.031	0.017	0.024	0.040	0.018	0.016	0.041	0.021	0.026	0.040	0.024	0.027	0.037	0.021	0.025	0.035	0.023	0.020
Friday	22	0.031	0.023	0.029	0.028	0.013	0.019	0.031	0.012	0.011	0.032	0.013	0.026	0.036	0.021	0.026	0.030	0.015	0.020	0.030	0.019	0.019
Friday	23	0.021	0.018	0.027	0.017	0.008	0.016	0.022	0.007	0.012	0.023	0.008	0.024	0.027	0.017	0.024	0.021	0.012	0.018	0.022	0.015	0.020
Saturday	0	0.016	0.028	0.043	0.013	0.022	0.035	0.012	0.008	0.014	0.024	0.009	0.025	0.020	0.031	0.046	0.012	0.031	0.042	0.015	0.030	0.044
Saturday	1	0.011	0.023	0.041	0.008	0.019	0.032	0.013	0.006	0.014	0.026	0.007	0.015	0.013	0.025	0.041	0.008	0.027	0.039	0.009	0.027	0.040
Saturday	2	0.009	0.022	0.040	0.005	0.017	0.031	0.013	0.004	0.011	0.025	0.004	0.013	0.011	0.023	0.039	0.006	0.025	0.038	0.006	0.026	0.039
Saturday	3	0.009	0.021	0.040	0.003	0.016	0.030	0.012	0.004	0.014	0.026	0.004	0.017	0.008	0.020	0.037	0.005	0.024	0.036	0.005	0.025	0.037

		Kern			Kings			Lake			Lassen			Los Angeles			Madera			Marin		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Saturday	4	0.014	0.025	0.041	0.004	0.016	0.031	0.014	0.008	0.020	0.029	0.007	0.025	0.010	0.022	0.038	0.008	0.027	0.037	0.006	0.027	0.037
Saturday	5	0.027	0.034	0.044	0.010	0.022	0.033	0.020	0.016	0.034	0.035	0.022	0.023	0.017	0.028	0.042	0.017	0.032	0.041	0.013	0.030	0.040
Saturday	6	0.034	0.038	0.045	0.023	0.031	0.041	0.025	0.025	0.043	0.039	0.035	0.033	0.027	0.036	0.046	0.026	0.039	0.046	0.023	0.035	0.042
Saturday	7	0.042	0.045	0.047	0.036	0.041	0.048	0.030	0.031	0.058	0.039	0.041	0.050	0.037	0.046	0.051	0.036	0.045	0.050	0.034	0.041	0.047
Saturday	8	0.050	0.052	0.050	0.045	0.049	0.053	0.036	0.041	0.070	0.044	0.057	0.053	0.046	0.052	0.054	0.047	0.052	0.054	0.046	0.047	0.049
Saturday	9	0.056	0.056	0.052	0.053	0.054	0.057	0.043	0.053	0.079	0.047	0.074	0.065	0.053	0.057	0.056	0.055	0.057	0.056	0.055	0.051	0.050
Saturday	10	0.060	0.057	0.053	0.061	0.063	0.059	0.052	0.069	0.082	0.050	0.080	0.075	0.057	0.060	0.056	0.062	0.062	0.060	0.061	0.054	0.051
Saturday	11	0.063	0.059	0.053	0.067	0.072	0.062	0.054	0.076	0.075	0.050	0.078	0.073	0.060	0.062	0.056	0.067	0.063	0.058	0.065	0.056	0.052
Saturday	12	0.065	0.061	0.052	0.071	0.072	0.064	0.061	0.080	0.070	0.053	0.075	0.066	0.062	0.062	0.054	0.068	0.062	0.056	0.066	0.058	0.055
Saturday	13	0.066	0.061	0.050	0.071	0.069	0.060	0.063	0.082	0.064	0.055	0.070	0.064	0.062	0.060	0.051	0.068	0.059	0.054	0.067	0.059	0.058
Saturday	14	0.067	0.060	0.049	0.071	0.070	0.060	0.065	0.081	0.062	0.053	0.068	0.063	0.062	0.058	0.048	0.068	0.059	0.051	0.067	0.058	0.057
Saturday	15	0.067	0.060	0.048	0.070	0.067	0.055	0.067	0.080	0.054	0.054	0.063	0.059	0.062	0.056	0.045	0.068	0.056	0.049	0.068	0.057	0.051
Saturday	16	0.064	0.056	0.044	0.070	0.061	0.049	0.071	0.081	0.051	0.057	0.064	0.055	0.062	0.053	0.042	0.068	0.054	0.046	0.068	0.056	0.047
Saturday	17	0.058	0.052	0.041	0.066	0.056	0.046	0.068	0.072	0.037	0.055	0.064	0.051	0.060	0.049	0.038	0.064	0.050	0.041	0.067	0.054	0.044
Saturday	18	0.051	0.046	0.036	0.059	0.048	0.038	0.062	0.053	0.032	0.052	0.049	0.044	0.057	0.044	0.034	0.057	0.042	0.035	0.060	0.048	0.036
Saturday	19	0.044	0.037	0.032	0.049	0.036	0.030	0.059	0.040	0.029	0.048	0.039	0.039	0.051	0.037	0.029	0.049	0.034	0.029	0.049	0.041	0.029
Saturday	20	0.039	0.033	0.028	0.043	0.032	0.027	0.051	0.032	0.021	0.046	0.034	0.030	0.046	0.033	0.026	0.043	0.030	0.025	0.043	0.036	0.025
Saturday	21	0.035	0.029	0.026	0.040	0.027	0.022	0.047	0.026	0.023	0.039	0.026	0.026	0.043	0.030	0.024	0.039	0.027	0.022	0.041	0.033	0.024
Saturday	22	0.030	0.024	0.024	0.037	0.024	0.020	0.037	0.019	0.020	0.031	0.020	0.020	0.042	0.029	0.024	0.035	0.024	0.019	0.037	0.029	0.023
Saturday	23	0.023	0.020	0.020	0.024	0.017	0.017	0.028	0.014	0.021	0.023	0.010	0.017	0.033	0.026	0.022	0.025	0.020	0.018	0.028	0.024	0.022
Holiday	0	0.015	0.023	0.028	0.011	0.017	0.026	0.010	0.004	0.009	0.020	0.007	0.015	0.017	0.024	0.031	0.010	0.023	0.027	0.013	0.027	0.034
Holiday	1	0.009	0.021	0.028	0.006	0.018	0.023	0.014	0.004	0.008	0.020	0.003	0.012	0.011	0.020	0.028	0.004	0.024	0.028	0.007	0.026	0.033
Holiday	2	0.007	0.020	0.028	0.002	0.018	0.027	0.010	0.003	0.014	0.025	0.003	0.011	0.009	0.019	0.027	0.002	0.022	0.027	0.004	0.025	0.033
Holiday	3	0.008	0.021	0.028	0.001	0.019	0.027	0.014	0.005	0.012	0.022	0.002	0.016	0.007	0.019	0.028	0.001	0.023	0.028	0.003	0.025	0.033
Holiday	4	0.013	0.024	0.028	0.002	0.015	0.027	0.014	0.006	0.017	0.024	0.004	0.015	0.012	0.023	0.030	0.006	0.026	0.030	0.007	0.029	0.035
Holiday	5	0.027	0.032	0.032	0.010	0.021	0.027	0.019	0.018	0.028	0.031	0.020	0.021	0.024	0.033	0.036	0.016	0.033	0.035	0.017	0.034	0.039
Holiday	6	0.033	0.037	0.033	0.026	0.034	0.037	0.028	0.034	0.042	0.033	0.025	0.028	0.034	0.041	0.040	0.028	0.040	0.039	0.029	0.040	0.044
Holiday	7	0.039	0.043	0.036	0.043	0.046	0.041	0.039	0.045	0.052	0.038	0.036	0.044	0.042	0.047	0.043	0.037	0.045	0.042	0.038	0.045	0.047
Holiday	8	0.043	0.047	0.037	0.050	0.052	0.042	0.041	0.051	0.059	0.044	0.054	0.043	0.045	0.050	0.045	0.044	0.051	0.045	0.045	0.050	0.051
Holiday	9	0.050	0.050	0.040	0.051	0.052	0.050	0.044	0.057	0.066	0.046	0.071	0.064	0.048	0.053	0.047	0.051	0.053	0.048	0.049	0.053	0.052
Holiday	10	0.055	0.055	0.042	0.060	0.067	0.052	0.050	0.069	0.075	0.051	0.088	0.073	0.054	0.058	0.050	0.060	0.060	0.053	0.056	0.056	0.053
Holiday	11	0.064	0.060	0.047	0.067	0.070	0.059	0.056	0.072	0.077	0.053	0.082	0.075	0.058	0.061	0.051	0.068	0.064	0.055	0.062	0.059	0.055
Holiday	12	0.068	0.061	0.050	0.073	0.077	0.064	0.058	0.080	0.078	0.055	0.082	0.072	0.061	0.063	0.053	0.072	0.066	0.056	0.067	0.061	0.056
Holiday	13	0.071	0.066	0.051	0.075	0.072	0.057	0.063	0.077	0.069	0.054	0.078	0.063	0.063	0.064	0.053	0.071	0.067	0.058	0.070	0.062	0.056
Holiday	14	0.073	0.064	0.052	0.076	0.070	0.062	0.068	0.083	0.067	0.060	0.077	0.067	0.064	0.064	0.053	0.073	0.064	0.058	0.073	0.062	0.057
Holiday	15	0.075	0.067	0.055	0.072	0.073	0.063	0.071	0.082	0.064	0.054	0.081	0.062	0.065	0.061	0.051	0.075	0.062	0.054	0.071	0.061	0.054
Holiday	16	0.072	0.064	0.055	0.075	0.066	0.057	0.075	0.083	0.061	0.062	0.077	0.063	0.064	0.057	0.050	0.076	0.060	0.054	0.070	0.057	0.050
Holiday	17	0.066	0.059	0.054	0.071	0.059	0.053	0.072	0.076	0.044	0.061	0.066	0.050	0.063	0.053	0.048	0.073	0.056	0.053	0.067	0.053	0.044
Holiday	18	0.056	0.046	0.049	0.059	0.046	0.048	0.054	0.048	0.040	0.057	0.043	0.042	0.058	0.046	0.045	0.061	0.044	0.046	0.059	0.045	0.038
Holiday	19	0.047	0.042	0.050	0.047	0.032	0.038	0.056	0.036	0.029	0.052	0.035	0.041	0.052	0.038	0.042	0.050	0.035	0.040	0.051	0.036	0.031
Holiday	20	0.039	0.033	0.046	0.040	0.029	0.033	0.049	0.025	0.029	0.043	0.022	0.034	0.047	0.032	0.039	0.043	0.029	0.037	0.046	0.031	0.028
Holiday	21	0.031	0.027	0.046	0.034	0.024	0.033	0.040	0.019	0.023	0.041	0.024	0.036	0.042	0.028	0.038	0.035	0.022	0.032	0.041	0.026	0.026
Holiday	22	0.025	0.021	0.043	0.030	0.015	0.031	0.029	0.012	0.018	0.031	0.011	0.026	0.037	0.025	0.037	0.028	0.018	0.029	0.033	0.021	0.025
Holiday	23	0.016	0.018	0.041	0.018	0.009	0.022	0.025	0.010	0.019	0.022	0.009	0.026	0.025	0.020	0.036	0.018	0.014	0.026	0.021	0.017	0.026

		Mariposa			Mendocino			Merced			Modoc			Mono			Monterey			Napa		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Sunday	0	0.010	0.014	0.032	0.013	0.011	0.008	0.014	0.025	0.037	0.019	0.009	0.017	0.010	0.014	0.032	0.019	0.010	0.029	0.017	0.035	0.054
Sunday	1	0.007	0.011	0.024	0.013	0.008	0.010	0.009	0.019	0.032	0.021	0.007	0.014	0.007	0.011	0.024	0.020	0.008	0.023	0.011	0.030	0.047
Sunday	2	0.005	0.011	0.022	0.012	0.006	0.008	0.007	0.016	0.029	0.022	0.006	0.013	0.005	0.011	0.022	0.020	0.007	0.021	0.007	0.028	0.044
Sunday	3	0.004	0.010	0.021	0.014	0.005	0.007	0.005	0.015	0.028	0.022	0.005	0.013	0.004	0.010	0.021	0.020	0.007	0.019	0.006	0.026	0.043
Sunday	4	0.004	0.010	0.020	0.014	0.004	0.011	0.006	0.016	0.028	0.023	0.006	0.013	0.004	0.010	0.020	0.024	0.012	0.019	0.006	0.025	0.038
Sunday	5	0.007	0.013	0.021	0.017	0.009	0.019	0.010	0.019	0.029	0.025	0.008	0.016	0.007	0.013	0.021	0.026	0.017	0.021	0.009	0.027	0.038
Sunday	6	0.012	0.019	0.026	0.021	0.014	0.028	0.015	0.023	0.031	0.028	0.014	0.024	0.012	0.019	0.026	0.029	0.024	0.026	0.014	0.030	0.038
Sunday	7	0.019	0.023	0.029	0.026	0.020	0.036	0.021	0.029	0.035	0.030	0.022	0.034	0.019	0.023	0.029	0.031	0.030	0.034	0.020	0.033	0.039
Sunday	8	0.032	0.035	0.038	0.031	0.032	0.043	0.031	0.038	0.040	0.033	0.036	0.048	0.032	0.035	0.038	0.035	0.038	0.040	0.031	0.038	0.042
Sunday	9	0.051	0.051	0.053	0.040	0.050	0.054	0.043	0.050	0.047	0.036	0.052	0.062	0.051	0.051	0.053	0.038	0.049	0.049	0.047	0.047	0.046
Sunday	10	0.067	0.067	0.071	0.047	0.064	0.067	0.055	0.060	0.051	0.040	0.071	0.075	0.067	0.067	0.071	0.041	0.057	0.057	0.060	0.054	0.046
Sunday	11	0.080	0.081	0.085	0.055	0.079	0.062	0.063	0.065	0.054	0.044	0.082	0.086	0.080	0.081	0.085	0.047	0.068	0.061	0.066	0.056	0.047
Sunday	12	0.083	0.081	0.076	0.061	0.087	0.065	0.070	0.070	0.055	0.049	0.089	0.088	0.083	0.081	0.076	0.051	0.074	0.063	0.067	0.056	0.045
Sunday	13	0.085	0.082	0.074	0.065	0.092	0.064	0.075	0.071	0.056	0.054	0.090	0.080	0.085	0.082	0.074	0.053	0.073	0.065	0.070	0.056	0.042
Sunday	14	0.085	0.083	0.069	0.067	0.087	0.065	0.077	0.069	0.055	0.058	0.089	0.072	0.085	0.083	0.069	0.059	0.078	0.065	0.071	0.057	0.038
Sunday	15	0.084	0.081	0.066	0.072	0.086	0.067	0.078	0.070	0.053	0.063	0.087	0.069	0.084	0.081	0.066	0.061	0.078	0.066	0.071	0.052	0.037
Sunday	16	0.082	0.079	0.060	0.077	0.086	0.072	0.077	0.067	0.052	0.064	0.081	0.059	0.082	0.079	0.060	0.064	0.074	0.060	0.072	0.055	0.036
Sunday	17	0.076	0.070	0.053	0.070	0.075	0.058	0.075	0.062	0.049	0.065	0.066	0.051	0.076	0.070	0.053	0.063	0.068	0.053	0.071	0.052	0.035
Sunday	18	0.064	0.056	0.043	0.067	0.059	0.054	0.068	0.055	0.046	0.065	0.055	0.044	0.064	0.056	0.043	0.064	0.060	0.049	0.068	0.051	0.036
Sunday	19	0.049	0.043	0.035	0.062	0.045	0.050	0.061	0.047	0.042	0.062	0.043	0.036	0.049	0.043	0.035	0.060	0.052	0.046	0.062	0.048	0.037
Sunday	20	0.038	0.033	0.024	0.054	0.035	0.047	0.051	0.039	0.040	0.057	0.032	0.028	0.038	0.033	0.024	0.055	0.043	0.041	0.056	0.046	0.038
Sunday	21	0.026	0.022	0.020	0.045	0.024	0.039	0.041	0.031	0.038	0.049	0.022	0.023	0.026	0.022	0.020	0.050	0.034	0.037	0.046	0.038	0.038
Sunday	22	0.017	0.014	0.017	0.033	0.015	0.033	0.029	0.024	0.036	0.041	0.015	0.019	0.017	0.014	0.017	0.039	0.022	0.031	0.033	0.032	0.043
Sunday	23	0.010	0.010	0.020	0.022	0.009	0.032	0.019	0.019	0.037	0.028	0.012	0.016	0.010	0.010	0.020	0.030	0.016	0.025	0.020	0.027	0.050
Monday	0	0.006	0.010	0.017	0.010	0.003	0.007	0.011	0.017	0.023	0.023	0.007	0.013	0.006	0.010	0.017	0.023	0.006	0.009	0.010	0.024	0.031
Monday	1	0.004	0.009	0.016	0.009	0.002	0.007	0.007	0.015	0.022	0.023	0.006	0.011	0.004	0.009	0.016	0.024	0.007	0.009	0.005	0.023	0.031
Monday	2	0.003	0.009	0.016	0.010	0.003	0.010	0.006	0.015	0.022	0.025	0.007	0.011	0.003	0.009	0.016	0.025	0.009	0.010	0.004	0.022	0.030
Monday	3	0.005	0.011	0.019	0.012	0.006	0.012	0.009	0.018	0.025	0.027	0.010	0.011	0.005	0.011	0.019	0.025	0.011	0.014	0.005	0.023	0.032
Monday	4	0.008	0.017	0.024	0.014	0.009	0.013	0.018	0.027	0.032	0.030	0.015	0.012	0.008	0.017	0.024	0.033	0.023	0.019	0.014	0.030	0.037
Monday	5	0.019	0.028	0.036	0.022	0.022	0.026	0.030	0.039	0.039	0.033	0.022	0.018	0.019	0.028	0.036	0.039	0.042	0.024	0.039	0.041	0.044
Monday	6	0.036	0.041	0.050	0.037	0.047	0.044	0.044	0.051	0.045	0.036	0.034	0.024	0.036	0.041	0.050	0.044	0.060	0.031	0.050	0.049	0.051
Monday	7	0.051	0.044	0.065	0.045	0.058	0.058	0.058	0.058	0.050	0.040	0.043	0.030	0.051	0.044	0.065	0.041	0.056	0.038	0.059	0.058	0.056
Monday	8	0.053	0.056	0.068	0.047	0.062	0.067	0.053	0.058	0.051	0.043	0.054	0.039	0.053	0.056	0.068	0.043	0.058	0.045	0.055	0.056	0.055
Monday	9	0.059	0.065	0.080	0.050	0.065	0.078	0.051	0.059	0.053	0.045	0.067	0.048	0.059	0.065	0.080	0.045	0.063	0.053	0.053	0.057	0.058
Monday	10	0.067	0.074	0.087	0.051	0.065	0.080	0.054	0.062	0.056	0.050	0.074	0.054	0.067	0.074	0.087	0.046	0.065	0.059	0.055	0.060	0.058
Monday	11	0.071	0.075	0.082	0.056	0.067	0.083	0.057	0.064	0.057	0.052	0.075	0.059	0.071	0.075	0.082	0.050	0.066	0.061	0.057	0.058	0.058
Monday	12	0.074	0.074	0.080	0.058	0.069	0.081	0.060	0.064	0.058	0.055	0.078	0.059	0.074	0.074	0.080	0.052	0.068	0.065	0.058	0.060	0.059
Monday	13	0.074	0.075	0.075	0.063	0.074	0.076	0.061	0.064	0.058	0.057	0.081	0.060	0.074	0.075	0.075	0.056	0.069	0.063	0.059	0.059	0.055
Monday	14	0.077	0.076	0.065	0.067	0.076	0.074	0.067	0.066	0.058	0.057	0.081	0.065	0.077	0.076	0.065	0.057	0.070	0.065	0.064	0.058	0.053
Monday	15	0.082	0.076	0.058	0.073	0.087	0.062	0.072	0.065	0.057	0.059	0.080	0.063	0.082	0.076	0.058	0.058	0.070	0.066	0.068	0.058	0.050
Monday	16	0.081	0.073	0.045	0.076	0.084	0.053	0.075	0.063	0.055	0.060	0.072	0.064	0.081	0.073	0.045	0.059	0.067	0.060	0.071	0.058	0.046
Monday	17	0.071	0.059	0.035	0.075	0.075	0.040	0.074	0.055	0.051	0.057	0.059	0.066	0.071	0.059	0.035	0.058	0.062	0.057	0.070	0.054	0.042
Monday	18	0.052	0.042	0.023	0.057	0.047	0.032	0.055	0.042	0.042	0.053	0.045	0.063	0.052	0.042	0.023	0.055	0.043	0.053	0.055	0.041	0.035
Monday	19	0.037	0.030	0.017	0.050	0.031	0.029	0.042	0.031	0.036	0.048	0.032	0.060	0.037	0.030	0.017	0.045	0.029	0.048	0.043	0.032	0.028
Monday	20	0.027	0.022	0.013	0.043	0.020	0.021	0.034	0.023	0.031	0.042	0.022	0.054	0.027	0.022	0.013	0.041	0.022	0.045	0.035	0.026	0.024
Monday	21	0.020	0.016	0.010	0.035	0.015	0.020	0.027	0.018	0.028	0.036	0.016	0.046	0.020	0.016	0.010	0.035	0.017	0.039	0.030	0.022	0.021
Monday	22	0.015	0.012	0.009	0.025	0.009	0.014	0.020	0.014	0.027	0.029	0.012	0.039	0.015	0.012	0.009	0.026	0.011	0.035	0.023	0.018	0.022
Monday	23	0.009	0.007	0.010	0.016	0.005	0.013	0.014	0.011	0.025	0.020	0.008	0.031	0.009	0.007	0.010	0.020	0.007	0.033	0.016	0.015	0.025
Tues/Wed/Thurs	0	0.005	0.009	0.017	0.010	0.004	0.008	0.008	0.016	0.025	0.023	0.007	0.018	0.005	0.009	0.017	0.020	0.006	0.023	0.009	0.023	0.033
Tues/Wed/Thurs	1	0.003	0.008	0.017	0.009	0.003	0.008	0.005	0.014	0.024	0.025	0.006	0.015	0.003	0.008	0.017	0.022	0.007	0.021	0.005	0.021	0.031
Tues/Wed/Thurs	2	0.002	0.009	0.017	0.010	0.002	0.012	0.005	0.014	0.025	0.027	0.006	0.013	0.002	0.009	0.017	0.023	0.007	0.021	0.004	0.021	0.031
Tues/Wed/Thurs	3	0.003	0.010	0.022	0.011	0.005	0.014	0.008	0.018	0.028	0.029	0.009	0.013	0.003	0.010	0.022	0.025	0.010	0.022	0.005	0.022	0.032

		Mariposa			Mendocino			Merced			Modoc			Mono			Monterey			Napa		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Tues/Wed/Thurs	4	0.006	0.014	0.025	0.015	0.010	0.021	0.017	0.026	0.034	0.032	0.014	0.016	0.006	0.014	0.025	0.030	0.019	0.024	0.013	0.028	0.039
Tues/Wed/Thurs	5	0.018	0.027	0.039	0.024	0.024	0.035	0.030	0.039	0.042	0.035	0.021	0.020	0.018	0.027	0.039	0.037	0.037	0.029	0.036	0.040	0.046
Tues/Wed/Thurs	6	0.037	0.042	0.052	0.037	0.048	0.048	0.044	0.050	0.047	0.038	0.033	0.027	0.037	0.042	0.052	0.043	0.057	0.038	0.048	0.048	0.051
Tues/Wed/Thurs	7	0.053	0.047	0.064	0.045	0.059	0.065	0.059	0.059	0.052	0.040	0.046	0.036	0.053	0.047	0.064	0.042	0.057	0.046	0.059	0.056	0.056
Tues/Wed/Thurs	8	0.054	0.056	0.070	0.047	0.063	0.069	0.055	0.058	0.052	0.042	0.056	0.046	0.054	0.056	0.070	0.045	0.062	0.050	0.056	0.057	0.057
Tues/Wed/Thurs	9	0.059	0.068	0.083	0.050	0.064	0.074	0.051	0.059	0.054	0.044	0.066	0.057	0.059	0.068	0.083	0.046	0.063	0.055	0.052	0.055	0.056
Tues/Wed/Thurs	10	0.064	0.069	0.081	0.051	0.065	0.075	0.052	0.060	0.056	0.045	0.071	0.065	0.064	0.069	0.081	0.047	0.061	0.058	0.053	0.057	0.057
Tues/Wed/Thurs	11	0.068	0.069	0.077	0.055	0.065	0.076	0.054	0.061	0.057	0.047	0.076	0.070	0.068	0.069	0.077	0.049	0.065	0.060	0.053	0.058	0.057
Tues/Wed/Thurs	12	0.069	0.071	0.074	0.057	0.068	0.076	0.057	0.062	0.057	0.050	0.076	0.070	0.069	0.071	0.074	0.051	0.066	0.060	0.055	0.058	0.056
Tues/Wed/Thurs	13	0.072	0.073	0.074	0.061	0.070	0.071	0.060	0.063	0.056	0.052	0.077	0.069	0.072	0.073	0.074	0.054	0.069	0.059	0.057	0.060	0.055
Tues/Wed/Thurs	14	0.077	0.076	0.067	0.066	0.074	0.068	0.066	0.065	0.056	0.057	0.081	0.067	0.077	0.076	0.067	0.058	0.072	0.059	0.064	0.061	0.053
Tues/Wed/Thurs	15	0.084	0.078	0.058	0.073	0.084	0.062	0.073	0.066	0.055	0.058	0.078	0.064	0.084	0.078	0.058	0.059	0.072	0.057	0.069	0.061	0.050
Tues/Wed/Thurs	16	0.082	0.074	0.048	0.078	0.086	0.053	0.077	0.064	0.053	0.057	0.072	0.061	0.082	0.074	0.048	0.060	0.070	0.053	0.072	0.058	0.046
Tues/Wed/Thurs	17	0.074	0.061	0.036	0.077	0.078	0.041	0.076	0.057	0.049	0.056	0.060	0.057	0.074	0.061	0.036	0.058	0.063	0.051	0.072	0.055	0.041
Tues/Wed/Thurs	18	0.053	0.044	0.023	0.059	0.047	0.030	0.058	0.044	0.041	0.053	0.046	0.053	0.053	0.044	0.023	0.052	0.044	0.046	0.058	0.044	0.035
Tues/Wed/Thurs	19	0.038	0.031	0.016	0.048	0.031	0.027	0.044	0.032	0.034	0.048	0.033	0.044	0.038	0.031	0.016	0.049	0.032	0.041	0.047	0.035	0.028
Tues/Wed/Thurs	20	0.030	0.025	0.012	0.041	0.021	0.020	0.036	0.025	0.030	0.045	0.025	0.038	0.030	0.025	0.012	0.043	0.024	0.037	0.039	0.029	0.024
Tues/Wed/Thurs	21	0.023	0.018	0.010	0.036	0.017	0.020	0.028	0.019	0.026	0.038	0.018	0.032	0.023	0.018	0.010	0.038	0.018	0.034	0.033	0.022	0.021
Tues/Wed/Thurs	22	0.017	0.013	0.010	0.025	0.009	0.014	0.021	0.014	0.025	0.032	0.014	0.026	0.017	0.013	0.010	0.029	0.011	0.030	0.025	0.018	0.022
Tues/Wed/Thurs	23	0.010	0.008	0.010	0.017	0.005	0.012	0.015	0.012	0.023	0.025	0.010	0.021	0.010	0.008	0.010	0.022	0.008	0.026	0.017	0.015	0.025
Friday	0	0.005	0.009	0.019	0.009	0.004	0.008	0.008	0.016	0.027	0.021	0.007	0.019	0.005	0.009	0.019	0.020	0.006	0.022	0.009	0.022	0.034
Friday	1	0.003	0.008	0.019	0.009	0.003	0.009	0.006	0.014	0.025	0.023	0.006	0.017	0.003	0.008	0.019	0.020	0.006	0.021	0.005	0.022	0.032
Friday	2	0.002	0.008	0.019	0.009	0.003	0.011	0.005	0.014	0.026	0.024	0.007	0.016	0.002	0.008	0.019	0.022	0.007	0.021	0.004	0.021	0.034
Friday	3	0.002	0.008	0.021	0.011	0.005	0.016	0.008	0.017	0.029	0.026	0.009	0.016	0.002	0.008	0.021	0.024	0.009	0.022	0.005	0.022	0.034
Friday	4	0.005	0.013	0.024	0.013	0.009	0.022	0.014	0.024	0.035	0.029	0.013	0.019	0.005	0.013	0.024	0.028	0.018	0.024	0.011	0.026	0.039
Friday	5	0.013	0.023	0.037	0.021	0.021	0.039	0.024	0.035	0.042	0.032	0.018	0.023	0.013	0.023	0.037	0.035	0.033	0.029	0.029	0.038	0.046
Friday	6	0.026	0.035	0.049	0.033	0.041	0.054	0.036	0.045	0.047	0.033	0.030	0.032	0.026	0.035	0.049	0.041	0.050	0.038	0.039	0.045	0.052
Friday	7	0.039	0.040	0.060	0.039	0.052	0.065	0.049	0.053	0.052	0.037	0.039	0.039	0.039	0.040	0.060	0.039	0.049	0.046	0.048	0.051	0.057
Friday	8	0.043	0.049	0.068	0.044	0.059	0.074	0.047	0.054	0.053	0.040	0.051	0.049	0.043	0.049	0.068	0.041	0.056	0.050	0.047	0.051	0.057
Friday	9	0.049	0.057	0.073	0.047	0.060	0.078	0.047	0.056	0.055	0.045	0.063	0.054	0.049	0.057	0.073	0.045	0.058	0.055	0.047	0.055	0.058
Friday	10	0.058	0.063	0.078	0.048	0.067	0.075	0.051	0.060	0.058	0.048	0.069	0.060	0.058	0.063	0.078	0.047	0.062	0.059	0.052	0.057	0.059
Friday	11	0.064	0.069	0.077	0.054	0.068	0.077	0.054	0.062	0.060	0.049	0.072	0.063	0.064	0.069	0.077	0.050	0.067	0.060	0.055	0.058	0.059
Friday	12	0.066	0.071	0.076	0.060	0.072	0.079	0.057	0.063	0.060	0.052	0.074	0.063	0.066	0.071	0.076	0.051	0.067	0.060	0.059	0.060	0.058
Friday	13	0.071	0.074	0.077	0.063	0.075	0.072	0.061	0.065	0.059	0.055	0.077	0.062	0.071	0.074	0.077	0.056	0.071	0.062	0.064	0.061	0.052
Friday	14	0.076	0.077	0.070	0.068	0.078	0.067	0.068	0.067	0.058	0.059	0.080	0.063	0.076	0.077	0.070	0.060	0.075	0.059	0.067	0.061	0.051
Friday	15	0.083	0.079	0.060	0.073	0.083	0.060	0.074	0.067	0.056	0.063	0.081	0.061	0.083	0.079	0.060	0.060	0.074	0.060	0.069	0.061	0.048
Friday	16	0.083	0.077	0.050	0.076	0.082	0.049	0.076	0.064	0.053	0.058	0.075	0.059	0.083	0.077	0.050	0.060	0.070	0.055	0.069	0.058	0.045
Friday	17	0.075	0.064	0.038	0.074	0.072	0.038	0.075	0.058	0.048	0.059	0.063	0.055	0.075	0.064	0.038	0.060	0.064	0.049	0.068	0.051	0.040
Friday	18	0.062	0.051	0.025	0.060	0.050	0.026	0.064	0.048	0.040	0.054	0.052	0.051	0.062	0.051	0.025	0.054	0.049	0.044	0.060	0.046	0.034
Friday	19	0.050	0.039	0.018	0.052	0.034	0.024	0.052	0.037	0.032	0.050	0.036	0.046	0.050	0.039	0.018	0.050	0.036	0.040	0.054	0.039	0.027
Friday	20	0.041	0.030	0.013	0.043	0.022	0.017	0.043	0.029	0.026	0.046	0.030	0.041	0.041	0.030	0.013	0.045	0.028	0.037	0.048	0.033	0.023
Friday	21	0.036	0.025	0.010	0.040	0.018	0.016	0.035	0.022	0.022	0.040	0.022	0.036	0.036	0.025	0.010	0.038	0.021	0.032	0.039	0.026	0.019
Friday	22	0.030	0.019	0.011	0.031	0.012	0.011	0.027	0.016	0.020	0.031	0.016	0.031	0.030	0.019	0.011	0.031	0.015	0.029	0.031	0.020	0.020
Friday	23	0.018	0.012	0.009	0.022	0.007	0.012	0.020	0.012	0.018	0.025	0.012	0.025	0.018	0.012	0.009	0.023	0.010	0.026	0.022	0.016	0.021
Saturday	0	0.010	0.015	0.027	0.012	0.008	0.014	0.015	0.026	0.040	0.026	0.013	0.020	0.010	0.015	0.027	0.023	0.011	0.030	0.014	0.029	0.051
Saturday	1	0.007	0.012	0.023	0.013	0.006	0.014	0.010	0.020	0.035	0.026	0.008	0.016	0.007	0.012	0.023	0.025	0.010	0.027	0.009	0.024	0.044
Saturday	2	0.005	0.011	0.022	0.013	0.004	0.011	0.008	0.018	0.032	0.027	0.007	0.015	0.005	0.011	0.022	0.025	0.009	0.026	0.007	0.022	0.041
Saturday	3	0.004	0.010	0.025	0.012	0.004	0.014	0.008	0.019	0.032	0.030	0.007	0.014	0.004	0.010	0.025	0.027	0.011	0.024	0.006	0.023	0.040
Saturday	4	0.005	0.013	0.028	0.014	0.008	0.020	0.011	0.021	0.035	0.029	0.009	0.016	0.005	0.013	0.028	0.031	0.020	0.025	0.007	0.023	0.041
Saturday	5	0.010	0.021	0.034	0.020	0.016	0.034	0.017	0.028	0.039	0.033	0.015	0.019	0.010	0.021	0.034	0.038	0.034	0.030	0.013	0.029	0.045
Saturday	6	0.017	0.028	0.039	0.025	0.025	0.043	0.025	0.036	0.045	0.036	0.023	0.025	0.017	0.028	0.039	0.038	0.047	0.040	0.021	0.033	0.047
Saturday	7	0.029	0.036	0.053	0.030	0.031	0.058	0.034	0.044	0.050	0.038	0.033	0.036	0.029	0.036	0.053	0.042	0.047	0.046	0.030	0.038	0.053

		Mariposa			Mendocino			Merced			Modoc			Mono			Monterey			Napa		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Saturday	8	0.044	0.045	0.060	0.036	0.041	0.070	0.044	0.053	0.055	0.041	0.047	0.047	0.044	0.045	0.060	0.043	0.055	0.050	0.042	0.046	0.052
Saturday	9	0.059	0.061	0.071	0.043	0.053	0.079	0.054	0.061	0.060	0.045	0.063	0.059	0.059	0.061	0.071	0.047	0.062	0.055	0.054	0.054	0.058
Saturday	10	0.073	0.074	0.078	0.052	0.069	0.082	0.062	0.068	0.063	0.049	0.075	0.067	0.073	0.074	0.078	0.047	0.067	0.062	0.063	0.058	0.055
Saturday	11	0.081	0.077	0.083	0.054	0.076	0.075	0.067	0.071	0.064	0.050	0.084	0.073	0.081	0.077	0.083	0.049	0.068	0.063	0.068	0.060	0.052
Saturday	12	0.078	0.077	0.075	0.061	0.080	0.070	0.069	0.070	0.062	0.053	0.083	0.071	0.078	0.077	0.075	0.055	0.071	0.060	0.069	0.060	0.052
Saturday	13	0.075	0.072	0.060	0.063	0.082	0.064	0.070	0.067	0.058	0.055	0.081	0.069	0.075	0.072	0.060	0.054	0.070	0.059	0.067	0.057	0.047
Saturday	14	0.075	0.068	0.055	0.065	0.081	0.062	0.070	0.064	0.054	0.057	0.076	0.065	0.075	0.068	0.055	0.055	0.066	0.058	0.067	0.057	0.045
Saturday	15	0.075	0.068	0.052	0.067	0.080	0.054	0.069	0.061	0.049	0.060	0.074	0.062	0.075	0.068	0.052	0.055	0.065	0.056	0.067	0.057	0.044
Saturday	16	0.072	0.070	0.047	0.071	0.081	0.051	0.068	0.057	0.045	0.056	0.070	0.058	0.072	0.070	0.047	0.057	0.065	0.052	0.068	0.054	0.038
Saturday	17	0.066	0.063	0.040	0.068	0.072	0.037	0.064	0.051	0.040	0.055	0.061	0.057	0.066	0.063	0.040	0.056	0.053	0.047	0.066	0.054	0.035
Saturday	18	0.058	0.052	0.031	0.062	0.053	0.032	0.056	0.042	0.033	0.051	0.049	0.052	0.058	0.052	0.031	0.052	0.044	0.042	0.060	0.049	0.032
Saturday	19	0.047	0.041	0.026	0.059	0.040	0.029	0.048	0.034	0.027	0.049	0.038	0.045	0.047	0.041	0.026	0.049	0.039	0.039	0.052	0.044	0.030
Saturday	20	0.038	0.031	0.020	0.051	0.032	0.021	0.041	0.029	0.024	0.042	0.031	0.038	0.038	0.031	0.020	0.043	0.031	0.035	0.046	0.040	0.028
Saturday	21	0.031	0.025	0.016	0.047	0.026	0.023	0.037	0.024	0.021	0.037	0.023	0.031	0.031	0.025	0.016	0.038	0.025	0.029	0.042	0.035	0.025
Saturday	22	0.025	0.020	0.018	0.037	0.019	0.020	0.031	0.020	0.019	0.031	0.017	0.026	0.025	0.020	0.018	0.030	0.017	0.026	0.036	0.030	0.023
Saturday	23	0.016	0.013	0.018	0.028	0.014	0.021	0.023	0.016	0.017	0.023	0.012	0.019	0.016	0.013	0.018	0.023	0.011	0.020	0.026	0.024	0.024
Holiday	0	0.008	0.011	0.020	0.010	0.004	0.009	0.013	0.020	0.027	0.024	0.008	0.015	0.008	0.011	0.020	0.024	0.008	0.016	0.014	0.028	0.038
Holiday	1	0.005	0.009	0.018	0.014	0.004	0.008	0.009	0.017	0.025	0.027	0.008	0.012	0.005	0.009	0.018	0.022	0.009	0.015	0.008	0.024	0.033
Holiday	2	0.003	0.010	0.018	0.010	0.003	0.014	0.007	0.015	0.024	0.024	0.008	0.012	0.003	0.010	0.018	0.024	0.007	0.015	0.005	0.026	0.033
Holiday	3	0.004	0.010	0.021	0.014	0.005	0.012	0.007	0.016	0.026	0.029	0.010	0.013	0.004	0.010	0.021	0.024	0.009	0.017	0.004	0.025	0.034
Holiday	4	0.005	0.012	0.020	0.014	0.006	0.017	0.011	0.020	0.029	0.029	0.012	0.014	0.005	0.012	0.020	0.031	0.019	0.019	0.008	0.025	0.035
Holiday	5	0.009	0.018	0.031	0.019	0.018	0.028	0.019	0.028	0.033	0.031	0.016	0.017	0.009	0.018	0.031	0.033	0.029	0.024	0.017	0.030	0.040
Holiday	6	0.018	0.023	0.038	0.028	0.034	0.042	0.027	0.035	0.038	0.037	0.025	0.023	0.018	0.023	0.038	0.038	0.042	0.030	0.024	0.036	0.044
Holiday	7	0.029	0.031	0.043	0.039	0.045	0.052	0.035	0.042	0.042	0.038	0.033	0.031	0.029	0.031	0.043	0.040	0.044	0.037	0.030	0.042	0.049
Holiday	8	0.041	0.044	0.056	0.041	0.051	0.059	0.040	0.048	0.046	0.040	0.049	0.040	0.041	0.044	0.056	0.037	0.050	0.041	0.039	0.047	0.049
Holiday	9	0.058	0.057	0.075	0.044	0.057	0.066	0.048	0.055	0.050	0.043	0.062	0.054	0.058	0.057	0.075	0.046	0.057	0.048	0.048	0.055	0.057
Holiday	10	0.076	0.083	0.087	0.050	0.069	0.075	0.059	0.064	0.055	0.050	0.076	0.060	0.076	0.083	0.087	0.048	0.066	0.056	0.060	0.060	0.056
Holiday	11	0.084	0.086	0.088	0.056	0.072	0.077	0.065	0.070	0.060	0.047	0.084	0.068	0.084	0.086	0.088	0.055	0.077	0.063	0.066	0.064	0.055
Holiday	12	0.085	0.087	0.089	0.058	0.080	0.078	0.069	0.072	0.061	0.053	0.083	0.070	0.085	0.087	0.089	0.052	0.074	0.065	0.068	0.063	0.060
Holiday	13	0.083	0.081	0.078	0.063	0.077	0.069	0.071	0.071	0.061	0.062	0.091	0.067	0.083	0.081	0.078	0.055	0.071	0.069	0.069	0.062	0.055
Holiday	14	0.080	0.074	0.068	0.068	0.083	0.067	0.072	0.069	0.059	0.059	0.087	0.069	0.080	0.074	0.068	0.050	0.071	0.067	0.071	0.060	0.055
Holiday	15	0.078	0.074	0.060	0.071	0.082	0.064	0.073	0.068	0.058	0.057	0.079	0.065	0.078	0.074	0.060	0.061	0.068	0.068	0.071	0.064	0.054
Holiday	16	0.078	0.072	0.049	0.075	0.083	0.061	0.073	0.065	0.055	0.056	0.072	0.062	0.078	0.072	0.049	0.062	0.069	0.058	0.068	0.057	0.046
Holiday	17	0.071	0.066	0.041	0.072	0.076	0.044	0.070	0.057	0.050	0.056	0.058	0.060	0.071	0.066	0.041	0.058	0.062	0.058	0.067	0.055	0.041
Holiday	18	0.057	0.049	0.033	0.054	0.048	0.040	0.060	0.046	0.044	0.053	0.044	0.058	0.057	0.049	0.033	0.054	0.050	0.049	0.061	0.042	0.038
Holiday	19	0.043	0.040	0.022	0.056	0.036	0.029	0.050	0.036	0.039	0.048	0.029	0.049	0.043	0.040	0.022	0.049	0.037	0.047	0.053	0.037	0.029
Holiday	20	0.033	0.026	0.013	0.049	0.025	0.029	0.042	0.029	0.034	0.044	0.024	0.045	0.033	0.026	0.013	0.046	0.032	0.043	0.049	0.029	0.024
Holiday	21	0.024	0.018	0.011	0.040	0.019	0.023	0.034	0.023	0.030	0.040	0.019	0.040	0.024	0.018	0.011	0.040	0.025	0.038	0.042	0.028	0.024
Holiday	22	0.017	0.012	0.009	0.029	0.012	0.018	0.027	0.017	0.028	0.031	0.014	0.030	0.017	0.012	0.009	0.031	0.016	0.032	0.035	0.022	0.025
Holiday	23	0.010	0.008	0.010	0.025	0.010	0.019	0.018	0.014	0.026	0.024	0.009	0.024	0.010	0.008	0.010	0.020	0.008	0.028	0.023	0.018	0.026

		Nevada			Orange			Placer			Plumas			Riverside			Sacramento			San Benito		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Sunday	0	0.013	0.020	0.031	0.023	0.045	0.061	0.013	0.020	0.031	0.015	0.010	0.015	0.022	0.036	0.050	0.019	0.031	0.044	0.019	0.010	0.029
Sunday	1	0.008	0.016	0.028	0.015	0.032	0.049	0.008	0.016	0.028	0.010	0.006	0.011	0.015	0.028	0.044	0.013	0.025	0.039	0.020	0.008	0.023
Sunday	2	0.006	0.013	0.026	0.011	0.025	0.041	0.006	0.013	0.026	0.007	0.004	0.012	0.011	0.023	0.040	0.009	0.021	0.036	0.020	0.007	0.021
Sunday	3	0.005	0.012	0.025	0.007	0.019	0.034	0.005	0.012	0.025	0.006	0.004	0.012	0.009	0.020	0.036	0.007	0.019	0.034	0.020	0.007	0.019
Sunday	4	0.005	0.012	0.025	0.007	0.018	0.031	0.005	0.012	0.025	0.006	0.005	0.017	0.009	0.020	0.035	0.008	0.020	0.034	0.024	0.012	0.019
Sunday	5	0.008	0.015	0.027	0.011	0.022	0.034	0.008	0.015	0.027	0.010	0.011	0.029	0.012	0.023	0.036	0.011	0.023	0.034	0.026	0.017	0.021
Sunday	6	0.013	0.020	0.030	0.018	0.029	0.038	0.013	0.020	0.030	0.016	0.017	0.037	0.019	0.029	0.039	0.017	0.027	0.037	0.029	0.024	0.026
Sunday	7	0.022	0.028	0.034	0.026	0.036	0.041	0.022	0.028	0.034	0.023	0.029	0.051	0.026	0.035	0.041	0.025	0.033	0.039	0.031	0.030	0.034
Sunday	8	0.034	0.041	0.040	0.037	0.046	0.046	0.034	0.041	0.040	0.033	0.043	0.071	0.036	0.045	0.044	0.035	0.042	0.043	0.035	0.038	0.040
Sunday	9	0.048	0.055	0.046	0.050	0.058	0.051	0.048	0.055	0.046	0.047	0.063	0.091	0.049	0.054	0.047	0.049	0.052	0.047	0.038	0.049	0.049
Sunday	10	0.064	0.068	0.052	0.059	0.065	0.052	0.064	0.068	0.052	0.057	0.075	0.084	0.057	0.061	0.047	0.060	0.060	0.049	0.041	0.057	0.057
Sunday	11	0.075	0.075	0.055	0.065	0.067	0.052	0.075	0.075	0.055	0.067	0.083	0.079	0.064	0.065	0.048	0.066	0.063	0.049	0.047	0.068	0.061
Sunday	12	0.082	0.079	0.058	0.068	0.066	0.049	0.082	0.079	0.058	0.074	0.090	0.070	0.067	0.066	0.047	0.072	0.066	0.049	0.051	0.074	0.063
Sunday	13	0.084	0.079	0.058	0.069	0.064	0.046	0.084	0.079	0.058	0.078	0.089	0.061	0.069	0.065	0.045	0.074	0.067	0.049	0.053	0.073	0.065
Sunday	14	0.084	0.077	0.057	0.068	0.059	0.043	0.084	0.077	0.057	0.079	0.081	0.057	0.069	0.063	0.044	0.074	0.064	0.047	0.059	0.078	0.065
Sunday	15	0.082	0.073	0.057	0.068	0.055	0.040	0.082	0.073	0.057	0.080	0.079	0.053	0.068	0.060	0.042	0.072	0.061	0.046	0.061	0.078	0.066
Sunday	16	0.079	0.068	0.055	0.067	0.051	0.038	0.079	0.068	0.055	0.079	0.075	0.045	0.067	0.056	0.041	0.071	0.059	0.045	0.064	0.074	0.060
Sunday	17	0.072	0.062	0.053	0.064	0.047	0.036	0.072	0.062	0.053	0.075	0.066	0.043	0.064	0.052	0.040	0.068	0.056	0.043	0.063	0.068	0.053
Sunday	18	0.060	0.052	0.049	0.060	0.041	0.034	0.060	0.052	0.049	0.066	0.054	0.039	0.061	0.047	0.039	0.061	0.049	0.041	0.064	0.060	0.049
Sunday	19	0.050	0.043	0.045	0.055	0.036	0.033	0.050	0.043	0.045	0.055	0.042	0.037	0.057	0.042	0.039	0.053	0.042	0.040	0.060	0.052	0.046
Sunday	20	0.041	0.035	0.042	0.052	0.034	0.034	0.041	0.035	0.042	0.045	0.031	0.030	0.053	0.037	0.039	0.048	0.038	0.039	0.055	0.043	0.041
Sunday	21	0.031	0.026	0.039	0.045	0.032	0.036	0.031	0.026	0.039	0.035	0.022	0.024	0.044	0.031	0.039	0.040	0.032	0.039	0.050	0.034	0.037
Sunday	22	0.021	0.019	0.036	0.034	0.028	0.038	0.021	0.019	0.036	0.023	0.013	0.018	0.032	0.024	0.038	0.029	0.027	0.038	0.039	0.022	0.031
Sunday	23	0.013	0.015	0.033	0.022	0.024	0.042	0.013	0.015	0.033	0.014	0.008	0.015	0.021	0.018	0.038	0.019	0.023	0.039	0.030	0.016	0.025
Monday	0	0.008	0.014	0.027	0.010	0.016	0.024	0.008	0.014	0.027	0.006	0.002	0.006	0.011	0.018	0.027	0.009	0.018	0.028	0.023	0.006	0.009
Monday	1	0.005	0.012	0.025	0.006	0.012	0.021	0.005	0.012	0.025	0.004	0.002	0.007	0.008	0.016	0.026	0.005	0.015	0.026	0.024	0.007	0.009
Monday	2	0.004	0.012	0.025	0.005	0.012	0.021	0.004	0.012	0.025	0.003	0.002	0.010	0.007	0.016	0.027	0.004	0.015	0.026	0.025	0.009	0.010
Monday	3	0.006	0.014	0.027	0.006	0.013	0.022	0.006	0.014	0.027	0.003	0.004	0.012	0.011	0.020	0.030	0.006	0.018	0.028	0.025	0.011	0.014
Monday	4	0.011	0.019	0.030	0.015	0.022	0.029	0.011	0.019	0.030	0.007	0.009	0.021	0.024	0.033	0.038	0.013	0.026	0.033	0.033	0.023	0.019
Monday	5	0.023	0.030	0.036	0.034	0.041	0.043	0.023	0.030	0.036	0.018	0.024	0.037	0.040	0.049	0.045	0.029	0.040	0.040	0.039	0.042	0.024
Monday	6	0.042	0.047	0.043	0.054	0.060	0.054	0.042	0.047	0.043	0.041	0.051	0.055	0.053	0.059	0.049	0.052	0.057	0.048	0.044	0.060	0.031
Monday	7	0.060	0.061	0.048	0.066	0.073	0.060	0.060	0.061	0.048	0.078	0.069	0.066	0.059	0.064	0.051	0.071	0.066	0.051	0.041	0.056	0.038
Monday	8	0.059	0.062	0.050	0.064	0.073	0.061	0.059	0.062	0.050	0.067	0.077	0.077	0.056	0.062	0.052	0.066	0.064	0.052	0.043	0.058	0.045
Monday	9	0.056	0.061	0.050	0.056	0.065	0.058	0.056	0.061	0.050	0.057	0.071	0.080	0.053	0.059	0.051	0.056	0.059	0.052	0.045	0.063	0.053
Monday	10	0.058	0.064	0.051	0.052	0.061	0.055	0.058	0.064	0.051	0.057	0.071	0.077	0.052	0.058	0.051	0.052	0.057	0.052	0.046	0.065	0.059
Monday	11	0.062	0.066	0.053	0.052	0.060	0.055	0.062	0.066	0.053	0.060	0.074	0.073	0.053	0.058	0.052	0.053	0.058	0.053	0.050	0.066	0.061
Monday	12	0.066	0.068	0.054	0.053	0.060	0.054	0.066	0.068	0.054	0.063	0.072	0.071	0.055	0.058	0.051	0.056	0.059	0.053	0.052	0.068	0.065
Monday	13	0.067	0.067	0.054	0.055	0.059	0.053	0.067	0.067	0.054	0.063	0.072	0.068	0.057	0.059	0.051	0.057	0.059	0.053	0.056	0.069	0.063
Monday	14	0.070	0.069	0.055	0.060	0.061	0.054	0.070	0.069	0.055	0.067	0.077	0.064	0.061	0.060	0.051	0.062	0.060	0.053	0.057	0.070	0.065
Monday	15	0.073	0.069	0.055	0.064	0.061	0.053	0.073	0.069	0.055	0.078	0.080	0.056	0.065	0.061	0.050	0.070	0.064	0.052	0.058	0.070	0.066
Monday	16	0.075	0.067	0.054	0.067	0.060	0.052	0.075	0.067	0.054	0.086	0.077	0.049	0.067	0.059	0.049	0.076	0.063	0.051	0.059	0.067	0.060
Monday	17	0.073	0.061	0.052	0.068	0.057	0.050	0.073	0.061	0.052	0.087	0.062	0.041	0.066	0.054	0.047	0.073	0.057	0.048	0.058	0.062	0.057
Monday	18	0.056	0.046	0.045	0.060	0.044	0.042	0.056	0.046	0.045	0.051	0.038	0.030	0.056	0.043	0.042	0.056	0.044	0.043	0.055	0.043	0.053
Monday	19	0.040	0.031	0.039	0.047	0.029	0.034	0.040	0.031	0.039	0.036	0.024	0.024	0.044	0.031	0.037	0.040	0.031	0.037	0.045	0.029	0.048
Monday	20	0.031	0.022	0.035	0.037	0.020	0.028	0.031	0.022	0.035	0.026	0.018	0.023	0.035	0.023	0.033	0.032	0.024	0.033	0.041	0.022	0.045
Monday	21	0.025	0.017	0.032	0.032	0.017	0.026	0.025	0.017	0.032	0.020	0.012	0.021	0.030	0.017	0.031	0.028	0.019	0.030	0.035	0.017	0.039
Monday	22	0.017	0.012	0.030	0.024	0.013	0.025	0.017	0.012	0.030	0.013	0.007	0.017	0.023	0.012	0.029	0.021	0.015	0.028	0.026	0.011	0.035
Monday	23	0.012	0.009	0.030	0.015	0.010	0.026	0.012	0.009	0.030	0.008	0.004	0.015	0.016	0.009	0.028	0.014	0.011	0.027	0.020	0.007	0.033
Tues/Wed/Thurs	0	0.008	0.014	0.029	0.009	0.015	0.026	0.008	0.014	0.029	0.006	0.003	0.010	0.010	0.017	0.030	0.008	0.018	0.031	0.020	0.006	0.023
Tues/Wed/Thurs	1	0.004	0.011	0.027	0.005	0.012	0.024	0.004	0.011	0.027	0.003	0.002	0.011	0.007	0.015	0.029	0.005	0.015	0.030	0.022	0.007	0.021
Tues/Wed/Thurs	2	0.004	0.011	0.027	0.004	0.012	0.023	0.004	0.011	0.027	0.003	0.002	0.013	0.006	0.015	0.029	0.004	0.015	0.029	0.023	0.007	0.021
Tues/Wed/Thurs	3	0.005	0.013	0.029	0.005	0.013	0.025	0.005	0.013	0.029	0.003	0.003	0.015	0.010	0.019	0.032	0.006	0.017	0.031	0.025	0.010	0.022

		Nevada			Orange			Placer			Plumas			Riverside			Sacramento			San Benito		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Tues/Wed/Thurs	4	0.010	0.018	0.031	0.013	0.022	0.031	0.010	0.018	0.031	0.006	0.008	0.022	0.022	0.032	0.040	0.012	0.024	0.036	0.030	0.019	0.024
Tues/Wed/Thurs	5	0.022	0.029	0.037	0.033	0.040	0.045	0.022	0.029	0.037	0.017	0.024	0.037	0.039	0.048	0.047	0.027	0.038	0.043	0.037	0.037	0.029
Tues/Wed/Thurs	6	0.042	0.047	0.044	0.054	0.061	0.057	0.042	0.047	0.044	0.041	0.053	0.054	0.053	0.060	0.051	0.052	0.057	0.050	0.043	0.057	0.038
Tues/Wed/Thurs	7	0.060	0.061	0.050	0.065	0.073	0.062	0.060	0.061	0.050	0.077	0.069	0.066	0.059	0.064	0.053	0.071	0.066	0.053	0.042	0.057	0.046
Tues/Wed/Thurs	8	0.060	0.062	0.051	0.063	0.073	0.062	0.060	0.062	0.051	0.066	0.077	0.077	0.056	0.062	0.053	0.066	0.063	0.053	0.045	0.062	0.050
Tues/Wed/Thurs	9	0.055	0.060	0.050	0.057	0.066	0.059	0.055	0.060	0.050	0.057	0.071	0.080	0.052	0.059	0.052	0.056	0.059	0.053	0.046	0.063	0.055
Tues/Wed/Thurs	10	0.056	0.061	0.051	0.052	0.061	0.056	0.056	0.061	0.051	0.056	0.071	0.077	0.051	0.058	0.052	0.051	0.057	0.053	0.047	0.061	0.058
Tues/Wed/Thurs	11	0.059	0.064	0.052	0.052	0.061	0.054	0.059	0.064	0.052	0.058	0.071	0.074	0.051	0.058	0.051	0.052	0.057	0.053	0.049	0.065	0.060
Tues/Wed/Thurs	12	0.061	0.065	0.053	0.053	0.060	0.053	0.061	0.065	0.053	0.062	0.070	0.069	0.053	0.058	0.051	0.054	0.058	0.053	0.051	0.066	0.060
Tues/Wed/Thurs	13	0.064	0.066	0.053	0.055	0.060	0.052	0.064	0.066	0.053	0.063	0.073	0.067	0.056	0.059	0.051	0.056	0.059	0.052	0.054	0.069	0.059
Tues/Wed/Thurs	14	0.068	0.068	0.053	0.059	0.061	0.052	0.068	0.068	0.053	0.066	0.076	0.063	0.060	0.061	0.050	0.061	0.061	0.051	0.058	0.072	0.059
Tues/Wed/Thurs	15	0.073	0.069	0.053	0.063	0.061	0.051	0.073	0.069	0.053	0.079	0.080	0.056	0.064	0.061	0.048	0.070	0.064	0.050	0.059	0.072	0.057
Tues/Wed/Thurs	16	0.075	0.067	0.052	0.065	0.059	0.049	0.075	0.067	0.052	0.087	0.076	0.045	0.066	0.060	0.047	0.075	0.063	0.048	0.060	0.070	0.053
Tues/Wed/Thurs	17	0.074	0.063	0.050	0.066	0.055	0.046	0.074	0.063	0.050	0.088	0.062	0.040	0.066	0.055	0.044	0.073	0.057	0.044	0.058	0.063	0.051
Tues/Wed/Thurs	18	0.059	0.048	0.044	0.060	0.044	0.040	0.059	0.048	0.044	0.054	0.039	0.031	0.058	0.045	0.040	0.059	0.046	0.041	0.052	0.044	0.046
Tues/Wed/Thurs	19	0.043	0.034	0.038	0.049	0.030	0.032	0.043	0.034	0.038	0.036	0.026	0.023	0.046	0.032	0.035	0.041	0.033	0.035	0.049	0.032	0.041
Tues/Wed/Thurs	20	0.035	0.025	0.034	0.040	0.021	0.027	0.035	0.025	0.034	0.028	0.019	0.021	0.038	0.024	0.032	0.034	0.026	0.031	0.043	0.024	0.037
Tues/Wed/Thurs	21	0.029	0.019	0.031	0.035	0.017	0.025	0.029	0.019	0.031	0.021	0.013	0.020	0.033	0.018	0.029	0.030	0.021	0.029	0.038	0.018	0.034
Tues/Wed/Thurs	22	0.020	0.013	0.029	0.026	0.013	0.024	0.020	0.013	0.029	0.014	0.007	0.016	0.025	0.012	0.027	0.022	0.016	0.027	0.029	0.011	0.030
Tues/Wed/Thurs	23	0.013	0.009	0.028	0.016	0.010	0.025	0.013	0.009	0.028	0.009	0.004	0.013	0.017	0.008	0.026	0.015	0.012	0.027	0.022	0.008	0.026
Friday	0	0.007	0.014	0.032	0.010	0.017	0.029	0.007	0.014	0.032	0.007	0.003	0.011	0.011	0.018	0.031	0.009	0.019	0.034	0.020	0.006	0.022
Friday	1	0.005	0.011	0.030	0.006	0.014	0.026	0.005	0.011	0.030	0.004	0.003	0.012	0.007	0.015	0.030	0.005	0.016	0.032	0.020	0.006	0.021
Friday	2	0.004	0.011	0.030	0.005	0.013	0.025	0.004	0.011	0.030	0.004	0.003	0.015	0.007	0.016	0.030	0.004	0.016	0.031	0.022	0.007	0.021
Friday	3	0.005	0.012	0.030	0.006	0.014	0.026	0.005	0.012	0.030	0.004	0.004	0.017	0.009	0.019	0.033	0.006	0.017	0.033	0.024	0.009	0.022
Friday	4	0.008	0.016	0.033	0.013	0.021	0.032	0.008	0.016	0.033	0.006	0.007	0.024	0.020	0.030	0.041	0.011	0.024	0.037	0.028	0.018	0.024
Friday	5	0.017	0.026	0.038	0.029	0.038	0.045	0.017	0.026	0.038	0.015	0.022	0.039	0.034	0.045	0.048	0.024	0.036	0.044	0.035	0.033	0.029
Friday	6	0.033	0.040	0.045	0.048	0.057	0.057	0.033	0.040	0.045	0.035	0.045	0.055	0.046	0.055	0.052	0.045	0.053	0.051	0.041	0.050	0.038
Friday	7	0.049	0.054	0.050	0.061	0.070	0.063	0.049	0.054	0.050	0.063	0.063	0.064	0.053	0.061	0.054	0.063	0.063	0.054	0.039	0.049	0.046
Friday	8	0.051	0.057	0.052	0.059	0.070	0.063	0.051	0.057	0.052	0.058	0.072	0.074	0.051	0.059	0.054	0.059	0.061	0.055	0.041	0.056	0.050
Friday	9	0.050	0.057	0.052	0.054	0.064	0.060	0.050	0.057	0.052	0.052	0.068	0.075	0.050	0.058	0.053	0.052	0.058	0.054	0.045	0.058	0.055
Friday	10	0.054	0.061	0.054	0.052	0.062	0.058	0.054	0.061	0.054	0.055	0.071	0.074	0.051	0.059	0.053	0.050	0.057	0.054	0.047	0.062	0.059
Friday	11	0.060	0.066	0.055	0.054	0.062	0.057	0.060	0.066	0.055	0.060	0.074	0.074	0.053	0.060	0.053	0.053	0.059	0.054	0.050	0.067	0.060
Friday	12	0.063	0.067	0.055	0.055	0.062	0.056	0.063	0.067	0.055	0.063	0.072	0.069	0.055	0.061	0.053	0.056	0.060	0.053	0.051	0.067	0.060
Friday	13	0.066	0.068	0.054	0.057	0.062	0.055	0.066	0.068	0.054	0.065	0.076	0.069	0.058	0.061	0.052	0.058	0.060	0.052	0.056	0.071	0.062
Friday	14	0.070	0.070	0.054	0.060	0.062	0.053	0.070	0.070	0.054	0.069	0.078	0.063	0.061	0.062	0.050	0.063	0.062	0.051	0.060	0.075	0.059
Friday	15	0.073	0.070	0.052	0.061	0.060	0.051	0.073	0.070	0.052	0.078	0.080	0.055	0.062	0.061	0.048	0.070	0.063	0.049	0.060	0.074	0.060
Friday	16	0.074	0.067	0.050	0.063	0.057	0.048	0.074	0.067	0.050	0.085	0.075	0.047	0.063	0.058	0.046	0.072	0.060	0.046	0.060	0.070	0.055
Friday	17	0.072	0.063	0.047	0.063	0.053	0.044	0.072	0.063	0.047	0.082	0.061	0.039	0.062	0.053	0.043	0.069	0.055	0.043	0.060	0.064	0.049
Friday	18	0.063	0.051	0.042	0.058	0.042	0.036	0.063	0.051	0.042	0.059	0.041	0.029	0.058	0.045	0.039	0.060	0.046	0.039	0.054	0.049	0.044
Friday	19	0.050	0.039	0.035	0.050	0.031	0.030	0.050	0.039	0.035	0.042	0.028	0.024	0.050	0.035	0.034	0.046	0.035	0.033	0.050	0.036	0.040
Friday	20	0.041	0.029	0.030	0.042	0.023	0.024	0.041	0.029	0.030	0.032	0.021	0.021	0.043	0.026	0.030	0.038	0.026	0.028	0.045	0.028	0.037
Friday	21	0.037	0.023	0.028	0.038	0.018	0.022	0.037	0.023	0.028	0.027	0.015	0.020	0.039	0.020	0.027	0.035	0.022	0.026	0.038	0.021	0.032
Friday	22	0.030	0.017	0.026	0.033	0.015	0.021	0.030	0.017	0.026	0.021	0.011	0.016	0.032	0.014	0.024	0.029	0.018	0.024	0.031	0.015	0.029
Friday	23	0.019	0.011	0.024	0.024	0.012	0.021	0.019	0.011	0.024	0.014	0.007	0.015	0.023	0.009	0.021	0.020	0.013	0.023	0.023	0.010	0.026
Saturday	0	0.013	0.019	0.038	0.017	0.030	0.049	0.013	0.019	0.038	0.012	0.007	0.021	0.017	0.027	0.047	0.016	0.027	0.046	0.023	0.011	0.030
Saturday	1	0.008	0.015	0.034	0.011	0.022	0.041	0.008	0.015	0.034	0.008	0.005	0.016	0.012	0.021	0.042	0.011	0.022	0.042	0.025	0.010	0.027
Saturday	2	0.006	0.014	0.032	0.009	0.019	0.037	0.006	0.014	0.032	0.006	0.004	0.020	0.010	0.019	0.040	0.008	0.020	0.039	0.025	0.009	0.026
Saturday	3	0.006	0.013	0.031	0.007	0.016	0.034	0.006	0.013	0.031	0.005	0.004	0.022	0.009	0.019	0.039	0.007	0.019	0.038	0.027	0.011	0.024
Saturday	4	0.007	0.014	0.032	0.009	0.018	0.036	0.007	0.014	0.032	0.006	0.008	0.024	0.012	0.021	0.041	0.009	0.022	0.039	0.031	0.020	0.025
Saturday	5	0.011	0.018	0.034	0.015	0.026	0.042	0.011	0.018	0.034	0.012	0.017	0.039	0.018	0.029	0.045	0.014	0.027	0.042	0.038	0.034	0.030
Saturday	6	0.019	0.026	0.039	0.026	0.037	0.050	0.019	0.026	0.039	0.021	0.028	0.049	0.028	0.039	0.050	0.023	0.035	0.046	0.038	0.047	0.040
Saturday	7	0.032	0.038	0.046	0.037	0.049	0.058	0.032	0.038	0.046	0.034	0.041	0.058	0.039	0.048	0.055	0.034	0.044	0.050	0.042	0.047	0.046

		Nevada			Orange			Placer			Plumas			Riverside			Sacramento			San Benito		
Day of Week	Hour	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Saturday	8	0.045	0.051	0.052	0.048	0.060	0.064	0.045	0.051	0.052	0.045	0.057	0.067	0.047	0.056	0.056	0.045	0.052	0.053	0.043	0.055	0.050
Saturday	9	0.057	0.062	0.056	0.055	0.065	0.065	0.057	0.062	0.056	0.054	0.068	0.074	0.054	0.062	0.057	0.054	0.059	0.055	0.047	0.062	0.055
Saturday	10	0.067	0.071	0.060	0.059	0.068	0.064	0.067	0.071	0.060	0.063	0.080	0.073	0.058	0.064	0.056	0.061	0.063	0.055	0.047	0.067	0.062
Saturday	11	0.074	0.076	0.061	0.062	0.069	0.062	0.074	0.076	0.061	0.068	0.082	0.071	0.062	0.066	0.054	0.066	0.065	0.055	0.049	0.068	0.063
Saturday	12	0.075	0.075	0.060	0.064	0.068	0.058	0.075	0.075	0.060	0.074	0.083	0.068	0.063	0.065	0.052	0.068	0.065	0.053	0.055	0.071	0.060
Saturday	13	0.075	0.074	0.057	0.064	0.064	0.053	0.075	0.074	0.057	0.074	0.079	0.062	0.064	0.064	0.050	0.068	0.064	0.051	0.054	0.070	0.059
Saturday	14	0.074	0.071	0.055	0.064	0.061	0.048	0.074	0.071	0.055	0.074	0.076	0.057	0.064	0.062	0.047	0.068	0.061	0.048	0.055	0.066	0.058
Saturday	15	0.072	0.068	0.051	0.064	0.057	0.044	0.072	0.068	0.051	0.073	0.074	0.052	0.064	0.059	0.044	0.067	0.059	0.045	0.055	0.065	0.056
Saturday	16	0.070	0.064	0.048	0.064	0.053	0.039	0.070	0.064	0.048	0.073	0.067	0.045	0.063	0.056	0.041	0.067	0.056	0.042	0.057	0.065	0.052
Saturday	17	0.066	0.057	0.044	0.062	0.048	0.034	0.066	0.057	0.044	0.069	0.058	0.039	0.061	0.051	0.037	0.064	0.052	0.039	0.056	0.053	0.047
Saturday	18	0.056	0.047	0.038	0.057	0.041	0.028	0.056	0.047	0.038	0.058	0.047	0.034	0.056	0.043	0.033	0.057	0.045	0.034	0.052	0.044	0.042
Saturday	19	0.046	0.037	0.033	0.050	0.032	0.022	0.046	0.037	0.033	0.046	0.036	0.029	0.049	0.035	0.028	0.048	0.037	0.030	0.049	0.039	0.039
Saturday	20	0.040	0.030	0.028	0.044	0.027	0.018	0.040	0.030	0.028	0.040	0.028	0.024	0.044	0.030	0.024	0.042	0.031	0.027	0.043	0.031	0.035
Saturday	21	0.035	0.025	0.025	0.042	0.026	0.018	0.035	0.025	0.025	0.036	0.022	0.023	0.042	0.026	0.022	0.040	0.029	0.025	0.038	0.025	0.029
Saturday	22	0.028	0.019	0.023	0.040	0.025	0.018	0.028	0.019	0.023	0.029	0.016	0.017	0.037	0.022	0.020	0.036	0.026	0.024	0.030	0.017	0.026
Saturday	23	0.020	0.014	0.021	0.030	0.021	0.019	0.020	0.014	0.021	0.020	0.011	0.017	0.029	0.017	0.018	0.026	0.020	0.022	0.023	0.011	0.020
Holiday	0	0.010	0.016	0.028	0.015	0.023	0.030	0.010	0.016	0.028	0.010	0.004	0.012	0.015	0.023	0.032	0.013	0.023	0.032	0.024	0.008	0.016
Holiday	1	0.006	0.013	0.027	0.009	0.018	0.027	0.006	0.013	0.027	0.006	0.004	0.011	0.010	0.018	0.030	0.008	0.019	0.030	0.022	0.009	0.015
Holiday	2	0.004	0.012	0.026	0.007	0.015	0.025	0.004	0.012	0.026	0.004	0.003	0.012	0.008	0.018	0.029	0.006	0.018	0.030	0.024	0.007	0.015
Holiday	3	0.005	0.013	0.027	0.006	0.015	0.025	0.005	0.013	0.027	0.004	0.005	0.015	0.009	0.020	0.031	0.006	0.019	0.030	0.024	0.009	0.017
Holiday	4	0.008	0.016	0.029	0.010	0.019	0.029	0.008	0.016	0.029	0.007	0.009	0.024	0.016	0.027	0.035	0.010	0.023	0.033	0.031	0.019	0.019
Holiday	5	0.014	0.023	0.032	0.023	0.032	0.038	0.014	0.023	0.032	0.014	0.020	0.037	0.026	0.036	0.041	0.019	0.032	0.037	0.033	0.029	0.024
Holiday	6	0.025	0.033	0.036	0.038	0.047	0.047	0.025	0.033	0.036	0.030	0.036	0.047	0.035	0.044	0.044	0.031	0.041	0.043	0.038	0.042	0.030
Holiday	7	0.036	0.044	0.042	0.047	0.057	0.053	0.036	0.044	0.042	0.044	0.052	0.061	0.041	0.049	0.046	0.042	0.049	0.046	0.040	0.044	0.037
Holiday	8	0.046	0.053	0.048	0.047	0.058	0.053	0.046	0.053	0.048	0.052	0.066	0.075	0.046	0.054	0.049	0.048	0.054	0.049	0.037	0.050	0.041
Holiday	9	0.054	0.059	0.050	0.050	0.060	0.054	0.054	0.059	0.050	0.053	0.071	0.081	0.051	0.057	0.050	0.052	0.057	0.051	0.046	0.057	0.048
Holiday	10	0.065	0.069	0.053	0.055	0.064	0.056	0.065	0.069	0.053	0.059	0.076	0.081	0.056	0.061	0.051	0.057	0.060	0.052	0.048	0.066	0.056
Holiday	11	0.074	0.074	0.057	0.059	0.067	0.058	0.074	0.074	0.057	0.066	0.076	0.071	0.061	0.065	0.053	0.063	0.065	0.054	0.055	0.077	0.063
Holiday	12	0.077	0.074	0.056	0.061	0.068	0.057	0.077	0.074	0.056	0.071	0.078	0.074	0.063	0.066	0.053	0.067	0.065	0.054	0.052	0.074	0.065
Holiday	13	0.076	0.074	0.058	0.062	0.067	0.057	0.076	0.074	0.058	0.071	0.076	0.065	0.064	0.066	0.053	0.068	0.066	0.055	0.055	0.071	0.069
Holiday	14	0.075	0.073	0.056	0.064	0.066	0.055	0.075	0.073	0.056	0.070	0.078	0.060	0.064	0.064	0.052	0.069	0.065	0.053	0.050	0.071	0.067
Holiday	15	0.074	0.070	0.055	0.065	0.062	0.052	0.074	0.070	0.055	0.075	0.075	0.053	0.064	0.061	0.050	0.070	0.063	0.052	0.061	0.068	0.068
Holiday	16	0.072	0.066	0.054	0.064	0.057	0.049	0.072	0.066	0.054	0.079	0.070	0.044	0.064	0.058	0.048	0.069	0.060	0.049	0.062	0.069	0.058
Holiday	17	0.068	0.059	0.051	0.064	0.051	0.045	0.068	0.059	0.051	0.074	0.064	0.041	0.064	0.053	0.045	0.066	0.054	0.046	0.058	0.062	0.058
Holiday	18	0.057	0.049	0.045	0.058	0.042	0.040	0.057	0.049	0.045	0.058	0.044	0.034	0.059	0.046	0.043	0.058	0.046	0.042	0.054	0.050	0.049
Holiday	19	0.047	0.036	0.041	0.052	0.032	0.034	0.047	0.036	0.041	0.047	0.033	0.026	0.052	0.036	0.038	0.049	0.036	0.037	0.049	0.037	0.047
Holiday	20	0.039	0.029	0.037	0.046	0.025	0.030	0.039	0.029	0.037	0.038	0.025	0.025	0.045	0.029	0.036	0.043	0.030	0.034	0.046	0.032	0.043
Holiday	21	0.030	0.020	0.033	0.041	0.021	0.029	0.030	0.020	0.033	0.030	0.018	0.021	0.039	0.022	0.032	0.037	0.024	0.031	0.040	0.025	0.038
Holiday	22	0.023	0.015	0.031	0.035	0.018	0.029	0.023	0.015	0.031	0.024	0.011	0.017	0.029	0.016	0.030	0.029	0.019	0.029	0.031	0.016	0.032
Holiday	23	0.015	0.010	0.029	0.023	0.014	0.030	0.015	0.010	0.029	0.014	0.007	0.014	0.021	0.011	0.028	0.020	0.014	0.029	0.020	0.008	0.028

		San Bernardino			San Diego			San Francisco			San Joaquin			San Luis Obispo			San Mateo			Santa Barbara		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Sunday	0	0.024	0.030	0.035	0.019	0.033	0.051	0.026	0.032	0.056	0.016	0.024	0.039	0.017	0.009	0.017	0.021	0.029	0.049	0.020	0.017	0.032
Sunday	1	0.017	0.025	0.031	0.012	0.029	0.044	0.019	0.030	0.050	0.010	0.017	0.034	0.017	0.006	0.012	0.013	0.029	0.047	0.021	0.015	0.026
Sunday	2	0.014	0.022	0.028	0.009	0.026	0.040	0.017	0.030	0.048	0.007	0.015	0.031	0.018	0.005	0.009	0.010	0.028	0.045	0.020	0.012	0.022
Sunday	3	0.011	0.020	0.027	0.007	0.023	0.036	0.011	0.028	0.042	0.006	0.014	0.030	0.018	0.004	0.011	0.006	0.029	0.043	0.019	0.010	0.022
Sunday	4	0.012	0.020	0.027	0.007	0.023	0.034	0.009	0.028	0.040	0.008	0.015	0.030	0.019	0.005	0.009	0.007	0.029	0.041	0.023	0.014	0.023
Sunday	5	0.015	0.022	0.028	0.011	0.026	0.035	0.011	0.029	0.039	0.011	0.018	0.031	0.022	0.009	0.012	0.010	0.030	0.040	0.023	0.017	0.029
Sunday	6	0.021	0.026	0.030	0.018	0.030	0.037	0.018	0.032	0.040	0.017	0.022	0.033	0.026	0.015	0.017	0.015	0.031	0.039	0.029	0.024	0.031
Sunday	7	0.027	0.031	0.033	0.026	0.035	0.040	0.024	0.032	0.039	0.023	0.027	0.036	0.030	0.024	0.025	0.022	0.033	0.038	0.031	0.029	0.031
Sunday	8	0.036	0.038	0.037	0.037	0.041	0.043	0.033	0.036	0.040	0.032	0.036	0.040	0.037	0.037	0.039	0.032	0.036	0.038	0.036	0.042	0.037
Sunday	9	0.046	0.046	0.041	0.050	0.048	0.047	0.047	0.042	0.043	0.045	0.048	0.046	0.043	0.056	0.050	0.047	0.040	0.039	0.042	0.054	0.047
Sunday	10	0.055	0.055	0.047	0.062	0.055	0.050	0.060	0.049	0.044	0.056	0.059	0.050	0.051	0.072	0.068	0.062	0.046	0.042	0.046	0.065	0.055
Sunday	11	0.060	0.060	0.050	0.068	0.059	0.050	0.065	0.053	0.045	0.063	0.067	0.054	0.054	0.079	0.080	0.069	0.052	0.042	0.049	0.072	0.059
Sunday	12	0.064	0.066	0.053	0.072	0.061	0.051	0.067	0.056	0.043	0.068	0.071	0.056	0.058	0.089	0.088	0.072	0.056	0.043	0.055	0.078	0.062
Sunday	13	0.067	0.067	0.054	0.072	0.062	0.049	0.067	0.056	0.041	0.071	0.074	0.055	0.059	0.085	0.081	0.073	0.057	0.042	0.057	0.074	0.057
Sunday	14	0.068	0.066	0.054	0.071	0.059	0.046	0.067	0.056	0.040	0.073	0.073	0.054	0.062	0.085	0.075	0.072	0.058	0.041	0.060	0.072	0.051
Sunday	15	0.066	0.063	0.053	0.071	0.057	0.043	0.066	0.056	0.039	0.073	0.071	0.053	0.065	0.081	0.066	0.070	0.059	0.041	0.061	0.070	0.051
Sunday	16	0.065	0.060	0.052	0.070	0.056	0.042	0.065	0.057	0.038	0.073	0.068	0.050	0.067	0.076	0.063	0.070	0.060	0.041	0.063	0.066	0.049
Sunday	17	0.063	0.056	0.051	0.067	0.053	0.040	0.063	0.057	0.038	0.072	0.063	0.049	0.065	0.070	0.064	0.068	0.060	0.043	0.064	0.059	0.049
Sunday	18	0.060	0.051	0.049	0.061	0.048	0.038	0.058	0.054	0.038	0.067	0.055	0.044	0.063	0.058	0.055	0.059	0.055	0.041	0.061	0.054	0.046
Sunday	19	0.056	0.045	0.047	0.054	0.043	0.036	0.053	0.048	0.037	0.061	0.047	0.041	0.057	0.046	0.044	0.052	0.049	0.040	0.059	0.046	0.043
Sunday	20	0.052	0.042	0.047	0.047	0.039	0.036	0.049	0.044	0.038	0.054	0.040	0.039	0.053	0.037	0.035	0.049	0.045	0.041	0.053	0.040	0.043
Sunday	21	0.044	0.036	0.045	0.039	0.035	0.036	0.045	0.038	0.039	0.044	0.031	0.036	0.045	0.026	0.032	0.045	0.039	0.041	0.045	0.031	0.046
Sunday	22	0.034	0.030	0.042	0.029	0.030	0.037	0.037	0.032	0.041	0.031	0.024	0.035	0.034	0.016	0.025	0.034	0.030	0.040	0.035	0.023	0.045
Sunday	23	0.023	0.025	0.041	0.019	0.027	0.040	0.025	0.025	0.044	0.019	0.019	0.036	0.023	0.010	0.024	0.021	0.022	0.040	0.026	0.017	0.042
Monday	0	0.015	0.017	0.023	0.009	0.018	0.023	0.012	0.020	0.031	0.010	0.012	0.022	0.018	0.004	0.008	0.009	0.016	0.025	0.016	0.005	0.012
Monday	1	0.011	0.015	0.022	0.005	0.017	0.022	0.007	0.021	0.030	0.006	0.010	0.021	0.017	0.003	0.008	0.004	0.018	0.026	0.015	0.004	0.014
Monday	2	0.010	0.015	0.022	0.004	0.017	0.023	0.005	0.021	0.031	0.006	0.010	0.022	0.018	0.003	0.010	0.003	0.019	0.028	0.016	0.005	0.016
Monday	3	0.014	0.018	0.024	0.005	0.018	0.024	0.005	0.022	0.031	0.011	0.015	0.025	0.020	0.006	0.014	0.003	0.020	0.029	0.018	0.007	0.019
Monday	4	0.025	0.028	0.029	0.012	0.022	0.028	0.010	0.025	0.035	0.029	0.028	0.033	0.024	0.011	0.019	0.007	0.022	0.031	0.020	0.013	0.028
Monday	5	0.041	0.044	0.038	0.031	0.034	0.037	0.023	0.031	0.040	0.043	0.043	0.042	0.031	0.027	0.029	0.020	0.026	0.034	0.028	0.025	0.038
Monday	6	0.052	0.053	0.044	0.055	0.050	0.047	0.045	0.040	0.046	0.053	0.052	0.048	0.040	0.048	0.041	0.044	0.035	0.041	0.037	0.048	0.045
Monday	7	0.061	0.065	0.052	0.068	0.066	0.057	0.064	0.057	0.055	0.061	0.059	0.053	0.046	0.065	0.053	0.071	0.058	0.057	0.048	0.071	0.046
Monday	8	0.056	0.056	0.047	0.063	0.062	0.058	0.064	0.064	0.057	0.055	0.057	0.053	0.049	0.066	0.057	0.071	0.070	0.064	0.054	0.083	0.052
Monday	9	0.051	0.051	0.045	0.055	0.056	0.054	0.059	0.054	0.054	0.051	0.056	0.055	0.051	0.069	0.064	0.065	0.059	0.058	0.054	0.078	0.055
Monday	10	0.050	0.050	0.045	0.051	0.055	0.054	0.055	0.053	0.054	0.051	0.058	0.056	0.051	0.070	0.073	0.057	0.052	0.053	0.053	0.069	0.060
Monday	11	0.052	0.052	0.046	0.052	0.056	0.055	0.053	0.053	0.055	0.052	0.060	0.058	0.054	0.070	0.074	0.052	0.050	0.051	0.056	0.072	0.066
Monday	12	0.054	0.054	0.049	0.054	0.058	0.057	0.053	0.054	0.053	0.054	0.061	0.058	0.055	0.070	0.070	0.051	0.053	0.051	0.060	0.073	0.069
Monday	13	0.055	0.057	0.051	0.056	0.059	0.057	0.053	0.056	0.053	0.056	0.063	0.057	0.058	0.071	0.070	0.052	0.055	0.051	0.062	0.072	0.064
Monday	14	0.059	0.062	0.055	0.063	0.062	0.057	0.059	0.059	0.052	0.063	0.068	0.058	0.064	0.076	0.067	0.056	0.059	0.052	0.065	0.075	0.062
Monday	15	0.063	0.065	0.058	0.072	0.065	0.057	0.063	0.061	0.051	0.069	0.072	0.059	0.068	0.083	0.061	0.063	0.065	0.055	0.070	0.077	0.060
Monday	16	0.064	0.066	0.060	0.075	0.065	0.057	0.065	0.061	0.049	0.072	0.071	0.056	0.068	0.079	0.053	0.070	0.070	0.057	0.067	0.067	0.052
Monday	17	0.064	0.065	0.060	0.073	0.062	0.055	0.067	0.068	0.049	0.070	0.065	0.052	0.064	0.065	0.047	0.074	0.077	0.059	0.058	0.046	0.041
Monday	18	0.054	0.050	0.052	0.058	0.046	0.044	0.062	0.056	0.042	0.055	0.045	0.041	0.051	0.041	0.040	0.067	0.059	0.048	0.050	0.034	0.037
Monday	19	0.042	0.035	0.043	0.041	0.033	0.034	0.050	0.039	0.033	0.041	0.031	0.033	0.043	0.026	0.036	0.051	0.039	0.035	0.045	0.025	0.035
Monday	20	0.035	0.028	0.038	0.033	0.026	0.029	0.039	0.030	0.027	0.033	0.023	0.028	0.037	0.018	0.030	0.037	0.029	0.028	0.036	0.017	0.033
Monday	21	0.031	0.023	0.036	0.028	0.022	0.025	0.036	0.024	0.024	0.027	0.017	0.026	0.031	0.014	0.027	0.033	0.022	0.024	0.030	0.013	0.034
Monday	22	0.025	0.018	0.033	0.020	0.017	0.023	0.031	0.018	0.023	0.021	0.013	0.023	0.024	0.009	0.026	0.025	0.016	0.022	0.024	0.010	0.032
Monday	23	0.018	0.013	0.030	0.013	0.015	0.022	0.021	0.013	0.025	0.014	0.010	0.022	0.017	0.005	0.021	0.015	0.011	0.020	0.016	0.007	0.030
Tues/Wed/Thurs	0	0.013	0.016	0.024	0.007	0.017	0.025	0.012	0.019	0.032	0.009	0.011	0.024	0.016	0.004	0.017	0.008	0.016	0.026	0.016	0.005	0.022
Tues/Wed/Thurs	1	0.010	0.014	0.023	0.004	0.016	0.024	0.007	0.019	0.031	0.006	0.010	0.023	0.016	0.003	0.014	0.003	0.017	0.027	0.015	0.004	0.022
Tues/Wed/Thurs	2	0.010	0.015	0.024	0.003	0.016	0.024	0.005	0.020	0.032	0.005	0.010	0.023	0.016	0.003	0.014	0.002	0.018	0.028	0.015	0.004	0.021
Tues/Wed/Thurs	3	0.013	0.018	0.025	0.004	0.017	0.026	0.005	0.021	0.032	0.010	0.014	0.026	0.018	0.004	0.017	0.003	0.019	0.029	0.017	0.006	0.024

		San Bernardino			San Diego			San Francisco			San Joaquin			San Luis Obispo			San Mateo			Santa Barbara		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Tues/Wed/Thurs	4	0.024	0.027	0.031	0.010	0.022	0.029	0.009	0.024	0.036	0.027	0.026	0.034	0.021	0.009	0.022	0.007	0.021	0.031	0.019	0.012	0.033
Tues/Wed/Thurs	5	0.041	0.044	0.040	0.029	0.033	0.038	0.024	0.029	0.041	0.043	0.041	0.042	0.030	0.023	0.032	0.020	0.025	0.034	0.026	0.025	0.045
Tues/Wed/Thurs	6	0.053	0.053	0.046	0.055	0.050	0.049	0.047	0.040	0.049	0.054	0.051	0.049	0.041	0.049	0.046	0.046	0.035	0.042	0.039	0.051	0.052
Tues/Wed/Thurs	7	0.062	0.065	0.054	0.068	0.067	0.059	0.065	0.058	0.057	0.062	0.059	0.054	0.048	0.066	0.057	0.073	0.059	0.058	0.051	0.072	0.052
Tues/Wed/Thurs	8	0.056	0.057	0.050	0.063	0.064	0.059	0.064	0.067	0.059	0.056	0.057	0.054	0.049	0.067	0.060	0.071	0.072	0.066	0.056	0.083	0.056
Tues/Wed/Thurs	9	0.050	0.051	0.046	0.055	0.056	0.055	0.058	0.054	0.055	0.051	0.055	0.055	0.050	0.066	0.065	0.064	0.058	0.058	0.056	0.079	0.057
Tues/Wed/Thurs	10	0.049	0.049	0.046	0.050	0.054	0.054	0.053	0.051	0.053	0.049	0.056	0.056	0.052	0.066	0.067	0.054	0.050	0.052	0.054	0.070	0.060
Tues/Wed/Thurs	11	0.050	0.051	0.047	0.051	0.056	0.055	0.051	0.052	0.054	0.050	0.058	0.056	0.053	0.067	0.071	0.050	0.049	0.050	0.057	0.072	0.064
Tues/Wed/Thurs	12	0.052	0.053	0.049	0.053	0.058	0.056	0.051	0.053	0.053	0.052	0.059	0.056	0.056	0.069	0.067	0.049	0.051	0.050	0.060	0.071	0.062
Tues/Wed/Thurs	13	0.054	0.056	0.051	0.055	0.059	0.055	0.052	0.055	0.052	0.055	0.062	0.056	0.060	0.071	0.065	0.050	0.054	0.051	0.063	0.072	0.060
Tues/Wed/Thurs	14	0.058	0.062	0.054	0.063	0.062	0.056	0.058	0.059	0.051	0.062	0.068	0.057	0.063	0.076	0.064	0.056	0.058	0.052	0.064	0.075	0.058
Tues/Wed/Thurs	15	0.062	0.065	0.057	0.072	0.065	0.055	0.060	0.061	0.050	0.069	0.074	0.058	0.069	0.084	0.058	0.062	0.065	0.054	0.067	0.076	0.052
Tues/Wed/Thurs	16	0.064	0.067	0.059	0.074	0.065	0.055	0.064	0.062	0.047	0.072	0.074	0.057	0.070	0.081	0.050	0.070	0.071	0.056	0.064	0.065	0.044
Tues/Wed/Thurs	17	0.064	0.066	0.058	0.073	0.063	0.054	0.065	0.070	0.047	0.070	0.067	0.053	0.063	0.067	0.045	0.072	0.081	0.061	0.056	0.045	0.036
Tues/Wed/Thurs	18	0.055	0.052	0.050	0.061	0.047	0.043	0.062	0.059	0.041	0.056	0.048	0.041	0.053	0.044	0.039	0.067	0.065	0.051	0.050	0.036	0.034
Tues/Wed/Thurs	19	0.044	0.037	0.041	0.044	0.033	0.033	0.052	0.041	0.032	0.043	0.033	0.033	0.044	0.029	0.034	0.053	0.041	0.036	0.044	0.026	0.031
Tues/Wed/Thurs	20	0.038	0.029	0.037	0.036	0.026	0.028	0.042	0.031	0.026	0.034	0.025	0.028	0.038	0.021	0.028	0.039	0.029	0.027	0.037	0.019	0.029
Tues/Wed/Thurs	21	0.033	0.023	0.033	0.031	0.021	0.025	0.039	0.024	0.024	0.028	0.019	0.025	0.032	0.016	0.026	0.035	0.022	0.023	0.031	0.015	0.031
Tues/Wed/Thurs	22	0.027	0.017	0.029	0.022	0.017	0.022	0.034	0.018	0.023	0.021	0.014	0.022	0.025	0.010	0.023	0.027	0.015	0.019	0.025	0.011	0.027
Tues/Wed/Thurs	23	0.020	0.012	0.025	0.014	0.014	0.021	0.023	0.012	0.024	0.015	0.010	0.021	0.018	0.006	0.019	0.017	0.010	0.017	0.018	0.008	0.026
Friday	0	0.014	0.016	0.025	0.008	0.018	0.027	0.014	0.020	0.034	0.008	0.012	0.025	0.016	0.004	0.016	0.009	0.016	0.027	0.016	0.006	0.024
Friday	1	0.011	0.014	0.024	0.005	0.017	0.026	0.008	0.020	0.033	0.006	0.010	0.024	0.016	0.003	0.014	0.005	0.017	0.029	0.016	0.005	0.022
Friday	2	0.010	0.014	0.024	0.004	0.017	0.027	0.007	0.020	0.033	0.005	0.010	0.024	0.016	0.003	0.014	0.003	0.018	0.029	0.016	0.005	0.021
Friday	3	0.013	0.017	0.026	0.005	0.018	0.028	0.006	0.022	0.034	0.009	0.013	0.027	0.017	0.004	0.017	0.003	0.020	0.031	0.016	0.006	0.025
Friday	4	0.021	0.024	0.030	0.009	0.021	0.031	0.009	0.024	0.036	0.022	0.023	0.034	0.020	0.007	0.022	0.007	0.021	0.032	0.020	0.011	0.033
Friday	5	0.035	0.037	0.038	0.026	0.032	0.040	0.022	0.029	0.042	0.036	0.036	0.042	0.027	0.018	0.031	0.019	0.025	0.035	0.025	0.022	0.043
Friday	6	0.046	0.046	0.044	0.048	0.047	0.050	0.043	0.039	0.048	0.046	0.045	0.048	0.038	0.042	0.045	0.042	0.034	0.042	0.038	0.046	0.050
Friday	7	0.055	0.056	0.050	0.061	0.060	0.058	0.060	0.053	0.056	0.053	0.052	0.053	0.044	0.058	0.054	0.067	0.053	0.056	0.046	0.068	0.051
Friday	8	0.052	0.052	0.048	0.057	0.058	0.058	0.060	0.059	0.058	0.049	0.051	0.054	0.048	0.061	0.059	0.068	0.060	0.061	0.053	0.079	0.056
Friday	9	0.049	0.048	0.046	0.052	0.055	0.056	0.055	0.052	0.056	0.046	0.052	0.055	0.049	0.064	0.065	0.061	0.054	0.056	0.054	0.079	0.062
Friday	10	0.050	0.050	0.047	0.051	0.055	0.056	0.052	0.052	0.056	0.048	0.055	0.057	0.052	0.068	0.070	0.054	0.050	0.052	0.053	0.071	0.063
Friday	11	0.052	0.053	0.050	0.054	0.058	0.058	0.052	0.055	0.056	0.050	0.058	0.059	0.054	0.070	0.072	0.053	0.051	0.052	0.058	0.074	0.066
Friday	12	0.054	0.055	0.051	0.056	0.060	0.058	0.053	0.055	0.054	0.054	0.061	0.058	0.056	0.072	0.070	0.052	0.054	0.052	0.059	0.073	0.061
Friday	13	0.056	0.058	0.053	0.059	0.061	0.057	0.054	0.057	0.053	0.058	0.065	0.058	0.060	0.074	0.068	0.053	0.057	0.053	0.064	0.073	0.058
Friday	14	0.059	0.063	0.056	0.066	0.063	0.056	0.058	0.060	0.052	0.065	0.070	0.059	0.064	0.079	0.066	0.059	0.062	0.055	0.066	0.073	0.056
Friday	15	0.060	0.066	0.058	0.071	0.065	0.055	0.060	0.063	0.050	0.069	0.075	0.059	0.067	0.083	0.058	0.064	0.070	0.057	0.067	0.074	0.052
Friday	16	0.061	0.066	0.058	0.070	0.064	0.054	0.062	0.064	0.047	0.071	0.073	0.057	0.068	0.078	0.051	0.069	0.073	0.058	0.064	0.062	0.045
Friday	17	0.060	0.064	0.056	0.068	0.060	0.050	0.062	0.067	0.046	0.069	0.069	0.053	0.062	0.064	0.047	0.069	0.079	0.059	0.057	0.046	0.038
Friday	18	0.055	0.053	0.050	0.060	0.048	0.041	0.059	0.056	0.039	0.061	0.052	0.041	0.056	0.048	0.039	0.064	0.063	0.049	0.050	0.036	0.035
Friday	19	0.048	0.043	0.043	0.048	0.035	0.031	0.052	0.043	0.031	0.050	0.038	0.031	0.047	0.033	0.032	0.052	0.043	0.035	0.046	0.028	0.031
Friday	20	0.043	0.035	0.038	0.039	0.027	0.025	0.042	0.032	0.025	0.042	0.029	0.026	0.042	0.025	0.028	0.039	0.031	0.026	0.038	0.022	0.029
Friday	21	0.039	0.029	0.034	0.035	0.023	0.021	0.039	0.025	0.021	0.035	0.022	0.022	0.036	0.019	0.024	0.034	0.023	0.021	0.032	0.017	0.029
Friday	22	0.033	0.022	0.029	0.029	0.020	0.019	0.039	0.020	0.020	0.028	0.017	0.019	0.028	0.014	0.021	0.031	0.017	0.017	0.027	0.014	0.026
Friday	23	0.025	0.016	0.024	0.020	0.016	0.017	0.031	0.014	0.020	0.020	0.012	0.017	0.021	0.009	0.017	0.023	0.011	0.014	0.019	0.010	0.024
Saturday	0	0.020	0.024	0.034	0.015	0.026	0.043	0.022	0.026	0.048	0.014	0.021	0.037	0.018	0.007	0.027	0.017	0.024	0.042	0.022	0.013	0.039
Saturday	1	0.015	0.020	0.031	0.010	0.023	0.039	0.015	0.025	0.045	0.009	0.016	0.032	0.020	0.006	0.022	0.010	0.024	0.041	0.021	0.010	0.032
Saturday	2	0.013	0.019	0.029	0.007	0.022	0.037	0.013	0.025	0.043	0.007	0.014	0.031	0.020	0.005	0.020	0.008	0.024	0.041	0.022	0.009	0.030
Saturday	3	0.013	0.018	0.029	0.006	0.020	0.035	0.009	0.025	0.041	0.007	0.015	0.031	0.021	0.005	0.021	0.006	0.025	0.041	0.022	0.010	0.032
Saturday	4	0.015	0.020	0.030	0.007	0.022	0.036	0.008	0.026	0.039	0.011	0.018	0.033	0.022	0.007	0.023	0.007	0.026	0.041	0.024	0.014	0.040
Saturday	5	0.021	0.025	0.033	0.014	0.026	0.039	0.013	0.028	0.041	0.018	0.025	0.037	0.025	0.013	0.031	0.011	0.028	0.042	0.028	0.021	0.046
Saturday	6	0.030	0.032	0.038	0.024	0.032	0.045	0.021	0.031	0.044	0.027	0.033	0.042	0.032	0.024	0.039	0.019	0.031	0.043	0.035	0.035	0.053
Saturday	7	0.039	0.040	0.043	0.036	0.040	0.051	0.031	0.036	0.047	0.036	0.042	0.048	0.038	0.041	0.051	0.031	0.035	0.044	0.040	0.048	0.054

		San Bernardino			San Diego			San Francisco			San Joaquin			San Luis Obispo			San Mateo			Santa Barbara		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Saturday	8	0.046	0.047	0.048	0.048	0.048	0.056	0.043	0.041	0.051	0.045	0.050	0.054	0.047	0.053	0.055	0.043	0.039	0.046	0.046	0.059	0.057
Saturday	9	0.052	0.052	0.050	0.056	0.054	0.059	0.052	0.046	0.052	0.054	0.059	0.058	0.050	0.067	0.062	0.054	0.045	0.048	0.050	0.068	0.060
Saturday	10	0.056	0.056	0.053	0.062	0.058	0.060	0.059	0.051	0.053	0.061	0.067	0.062	0.054	0.078	0.069	0.062	0.050	0.051	0.053	0.070	0.059
Saturday	11	0.059	0.060	0.055	0.066	0.061	0.060	0.062	0.055	0.052	0.065	0.071	0.063	0.059	0.084	0.078	0.067	0.056	0.053	0.057	0.073	0.059
Saturday	12	0.061	0.063	0.057	0.068	0.063	0.058	0.063	0.057	0.051	0.067	0.072	0.062	0.060	0.082	0.070	0.068	0.059	0.051	0.059	0.074	0.056
Saturday	13	0.062	0.063	0.055	0.068	0.062	0.055	0.062	0.058	0.048	0.067	0.070	0.059	0.061	0.079	0.064	0.067	0.060	0.050	0.061	0.070	0.051
Saturday	14	0.062	0.063	0.055	0.068	0.061	0.051	0.062	0.059	0.046	0.067	0.068	0.056	0.060	0.074	0.061	0.067	0.061	0.049	0.061	0.068	0.048
Saturday	15	0.062	0.062	0.054	0.068	0.059	0.047	0.063	0.059	0.043	0.067	0.065	0.052	0.062	0.072	0.053	0.067	0.062	0.048	0.061	0.061	0.045
Saturday	16	0.061	0.060	0.052	0.067	0.057	0.043	0.063	0.059	0.042	0.066	0.061	0.048	0.061	0.066	0.050	0.067	0.062	0.046	0.059	0.059	0.041
Saturday	17	0.059	0.057	0.049	0.064	0.054	0.039	0.061	0.059	0.039	0.063	0.055	0.043	0.059	0.059	0.044	0.067	0.061	0.044	0.057	0.053	0.036
Saturday	18	0.055	0.051	0.044	0.057	0.047	0.033	0.058	0.056	0.036	0.057	0.045	0.036	0.053	0.050	0.037	0.061	0.055	0.040	0.052	0.046	0.033
Saturday	19	0.048	0.042	0.039	0.048	0.040	0.027	0.051	0.047	0.031	0.049	0.036	0.030	0.048	0.038	0.031	0.049	0.046	0.034	0.045	0.036	0.029
Saturday	20	0.043	0.037	0.035	0.042	0.035	0.023	0.044	0.040	0.028	0.043	0.030	0.026	0.043	0.032	0.029	0.042	0.039	0.030	0.041	0.031	0.029
Saturday	21	0.041	0.034	0.033	0.039	0.033	0.022	0.044	0.034	0.026	0.040	0.026	0.023	0.037	0.027	0.025	0.042	0.035	0.028	0.035	0.027	0.024
Saturday	22	0.037	0.029	0.030	0.034	0.031	0.021	0.045	0.032	0.027	0.035	0.023	0.021	0.028	0.018	0.021	0.040	0.030	0.025	0.029	0.023	0.023
Saturday	23	0.030	0.023	0.026	0.025	0.027	0.020	0.036	0.025	0.026	0.025	0.017	0.019	0.021	0.013	0.017	0.029	0.022	0.022	0.023	0.019	0.021
Holiday	0	0.018	0.020	0.026	0.013	0.023	0.029	0.021	0.023	0.035	0.012	0.015	0.027	0.018	0.006	0.012	0.014	0.020	0.030	0.020	0.010	0.020
Holiday	1	0.014	0.018	0.024	0.008	0.021	0.027	0.013	0.022	0.033	0.008	0.013	0.025	0.019	0.004	0.009	0.008	0.021	0.031	0.021	0.008	0.020
Holiday	2	0.012	0.017	0.024	0.006	0.020	0.027	0.010	0.024	0.033	0.006	0.012	0.025	0.019	0.003	0.011	0.005	0.022	0.031	0.019	0.006	0.018
Holiday	3	0.013	0.018	0.026	0.005	0.020	0.027	0.007	0.025	0.033	0.008	0.014	0.026	0.022	0.005	0.013	0.004	0.024	0.033	0.021	0.008	0.023
Holiday	4	0.019	0.024	0.029	0.008	0.023	0.030	0.008	0.028	0.035	0.015	0.020	0.030	0.022	0.008	0.015	0.006	0.025	0.034	0.022	0.012	0.028
Holiday	5	0.029	0.032	0.034	0.019	0.029	0.034	0.016	0.031	0.039	0.023	0.028	0.035	0.028	0.017	0.021	0.014	0.029	0.037	0.027	0.023	0.037
Holiday	6	0.036	0.038	0.037	0.035	0.040	0.042	0.028	0.036	0.044	0.031	0.035	0.039	0.034	0.030	0.031	0.027	0.035	0.041	0.031	0.034	0.042
Holiday	7	0.043	0.045	0.041	0.046	0.048	0.049	0.039	0.042	0.047	0.036	0.040	0.043	0.041	0.044	0.040	0.044	0.043	0.046	0.042	0.060	0.045
Holiday	8	0.047	0.048	0.043	0.048	0.050	0.050	0.046	0.049	0.050	0.041	0.045	0.047	0.046	0.055	0.046	0.053	0.048	0.050	0.048	0.073	0.051
Holiday	9	0.049	0.050	0.045	0.052	0.053	0.053	0.051	0.049	0.053	0.047	0.051	0.050	0.050	0.065	0.062	0.055	0.050	0.050	0.051	0.075	0.059
Holiday	10	0.053	0.053	0.047	0.057	0.058	0.056	0.057	0.054	0.054	0.055	0.061	0.056	0.052	0.076	0.072	0.058	0.052	0.052	0.053	0.071	0.058
Holiday	11	0.057	0.059	0.052	0.062	0.063	0.059	0.061	0.057	0.056	0.063	0.069	0.061	0.052	0.082	0.088	0.062	0.056	0.053	0.057	0.076	0.066
Holiday	12	0.060	0.063	0.053	0.065	0.065	0.060	0.063	0.059	0.055	0.066	0.072	0.062	0.058	0.086	0.085	0.062	0.060	0.055	0.059	0.079	0.070
Holiday	13	0.062	0.064	0.055	0.066	0.066	0.059	0.065	0.062	0.057	0.068	0.074	0.062	0.061	0.081	0.082	0.065	0.062	0.055	0.061	0.072	0.056
Holiday	14	0.063	0.066	0.056	0.068	0.065	0.058	0.067	0.063	0.055	0.070	0.073	0.060	0.059	0.076	0.075	0.067	0.066	0.056	0.060	0.073	0.060
Holiday	15	0.062	0.066	0.057	0.070	0.064	0.057	0.065	0.064	0.053	0.071	0.072	0.058	0.064	0.077	0.065	0.068	0.067	0.054	0.064	0.072	0.055
Holiday	16	0.062	0.063	0.057	0.069	0.060	0.053	0.063	0.062	0.048	0.071	0.068	0.054	0.068	0.072	0.057	0.069	0.067	0.055	0.060	0.061	0.050
Holiday	17	0.062	0.061	0.056	0.066	0.055	0.048	0.061	0.058	0.045	0.068	0.061	0.050	0.062	0.063	0.046	0.069	0.063	0.051	0.059	0.047	0.037
Holiday	18	0.056	0.053	0.052	0.058	0.045	0.042	0.057	0.052	0.040	0.060	0.050	0.042	0.053	0.044	0.039	0.060	0.053	0.044	0.053	0.038	0.036
Holiday	19	0.048	0.043	0.046	0.049	0.037	0.035	0.049	0.042	0.032	0.051	0.040	0.037	0.047	0.035	0.037	0.050	0.044	0.037	0.049	0.029	0.036
Holiday	20	0.043	0.034	0.041	0.043	0.030	0.030	0.044	0.034	0.029	0.044	0.031	0.032	0.041	0.027	0.028	0.045	0.033	0.032	0.040	0.024	0.032
Holiday	21	0.037	0.027	0.037	0.037	0.025	0.027	0.042	0.028	0.024	0.037	0.025	0.029	0.035	0.019	0.023	0.042	0.027	0.028	0.036	0.020	0.038
Holiday	22	0.031	0.021	0.033	0.030	0.022	0.025	0.040	0.021	0.025	0.029	0.019	0.026	0.027	0.014	0.022	0.033	0.020	0.025	0.028	0.017	0.034
Holiday	23	0.023	0.015	0.030	0.020	0.018	0.024	0.028	0.016	0.026	0.020	0.013	0.024	0.021	0.010	0.020	0.023	0.014	0.022	0.021	0.013	0.031

		Santa Clara			Santa Cruz			Shasta			Sierra			Siskiyou			Solano			Sonoma		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Sunday	0	0.018	0.036	0.052	0.011	0.032	0.036	0.013	0.008	0.016	0.013	0.020	0.031	0.019	0.009	0.017	0.017	0.037	0.059	0.019	0.038	0.053
Sunday	1	0.011	0.034	0.046	0.006	0.031	0.036	0.013	0.006	0.013	0.008	0.016	0.028	0.021	0.007	0.014	0.011	0.032	0.052	0.012	0.034	0.047
Sunday	2	0.008	0.032	0.042	0.003	0.030	0.037	0.012	0.006	0.011	0.006	0.013	0.026	0.022	0.006	0.013	0.009	0.030	0.048	0.008	0.031	0.043
Sunday	3	0.005	0.032	0.039	0.002	0.034	0.035	0.012	0.005	0.011	0.005	0.012	0.025	0.022	0.005	0.013	0.007	0.027	0.044	0.006	0.030	0.040
Sunday	4	0.005	0.032	0.037	0.003	0.035	0.038	0.015	0.007	0.013	0.005	0.012	0.025	0.023	0.006	0.013	0.007	0.028	0.042	0.006	0.029	0.038
Sunday	5	0.008	0.033	0.036	0.006	0.035	0.035	0.018	0.012	0.018	0.008	0.015	0.027	0.025	0.008	0.016	0.010	0.029	0.042	0.010	0.031	0.038
Sunday	6	0.014	0.035	0.037	0.013	0.036	0.036	0.021	0.019	0.026	0.013	0.020	0.030	0.028	0.014	0.024	0.016	0.032	0.042	0.016	0.033	0.039
Sunday	7	0.021	0.037	0.039	0.022	0.038	0.039	0.029	0.030	0.039	0.022	0.028	0.034	0.030	0.022	0.034	0.021	0.035	0.043	0.023	0.036	0.040
Sunday	8	0.032	0.040	0.040	0.034	0.036	0.040	0.037	0.043	0.053	0.034	0.041	0.040	0.033	0.036	0.048	0.031	0.041	0.045	0.033	0.040	0.042
Sunday	9	0.047	0.046	0.044	0.051	0.043	0.043	0.043	0.055	0.067	0.048	0.055	0.046	0.036	0.052	0.062	0.046	0.048	0.046	0.048	0.046	0.044
Sunday	10	0.061	0.051	0.047	0.064	0.044	0.047	0.053	0.071	0.079	0.064	0.068	0.052	0.040	0.071	0.075	0.059	0.053	0.045	0.062	0.051	0.045
Sunday	11	0.068	0.053	0.047	0.071	0.047	0.046	0.060	0.077	0.080	0.075	0.075	0.055	0.044	0.082	0.086	0.067	0.055	0.044	0.067	0.053	0.046
Sunday	12	0.073	0.054	0.046	0.073	0.046	0.043	0.064	0.084	0.077	0.082	0.079	0.058	0.049	0.089	0.088	0.069	0.055	0.041	0.070	0.054	0.046
Sunday	13	0.075	0.055	0.045	0.076	0.047	0.041	0.066	0.083	0.070	0.084	0.079	0.058	0.054	0.090	0.080	0.070	0.055	0.038	0.073	0.055	0.050
Sunday	14	0.075	0.055	0.044	0.078	0.052	0.047	0.067	0.085	0.065	0.084	0.077	0.057	0.058	0.089	0.072	0.071	0.053	0.036	0.073	0.055	0.047
Sunday	15	0.075	0.054	0.042	0.081	0.054	0.051	0.072	0.083	0.061	0.082	0.073	0.057	0.063	0.087	0.069	0.071	0.052	0.035	0.073	0.053	0.041
Sunday	16	0.073	0.053	0.041	0.082	0.055	0.051	0.073	0.080	0.058	0.079	0.068	0.055	0.064	0.081	0.059	0.071	0.051	0.033	0.072	0.052	0.039
Sunday	17	0.071	0.051	0.040	0.080	0.058	0.052	0.068	0.066	0.056	0.072	0.062	0.053	0.065	0.066	0.051	0.070	0.051	0.033	0.070	0.050	0.038
Sunday	18	0.064	0.047	0.039	0.069	0.051	0.048	0.065	0.056	0.049	0.060	0.052	0.049	0.065	0.055	0.044	0.066	0.048	0.033	0.063	0.047	0.036
Sunday	19	0.057	0.044	0.038	0.058	0.051	0.047	0.058	0.043	0.041	0.050	0.043	0.045	0.062	0.043	0.036	0.060	0.046	0.034	0.056	0.044	0.035
Sunday	20	0.050	0.040	0.037	0.048	0.047	0.044	0.048	0.031	0.032	0.041	0.035	0.042	0.057	0.032	0.028	0.055	0.043	0.035	0.051	0.041	0.036
Sunday	21	0.041	0.034	0.038	0.036	0.039	0.039	0.041	0.023	0.026	0.031	0.026	0.039	0.049	0.022	0.023	0.045	0.039	0.039	0.042	0.038	0.037
Sunday	22	0.029	0.029	0.040	0.022	0.033	0.036	0.031	0.016	0.021	0.021	0.019	0.036	0.041	0.015	0.019	0.032	0.033	0.043	0.030	0.032	0.039
Sunday	23	0.018	0.024	0.044	0.011	0.028	0.032	0.020	0.012	0.017	0.013	0.015	0.033	0.028	0.012	0.016	0.020	0.028	0.049	0.019	0.027	0.043
Monday	0	0.007	0.022	0.028	0.004	0.024	0.033	0.013	0.006	0.012	0.008	0.014	0.027	0.023	0.007	0.013	0.010	0.026	0.035	0.007	0.023	0.029
Monday	1	0.003	0.022	0.027	0.001	0.025	0.031	0.012	0.006	0.011	0.005	0.012	0.025	0.023	0.006	0.011	0.006	0.025	0.034	0.003	0.022	0.028
Monday	2	0.002	0.023	0.028	0.001	0.025	0.034	0.013	0.006	0.011	0.004	0.012	0.025	0.025	0.007	0.011	0.005	0.024	0.034	0.002	0.022	0.029
Monday	3	0.003	0.025	0.030	0.002	0.025	0.034	0.015	0.010	0.012	0.006	0.014	0.027	0.027	0.010	0.011	0.006	0.026	0.035	0.003	0.023	0.030
Monday	4	0.007	0.029	0.033	0.007	0.031	0.038	0.019	0.019	0.015	0.011	0.019	0.030	0.030	0.015	0.012	0.015	0.032	0.040	0.012	0.028	0.035
Monday	5	0.024	0.035	0.040	0.026	0.034	0.038	0.025	0.030	0.021	0.023	0.030	0.036	0.033	0.022	0.018	0.037	0.043	0.046	0.033	0.041	0.042
Monday	6	0.047	0.046	0.049	0.061	0.043	0.049	0.032	0.041	0.024	0.042	0.047	0.043	0.036	0.034	0.024	0.050	0.051	0.050	0.054	0.051	0.048
Monday	7	0.065	0.054	0.057	0.082	0.053	0.056	0.034	0.048	0.032	0.060	0.061	0.048	0.040	0.043	0.030	0.061	0.058	0.053	0.066	0.058	0.053
Monday	8	0.068	0.057	0.060	0.079	0.054	0.059	0.039	0.059	0.039	0.059	0.062	0.050	0.043	0.054	0.039	0.056	0.057	0.055	0.062	0.060	0.055
Monday	9	0.065	0.055	0.055	0.073	0.053	0.053	0.047	0.065	0.046	0.056	0.061	0.050	0.045	0.067	0.048	0.054	0.056	0.055	0.055	0.056	0.054
Monday	10	0.056	0.053	0.054	0.064	0.050	0.052	0.050	0.070	0.053	0.058	0.064	0.051	0.050	0.074	0.054	0.055	0.058	0.056	0.052	0.054	0.053
Monday	11	0.052	0.054	0.054	0.059	0.055	0.054	0.056	0.072	0.055	0.062	0.066	0.053	0.052	0.075	0.059	0.056	0.057	0.055	0.053	0.055	0.054
Monday	12	0.053	0.055	0.054	0.055	0.060	0.059	0.059	0.073	0.055	0.066	0.068	0.054	0.055	0.078	0.059	0.057	0.058	0.054	0.054	0.056	0.054
Monday	13	0.054	0.056	0.053	0.056	0.054	0.052	0.060	0.076	0.058	0.067	0.067	0.054	0.057	0.081	0.060	0.058	0.057	0.052	0.056	0.056	0.054
Monday	14	0.062	0.060	0.054	0.059	0.061	0.057	0.065	0.079	0.059	0.070	0.069	0.055	0.057	0.081	0.065	0.064	0.057	0.051	0.063	0.059	0.056
Monday	15	0.068	0.063	0.055	0.063	0.060	0.051	0.071	0.081	0.062	0.073	0.069	0.055	0.059	0.080	0.063	0.069	0.056	0.048	0.069	0.063	0.058
Monday	16	0.071	0.063	0.054	0.067	0.059	0.051	0.070	0.070	0.063	0.075	0.067	0.054	0.060	0.072	0.064	0.071	0.054	0.044	0.072	0.060	0.052
Monday	17	0.074	0.062	0.052	0.069	0.058	0.047	0.065	0.057	0.066	0.073	0.061	0.052	0.057	0.059	0.066	0.070	0.050	0.040	0.073	0.056	0.047
Monday	18	0.065	0.050	0.042	0.057	0.051	0.040	0.058	0.042	0.064	0.056	0.046	0.045	0.053	0.045	0.063	0.054	0.041	0.035	0.061	0.045	0.039
Monday	19	0.052	0.037	0.031	0.040	0.042	0.034	0.054	0.031	0.059	0.040	0.031	0.039	0.048	0.032	0.060	0.042	0.032	0.028	0.045	0.033	0.031
Monday	20	0.036	0.028	0.025	0.028	0.030	0.025	0.050	0.022	0.054	0.031	0.022	0.035	0.042	0.022	0.054	0.035	0.026	0.025	0.035	0.026	0.026
Monday	21	0.030	0.022	0.022	0.023	0.024	0.020	0.041	0.017	0.051	0.025	0.017	0.032	0.036	0.016	0.046	0.029	0.022	0.023	0.031	0.022	0.024
Monday	22	0.022	0.016	0.020	0.015	0.018	0.017	0.030	0.011	0.043	0.017	0.012	0.030	0.029	0.012	0.039	0.023	0.018	0.024	0.023	0.017	0.023
Monday	23	0.014	0.012	0.022	0.009	0.013	0.017	0.022	0.008	0.034	0.012	0.009	0.030	0.020	0.008	0.031	0.016	0.016	0.028	0.014	0.014	0.025
Tues/Wed/Thurs	0	0.006	0.022	0.029	0.004	0.023	0.029	0.012	0.006	0.017	0.008	0.014	0.029	0.023	0.007	0.018	0.009	0.025	0.037	0.006	0.022	0.031
Tues/Wed/Thurs	1	0.003	0.022	0.029	0.001	0.024	0.032	0.012	0.005	0.015	0.004	0.011	0.027	0.025	0.006	0.015	0.005	0.023	0.036	0.003	0.021	0.030
Tues/Wed/Thurs	2	0.002	0.023	0.029	0.001	0.025	0.032	0.013	0.006	0.014	0.004	0.011	0.027	0.027	0.006	0.013	0.004	0.023	0.036	0.002	0.021	0.030
Tues/Wed/Thurs	3	0.003	0.025	0.031	0.001	0.027	0.034	0.014	0.009	0.015	0.005	0.013	0.029	0.029	0.009	0.013	0.005	0.025	0.037	0.003	0.023	0.031

		Santa Clara			Santa Cruz			Shasta			Sierra			Siskiyou			Solano			Sonoma		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Tues/Wed/Thurs	4	0.007	0.028	0.034	0.006	0.029	0.036	0.018	0.017	0.017	0.010	0.018	0.031	0.032	0.014	0.016	0.013	0.030	0.041	0.011	0.028	0.036
Tues/Wed/Thurs	5	0.025	0.036	0.042	0.026	0.032	0.038	0.023	0.026	0.022	0.022	0.029	0.037	0.035	0.021	0.020	0.035	0.042	0.048	0.034	0.040	0.044
Tues/Wed/Thurs	6	0.050	0.047	0.052	0.065	0.040	0.045	0.030	0.042	0.030	0.042	0.047	0.044	0.038	0.033	0.027	0.050	0.050	0.052	0.056	0.052	0.049
Tues/Wed/Thurs	7	0.067	0.055	0.059	0.084	0.055	0.056	0.038	0.051	0.039	0.060	0.061	0.050	0.040	0.046	0.036	0.061	0.057	0.054	0.068	0.059	0.054
Tues/Wed/Thurs	8	0.069	0.058	0.061	0.080	0.055	0.055	0.042	0.061	0.048	0.060	0.062	0.051	0.042	0.056	0.046	0.056	0.056	0.055	0.063	0.060	0.056
Tues/Wed/Thurs	9	0.065	0.055	0.055	0.074	0.054	0.056	0.047	0.064	0.058	0.055	0.060	0.050	0.044	0.066	0.057	0.053	0.056	0.055	0.055	0.055	0.053
Tues/Wed/Thurs	10	0.055	0.053	0.054	0.062	0.052	0.053	0.051	0.067	0.066	0.056	0.061	0.051	0.045	0.071	0.065	0.052	0.057	0.055	0.051	0.053	0.052
Tues/Wed/Thurs	11	0.051	0.053	0.053	0.057	0.053	0.055	0.054	0.070	0.069	0.059	0.064	0.052	0.047	0.076	0.070	0.052	0.057	0.054	0.050	0.054	0.052
Tues/Wed/Thurs	12	0.051	0.055	0.053	0.054	0.057	0.055	0.058	0.072	0.067	0.061	0.065	0.053	0.050	0.076	0.070	0.054	0.057	0.053	0.052	0.055	0.053
Tues/Wed/Thurs	13	0.054	0.056	0.052	0.054	0.058	0.054	0.061	0.074	0.066	0.064	0.066	0.053	0.052	0.077	0.069	0.057	0.057	0.051	0.054	0.056	0.054
Tues/Wed/Thurs	14	0.061	0.059	0.052	0.058	0.061	0.056	0.065	0.077	0.063	0.068	0.068	0.053	0.057	0.081	0.067	0.064	0.058	0.049	0.062	0.059	0.054
Tues/Wed/Thurs	15	0.067	0.063	0.054	0.062	0.061	0.055	0.070	0.080	0.061	0.073	0.069	0.053	0.058	0.078	0.064	0.070	0.058	0.046	0.067	0.063	0.056
Tues/Wed/Thurs	16	0.070	0.064	0.053	0.065	0.060	0.053	0.072	0.072	0.058	0.075	0.067	0.052	0.057	0.072	0.061	0.073	0.056	0.043	0.070	0.060	0.051
Tues/Wed/Thurs	17	0.072	0.062	0.051	0.067	0.057	0.047	0.065	0.057	0.056	0.074	0.063	0.050	0.056	0.060	0.057	0.072	0.052	0.039	0.071	0.057	0.046
Tues/Wed/Thurs	18	0.065	0.052	0.042	0.058	0.050	0.043	0.060	0.044	0.052	0.059	0.048	0.044	0.053	0.046	0.053	0.058	0.043	0.033	0.062	0.047	0.039
Tues/Wed/Thurs	19	0.053	0.037	0.030	0.041	0.041	0.034	0.053	0.032	0.045	0.043	0.034	0.038	0.048	0.033	0.044	0.046	0.034	0.028	0.048	0.035	0.031
Tues/Wed/Thurs	20	0.038	0.027	0.024	0.029	0.032	0.028	0.047	0.024	0.039	0.035	0.025	0.034	0.045	0.025	0.038	0.038	0.028	0.024	0.038	0.027	0.026
Tues/Wed/Thurs	21	0.032	0.021	0.021	0.024	0.024	0.021	0.042	0.021	0.034	0.029	0.019	0.031	0.038	0.018	0.032	0.032	0.023	0.022	0.033	0.022	0.024
Tues/Wed/Thurs	22	0.023	0.016	0.019	0.017	0.018	0.019	0.031	0.013	0.028	0.020	0.013	0.029	0.032	0.014	0.026	0.025	0.018	0.023	0.024	0.017	0.022
Tues/Wed/Thurs	23	0.014	0.011	0.020	0.009	0.012	0.015	0.022	0.010	0.022	0.013	0.009	0.028	0.025	0.010	0.021	0.016	0.015	0.028	0.015	0.013	0.024
Friday	0	0.007	0.022	0.032	0.005	0.023	0.030	0.013	0.007	0.021	0.007	0.014	0.032	0.021	0.007	0.019	0.009	0.025	0.040	0.008	0.022	0.033
Friday	1	0.004	0.023	0.031	0.002	0.022	0.031	0.012	0.005	0.018	0.005	0.011	0.030	0.023	0.006	0.017	0.006	0.024	0.039	0.004	0.021	0.031
Friday	2	0.003	0.024	0.032	0.001	0.024	0.032	0.012	0.006	0.018	0.004	0.011	0.030	0.024	0.007	0.016	0.005	0.024	0.039	0.003	0.022	0.032
Friday	3	0.003	0.025	0.033	0.002	0.027	0.034	0.014	0.008	0.018	0.005	0.012	0.030	0.026	0.009	0.016	0.005	0.025	0.040	0.004	0.023	0.033
Friday	4	0.007	0.029	0.036	0.005	0.030	0.038	0.016	0.015	0.021	0.008	0.016	0.033	0.029	0.013	0.019	0.011	0.030	0.044	0.010	0.028	0.036
Friday	5	0.022	0.035	0.044	0.022	0.033	0.041	0.023	0.023	0.026	0.017	0.026	0.038	0.032	0.018	0.023	0.027	0.040	0.050	0.030	0.039	0.044
Friday	6	0.044	0.045	0.053	0.054	0.040	0.046	0.029	0.035	0.033	0.033	0.040	0.045	0.033	0.030	0.032	0.039	0.047	0.053	0.050	0.049	0.050
Friday	7	0.060	0.052	0.058	0.075	0.049	0.055	0.034	0.044	0.041	0.049	0.054	0.050	0.037	0.039	0.039	0.050	0.053	0.056	0.063	0.057	0.055
Friday	8	0.063	0.054	0.060	0.071	0.047	0.050	0.039	0.055	0.049	0.051	0.057	0.052	0.040	0.051	0.049	0.048	0.054	0.057	0.059	0.057	0.056
Friday	9	0.060	0.054	0.057	0.068	0.049	0.051	0.042	0.060	0.055	0.050	0.057	0.052	0.045	0.063	0.054	0.048	0.055	0.057	0.053	0.054	0.054
Friday	10	0.054	0.053	0.056	0.061	0.051	0.053	0.049	0.063	0.058	0.054	0.061	0.054	0.048	0.069	0.060	0.052	0.056	0.056	0.051	0.053	0.053
Friday	11	0.053	0.055	0.056	0.061	0.056	0.054	0.052	0.069	0.061	0.060	0.066	0.055	0.049	0.072	0.063	0.056	0.058	0.055	0.053	0.055	0.054
Friday	12	0.055	0.057	0.056	0.058	0.056	0.053	0.057	0.070	0.061	0.063	0.067	0.055	0.052	0.074	0.063	0.059	0.058	0.053	0.056	0.057	0.055
Friday	13	0.058	0.058	0.054	0.060	0.059	0.058	0.057	0.075	0.061	0.066	0.068	0.054	0.055	0.077	0.062	0.063	0.058	0.051	0.058	0.058	0.056
Friday	14	0.064	0.061	0.053	0.064	0.062	0.056	0.065	0.080	0.060	0.070	0.070	0.054	0.059	0.080	0.063	0.067	0.058	0.048	0.064	0.059	0.056
Friday	15	0.067	0.063	0.054	0.065	0.061	0.055	0.070	0.082	0.059	0.073	0.070	0.052	0.063	0.081	0.061	0.069	0.057	0.045	0.066	0.062	0.056
Friday	16	0.069	0.062	0.051	0.065	0.062	0.054	0.072	0.073	0.057	0.074	0.067	0.050	0.058	0.075	0.059	0.070	0.054	0.041	0.067	0.059	0.050
Friday	17	0.069	0.060	0.048	0.064	0.059	0.049	0.065	0.062	0.055	0.072	0.063	0.047	0.059	0.063	0.055	0.067	0.050	0.037	0.067	0.055	0.046
Friday	18	0.063	0.049	0.038	0.056	0.053	0.046	0.061	0.047	0.051	0.063	0.051	0.042	0.054	0.052	0.051	0.061	0.044	0.031	0.060	0.047	0.039
Friday	19	0.053	0.037	0.028	0.044	0.043	0.035	0.059	0.039	0.046	0.050	0.039	0.035	0.050	0.036	0.046	0.054	0.037	0.026	0.049	0.036	0.030
Friday	20	0.039	0.028	0.021	0.032	0.034	0.027	0.051	0.028	0.040	0.041	0.029	0.030	0.046	0.030	0.041	0.047	0.031	0.022	0.040	0.029	0.023
Friday	21	0.033	0.022	0.018	0.027	0.027	0.022	0.045	0.022	0.035	0.037	0.023	0.028	0.040	0.022	0.036	0.039	0.025	0.020	0.035	0.023	0.020
Friday	22	0.028	0.017	0.016	0.023	0.019	0.016	0.037	0.018	0.031	0.030	0.017	0.026	0.031	0.016	0.031	0.030	0.020	0.020	0.030	0.019	0.019
Friday	23	0.021	0.013	0.016	0.015	0.014	0.013	0.026	0.012	0.025	0.019	0.011	0.024	0.025	0.012	0.025	0.021	0.016	0.022	0.022	0.015	0.020
Saturday	0	0.015	0.029	0.046	0.009	0.028	0.038	0.015	0.011	0.021	0.013	0.019	0.038	0.026	0.013	0.020	0.014	0.031	0.057	0.015	0.030	0.044
Saturday	1	0.009	0.028	0.042	0.005	0.028	0.038	0.014	0.008	0.018	0.008	0.015	0.034	0.026	0.008	0.016	0.009	0.028	0.052	0.009	0.027	0.040
Saturday	2	0.007	0.028	0.040	0.003	0.029	0.042	0.014	0.008	0.016	0.006	0.014	0.032	0.027	0.007	0.015	0.007	0.027	0.049	0.006	0.026	0.039
Saturday	3	0.005	0.029	0.038	0.002	0.032	0.042	0.014	0.007	0.016	0.006	0.013	0.031	0.030	0.007	0.014	0.006	0.026	0.046	0.005	0.025	0.037
Saturday	4	0.006	0.030	0.039	0.003	0.032	0.042	0.017	0.014	0.017	0.007	0.014	0.032	0.029	0.009	0.016	0.008	0.028	0.047	0.006	0.027	0.037
Saturday	5	0.011	0.033	0.042	0.009	0.035	0.041	0.021	0.018	0.021	0.011	0.018	0.034	0.033	0.015	0.019	0.014	0.031	0.049	0.013	0.030	0.040
Saturday	6	0.020	0.037	0.046	0.019	0.034	0.043	0.025	0.027	0.028	0.019	0.026	0.039	0.036	0.023	0.025	0.022	0.037	0.052	0.023	0.035	0.042
Saturday	7	0.032	0.041	0.050	0.033	0.038	0.041	0.032	0.038	0.039	0.032	0.038	0.046	0.038	0.033	0.036	0.032	0.042	0.054	0.034	0.041	0.047

		Santa Clara			Santa Cruz			Shasta			Sierra			Siskiyou			Solano			Sonoma		
Day of Week	Hour	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Saturday	8	0.045	0.046	0.053	0.049	0.041	0.046	0.040	0.055	0.051	0.045	0.051	0.052	0.041	0.047	0.047	0.044	0.049	0.056	0.046	0.047	0.049
Saturday	9	0.055	0.051	0.056	0.059	0.046	0.046	0.044	0.064	0.061	0.057	0.062	0.056	0.045	0.063	0.059	0.056	0.054	0.055	0.055	0.051	0.050
Saturday	10	0.062	0.054	0.056	0.066	0.047	0.047	0.051	0.071	0.067	0.067	0.071	0.060	0.049	0.075	0.067	0.065	0.057	0.052	0.061	0.054	0.051
Saturday	11	0.067	0.057	0.056	0.068	0.052	0.052	0.058	0.077	0.068	0.074	0.076	0.061	0.050	0.084	0.073	0.068	0.058	0.050	0.065	0.056	0.052
Saturday	12	0.069	0.057	0.054	0.067	0.053	0.050	0.060	0.076	0.067	0.075	0.075	0.060	0.053	0.083	0.071	0.067	0.057	0.047	0.066	0.058	0.055
Saturday	13	0.069	0.057	0.051	0.067	0.055	0.049	0.059	0.073	0.066	0.075	0.074	0.057	0.055	0.081	0.069	0.066	0.056	0.044	0.067	0.059	0.058
Saturday	14	0.069	0.057	0.049	0.069	0.053	0.049	0.065	0.076	0.066	0.074	0.071	0.055	0.057	0.076	0.065	0.066	0.055	0.041	0.067	0.058	0.057
Saturday	15	0.069	0.057	0.045	0.072	0.056	0.049	0.067	0.073	0.064	0.072	0.068	0.051	0.060	0.074	0.062	0.066	0.054	0.038	0.068	0.057	0.051
Saturday	16	0.068	0.055	0.043	0.074	0.055	0.048	0.065	0.069	0.059	0.070	0.064	0.048	0.056	0.070	0.058	0.066	0.053	0.034	0.068	0.056	0.047
Saturday	17	0.067	0.052	0.038	0.074	0.055	0.046	0.064	0.062	0.055	0.066	0.057	0.044	0.055	0.061	0.057	0.065	0.050	0.031	0.067	0.054	0.044
Saturday	18	0.061	0.047	0.034	0.066	0.052	0.040	0.061	0.048	0.050	0.056	0.047	0.038	0.051	0.049	0.052	0.058	0.046	0.029	0.060	0.048	0.036
Saturday	19	0.050	0.040	0.029	0.054	0.045	0.035	0.059	0.041	0.044	0.046	0.037	0.033	0.049	0.038	0.045	0.050	0.040	0.026	0.049	0.041	0.029
Saturday	20	0.042	0.035	0.025	0.044	0.041	0.033	0.050	0.031	0.036	0.040	0.030	0.028	0.042	0.031	0.038	0.045	0.036	0.023	0.043	0.036	0.025
Saturday	21	0.040	0.031	0.023	0.039	0.037	0.032	0.044	0.023	0.030	0.035	0.025	0.025	0.037	0.023	0.031	0.041	0.033	0.023	0.041	0.033	0.024
Saturday	22	0.036	0.027	0.023	0.032	0.031	0.028	0.034	0.017	0.024	0.028	0.019	0.023	0.031	0.017	0.026	0.035	0.029	0.023	0.037	0.029	0.023
Saturday	23	0.026	0.022	0.022	0.020	0.025	0.025	0.026	0.013	0.019	0.020	0.014	0.021	0.023	0.012	0.019	0.026	0.023	0.023	0.028	0.024	0.022
Holiday	0	0.012	0.025	0.032	0.008	0.024	0.031	0.014	0.008	0.015	0.010	0.016	0.028	0.024	0.008	0.015	0.013	0.029	0.038	0.013	0.027	0.034
Holiday	1	0.007	0.025	0.031	0.003	0.025	0.034	0.013	0.007	0.013	0.006	0.013	0.027	0.027	0.008	0.012	0.008	0.027	0.038	0.007	0.026	0.033
Holiday	2	0.004	0.026	0.032	0.002	0.025	0.034	0.013	0.006	0.012	0.004	0.012	0.026	0.024	0.008	0.012	0.005	0.025	0.037	0.004	0.025	0.033
Holiday	3	0.003	0.027	0.032	0.001	0.024	0.029	0.013	0.006	0.012	0.005	0.013	0.027	0.029	0.010	0.013	0.005	0.026	0.037	0.003	0.025	0.033
Holiday	4	0.005	0.029	0.034	0.004	0.030	0.034	0.016	0.013	0.014	0.008	0.016	0.029	0.029	0.012	0.014	0.008	0.028	0.039	0.007	0.029	0.035
Holiday	5	0.014	0.034	0.038	0.012	0.033	0.041	0.020	0.017	0.020	0.014	0.023	0.032	0.031	0.016	0.017	0.018	0.034	0.043	0.017	0.034	0.039
Holiday	6	0.027	0.039	0.044	0.028	0.037	0.045	0.025	0.028	0.026	0.025	0.033	0.036	0.037	0.025	0.023	0.025	0.040	0.046	0.029	0.040	0.044
Holiday	7	0.039	0.043	0.048	0.043	0.035	0.038	0.030	0.037	0.036	0.036	0.044	0.042	0.038	0.033	0.031	0.032	0.045	0.050	0.038	0.045	0.047
Holiday	8	0.050	0.048	0.052	0.052	0.048	0.053	0.036	0.051	0.046	0.046	0.053	0.048	0.040	0.049	0.040	0.041	0.050	0.053	0.045	0.050	0.051
Holiday	9	0.054	0.052	0.054	0.058	0.051	0.053	0.047	0.068	0.056	0.054	0.059	0.050	0.043	0.062	0.054	0.051	0.055	0.055	0.049	0.053	0.052
Holiday	10	0.058	0.055	0.056	0.064	0.049	0.054	0.051	0.068	0.064	0.065	0.069	0.053	0.050	0.076	0.060	0.062	0.060	0.055	0.056	0.056	0.053
Holiday	11	0.061	0.058	0.057	0.069	0.055	0.050	0.059	0.083	0.069	0.074	0.074	0.057	0.047	0.084	0.068	0.068	0.063	0.056	0.062	0.059	0.055
Holiday	12	0.063	0.060	0.057	0.067	0.057	0.059	0.066	0.081	0.071	0.077	0.074	0.056	0.053	0.083	0.070	0.070	0.061	0.054	0.067	0.061	0.056
Holiday	13	0.066	0.062	0.057	0.068	0.069	0.064	0.062	0.084	0.068	0.076	0.074	0.058	0.062	0.091	0.067	0.071	0.062	0.052	0.070	0.062	0.056
Holiday	14	0.069	0.062	0.056	0.073	0.058	0.060	0.069	0.076	0.064	0.075	0.073	0.056	0.059	0.087	0.069	0.072	0.060	0.051	0.073	0.062	0.057
Holiday	15	0.071	0.062	0.054	0.072	0.070	0.056	0.065	0.081	0.061	0.074	0.070	0.055	0.057	0.079	0.065	0.068	0.056	0.046	0.071	0.061	0.054
Holiday	16	0.072	0.060	0.051	0.071	0.059	0.052	0.070	0.068	0.061	0.072	0.066	0.054	0.056	0.072	0.062	0.066	0.054	0.044	0.070	0.057	0.050
Holiday	17	0.071	0.057	0.047	0.070	0.058	0.048	0.068	0.063	0.060	0.068	0.059	0.051	0.056	0.058	0.060	0.064	0.050	0.040	0.067	0.053	0.044
Holiday	18	0.064	0.048	0.039	0.063	0.054	0.045	0.063	0.047	0.055	0.057	0.049	0.045	0.053	0.044	0.058	0.058	0.042	0.034	0.059	0.045	0.038
Holiday	19	0.054	0.038	0.032	0.052	0.035	0.029	0.056	0.035	0.048	0.047	0.036	0.041	0.048	0.029	0.049	0.051	0.037	0.029	0.051	0.036	0.031
Holiday	20	0.045	0.031	0.026	0.043	0.035	0.027	0.050	0.028	0.041	0.039	0.029	0.037	0.044	0.024	0.045	0.047	0.031	0.025	0.046	0.031	0.028
Holiday	21	0.039	0.025	0.024	0.036	0.029	0.026	0.045	0.021	0.035	0.030	0.020	0.033	0.040	0.019	0.040	0.042	0.026	0.024	0.041	0.026	0.026
Holiday	22	0.031	0.019	0.022	0.024	0.021	0.022	0.027	0.013	0.029	0.023	0.015	0.031	0.031	0.014	0.030	0.033	0.022	0.025	0.033	0.021	0.025
Holiday	23	0.020	0.014	0.024	0.015	0.016	0.015	0.022	0.010	0.023	0.015	0.010	0.029	0.024	0.009	0.024	0.022	0.018	0.029	0.021	0.017	0.026

		Stanislaus			Sutter			Tehama			Trinity			Tulare			Tuolumne			Ventura		
Day of Week	Hour	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Sunday	0	0.014	0.025	0.037	0.013	0.020	0.031	0.013	0.008	0.016	0.019	0.009	0.017	0.022	0.015	0.017	0.010	0.014	0.032	0.014	0.036	0.048
Sunday	1	0.009	0.019	0.032	0.008	0.016	0.028	0.013	0.006	0.013	0.021	0.007	0.014	0.024	0.015	0.009	0.007	0.011	0.024	0.009	0.026	0.042
Sunday	2	0.007	0.016	0.029	0.006	0.013	0.026	0.012	0.006	0.011	0.022	0.006	0.013	0.023	0.011	0.008	0.005	0.011	0.022	0.006	0.021	0.038
Sunday	3	0.005	0.015	0.028	0.005	0.012	0.025	0.012	0.005	0.011	0.022	0.005	0.013	0.023	0.009	0.010	0.004	0.010	0.021	0.004	0.018	0.036
Sunday	4	0.006	0.016	0.028	0.005	0.012	0.025	0.015	0.007	0.013	0.023	0.006	0.013	0.024	0.010	0.018	0.004	0.010	0.020	0.004	0.018	0.035
Sunday	5	0.010	0.019	0.029	0.008	0.015	0.027	0.018	0.012	0.018	0.025	0.008	0.016	0.026	0.018	0.025	0.007	0.013	0.021	0.008	0.021	0.036
Sunday	6	0.015	0.023	0.031	0.013	0.020	0.030	0.021	0.019	0.026	0.028	0.014	0.024	0.030	0.031	0.042	0.012	0.019	0.026	0.014	0.027	0.038
Sunday	7	0.021	0.029	0.035	0.022	0.028	0.034	0.029	0.030	0.039	0.030	0.022	0.034	0.034	0.035	0.050	0.019	0.023	0.029	0.022	0.034	0.041
Sunday	8	0.031	0.038	0.040	0.034	0.041	0.040	0.037	0.043	0.053	0.033	0.036	0.048	0.035	0.042	0.052	0.032	0.035	0.038	0.034	0.044	0.044
Sunday	9	0.043	0.050	0.047	0.048	0.055	0.046	0.043	0.055	0.067	0.036	0.052	0.062	0.040	0.057	0.047	0.051	0.051	0.053	0.049	0.057	0.047
Sunday	10	0.055	0.060	0.051	0.064	0.068	0.052	0.053	0.071	0.079	0.040	0.071	0.075	0.044	0.066	0.054	0.067	0.067	0.071	0.065	0.070	0.050
Sunday	11	0.063	0.065	0.054	0.075	0.075	0.055	0.060	0.077	0.080	0.044	0.082	0.086	0.047	0.070	0.055	0.080	0.081	0.085	0.074	0.076	0.051
Sunday	12	0.070	0.070	0.055	0.082	0.079	0.058	0.064	0.084	0.077	0.049	0.089	0.088	0.051	0.076	0.058	0.083	0.081	0.076	0.078	0.077	0.051
Sunday	13	0.075	0.071	0.056	0.084	0.079	0.058	0.066	0.083	0.070	0.054	0.090	0.080	0.054	0.073	0.070	0.085	0.082	0.074	0.080	0.074	0.049
Sunday	14	0.077	0.069	0.055	0.084	0.077	0.057	0.067	0.085	0.065	0.058	0.089	0.072	0.056	0.071	0.068	0.085	0.083	0.069	0.079	0.068	0.047
Sunday	15	0.078	0.070	0.053	0.082	0.073	0.057	0.072	0.083	0.061	0.063	0.087	0.069	0.059	0.071	0.067	0.084	0.081	0.066	0.077	0.062	0.045
Sunday	16	0.077	0.067	0.052	0.079	0.068	0.055	0.073	0.080	0.058	0.064	0.081	0.059	0.060	0.066	0.066	0.082	0.079	0.060	0.075	0.057	0.043
Sunday	17	0.075	0.062	0.049	0.072	0.062	0.053	0.068	0.066	0.056	0.065	0.066	0.051	0.061	0.063	0.064	0.076	0.070	0.053	0.070	0.050	0.041
Sunday	18	0.068	0.055	0.046	0.060	0.052	0.049	0.065	0.056	0.049	0.065	0.055	0.044	0.060	0.052	0.056	0.064	0.056	0.043	0.062	0.040	0.038
Sunday	19	0.061	0.047	0.042	0.050	0.043	0.045	0.058	0.043	0.041	0.062	0.043	0.036	0.059	0.050	0.051	0.049	0.043	0.035	0.055	0.034	0.037
Sunday	20	0.051	0.039	0.040	0.041	0.035	0.042	0.048	0.031	0.032	0.057	0.032	0.028	0.055	0.037	0.040	0.038	0.033	0.024	0.046	0.028	0.036
Sunday	21	0.041	0.031	0.038	0.031	0.026	0.039	0.041	0.023	0.026	0.049	0.022	0.023	0.048	0.029	0.028	0.026	0.022	0.020	0.037	0.024	0.036
Sunday	22	0.029	0.024	0.036	0.021	0.019	0.036	0.031	0.016	0.021	0.041	0.015	0.019	0.038	0.018	0.029	0.017	0.014	0.017	0.026	0.020	0.035
Sunday	23	0.019	0.019	0.037	0.013	0.015	0.033	0.020	0.012	0.017	0.028	0.012	0.016	0.028	0.014	0.019	0.010	0.010	0.020	0.015	0.018	0.037
Monday	0	0.011	0.017	0.023	0.008	0.014	0.027	0.013	0.006	0.012	0.023	0.007	0.013	0.022	0.004	0.006	0.006	0.010	0.017	0.006	0.015	0.027
Monday	1	0.007	0.015	0.022	0.005	0.012	0.025	0.012	0.006	0.011	0.023	0.006	0.011	0.023	0.004	0.004	0.004	0.009	0.016	0.003	0.012	0.026
Monday	2	0.006	0.015	0.022	0.004	0.012	0.025	0.013	0.006	0.011	0.025	0.007	0.011	0.023	0.004	0.005	0.003	0.009	0.016	0.002	0.012	0.026
Monday	3	0.009	0.018	0.025	0.006	0.014	0.027	0.015	0.010	0.012	0.027	0.010	0.011	0.024	0.006	0.011	0.005	0.011	0.019	0.003	0.013	0.028
Monday	4	0.018	0.027	0.032	0.011	0.019	0.030	0.019	0.019	0.015	0.030	0.015	0.012	0.027	0.015	0.020	0.008	0.017	0.024	0.008	0.019	0.032
Monday	5	0.030	0.039	0.039	0.023	0.030	0.036	0.025	0.030	0.021	0.033	0.022	0.018	0.035	0.035	0.032	0.019	0.028	0.036	0.024	0.034	0.039
Monday	6	0.044	0.051	0.045	0.042	0.047	0.043	0.032	0.041	0.024	0.036	0.034	0.024	0.040	0.056	0.050	0.036	0.041	0.050	0.049	0.055	0.045
Monday	7	0.058	0.058	0.050	0.060	0.061	0.048	0.034	0.048	0.032	0.040	0.043	0.030	0.044	0.063	0.057	0.051	0.044	0.065	0.075	0.072	0.050
Monday	8	0.053	0.058	0.051	0.059	0.062	0.050	0.039	0.059	0.039	0.043	0.054	0.039	0.046	0.071	0.059	0.053	0.056	0.068	0.071	0.071	0.052
Monday	9	0.051	0.059	0.053	0.056	0.061	0.050	0.047	0.065	0.046	0.045	0.067	0.048	0.046	0.066	0.060	0.059	0.065	0.080	0.057	0.064	0.052
Monday	10	0.054	0.062	0.056	0.058	0.064	0.051	0.050	0.070	0.053	0.050	0.074	0.054	0.049	0.070	0.066	0.067	0.074	0.087	0.053	0.062	0.053
Monday	11	0.057	0.064	0.057	0.062	0.066	0.053	0.056	0.072	0.055	0.052	0.075	0.059	0.051	0.070	0.065	0.071	0.075	0.082	0.056	0.063	0.054
Monday	12	0.060	0.064	0.058	0.066	0.068	0.054	0.059	0.073	0.055	0.055	0.078	0.059	0.056	0.072	0.066	0.074	0.074	0.080	0.058	0.064	0.054
Monday	13	0.061	0.064	0.058	0.067	0.067	0.054	0.060	0.076	0.058	0.057	0.081	0.060	0.055	0.073	0.071	0.074	0.075	0.075	0.058	0.061	0.053
Monday	14	0.067	0.066	0.058	0.070	0.069	0.055	0.065	0.079	0.059	0.057	0.081	0.065	0.058	0.073	0.070	0.077	0.076	0.065	0.063	0.063	0.053
Monday	15	0.072	0.065	0.057	0.073	0.069	0.055	0.071	0.081	0.062	0.059	0.080	0.063	0.061	0.077	0.074	0.082	0.076	0.058	0.072	0.065	0.052
Monday	16	0.075	0.063	0.055	0.075	0.067	0.054	0.070	0.070	0.063	0.060	0.072	0.064	0.061	0.073	0.064	0.081	0.073	0.045	0.078	0.064	0.050
Monday	17	0.074	0.055	0.051	0.073	0.061	0.052	0.065	0.057	0.066	0.057	0.059	0.066	0.059	0.059	0.057	0.071	0.059	0.035	0.080	0.060	0.049
Monday	18	0.055	0.042	0.042	0.056	0.046	0.045	0.058	0.042	0.064	0.053	0.045	0.063	0.050	0.037	0.047	0.052	0.042	0.023	0.063	0.046	0.043
Monday	19	0.042	0.031	0.036	0.040	0.031	0.039	0.054	0.031	0.059	0.048	0.032	0.060	0.045	0.024	0.036	0.037	0.030	0.017	0.042	0.029	0.038
Monday	20	0.034	0.023	0.031	0.031	0.022	0.035	0.050	0.022	0.054	0.042	0.022	0.054	0.040	0.017	0.031	0.027	0.022	0.013	0.031	0.020	0.033
Monday	21	0.027	0.018	0.028	0.025	0.017	0.032	0.041	0.017	0.051	0.036	0.016	0.046	0.035	0.013	0.023	0.020	0.016	0.010	0.025	0.015	0.032
Monday	22	0.020	0.014	0.027	0.017	0.012	0.030	0.030	0.011	0.043	0.029	0.012	0.039	0.029	0.010	0.017	0.015	0.012	0.009	0.016	0.010	0.030
Monday	23	0.014	0.011	0.025	0.012	0.009	0.030	0.022	0.008	0.034	0.020	0.008	0.031	0.022	0.006	0.011	0.009	0.007	0.010	0.009	0.008	0.030
Tues/Wed/Thurs	0	0.008	0.016	0.025	0.008	0.014	0.029	0.012	0.006	0.017	0.023	0.007	0.018	0.021	0.004	0.009	0.005	0.009	0.017	0.005	0.015	0.032
Tues/Wed/Thurs	1	0.005	0.014	0.024	0.004	0.011	0.027	0.012	0.005	0.015	0.025	0.006	0.015	0.021	0.004	0.007	0.003	0.008	0.017	0.002	0.012	0.030
Tues/Wed/Thurs	2	0.005	0.014	0.025	0.004	0.011	0.027	0.013	0.006	0.014	0.027	0.006	0.013	0.022	0.004	0.009	0.002	0.009	0.017	0.001	0.012	0.030
Tues/Wed/Thurs	3	0.008	0.018	0.028	0.005	0.013	0.029	0.014	0.009	0.015	0.029	0.009	0.013	0.024	0.005	0.012	0.003	0.010	0.022	0.002	0.013	0.031

		Stanislaus			Sutter			Tehama			Trinity			Tulare			Tuolumne			Ventura		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Tues/Wed/Thurs	4	0.017	0.026	0.034	0.010	0.018	0.031	0.018	0.017	0.017	0.032	0.014	0.016	0.028	0.014	0.018	0.006	0.014	0.025	0.007	0.019	0.035
Tues/Wed/Thurs	5	0.030	0.039	0.042	0.022	0.029	0.037	0.023	0.026	0.022	0.035	0.021	0.020	0.035	0.033	0.032	0.018	0.027	0.039	0.022	0.034	0.043
Tues/Wed/Thurs	6	0.044	0.050	0.047	0.042	0.047	0.044	0.030	0.042	0.030	0.038	0.033	0.027	0.041	0.056	0.052	0.037	0.042	0.052	0.049	0.055	0.049
Tues/Wed/Thurs	7	0.059	0.059	0.052	0.060	0.061	0.050	0.038	0.051	0.039	0.040	0.046	0.036	0.044	0.067	0.060	0.053	0.047	0.064	0.075	0.072	0.052
Tues/Wed/Thurs	8	0.055	0.058	0.052	0.060	0.062	0.051	0.042	0.061	0.048	0.042	0.056	0.046	0.046	0.071	0.063	0.054	0.056	0.070	0.071	0.071	0.054
Tues/Wed/Thurs	9	0.051	0.059	0.054	0.055	0.060	0.050	0.047	0.064	0.058	0.044	0.066	0.057	0.047	0.067	0.065	0.059	0.068	0.083	0.057	0.064	0.053
Tues/Wed/Thurs	10	0.052	0.060	0.056	0.056	0.061	0.051	0.051	0.067	0.066	0.045	0.071	0.065	0.049	0.069	0.065	0.064	0.069	0.081	0.052	0.061	0.053
Tues/Wed/Thurs	11	0.054	0.061	0.057	0.059	0.064	0.052	0.054	0.070	0.069	0.047	0.076	0.070	0.052	0.071	0.062	0.068	0.069	0.077	0.054	0.062	0.053
Tues/Wed/Thurs	12	0.057	0.062	0.057	0.061	0.065	0.053	0.058	0.072	0.067	0.050	0.076	0.070	0.054	0.069	0.065	0.069	0.071	0.074	0.056	0.063	0.053
Tues/Wed/Thurs	13	0.060	0.063	0.056	0.064	0.066	0.053	0.061	0.074	0.066	0.052	0.077	0.069	0.056	0.072	0.067	0.072	0.073	0.074	0.057	0.061	0.051
Tues/Wed/Thurs	14	0.066	0.065	0.056	0.068	0.068	0.053	0.065	0.077	0.063	0.057	0.081	0.067	0.059	0.074	0.070	0.077	0.076	0.067	0.063	0.063	0.050
Tues/Wed/Thurs	15	0.073	0.066	0.055	0.073	0.069	0.053	0.070	0.080	0.061	0.058	0.078	0.064	0.061	0.080	0.071	0.084	0.078	0.058	0.071	0.065	0.049
Tues/Wed/Thurs	16	0.077	0.064	0.053	0.075	0.067	0.052	0.072	0.072	0.058	0.057	0.072	0.061	0.060	0.072	0.063	0.082	0.074	0.048	0.078	0.063	0.046
Tues/Wed/Thurs	17	0.076	0.057	0.049	0.074	0.063	0.050	0.065	0.057	0.056	0.056	0.060	0.057	0.057	0.059	0.054	0.074	0.061	0.036	0.079	0.060	0.044
Tues/Wed/Thurs	18	0.058	0.044	0.041	0.059	0.048	0.044	0.060	0.044	0.052	0.053	0.046	0.053	0.051	0.037	0.043	0.053	0.044	0.023	0.065	0.047	0.040
Tues/Wed/Thurs	19	0.044	0.032	0.034	0.043	0.034	0.038	0.053	0.032	0.045	0.048	0.033	0.044	0.045	0.025	0.036	0.038	0.031	0.016	0.044	0.031	0.034
Tues/Wed/Thurs	20	0.036	0.025	0.030	0.035	0.025	0.034	0.047	0.024	0.039	0.045	0.025	0.038	0.041	0.019	0.027	0.030	0.025	0.012	0.034	0.021	0.030
Tues/Wed/Thurs	21	0.028	0.019	0.026	0.029	0.019	0.031	0.042	0.021	0.034	0.038	0.018	0.032	0.035	0.014	0.021	0.023	0.018	0.010	0.028	0.016	0.029
Tues/Wed/Thurs	22	0.021	0.014	0.025	0.020	0.013	0.029	0.031	0.013	0.028	0.032	0.014	0.026	0.029	0.010	0.015	0.017	0.013	0.010	0.018	0.011	0.028
Tues/Wed/Thurs	23	0.015	0.012	0.023	0.013	0.009	0.028	0.022	0.010	0.022	0.025	0.010	0.021	0.022	0.006	0.011	0.010	0.008	0.010	0.010	0.008	0.030
Friday	0	0.008	0.016	0.027	0.007	0.014	0.032	0.013	0.007	0.021	0.021	0.007	0.019	0.020	0.004	0.010	0.005	0.009	0.019	0.006	0.016	0.033
Friday	1	0.006	0.014	0.025	0.005	0.011	0.030	0.012	0.005	0.018	0.023	0.006	0.017	0.021	0.003	0.007	0.003	0.008	0.019	0.003	0.013	0.031
Friday	2	0.005	0.014	0.026	0.004	0.011	0.030	0.012	0.006	0.018	0.024	0.007	0.016	0.023	0.004	0.008	0.002	0.008	0.019	0.002	0.012	0.031
Friday	3	0.008	0.017	0.029	0.005	0.012	0.030	0.014	0.008	0.018	0.026	0.009	0.016	0.022	0.005	0.013	0.002	0.008	0.021	0.003	0.014	0.032
Friday	4	0.014	0.024	0.035	0.008	0.016	0.033	0.016	0.015	0.021	0.029	0.013	0.019	0.027	0.013	0.020	0.005	0.013	0.024	0.007	0.019	0.036
Friday	5	0.024	0.035	0.042	0.017	0.026	0.038	0.023	0.023	0.026	0.032	0.018	0.023	0.034	0.032	0.033	0.013	0.023	0.037	0.020	0.032	0.042
Friday	6	0.036	0.045	0.047	0.033	0.040	0.045	0.029	0.035	0.033	0.033	0.030	0.032	0.038	0.051	0.057	0.026	0.035	0.049	0.043	0.052	0.049
Friday	7	0.049	0.053	0.052	0.049	0.054	0.050	0.034	0.044	0.041	0.037	0.039	0.039	0.042	0.062	0.063	0.039	0.040	0.060	0.067	0.068	0.052
Friday	8	0.047	0.054	0.053	0.051	0.057	0.052	0.039	0.055	0.049	0.040	0.051	0.049	0.046	0.070	0.063	0.043	0.049	0.068	0.064	0.069	0.054
Friday	9	0.047	0.056	0.055	0.050	0.057	0.052	0.042	0.060	0.055	0.045	0.063	0.054	0.047	0.066	0.063	0.049	0.057	0.073	0.054	0.062	0.053
Friday	10	0.051	0.060	0.058	0.054	0.061	0.054	0.049	0.063	0.058	0.048	0.069	0.060	0.050	0.070	0.066	0.058	0.063	0.078	0.053	0.061	0.054
Friday	11	0.054	0.062	0.060	0.060	0.066	0.055	0.052	0.069	0.061	0.049	0.072	0.063	0.052	0.071	0.063	0.064	0.069	0.077	0.057	0.064	0.054
Friday	12	0.057	0.063	0.060	0.063	0.067	0.055	0.057	0.070	0.061	0.052	0.074	0.063	0.054	0.070	0.067	0.066	0.071	0.076	0.059	0.064	0.053
Friday	13	0.061	0.065	0.059	0.066	0.068	0.054	0.057	0.075	0.061	0.055	0.077	0.062	0.056	0.072	0.067	0.071	0.074	0.077	0.061	0.065	0.052
Friday	14	0.068	0.067	0.058	0.070	0.070	0.054	0.065	0.080	0.060	0.059	0.080	0.063	0.058	0.074	0.070	0.076	0.077	0.070	0.065	0.065	0.050
Friday	15	0.074	0.067	0.056	0.073	0.070	0.052	0.070	0.082	0.059	0.063	0.081	0.061	0.059	0.075	0.068	0.083	0.079	0.060	0.071	0.065	0.049
Friday	16	0.076	0.064	0.053	0.074	0.067	0.050	0.072	0.073	0.057	0.058	0.075	0.059	0.059	0.070	0.059	0.083	0.077	0.050	0.075	0.063	0.046
Friday	17	0.075	0.058	0.048	0.072	0.063	0.047	0.065	0.062	0.055	0.059	0.063	0.055	0.055	0.057	0.055	0.075	0.064	0.038	0.074	0.059	0.043
Friday	18	0.064	0.048	0.040	0.063	0.051	0.042	0.061	0.047	0.051	0.054	0.052	0.051	0.053	0.041	0.043	0.062	0.051	0.025	0.064	0.046	0.040
Friday	19	0.052	0.037	0.032	0.050	0.039	0.035	0.059	0.039	0.046	0.050	0.036	0.046	0.045	0.027	0.036	0.050	0.039	0.018	0.048	0.032	0.034
Friday	20	0.043	0.029	0.026	0.041	0.029	0.030	0.051	0.028	0.040	0.046	0.030	0.041	0.042	0.020	0.026	0.041	0.030	0.013	0.037	0.022	0.029
Friday	21	0.035	0.022	0.022	0.037	0.023	0.028	0.045	0.022	0.035	0.040	0.022	0.036	0.039	0.017	0.019	0.036	0.025	0.010	0.032	0.017	0.027
Friday	22	0.027	0.016	0.020	0.030	0.017	0.026	0.037	0.018	0.031	0.031	0.016	0.031	0.032	0.014	0.015	0.030	0.019	0.011	0.024	0.012	0.027
Friday	23	0.020	0.012	0.018	0.019	0.011	0.024	0.026	0.012	0.025	0.025	0.012	0.025	0.026	0.011	0.010	0.018	0.012	0.009	0.016	0.009	0.027
Saturday	0	0.015	0.026	0.040	0.013	0.019	0.038	0.015	0.011	0.021	0.026	0.013	0.020	0.025	0.010	0.013	0.010	0.015	0.027	0.011	0.024	0.043
Saturday	1	0.010	0.020	0.035	0.008	0.015	0.034	0.014	0.008	0.018	0.026	0.008	0.016	0.025	0.007	0.010	0.007	0.012	0.023	0.006	0.018	0.040
Saturday	2	0.008	0.018	0.032	0.006	0.014	0.032	0.014	0.008	0.016	0.027	0.007	0.015	0.026	0.007	0.011	0.005	0.011	0.022	0.004	0.016	0.038
Saturday	3	0.008	0.019	0.032	0.006	0.013	0.031	0.014	0.007	0.016	0.030	0.007	0.014	0.027	0.009	0.013	0.004	0.010	0.025	0.003	0.015	0.037
Saturday	4	0.011	0.021	0.035	0.007	0.014	0.032	0.017	0.014	0.017	0.029	0.009	0.016	0.029	0.014	0.024	0.005	0.013	0.028	0.005	0.017	0.038
Saturday	5	0.017	0.028	0.039	0.011	0.018	0.034	0.021	0.018	0.021	0.033	0.015	0.019	0.036	0.033	0.032	0.010	0.021	0.034	0.011	0.023	0.041
Saturday	6	0.025	0.036	0.045	0.019	0.026	0.039	0.025	0.027	0.028	0.036	0.023	0.025	0.042	0.056	0.054	0.017	0.028	0.039	0.021	0.033	0.045
Saturday	7	0.034	0.044	0.050	0.032	0.038	0.046	0.032	0.038	0.039	0.038	0.033	0.036	0.041	0.055	0.068	0.029	0.036	0.053	0.034	0.046	0.050

		Stanislaus			Sutter			Tehama			Trinity			Tulare			Tuolumne			Ventura		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Saturday	8	0.044	0.053	0.055	0.045	0.051	0.052	0.040	0.055	0.051	0.041	0.047	0.047	0.043	0.057	0.069	0.044	0.045	0.060	0.046	0.057	0.053
Saturday	9	0.054	0.061	0.060	0.057	0.062	0.056	0.044	0.064	0.061	0.045	0.063	0.059	0.045	0.061	0.069	0.059	0.061	0.071	0.057	0.065	0.055
Saturday	10	0.062	0.068	0.063	0.067	0.071	0.060	0.051	0.071	0.067	0.049	0.075	0.067	0.048	0.066	0.068	0.073	0.074	0.078	0.065	0.071	0.056
Saturday	11	0.067	0.071	0.064	0.074	0.076	0.061	0.058	0.077	0.068	0.050	0.084	0.073	0.050	0.067	0.068	0.081	0.077	0.083	0.070	0.076	0.056
Saturday	12	0.069	0.070	0.062	0.075	0.075	0.060	0.060	0.076	0.067	0.053	0.083	0.071	0.052	0.068	0.065	0.078	0.077	0.075	0.072	0.074	0.054
Saturday	13	0.070	0.067	0.058	0.075	0.074	0.057	0.059	0.073	0.066	0.055	0.081	0.069	0.053	0.067	0.068	0.075	0.072	0.060	0.072	0.071	0.053
Saturday	14	0.070	0.064	0.054	0.074	0.071	0.055	0.065	0.076	0.066	0.057	0.076	0.065	0.055	0.070	0.070	0.075	0.068	0.055	0.072	0.068	0.050
Saturday	15	0.069	0.061	0.049	0.072	0.068	0.051	0.067	0.073	0.064	0.060	0.074	0.062	0.058	0.077	0.065	0.075	0.068	0.052	0.072	0.063	0.047
Saturday	16	0.068	0.057	0.045	0.070	0.064	0.048	0.065	0.069	0.059	0.056	0.070	0.058	0.057	0.066	0.055	0.072	0.070	0.047	0.072	0.059	0.044
Saturday	17	0.064	0.051	0.040	0.066	0.057	0.044	0.064	0.062	0.055	0.055	0.061	0.057	0.054	0.053	0.050	0.066	0.063	0.040	0.068	0.051	0.040
Saturday	18	0.056	0.042	0.033	0.056	0.047	0.038	0.061	0.048	0.050	0.051	0.049	0.052	0.052	0.040	0.039	0.058	0.052	0.031	0.059	0.041	0.035
Saturday	19	0.048	0.034	0.027	0.046	0.037	0.033	0.059	0.041	0.044	0.049	0.038	0.045	0.046	0.034	0.030	0.047	0.041	0.026	0.048	0.031	0.030
Saturday	20	0.041	0.029	0.024	0.040	0.030	0.028	0.050	0.031	0.036	0.042	0.031	0.038	0.042	0.027	0.021	0.038	0.031	0.020	0.040	0.024	0.027
Saturday	21	0.037	0.024	0.021	0.035	0.025	0.025	0.044	0.023	0.030	0.037	0.023	0.031	0.038	0.023	0.018	0.031	0.025	0.016	0.037	0.022	0.024
Saturday	22	0.031	0.020	0.019	0.028	0.019	0.023	0.034	0.017	0.024	0.031	0.017	0.026	0.032	0.019	0.011	0.025	0.020	0.018	0.031	0.019	0.023
Saturday	23	0.023	0.016	0.017	0.020	0.014	0.021	0.026	0.013	0.019	0.023	0.012	0.019	0.025	0.014	0.008	0.016	0.013	0.018	0.022	0.016	0.022
Holiday	0	0.013	0.020	0.027	0.010	0.016	0.028	0.014	0.008	0.015	0.024	0.008	0.015	0.024	0.008	0.009	0.008	0.011	0.020	0.009	0.019	0.032
Holiday	1	0.009	0.017	0.025	0.006	0.013	0.027	0.013	0.007	0.013	0.027	0.008	0.012	0.024	0.007	0.010	0.005	0.009	0.018	0.005	0.016	0.030
Holiday	2	0.007	0.015	0.024	0.004	0.012	0.026	0.013	0.006	0.012	0.024	0.008	0.012	0.023	0.006	0.007	0.003	0.010	0.018	0.003	0.014	0.029
Holiday	3	0.007	0.016	0.026	0.005	0.013	0.027	0.013	0.006	0.012	0.029	0.010	0.013	0.023	0.007	0.011	0.004	0.010	0.021	0.003	0.015	0.031
Holiday	4	0.011	0.020	0.029	0.008	0.016	0.029	0.016	0.013	0.014	0.029	0.012	0.014	0.027	0.016	0.017	0.005	0.012	0.020	0.007	0.018	0.032
Holiday	5	0.019	0.028	0.033	0.014	0.023	0.032	0.020	0.017	0.020	0.031	0.016	0.017	0.033	0.030	0.032	0.009	0.018	0.031	0.016	0.029	0.038
Holiday	6	0.027	0.035	0.038	0.025	0.033	0.036	0.025	0.028	0.026	0.037	0.025	0.023	0.035	0.045	0.052	0.018	0.023	0.038	0.031	0.042	0.043
Holiday	7	0.035	0.042	0.042	0.036	0.044	0.042	0.030	0.037	0.036	0.038	0.033	0.031	0.040	0.052	0.064	0.029	0.031	0.043	0.047	0.056	0.047
Holiday	8	0.040	0.048	0.046	0.046	0.053	0.048	0.036	0.051	0.046	0.040	0.049	0.040	0.043	0.065	0.066	0.041	0.044	0.056	0.051	0.059	0.049
Holiday	9	0.048	0.055	0.050	0.054	0.059	0.050	0.047	0.068	0.056	0.043	0.062	0.054	0.045	0.061	0.058	0.058	0.057	0.075	0.052	0.061	0.051
Holiday	10	0.059	0.064	0.055	0.065	0.069	0.053	0.051	0.068	0.064	0.050	0.076	0.060	0.050	0.075	0.055	0.076	0.083	0.087	0.059	0.066	0.053
Holiday	11	0.065	0.070	0.060	0.074	0.074	0.057	0.059	0.083	0.069	0.047	0.084	0.068	0.049	0.076	0.055	0.084	0.086	0.088	0.066	0.069	0.054
Holiday	12	0.069	0.072	0.061	0.077	0.074	0.056	0.066	0.081	0.071	0.053	0.083	0.070	0.058	0.075	0.060	0.085	0.087	0.089	0.068	0.072	0.055
Holiday	13	0.071	0.071	0.061	0.076	0.074	0.058	0.062	0.084	0.068	0.062	0.091	0.067	0.052	0.069	0.068	0.083	0.081	0.078	0.070	0.070	0.053
Holiday	14	0.072	0.069	0.059	0.075	0.073	0.056	0.069	0.076	0.064	0.059	0.087	0.069	0.055	0.069	0.070	0.080	0.074	0.068	0.071	0.068	0.053
Holiday	15	0.073	0.068	0.058	0.074	0.070	0.055	0.065	0.081	0.061	0.057	0.079	0.065	0.062	0.070	0.078	0.078	0.074	0.060	0.073	0.064	0.050
Holiday	16	0.073	0.065	0.055	0.072	0.066	0.054	0.070	0.068	0.061	0.056	0.072	0.062	0.065	0.074	0.069	0.078	0.072	0.049	0.073	0.061	0.049
Holiday	17	0.070	0.057	0.050	0.068	0.059	0.051	0.068	0.063	0.060	0.056	0.058	0.060	0.053	0.057	0.062	0.071	0.066	0.041	0.071	0.056	0.046
Holiday	18	0.060	0.046	0.044	0.057	0.049	0.045	0.063	0.047	0.055	0.053	0.044	0.058	0.051	0.040	0.046	0.057	0.049	0.033	0.061	0.045	0.041
Holiday	19	0.050	0.036	0.039	0.047	0.036	0.041	0.056	0.035	0.048	0.048	0.029	0.049	0.047	0.031	0.041	0.043	0.040	0.022	0.049	0.032	0.036
Holiday	20	0.042	0.029	0.034	0.039	0.029	0.037	0.050	0.028	0.041	0.044	0.024	0.045	0.046	0.027	0.026	0.033	0.026	0.013	0.041	0.024	0.033
Holiday	21	0.034	0.023	0.030	0.030	0.020	0.033	0.045	0.021	0.035	0.040	0.019	0.040	0.040	0.019	0.021	0.024	0.018	0.011	0.034	0.019	0.032
Holiday	22	0.027	0.017	0.028	0.023	0.015	0.031	0.027	0.013	0.029	0.031	0.014	0.030	0.034	0.014	0.014	0.017	0.012	0.009	0.025	0.014	0.031
Holiday	23	0.018	0.014	0.026	0.015	0.010	0.029	0.022	0.010	0.023	0.024	0.009	0.024	0.024	0.011	0.011	0.010	0.008	0.010	0.016	0.012	0.032

		Yolo			Yuba		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Sunday	0	0.016	0.026	0.044	0.013	0.020	0.031
Sunday	1	0.011	0.019	0.036	0.008	0.016	0.028
Sunday	2	0.008	0.017	0.033	0.006	0.013	0.026
Sunday	3	0.006	0.015	0.030	0.005	0.012	0.025
Sunday	4	0.007	0.016	0.029	0.005	0.012	0.025
Sunday	5	0.011	0.020	0.032	0.008	0.015	0.027
Sunday	6	0.016	0.025	0.034	0.013	0.020	0.030
Sunday	7	0.023	0.031	0.040	0.022	0.028	0.034
Sunday	8	0.034	0.041	0.046	0.034	0.041	0.040
Sunday	9	0.048	0.054	0.051	0.048	0.055	0.046
Sunday	10	0.060	0.063	0.054	0.064	0.068	0.052
Sunday	11	0.067	0.067	0.054	0.075	0.075	0.055
Sunday	12	0.071	0.070	0.053	0.082	0.079	0.058
Sunday	13	0.072	0.070	0.052	0.084	0.079	0.058
Sunday	14	0.073	0.069	0.050	0.084	0.077	0.057
Sunday	15	0.073	0.067	0.047	0.082	0.073	0.057
Sunday	16	0.072	0.063	0.045	0.079	0.068	0.055
Sunday	17	0.070	0.059	0.043	0.072	0.062	0.053
Sunday	18	0.063	0.051	0.041	0.060	0.052	0.049
Sunday	19	0.057	0.044	0.038	0.050	0.043	0.045
Sunday	20	0.051	0.038	0.036	0.041	0.035	0.042
Sunday	21	0.042	0.032	0.037	0.031	0.026	0.039
Sunday	22	0.030	0.025	0.037	0.021	0.019	0.036
Sunday	23	0.019	0.020	0.040	0.013	0.015	0.033
Monday	0	0.010	0.018	0.028	0.008	0.014	0.027
Monday	1	0.006	0.015	0.026	0.005	0.012	0.025
Monday	2	0.005	0.014	0.026	0.004	0.012	0.025
Monday	3	0.007	0.016	0.028	0.006	0.014	0.027
Monday	4	0.016	0.025	0.034	0.011	0.019	0.030
Monday	5	0.032	0.040	0.043	0.023	0.030	0.036
Monday	6	0.048	0.052	0.050	0.042	0.047	0.043
Monday	7	0.066	0.065	0.056	0.060	0.061	0.048
Monday	8	0.064	0.064	0.057	0.059	0.062	0.050
Monday	9	0.057	0.062	0.056	0.056	0.061	0.050
Monday	10	0.055	0.061	0.057	0.058	0.064	0.051
Monday	11	0.056	0.062	0.056	0.062	0.066	0.053
Monday	12	0.058	0.062	0.056	0.066	0.068	0.054
Monday	13	0.059	0.061	0.055	0.067	0.067	0.054
Monday	14	0.062	0.062	0.054	0.070	0.069	0.055
Monday	15	0.068	0.063	0.053	0.073	0.069	0.055
Monday	16	0.073	0.062	0.051	0.075	0.067	0.054
Monday	17	0.072	0.057	0.046	0.073	0.061	0.052
Monday	18	0.053	0.043	0.039	0.056	0.046	0.045
Monday	19	0.039	0.030	0.031	0.040	0.031	0.039
Monday	20	0.032	0.023	0.026	0.031	0.022	0.035
Monday	21	0.027	0.018	0.024	0.025	0.017	0.032
Monday	22	0.021	0.014	0.023	0.017	0.012	0.030
Monday	23	0.014	0.011	0.025	0.012	0.009	0.030
Tues/Wed/Thurs	0	0.009	0.017	0.031	0.008	0.014	0.029
Tues/Wed/Thurs	1	0.006	0.014	0.028	0.004	0.011	0.027
Tues/Wed/Thurs	2	0.005	0.014	0.028	0.004	0.011	0.027
Tues/Wed/Thurs	3	0.006	0.016	0.030	0.005	0.013	0.029

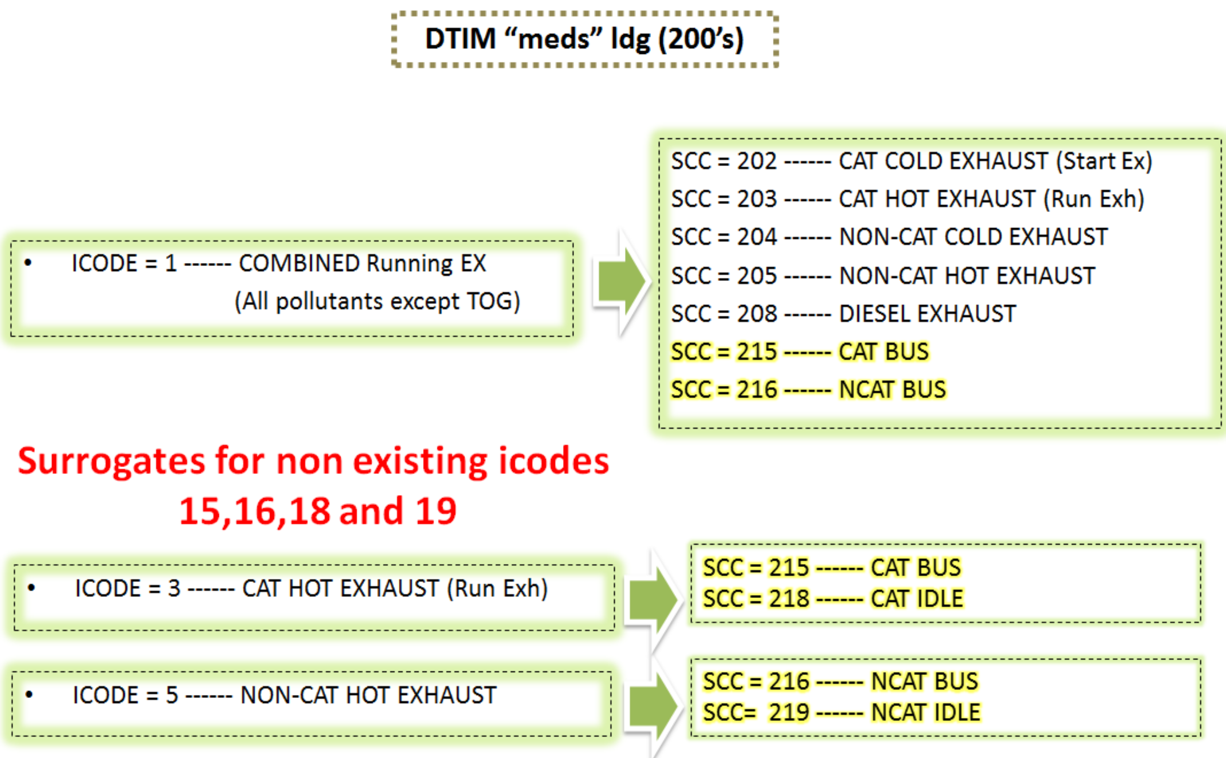
		Yolo			Yuba		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Tues/Wed/Thurs	4	0.014	0.023	0.036	0.010	0.018	0.031
Tues/Wed/Thurs	5	0.029	0.037	0.044	0.022	0.029	0.037
Tues/Wed/Thurs	6	0.046	0.051	0.052	0.042	0.047	0.044
Tues/Wed/Thurs	7	0.066	0.065	0.057	0.060	0.061	0.050
Tues/Wed/Thurs	8	0.065	0.064	0.057	0.060	0.062	0.051
Tues/Wed/Thurs	9	0.057	0.062	0.057	0.055	0.060	0.050
Tues/Wed/Thurs	10	0.053	0.061	0.057	0.056	0.061	0.051
Tues/Wed/Thurs	11	0.054	0.061	0.057	0.059	0.064	0.052
Tues/Wed/Thurs	12	0.056	0.061	0.056	0.061	0.065	0.053
Tues/Wed/Thurs	13	0.058	0.061	0.055	0.064	0.066	0.053
Tues/Wed/Thurs	14	0.062	0.062	0.053	0.068	0.068	0.053
Tues/Wed/Thurs	15	0.069	0.063	0.051	0.073	0.069	0.053
Tues/Wed/Thurs	16	0.074	0.062	0.048	0.075	0.067	0.052
Tues/Wed/Thurs	17	0.073	0.058	0.044	0.074	0.063	0.050
Tues/Wed/Thurs	18	0.056	0.045	0.037	0.059	0.048	0.044
Tues/Wed/Thurs	19	0.041	0.032	0.030	0.043	0.034	0.038
Tues/Wed/Thurs	20	0.034	0.025	0.025	0.035	0.025	0.034
Tues/Wed/Thurs	21	0.029	0.020	0.023	0.029	0.019	0.031
Tues/Wed/Thurs	22	0.022	0.015	0.022	0.020	0.013	0.029
Tues/Wed/Thurs	23	0.015	0.011	0.023	0.013	0.009	0.028
Friday	0	0.009	0.017	0.032	0.007	0.014	0.032
Friday	1	0.006	0.014	0.030	0.005	0.011	0.030
Friday	2	0.005	0.014	0.030	0.004	0.011	0.030
Friday	3	0.006	0.015	0.032	0.005	0.012	0.030
Friday	4	0.012	0.022	0.037	0.008	0.016	0.033
Friday	5	0.024	0.034	0.044	0.017	0.026	0.038
Friday	6	0.038	0.047	0.052	0.033	0.040	0.045
Friday	7	0.054	0.059	0.058	0.049	0.054	0.050
Friday	8	0.055	0.059	0.059	0.051	0.057	0.052
Friday	9	0.051	0.059	0.058	0.050	0.057	0.052
Friday	10	0.052	0.060	0.058	0.054	0.061	0.054
Friday	11	0.056	0.062	0.058	0.060	0.066	0.055
Friday	12	0.059	0.063	0.056	0.063	0.067	0.055
Friday	13	0.062	0.064	0.055	0.066	0.068	0.054
Friday	14	0.066	0.064	0.053	0.070	0.070	0.054
Friday	15	0.070	0.063	0.050	0.073	0.070	0.052
Friday	16	0.071	0.061	0.046	0.074	0.067	0.050
Friday	17	0.069	0.057	0.041	0.072	0.063	0.047
Friday	18	0.060	0.047	0.037	0.063	0.051	0.042
Friday	19	0.049	0.036	0.029	0.050	0.039	0.035
Friday	20	0.041	0.028	0.024	0.041	0.029	0.030
Friday	21	0.036	0.023	0.021	0.037	0.023	0.028
Friday	22	0.029	0.018	0.019	0.030	0.017	0.026
Friday	23	0.019	0.013	0.019	0.019	0.011	0.024
Saturday	0	0.014	0.024	0.050	0.013	0.019	0.038
Saturday	1	0.009	0.019	0.042	0.008	0.015	0.034
Saturday	2	0.008	0.017	0.039	0.006	0.014	0.032
Saturday	3	0.007	0.016	0.037	0.006	0.013	0.031
Saturday	4	0.009	0.019	0.038	0.007	0.014	0.032
Saturday	5	0.014	0.025	0.043	0.011	0.018	0.034
Saturday	6	0.023	0.033	0.049	0.019	0.026	0.039
Saturday	7	0.034	0.044	0.055	0.032	0.038	0.046

		Yolo			Yuba		
Day of Week	**Hour**	**LD**	**LM**	**HH**	**LD**	**LM**	**HH**
Saturday	8	0.046	0.055	0.059	0.045	0.051	0.052
Saturday	9	0.057	0.064	0.061	0.057	0.062	0.056
Saturday	10	0.065	0.070	0.063	0.067	0.071	0.060
Saturday	11	0.069	0.071	0.059	0.074	0.076	0.061
Saturday	12	0.069	0.068	0.056	0.075	0.075	0.060
Saturday	13	0.069	0.065	0.052	0.075	0.074	0.057
Saturday	14	0.068	0.063	0.047	0.074	0.071	0.055
Saturday	15	0.067	0.060	0.043	0.072	0.068	0.051
Saturday	16	0.066	0.056	0.039	0.070	0.064	0.048
Saturday	17	0.063	0.052	0.035	0.066	0.057	0.044
Saturday	18	0.057	0.045	0.029	0.056	0.047	0.038
Saturday	19	0.048	0.035	0.025	0.046	0.037	0.033
Saturday	20	0.042	0.030	0.021	0.040	0.030	0.028
Saturday	21	0.039	0.027	0.020	0.035	0.025	0.025
Saturday	22	0.034	0.023	0.020	0.028	0.019	0.023
Saturday	23	0.024	0.018	0.019	0.020	0.014	0.021
Holiday	0	0.012	0.022	0.032	0.010	0.016	0.028
Holiday	1	0.008	0.017	0.029	0.006	0.013	0.027
Holiday	2	0.006	0.015	0.029	0.004	0.012	0.026
Holiday	3	0.006	0.017	0.029	0.005	0.013	0.027
Holiday	4	0.011	0.021	0.032	0.008	0.016	0.029
Holiday	5	0.019	0.030	0.038	0.014	0.023	0.032
Holiday	6	0.027	0.038	0.044	0.025	0.033	0.036
Holiday	7	0.037	0.046	0.050	0.036	0.044	0.042
Holiday	8	0.046	0.054	0.053	0.046	0.053	0.048
Holiday	9	0.053	0.059	0.056	0.054	0.059	0.050
Holiday	10	0.061	0.065	0.058	0.065	0.069	0.053
Holiday	11	0.067	0.069	0.060	0.074	0.074	0.057
Holiday	12	0.069	0.068	0.059	0.077	0.074	0.056
Holiday	13	0.069	0.068	0.057	0.076	0.074	0.058
Holiday	14	0.070	0.066	0.055	0.075	0.073	0.056
Holiday	15	0.069	0.065	0.052	0.074	0.070	0.055
Holiday	16	0.067	0.060	0.049	0.072	0.066	0.054
Holiday	17	0.064	0.055	0.044	0.068	0.059	0.051
Holiday	18	0.057	0.046	0.039	0.057	0.049	0.045
Holiday	19	0.050	0.036	0.033	0.047	0.036	0.041
Holiday	20	0.044	0.029	0.028	0.039	0.029	0.037
Holiday	21	0.039	0.023	0.025	0.030	0.020	0.033
Holiday	22	0.030	0.018	0.024	0.023	0.015	0.031
Holiday	23	0.020	0.014	0.026	0.015	0.010	0.029

Appendix C: Scaling procedures after DTIM processing

C1. Block Diagram of Scaling Process: ldg (gas: heavy- and light-duty; diesel: light-duty)

DTIM has 1 to 12 Source Classification Codes (SCC) that vary by species. For CO, NOx, SOx and PM species, DTIM only uses SCC=1 for the running exhaust emissions regardless of the fuel type and process. However, distribution of the running exhaust emissions according to the fuel type and process is needed. The following diagram explains how to distribute the running exhaust emissions for the light-duty gas. The running exhaust emissions are distributed to the catalyst cold exhaust, catalyst hot exhaust, non-catalyst cold exhaust, non-catalyst hot exhaust, catalyst bus and non-catalyst bus by using the corresponding emissions from EMFAC. Since there are no idle emissions in DTIM, surrogates are needed for the catalyst idle and non-catalyst idle. The surrogates for the catalyst idle and non-catalyst idle are catalyst hot exhaust, and non-catalyst hot exhaust, respectively.



C2. Block Diagram of Scaling Process: hdd (heavy-duty diesel)

The following diagram explains how to distribute the running exhaust emissions for heavy-duty diesel. The running exhaust emissions are distributed to the diesel exhaust or diesel bus exhaust depending on the vehicle type by using the corresponding emissions from EMFAC. Since there are no idle emissions in DTIM, a surrogate is used. The surrogate for the diesel idle emissions is diesel exhaust or diesel bus exhaust, depending on the vehicle type.

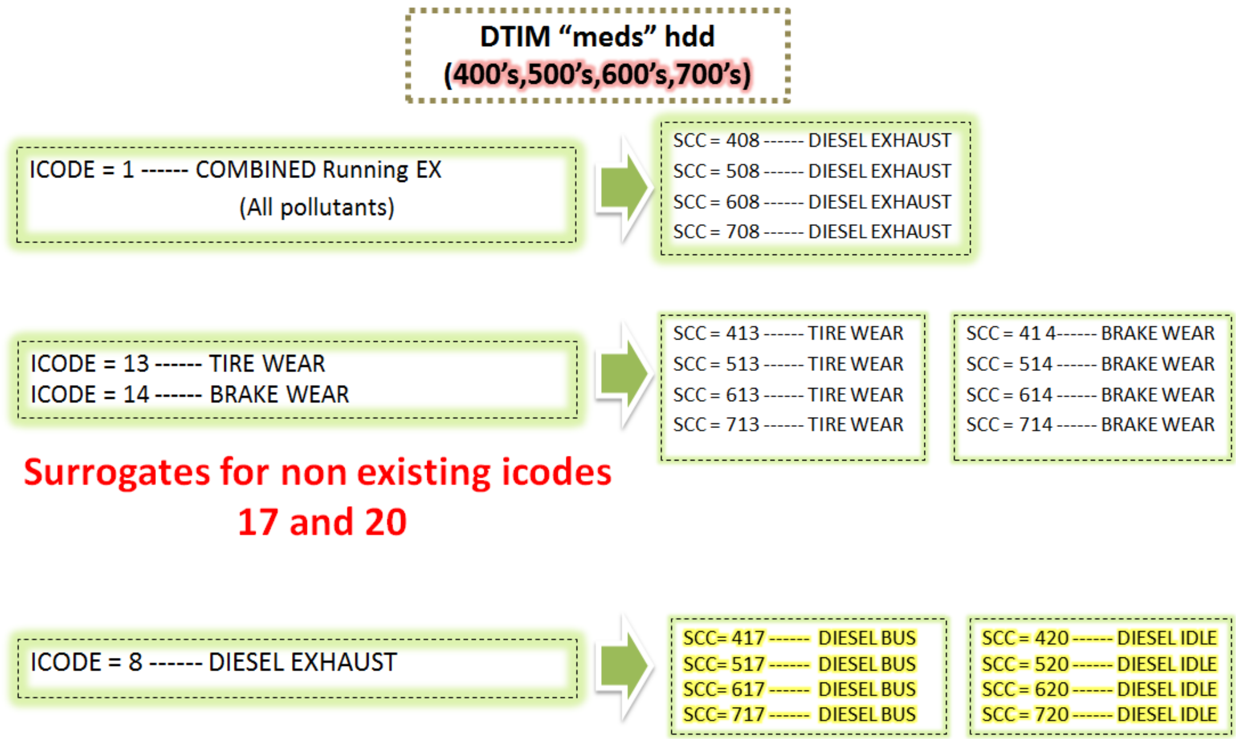


Figure 7 Block diagram of scaling process

Appendix D: Additional temporal profiles

Temporal profiles developed from the AGTOOL are applied as potential replacements when processing the emissions inventories for modeling using the SMOKE processor. This would apply for agriculturally related emissions with time-invariant temporal distributions, which includes the following emission source categories: food and agricultural processing, pesticides and fertilizers, farming operations, unpaved road dust, fugitive windblown dust, managed burning and disposal, and farming equipment

Table 11 Day of week temporal profiles from the Agricultural Emissions Temporal and Spatial Allocation Tool (AgTool)

Code	M	T	W	TH	F	S	S
201	1	174	248	182	203	97	95
202	1	2	1	0	2	1	993
203	1	117	192	190	229	222	48
204	2	16	13	13	10	928	17
205	3	342	597	25	4	5	24
206	4	100	33	241	105	455	62
207	5	50	284	126	125	315	95
208	6	94	41	40	348	358	112
209	7	203	111	236	340	0	102
210	8	221	225	123	117	80	225
211	9	37	63	667	111	37	77
212	11	2	881	41	40	18	8
213	12	96	105	153	201	425	8
214	13	370	306	90	47	101	73
215	13	368	72	498	2	41	6
216	19	562	125	102	47	39	107
217	22	348	74	115	125	215	102
218	22	292	63	229	65	104	224
219	22	482	41	111	167	93	83
220	25	184	100	136	223	152	182
221	25	192	107	223	278	75	101
222	27	40	51	99	310	58	415
223	29	51	237	127	172	308	77
224	30	219	195	158	222	112	64
225	30	185	151	125	186	120	203
226	35	131	195	172	151	201	114
227	35	146	162	175	157	180	143
228	36	179	200	93	188	186	117
229	37	82	363	208	2	73	235
230	40	211	162	182	160	165	81
231	40	468	0	420	0	72	0
232	41	269	293	118	95	121	62
233	44	56	399	13	268	61	160
234	45	335	72	82	210	180	77
235	46	124	139	148	199	168	177
236	46	207	54	453	54	134	52
237	48	310	346	83	84	91	38
238	52	201	140	196	121	160	132
239	53	134	123	144	206	192	149
240	53	108	150	163	171	207	148
241	57	156	183	117	92	220	175
242	63	105	176	154	148	195	160
243	63	186	136	175	187	134	120

Code	M	T	W	TH	F	S	S
244	64	230	173	136	83	251	63
245	66	249	149	127	105	185	120
246	67	222	278	236	65	129	2
247	70	120	192	168	188	145	116
248	74	95	170	197	157	144	162
249	74	190	108	126	246	116	138
250	77	295	104	187	155	88	93
251	79	135	291	129	86	182	97
252	80	360	9	19	424	79	29
253	81	133	132	125	226	167	135
254	82	136	151	118	160	196	157
255	82	92	125	207	177	153	164
256	85	133	152	145	188	173	124
257	87	295	16	111	47	244	201
258	96	128	104	169	161	224	119
259	104	196	118	155	202	132	94
260	104	111	196	121	181	127	162
261	107	161	70	90	227	243	102
262	107	145	115	203	187	147	95
263	111	171	137	0	297	202	81
264	112	121	144	165	155	172	131
265	113	199	97	132	218	147	94
266	113	167	15	156	399	70	80
267	115	150	128	153	192	139	122
268	115	103	120	138	117	251	156
269	119	125	119	87	144	158	248
270	120	145	130	137	155	166	147
271	125	155	141	108	179	149	142
272	130	140	137	170	93	139	192
273	135	222	191	83	169	110	90
274	136	160	156	162	144	156	86
275	138	109	107	137	227	147	137
276	139	101	117	171	167	171	134
277	143	143	143	143	143	143	143
278	150	230	118	72	144	170	116
279	163	118	106	135	185	112	181
280	199	136	81	163	143	180	99
281	218	8	2	14	6	525	226
282	250	35	290	130	50	109	137
283	255	116	82	103	128	63	252
284	278	182	148	36	105	112	139
285	326	168	189	0	105	0	211
286	0	212	165	131	202	128	161
287	0	289	0	0	356	222	133
288	0	321	93	208	109	81	188
289	0	431	4	160	246	15	144
290	0	515	122	111	48	128	76
291	0	0	0	916	84	0	0
292	0	0	0	0	148	0	852
294	0	0	0	0	1000	0	0

Table 12 Daily temporal profiles from the Agricultural Emissions Temporal and Spatial Allocation Tool (AgTool)

Code	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
201	0	0	0	0	0	10	102	2	26	358	259	134	65	1	26	10	3	2	1	0	0	0	0	0
202	0	0	0	5	3	2	5	59	44	38	28	640	19	21	48	34	21	22	10	1	0	1	0	0
203	1	0	0	0	10	162	64	51	139	270	115	46	61	3	15	16	16	4	12	6	3	1	3	2
204	1	0	0	0	0	1	139	405	79	126	69	54	33	31	13	20	14	14	2	0	0	0	0	0
205	1	3	6	2	3	8	1	2	5	29	73	112	125	115	101	164	46	49	65	68	3	10	5	2
206	2	5	0	4	22	5	6	8	26	31	88	90	66	397	38	28	43	100	34	5	0	0	0	0
207	2	3	0	0	37	177	45	57	167	203	123	102	23	15	8	6	22	6	1	0	0	0	0	1
208	2	0	0	0	0	20	1	498	9	15	28	8	42	6	358	2	2	0	9	0	0	0	0	0
209	2	0	0	12	54	3	41	471	18	105	94	31	7	9	68	33	43	7	0	0	0	0	0	0
210	2	4	2	4	4	3	17	40	60	137	87	178	42	67	82	198	60	6	3	1	1	1	1	1
211	3	2	3	2	0	2	6	12	43	75	220	413	2	199	2	5	4	7	0	0	0	0	0	0
212	4	5	0	0	6	220	16	73	212	321	135	6	0	0	0	0	0	0	3	0	0	0	0	0
213	4	159	11	187	7	0	0	16	71	536	0	1	0	0	0	0	0	0	7	0	0	0	0	0
214	5	5	5	7	6	13	6	91	50	29	237	161	11	37	123	78	76	1	51	1	1	1	1	2
215	8	5	19	15	44	48	35	44	88	109	96	100	58	112	62	44	30	52	13	3	3	3	3	6
216	9	0	0	0	0	10	19	157	83	105	65	92	15	19	73	308	32	6	2	4	1	0	1	0
217	9	9	6	7	10	84	13	35	113	187	138	63	57	58	25	40	44	45	30	4	5	4	3	13
218	10	3	6	5	7	11	17	61	30	44	61	73	88	56	119	265	18	3	108	3	1	3	3	6
219	0	0	0	0	0	393	374	26	0	139	0	4	11	1	2	15	33	2	0	0	0	0	0	0
220	11	11	8	2	25	16	144	131	173	251	106	55	56	4	1	4	1	0	0	0	0	0	0	0
221	13	13	15	25	32	11	8	12	8	123	19	135	6	47	157	65	26	96	154	7	6	6	6	8
222	9	9	2	19	3	19	7	16	76	20	39	156	44	277	29	52	176	37	2	2	2	1	1	2
223	5	5	3	4	13	23	108	64	68	61	92	278	59	38	56	34	38	22	14	5	1	1	2	5
224	1	1	10	4	8	32	50	118	64	72	75	123	130	51	72	63	61	24	8	2	16	2	11	1
225	4	4	8	12	25	22	33	74	62	76	86	114	72	84	86	92	80	33	12	7	3	4	3	4
226	4	4	8	11	12	26	26	46	37	85	114	231	83	67	71	91	57	12	4	4	1	2	3	2
227	7	7	9	10	19	39	25	45	61	92	97	102	73	120	66	66	72	45	19	7	5	5	5	5
228	4	4	8	9	28	20	30	24	34	58	53	180	122	60	128	104	67	29	22	3	2	4	4	3
229	10	10	15	14	18	171	37	47	47	41	38	40	45	22	27	57	13	3	305	4	6	5	5	20
230	19	19	40	29	38	80	48	119	50	39	31	35	75	49	84	80	64	27	22	21	12	10	9	1
231	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42
232	0	0	0	0	0	2	20	24	22	21	37	146	32	41	17	219	406	5	4	4	0	1	0	0
233	0	0	0	0	0	0	0	0	512	0	0	0	0	0	488	0	0	0	0	0	0	0	0	0
234	9	9	7	5	9	32	20	58	39	80	110	105	136	66	131	41	89	12	16	9	9	0	7	1
235	2	2	2	5	6	31	48	95	72	51	41	460	48	29	19	20	34	17	9	8	1	0	0	0
236	11	11	23	12	20	28	23	22	28	64	96	55	75	53	105	105	146	58	13	11	8	10	14	9
237	18	18	12	10	15	7	11	24	20	49	77	80	54	38	59	177	120	20	10	35	38	44	39	26
238	1	1	1	4	1	20	52	86	79	118	93	120	71	56	132	73	42	27	8	4	2	3	3	1
239	2	2	1	3	2	42	31	82	79	79	87	78	85	78	76	67	142	38	15	4	1	2	2	1
240	0	0	0	19	27	55	26	23	26	51	112	162	192	112	85	60	22	8	1	12	6	0	0	1
241	3	3	7	34	3	37	32	238	35	45	66	70	64	43	166	68	52	16	4	5	1	1	4	0
242	3	3	2	35	6	40	47	69	76	97	85	95	80	78	105	42	48	56	12	4	1	15	2	0
243	0	0	0	2	18	6	70	47	130	146	115	21	62	64	247	42	22	4	2	0	0	0	1	0
244	22	22	18	16	38	65	86	87	74	83	68	64	61	34	32	51	105	25	17	10	2	2	6	12
245	6	6	5	7	16	30	26	53	78	126	75	74	33	44	63	118	131	12	8	2	68	8	8	4
246	0	0	0	1	7	426	80	147	29	25	23	109	2	29	53	6	45	0	0	0	0	17	0	0
247	0	0	5	175	1	6	0	37	49	13	4	11	250	0	1	0	439	0	0	9	0	0	0	0
248	4	4	12	8	64	229	105	285	61	59	32	42	10	71	3	4	8	0	0	0	0	0	0	0

Code	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
249	0	0	0	0	1	6	51	4	11	34	153	492	8	40	7	15	167	8	0	1	0	0	0	0
250	8	8	8	1	1	4	4	4	368	389	188	12	1	1	1	1	1	0	0	0	0	0	0	0
251	17	17	7	68	22	64	11	227	26	299	87	17	4	4	60	15	0	0	0	1	2	25	15	12
252	0	0	0	0	0	3	2	1	2	2	958	9	3	3	2	3	3	8	2	0	0	0	0	0
253	0	2	0	0	0	2	60	212	153	137	76	138	58	47	61	25	13	7	9	1	0	0	0	0
254	0	6	0	0	151	178	73	63	226	62	12	58	9	7	39	21	80	15	0	0	0	0	0	0
255	0	17	356	0	0	149	0	213	0	2	258	0	0	0	0	0	0	0	4	0	0	0	0	0
256	0	0	0	1	0	244	44	98	70	1	0	538	2	0	0	0	0	2	0	0	0	0	0	0
257	0	0	0	0	0	0	11	38	8	77	89	690	18	14	14	10	21	2	8	0	0	0	0	0
258	0	0	0	0	1	217	54	47	60	119	118	231	0	82	0	54	17	0	0	0	0	0	0	0
259	0	0	0	0	8	312	108	95	177	227	73	0	0	0	0	0	0	0	0	0	0	0	0	0
260	0	0	0	0	77	0	1	18	74	134	241	243	121	48	8	11	0	23	0	1	0	0	0	0
261	0	0	0	0	0	1	10	58	48	373	106	114	34	70	38	15	0	0	0	0	0	58	0	76
262	0	0	0	0	0	3	2	20	7	113	26	792	4	5	9	4	10	5	0	0	0	0	0	0
263	0	0	0	0	0	72	919	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
264	0	0	0	0	0	75	0	618	307	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
265	0	0	0	0	0	89	14	0	0	0	0	897	0	0	0	0	0	0	0	0	0	0	0	0
266	0	0	0	0	0	92	0	263	71	187	123	70	50	6	19	4	10	85	19	0	0	0	0	0
267	0	0	0	0	0	377	95	0	0	32	0	495	0	0	0	0	0	0	0	0	0	0	0	0
268	0	0	0	0	0	772	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	206
269	0	0	0	0	0	795	121	7	1	16	9	22	5	3	7	8	4	0	0	0	0	0	0	0
270	0	0	0	0	0	0	67	0	9	371	397	127	26	3	1	0	0	0	0	0	1	0	0	0
271	0	0	0	0	0	0	495	0	31	269	0	0	0	144	0	61	0	0	0	0	0	0	0	0
272	0	0	0	0	0	0	929	34	0	0	0	37	0	0	0	0	0	0	0	0	0	0	0	0
273	0	0	0	0	0	0	0	1	0	0	0	997	0	1	0	0	0	0	0	0	0	0	0	0
274	0	0	0	0	0	0	0	6	24	368	49	198	25	32	42	95	45	58	56	1	0	0	0	0
275	0	0	0	0	0	0	0	46	483	33	11	12	7	17	50	4	336	0	0	0	0	0	0	0
276	0	0	0	0	0	0	0	864	0	0	0	0	136	0	0	0	0	0	0	0	0	0	0	0
277	0	0	0	0	0	0	0	0	42	75	167	483	0	233	0	0	0	0	0	0	0	0	0	0
278	0	0	0	0	0	0	0	0	0	84	93	823	0	0	0	0	0	0	0	0	0	0	0	0
279	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1000	0	0	0	0	0	0	0
281	0	0	0	0	0	0	0	0	0	0	0	1000	0	0	0	0	0	0	0	0	0	0	0	0
282	0	0	0	0	0	0	0	1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
283	0	0	0	0	0	0	1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284	0	0	0	0	0	1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix I

179B Attainment Demonstration for the 2017 Imperial County State Implementation Plan for the 2008 8-Hour Ozone Standard

179B ATTAINMENT DEMONSTRATION FOR THE 2017 IMPERIAL COUNTY STATE IMPLEMENTATION PLAN FOR THE 2008 8-HOUR OZONE STANDARD

Prepared for

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September 12, 2017

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I. Regulatory Requirements and Guidance

Section 179B of the Clean Air Act (CAA) allows the United States Environmental Protection Agency (USEPA) to approve a submitted State Implementation Plan (SIP) that demonstrates attainment and maintenance of the relevant National Ambient Air Quality Standards (NAAQS) but for international emissions provided that the state meets all other applicable implementation plan requirements. The USEPA guidelines for application of Section 179B identify five types of information that may be used to evaluate the effect of emissions from outside the United States on a nonattainment area. One or more of these approaches, or another weight of evidence analysis, may be used based on the available data and specific case. To date, the USEPA has only issued Section 179B guidance specific to particulate matter; however, that guidance can be applied to ozone as applicable. Summarized with respect to particulate matter less than 10 microns in diameter (PM_{10}), the five types of information are as follows:[1]

1. Evaluate and quantify any changes in monitored PM_{10} concentrations with a change in predominant wind direction;

2. Comprehensively inventory emissions within the United States in the vicinity of the nonattainment area and demonstrate that the impact of those sources on the nonattainment area after application of reasonably available controls does not cause the NAAQS to be exceeded. Analysis must include an influx of background PM in the area. Background PM levels could be based, for example, on concentrations measured in a similar nearby area not influenced by emissions from outside the United States;

3. Analyze ambient sample filters for specific types of particles emanating from across the border (although not required, the characteristics of emissions from foreign sources may be helpful);

4. Inventory the sources on both sides of the border and compare the magnitude of PM emissions originating from within the United States to those emanating from outside the United States;

5. Perform air dispersion and/or receptor modeling to quantify the relative impacts on the nonattainment area of sources located within the United Sates and of foreign sources of PM emissions (this approach combines information collected from the international emission inventory, meteorological stations, ambient monitoring network, and analysis of filters).

For this 179B demonstration, ambient air quality, emissions, and wind direction were analyzed in combination with photochemical modeling to evaluate the effect of international emissions on the Imperial County Federal Nonattainment Area (IFNA). These analyses involved the types of information specified in (1), (2), (4), and (5) above. Speciation analyses were not included, as ambient ozone is primarily the result of interactions between reactive organic gases (ROG) and oxides of nitrogen (NO_X).

[1] 40 CFR Part 52. State Implementation Plans for Serious PM_{10} Nonattainment Areas, and Attainment Date Waivers for PM_{10} Nonattainment Areas Generally; Addendum to the General Preamble for the implementation of Title I of the Clean Air Act Amendments of 1990.

II. Border Area Meteorology and Air Quality

Overview

For many years, Imperial County and the California Air Resources Board's control strategy has successfully reduced the emissions of ozone precursors from stationary, area, and mobile sources, resulting in a general decrease in the number of ozone exceedance days and the magnitude of ozone design values in Imperial County.[2] However, as of 2015, the two southernmost ozone monitoring stations in Imperial County, the Calexico and El Centro stations, have continued to exhibit exceedances of the 2008 8-hour ozone standard. An analysis of the Imperial County and Mexicali, Mexico emission inventories as well as local meteorology has shown that under certain conditions, emissions of ozone precursors in Mexico can cause exceedances of the ozone standard at these stations. Estimates of precursor emissions originating in the Mexicali metropolitan area are approximately 3 to 5 times larger than those of all of Imperial County. On days with low wind speeds, ozone precursors react in the stagnant air and this leads to a build-up of ozone concentrations in the region. This effect is especially pronounced in the summer, when ozone generation is at its highest.

The photochemical modeling performed in support of the attainment demonstration of this SIP supports the above observations and helps quantify the international contribution to Imperial County design values. Because the Calexico station is only 0.8 miles from the international border, it is essentially located in the source area of emissions and experiences a 13 parts per billion (ppb) contribution to its future year design value from Mexicali sources. The El Centro station is also affected by its proximity to the border, with 11 ppb of its future year design value attributable to emissions from Mexicali. This amount is slightly less than Calexico's 13 ppb, because El Centro is farther north, about 9 miles from the border.[3] In contrast, the Niland station, which is more than 35 miles away from the international border, is far enough that the international ozone contribution is largely dispersed by the time it reaches that monitor, with a contribution of only 3 ppb attributed to Mexico. When the Mexico inventory is removed from the modeling domain, the IFNA shows attainment of the 2008 8-hour ozone standard in 2017. The following sections expand on this discussion and provide support for the 179B attainment demonstration.

Geography

From an air quality perspective, the southern portion of Imperial County (containing the Calexico and El Centro air monitoring stations) shares a common air shed with the Mexicali metropolitan area (Figure 1). This shared air shed is recognized by the USEPA, which includes an air pollution reduction program for the Imperial County/Mexicali air shed in the Border 2020 Program.[4] Since airflow is not restricted by topography from either side of the border and the

[2] See Chapters 6 and 7 of the main text of the SIP for more information on the current control strategy in Imperial County; Chapter 5 demonstrates that the area has made reasonable progress towards attainment.

[3] It is important to note that despite Calexico being the closest monitoring station to the international border, the highest ozone levels in Imperial County are often measured at the El Centro monitoring station. This can be attributed to a number of potential factors including transport from other areas, stagnation, and the process of ozone formation which requires time for the chemical reactions to take place between NOx and VOCs in the presence of sunlight. However, as shown in the photochemical modeling, but for international emissions, the future year design value at El Centro is below the 2008 8-hour ozone standard.

[4] USEPA. Border 2020 Goals and Objectives. Available at: https://www.epa.gov/border2020/goals-and-objectives. Accessed: May 2017.

sites have similar meteorology, pollution from Mexicali impacts ambient air quality in Calexico and neighboring towns.

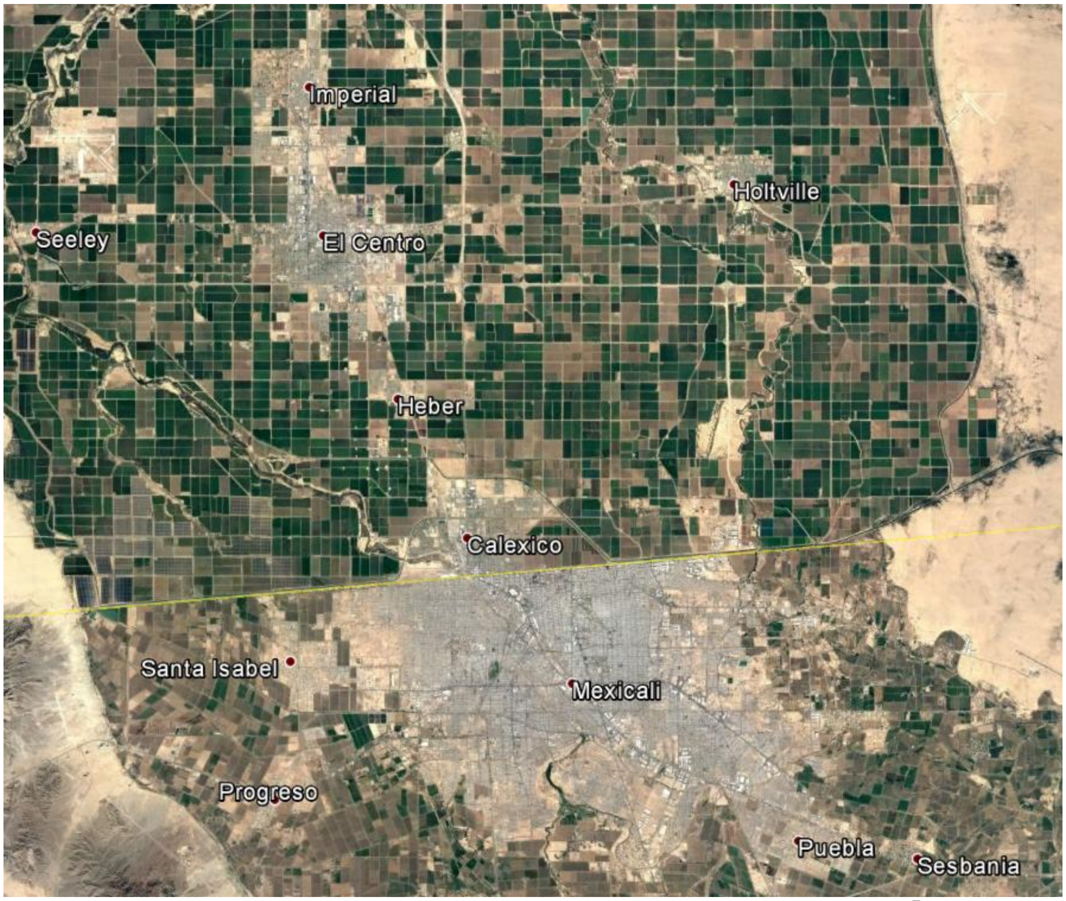


Figure 1. Mexicali and Calexico Separated by the International Border[5]

Ambient Air Quality Monitoring

Currently, ground-level ozone concentrations in Imperial County are measured at four monitoring stations: Calexico-Ethel, El Centro, Westmorland, and Niland. These stations form a monitoring network oriented south to north from the United States-Mexico border. Figure 2 shows the location of these monitoring stations plus Imperial County's fifth monitoring station, Brawley, which does not measure ozone. In addition to the Imperial County monitoring stations, ozone monitoring stations have been established across the border in Mexicali, Mexico. These stations were originally founded to help identify cross-border transport of pollutants and associated pollutant precursors but data collection from these monitors has been historically discontinuous.

[5] Image obtained from Google Earth aerial photo.

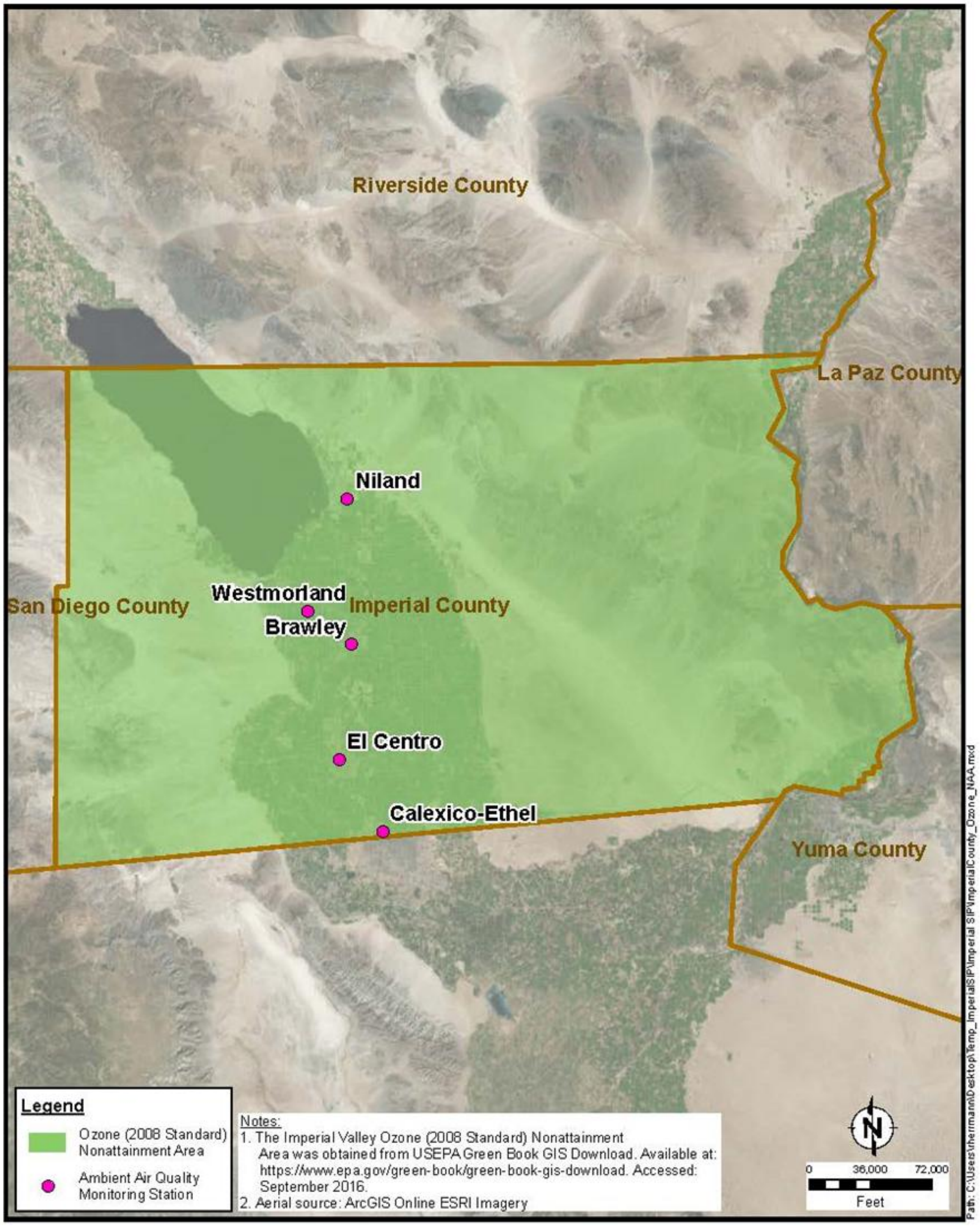


Figure 2. Locations of Imperial County Monitoring Stations

Calexico-Ethel – The Calexico-Ethel monitoring station was installed in 1994 and is operated and maintained by the California Air Resources Board (CARB). Located above sea level, it has an absolute location of latitude 32° 40' 34" and longitude 115° 28' 59". Its relative location is 1029 Belcher Street within the property boundary on the southeast corner of the Calexico High School football field parking lot. To the north is located an athletic sports field used for football, baseball, and track. The monitoring station is surrounded by a suburban neighborhood directly to the south, southeast, and southwest and is approximately 0.75 miles (1.2 kilometers) directly north of the international border crossing. The site currently records measurements for ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), PM_{10}, lead (Pb), and toxics.

El Centro - The El Centro monitoring station was installed in 1986. Located above sea level, its absolute location is latitude 32° 47' 32" and longitude 115°33' 47". Its relative location is 150 South 9th Street on the roof of the Imperial County Air Pollution Control District (ICAPCD) building. The monitoring station is surrounded by government and commercial buildings. It is the first monitoring site north of the City of Calexico, continuing the south to north monitoring network for Imperial County and is approximately 9.2 miles (14.8 kilometers) from the international border. The El Centro monitoring station is classified as urban with large agricultural areas to the east and west of the city's boundaries. This site records measurements for O_3, CO, NO_2, $PM_{2.5}$, and PM_{10}.

Brawley - The current Brawley monitoring station, which was installed in 2003 as a new station, replaced the old one which was installed in 1982. It is located below sea level and has an absolute location of latitude 32° 58' 42" and longitude 115° 32' 21". Its relative location is 220 Main Street atop the Imperial County courthouse in the middle of the city of Brawley, surrounded by commercial buildings. Like other cities within Imperial County, Brawley is surrounded by agricultural lands to the east, north, and west. The Brawley station is the third northernmost station within the Imperial County monitoring network. This site records measurements for $PM_{2.5}$ and PM_{10}.

Westmorland - The Westmorland monitoring station was installed in 1994 and commenced measuring ozone in 1998. Located below sea level, its absolute location is latitude 33° 1' 57" and longitude 115° 37' 25". Its relative location is 570 Cook Street in Westmorland. The site is the second northernmost station within the Imperial County monitoring network. It lies west of the Brawley monitor, but southwest of the Niland monitor. Residential and agricultural areas lie within 10 meters and 400 meters of the site, respectively. The site originally monitored both O_3 and PM_{10} concentrations, but in November 2012, the station experienced an electrical fire and the O_3 monitor was placed out of commission.

Niland - The Niland monitoring station was installed in 1996 and commenced measuring ozone in 1997. Located below sea level, its absolute location is latitude 33° 12' 49" and longitude 115° 32' 43". Its relative location is 7711 English Road. It is adjacent to English Road, which is an unpaved and lightly travelled road (approximately 100 vehicles per day). The monitoring site is surrounded by agricultural land to the south, southwest, and southeast. A single residence exists to the west of the station, across English Road. The monitoring station is southeast of Riverside County and the Salton Sea and is the most northerly site within the Imperial County monitoring network. The site records measurements for O_3 and PM_{10}.

Imperial County Ozone Air Quality

According to 40 CFR Part 50, the primary and secondary 2008 8-hour ozone standard is met when a given three-year average of the annual fourth highest daily maximum 8-hour average ambient air ozone concentration is less than or equal to 0.075 parts per million (ppm). Simply put, ozone is measured hourly at each monitoring site. From the hourly measurements, 8-hour running averages are calculated for each hour of the day, at each monitoring site. From these values, the highest daily 8-hour average is identified for each day and monitoring site. ***Compliance with the standard is determined by taking the annual fourth highest daily maximum 8-hour ozone concentration and averaging it over three years for each site. This three-year average is referred to as the design value.*** When the design value is less than or equal to 0.075 ppm at each monitor within the area, then the area is meeting the NAAQS.

Figure 3 presents the annual design values for all four Imperial County ozone monitoring stations. As can be seen in the figure, after 2010 the design value measured at the Niland monitoring station (the station farthest from the United States-Mexico border) fell below the 2008 8-hour ozone standard. Alternatively, in recent years the design values at the Calexico and El Centro monitoring stations have remained above the standard.

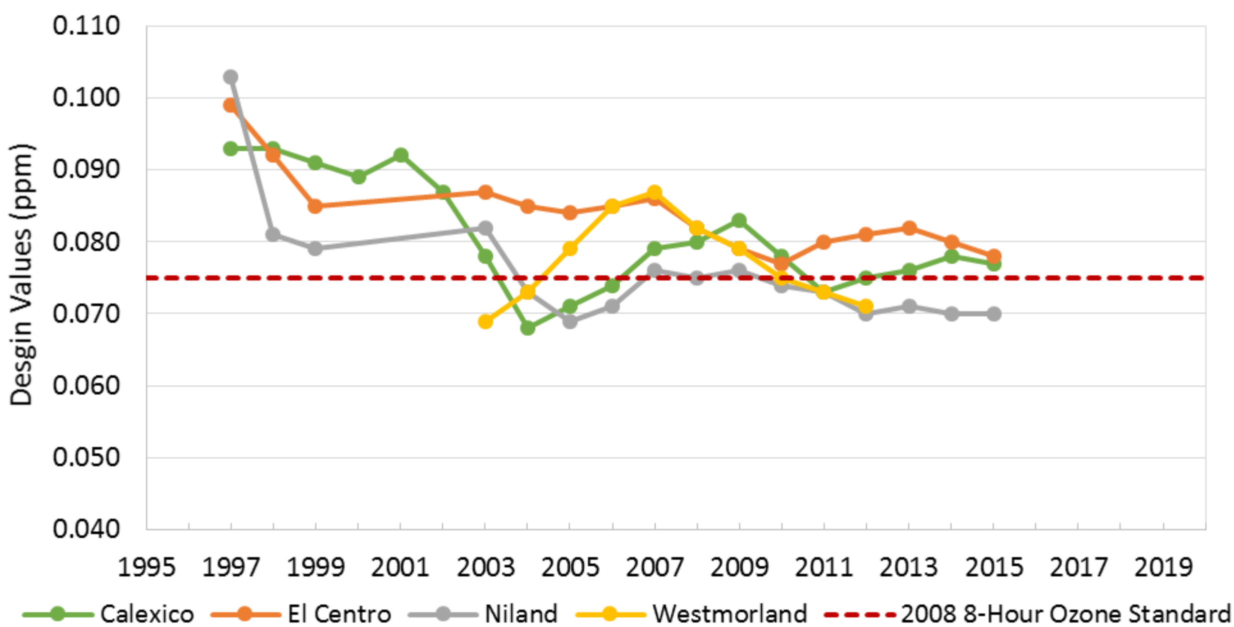


Figure 3. Design Value Trends, Imperial County Monitoring Sites, 1995 through 2020

Similar trends are observed among the Imperial County monitoring sites for the “exceedance days” and “mean of top 30” indicators, as presented in Figures 4 and 5, respectively.

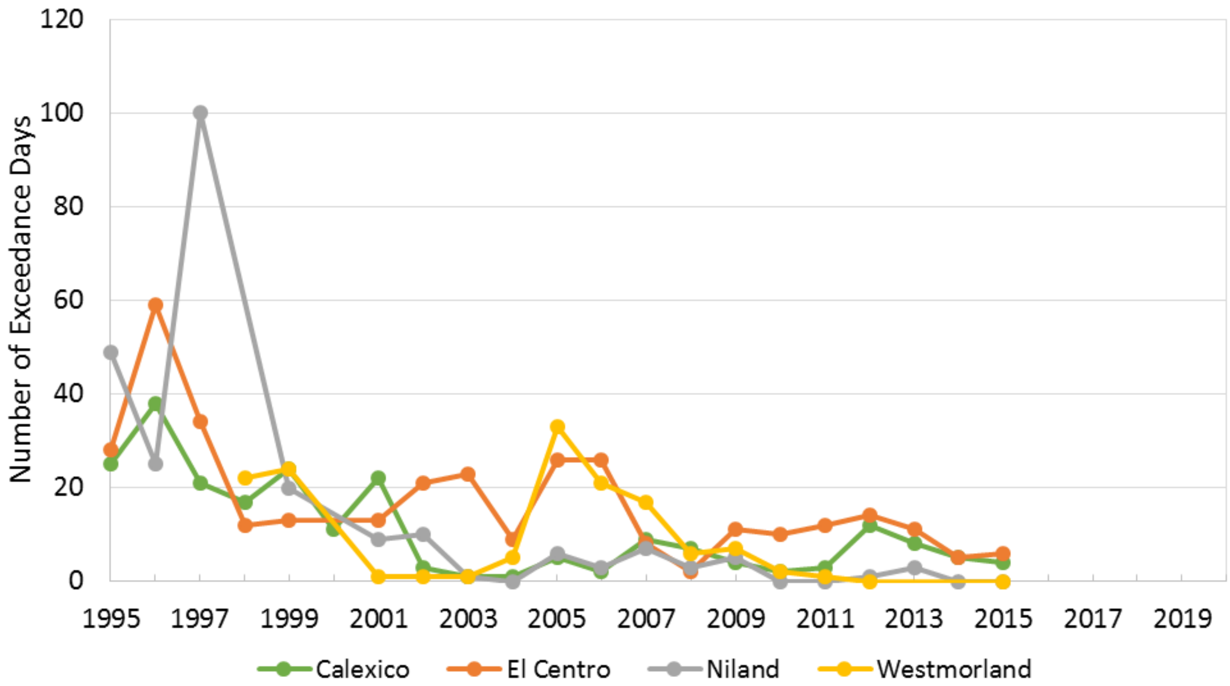


Figure 4. Exceedance Day Trends, Imperial County Monitoring Sites, 1995 through 2020

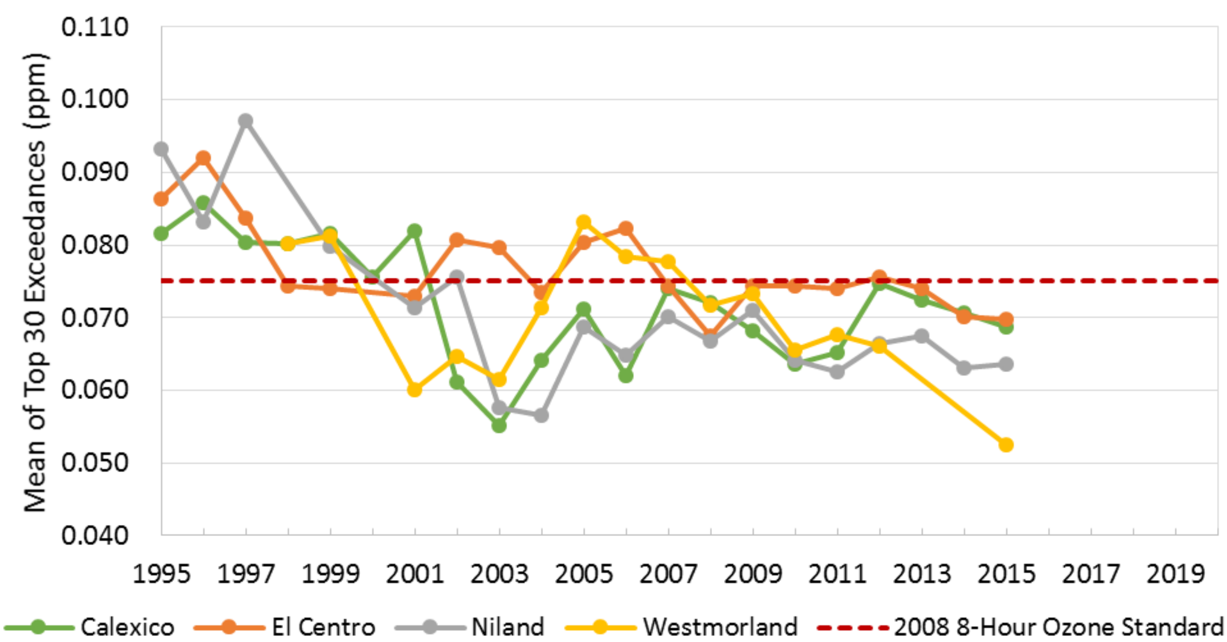
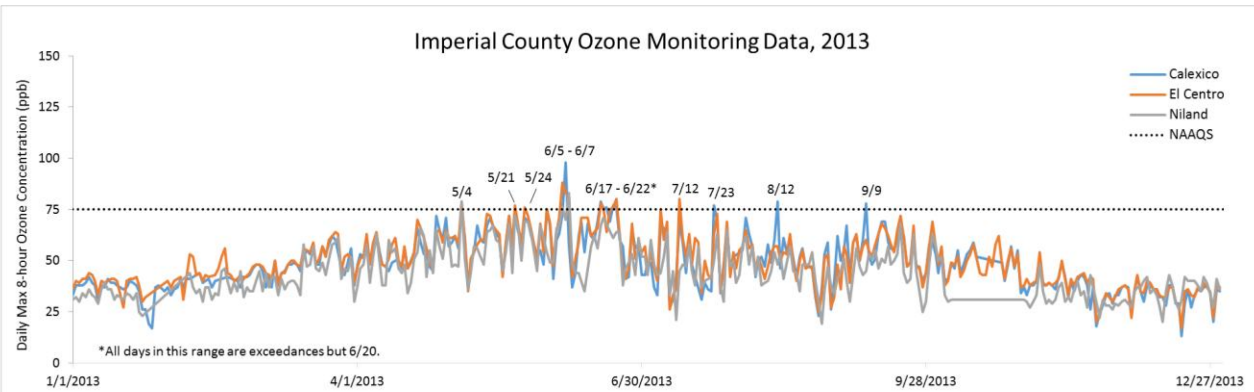


Figure 5. Mean of Top 30 Trends, Imperial County Monitoring Sites, 1995 through 2020

Figures 6 through 8 show the daily maximum 8-hour ozone concentration measurements at the Calexico, El Centro, and Niland monitoring stations in Imperial County during 2013, 2014, and 2015. The ozone concentrations at all three monitoring stations follow the same general pattern through the course of a year, with the highest concentrations generally occurring in the month of June. Exceedances of the 2008 8-hour ozone standard occur when the ozone concentration spikes at the El Centro and Calexico monitoring stations. These spikes also occur at the Niland station, however concentrations are low enough that an exceedance doesn't occur. The continued exceedances at the El Centro and Calexico monitoring stations are primarily driven by two main factors: 1) the wind conditions at the stations; and 2) the proximity of the stations to the international border.

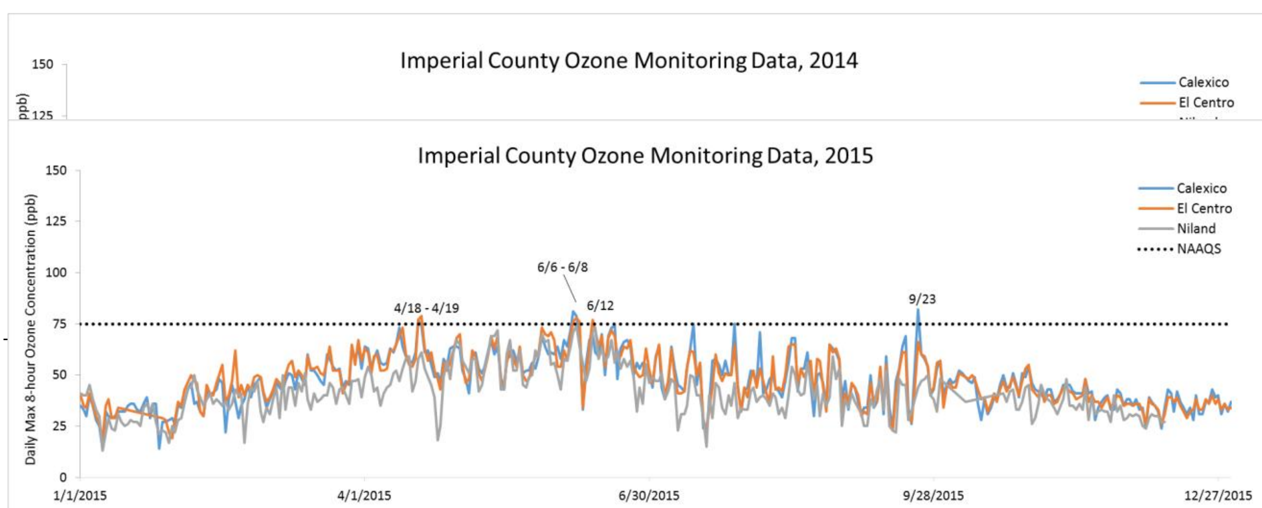
Figure 6. Daily Maximum 8-Hour Ozone Concentration for Imperial County Monitoring



Sites, 2013

Figure 7. Daily Maximum 8-Hour Ozone Concentration for Imperial County Monitoring Sites, 2014

Figure 8. Daily Maximum 8-Hour Ozone Concentration for Imperial County Monitoring Sites, 2015



Wind Speed and Direction

The wind in Imperial County follows two general patterns. Wind statistics indicate prevailing winds are from the west-northwest through southwest; a secondary flow maximum from the southeast is also evident. The prevailing winds from the west and northwest occur seasonally from fall through spring and are known to be from the Los Angeles area. Occasionally, Imperial County experiences periods of extremely high wind speeds. Wind speeds can exceed 31 miles per hour (mph) (13.9 meters per second [m/s]) and this occurs most frequently during the months of April and May. However, speeds of less than 6.8 mph (3 m/s) account for more than one-half of the observed wind measurements.

Wind speed and direction as measured at the Calexico and El Centro monitoring stations, the two stations that continue to violate the 2008 8-hour ozone standard, were analyzed using 2014 and 2015 data over four periods: 1) All hourly readings; 2) hourly readings during summer months (i.e., May through September); 3) hourly readings during days when the 8-hour ozone standard was exceeded; and 4) hourly readings during daylight hours (i.e., from 6AM to 6PM) during days when the 8-hour ozone standard was exceeded. Wind roses associated with these periods are shown in Figures 9a-12b.

Figure 9a. 2014-2015 Wind Rose for Calexico Station – All Days

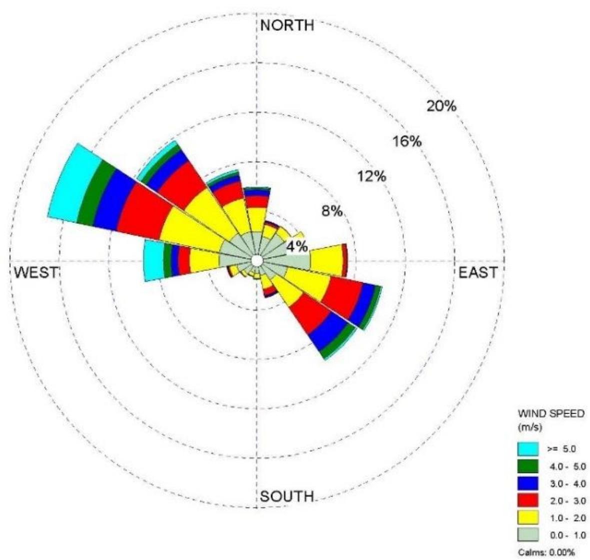


Figure 9b. 2014-2015 Wind Rose for El Centro Station – All Days

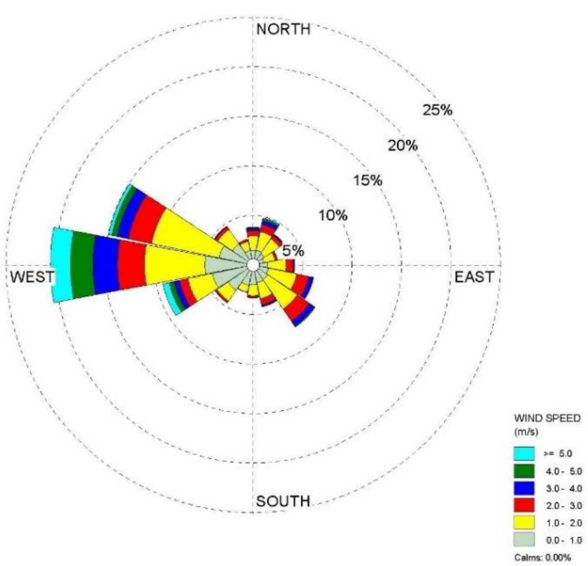


Figure 10a. 2014-2015 Wind Rose for Calexico Station – May-September Days

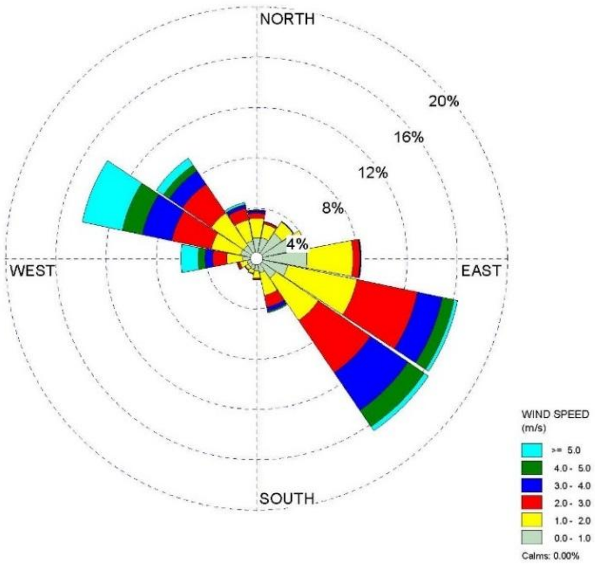


Figure 10b. 2014-2015 Wind Rose for El Centro Station – May-September Days

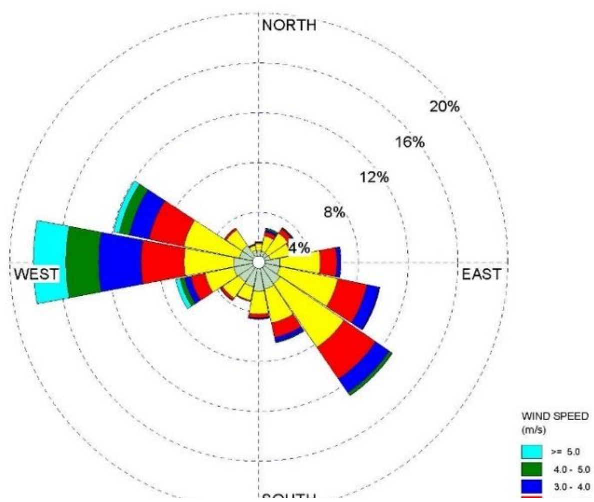
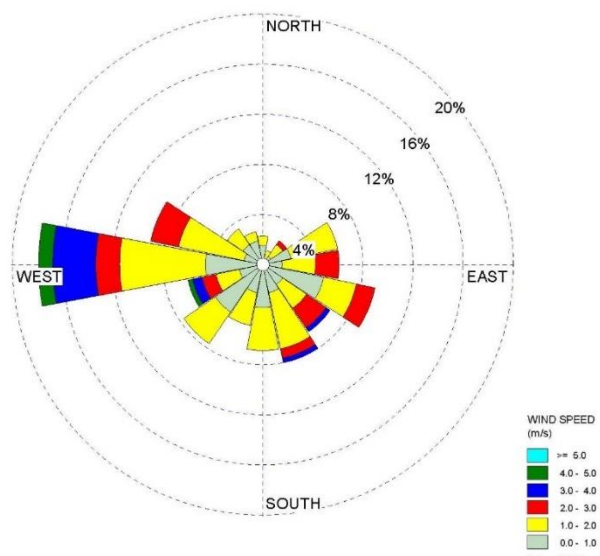
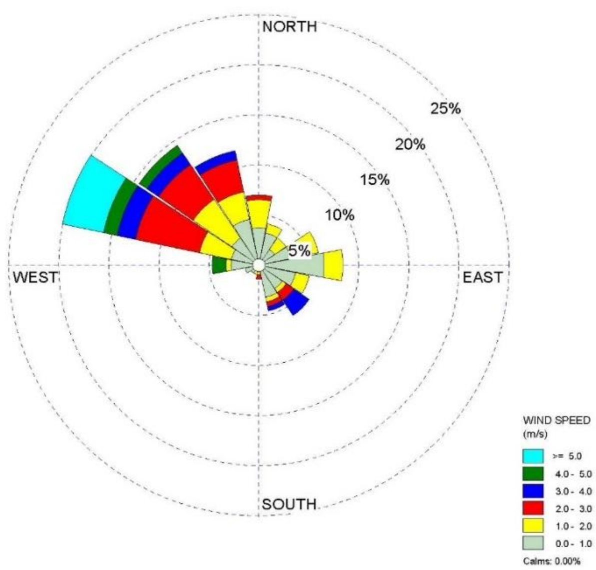


Figure 11a. 2014-2015 Wind Rose for Calexico Station – Exceedance Days

Figure 11b. 2014-2015 Wind Rose for





El Centro Station – Exceedance Days

Figure 12a. 2014-2015 Wind Rose for Calexico Station – Exceedance Days (6AM-6PM)

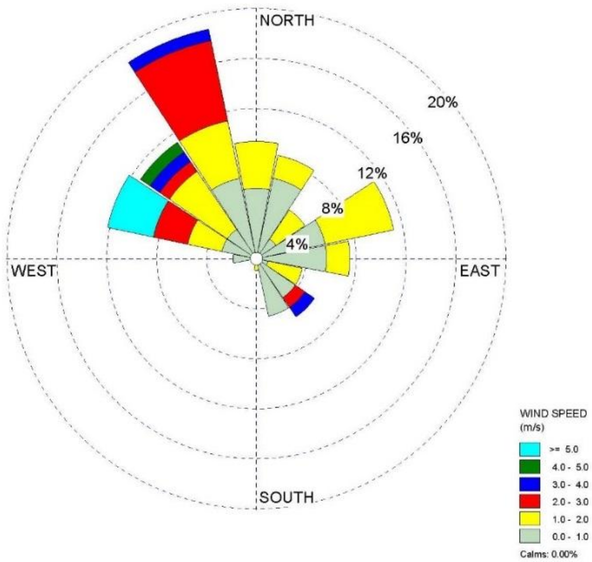
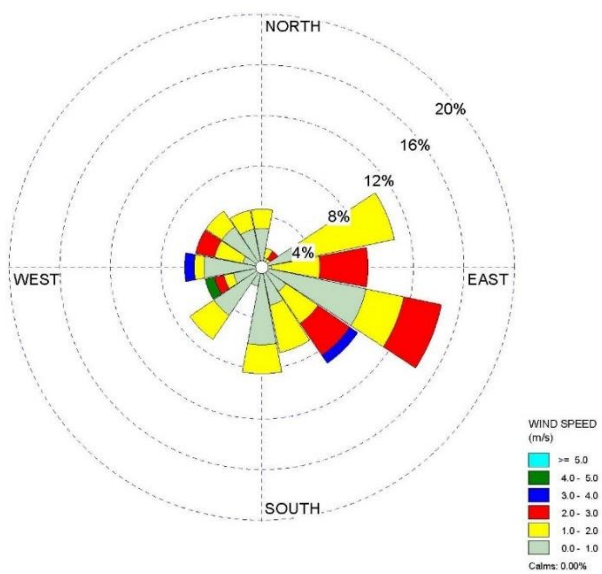


Figure 12b. 2014-2015 Wind Rose for El Centro Station – Exceedance Days (6AM-6PM)



The wind rose for all hourly readings at the Calexico station shows that on average the wind primarily blows from the northwest and southeast with the highest wind speeds coming from the northwest (see Figure 9a). This is consistent with the general wind characteristics for the County. During the summer, a greater percentage of wind blows from the southeast (see Figure 10a). Due to the proximity of the Calexico monitoring station to the international border, little to no wind is required for the transport of ozone and ozone precursors from the Mexicali metropolitan area to the monitor. This is confirmed in the wind roses for the days when the ozone standard was exceeded in 2014 and 2015, as a greater frequency of low wind speeds were observed, especially during daylight hours when ozone generation occurs (see Figures

11a and 12a). The directionality of the wind was also more varied, which is characteristic of low wind speeds and stagnant conditions.

Stagnant conditions lead to higher ozone concentrations as they allow the concentration of ozone precursors to build and photochemically react rather than be dispersed. As shown in Figure 13, nearly 50 percent of wind speeds measured between 6AM and 6PM were less than one m/s on days when the 8-hour ozone standard was exceeded in 2014 and 2015. Additionally, hourly monitoring data recorded at the Calexico station suggests a correlation between wind speed and ambient ozone concentration (see Figure 14). Here one can see that the highest hourly ozone concentrations only occur when the wind speed is less than 1.5 m/s and the vast majority of the higher readings occur on exceedance days. This indicates that slower winds, which produce a more stagnant environment, are associated with exceedances of the 2008 8-hour ozone standard at the Calexico station.

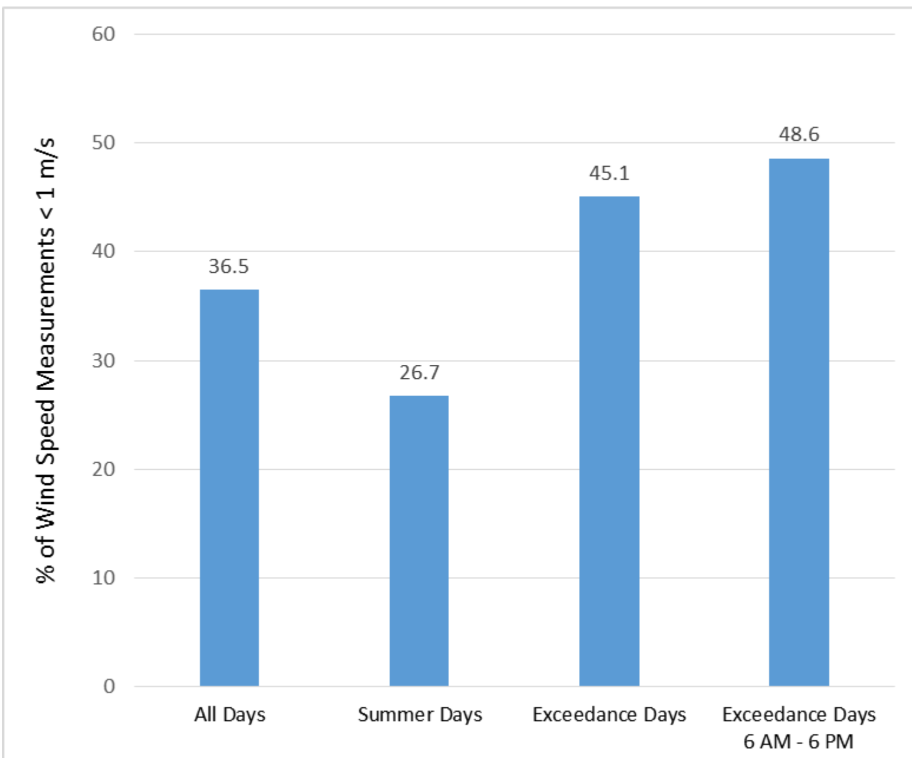
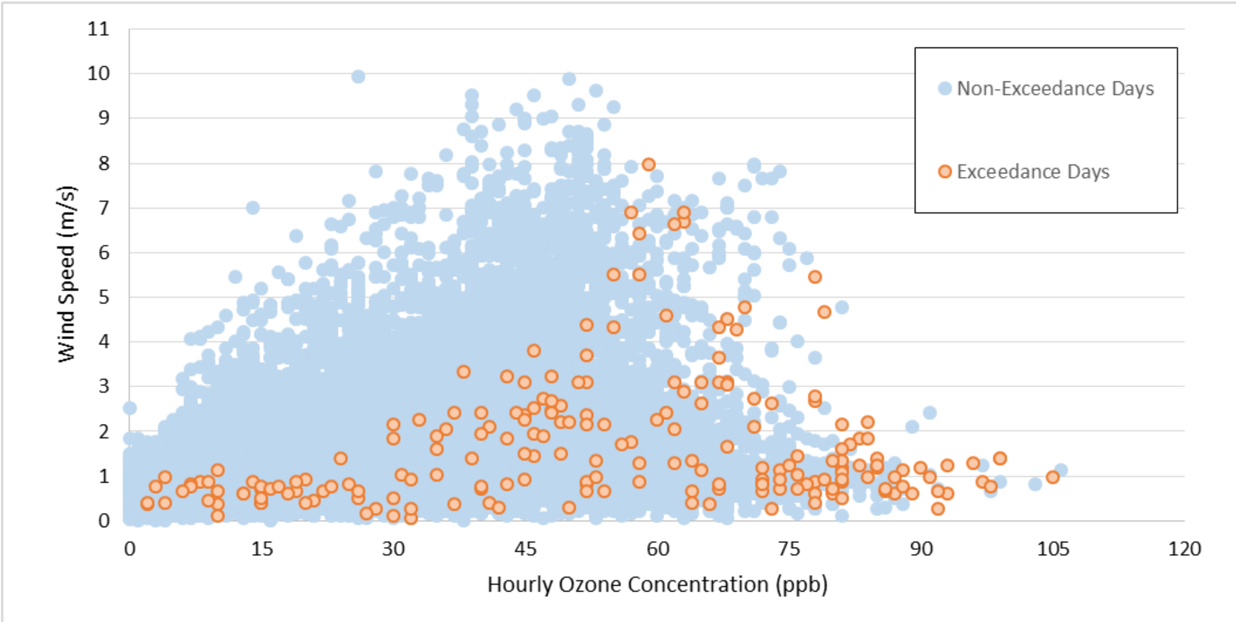


Figure 13. Percentage of Low Wind Speeds, Calexico Monitoring Station, 2014-2015

Figure 14. Hourly Wind Speed Versus Hourly Ozone Concentration,



Calexico Monitoring Station, 2014-2015

The wind analysis at the El Centro monitoring station shows that El Centro frequently experiences strong winds from the west throughout the year (see Figure 9b). However, during the summer months, there is a higher frequency of wind blowing from the southeast from the direction of Mexicali (see Figure 10b). On days when the ozone standard was exceeded in 2014 and 2015, the strong westerly wind appeared to die down, especially during daylight hours (see Figures 11b and 12b). This wind pattern allowed for the slower winds from the south to transport ozone and ozone precursors from the Mexicali metropolitan area to the El Centro monitoring station. The pollution rose for El Centro further indicates that the highest ozone concentrations were measured from the winds blowing from the southeast (Figure 15).

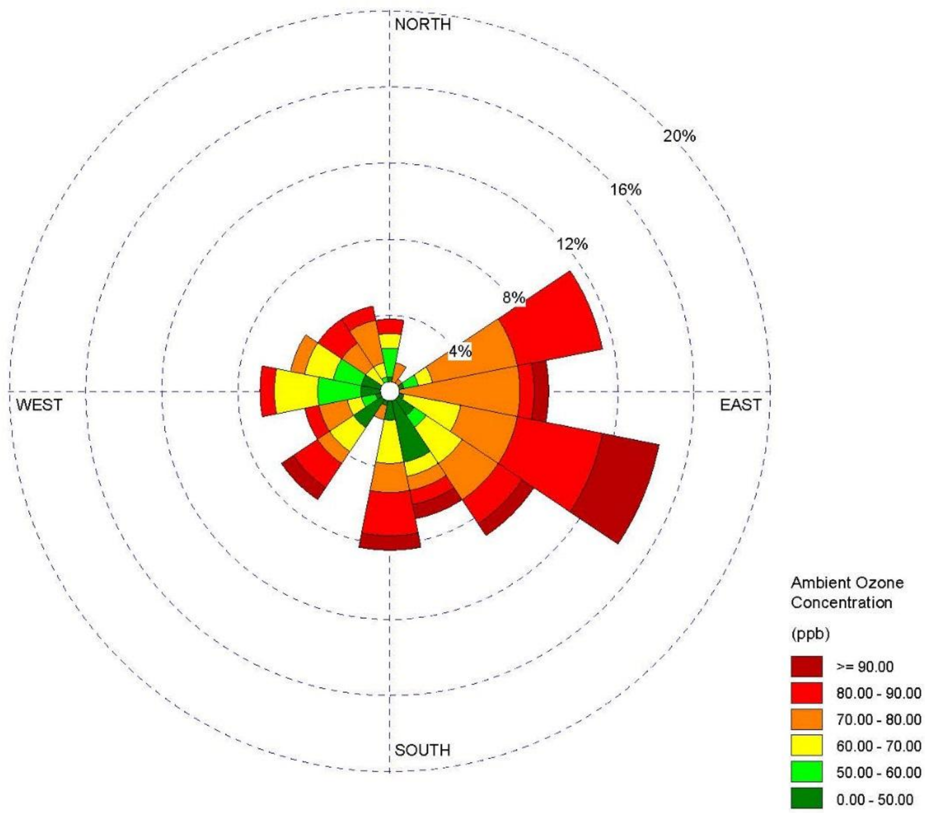


Figure 15. 2014-2015 Pollution Rose for El Centro Station – Exceedance Days (6AM-6PM)

III. Emission Inventories

The USEPA's Section 179B guidance specifies that inventorying the sources and emissions on both sides of the border and comparing the magnitude of those emissions is one way to evaluate the effect of emissions from outside the United States on a nonattainment area. Since ozone is not directly emitted, this emissions analysis focuses on ozone precursors, NO_x and ROG. Table 1 summarizes the 2012 and 2017 IFNA anthropogenic emissions used in the attainment demonstration modeling, as well as the Mexicali metropolitan area emissions for the same years. 2017 was chosen as the future year, as the IFNA is required to demonstrate attainment of the 2008 8-hour ozone standard in the first full ozone season prior to the July 2018 attainment date (i.e., the 2017 ozone season). 2017 emissions are estimated based on growth factors, regulatory measures, and the 2012 baseline emissions. Overall, anthropogenic NO_x in Imperial County are projected to decrease by 17 percent from 21.8 tons per day (tpd) in 2012 to 18.0 tpd in 2017. Over the same time period, NO_x emissions in the Mexicali metropolitan area are expected to rise to 97.8 tpd (a 15 percent increase).

Anthropogenic ROG emissions in Imperial County are also projected to decrease between 2012 and 2017 to 16.9 tpd (a 12 percent decrease), while ROG emissions in the Mexicali metropolitan area are expected to rise to 65.8 tpd in 2017 (a 12 percent increase).

Table 1. Imperial County Summer Planning Emissions and the Mexicali Metropolitan Area Emissions for 2012 and 2017 (tons/day)[1,2]

Source Category	NOx [tpd]				ROG [tpd]			
	Imperial		Mexicali		Imperial		Mexicali	
	2012	2017	2012	2017	2012	2017	2012	2017
Stationary	1.7	1.5	15.3	24.8	1.3	1.4	14.2	17.4
Area	0.7	0.6	10.0	10.6	8.5	7.7	27.0	30.0
On-Road Mobile	10.0	6.5	55.7	58.2	4.3	3.1	17.4	18.0
Other Mobile	9.4	9.4	3.8	4.2	5.1	4.6	0.4	0.5
Total	**21.8**	**18.0**	**84.8**	**97.8**	**19.2**	**16.9**	**59.0**	**65.8**

Notes:

[1] Mexicali emissions were based on the USEPA 2011 Version 6.3 Platform inventory.

[2] Imperial County inventory totals do not include ERC balances.

In addition to the difference in regulations between Imperial County and Mexicali (where Imperial County's regulations are generally more stringent), the difference in emissions between Imperial County and Mexicali can be directly attributed to the difference in population of the two areas (see Figure 16). This difference results in ozone precursor emissions being 3.8 to 5.4 times higher for NO_X and 3.1 to 3.9 times higher for ROG in the Mexicali metropolitan area as compared to all of Imperial County. Due to the proximity of Mexicali to the international border, the ambient air quality in the southern portion of Imperial County would be heavily influenced by emission sources from the Mexicali metropolitan area. This is further demonstrated through photochemical modeling.

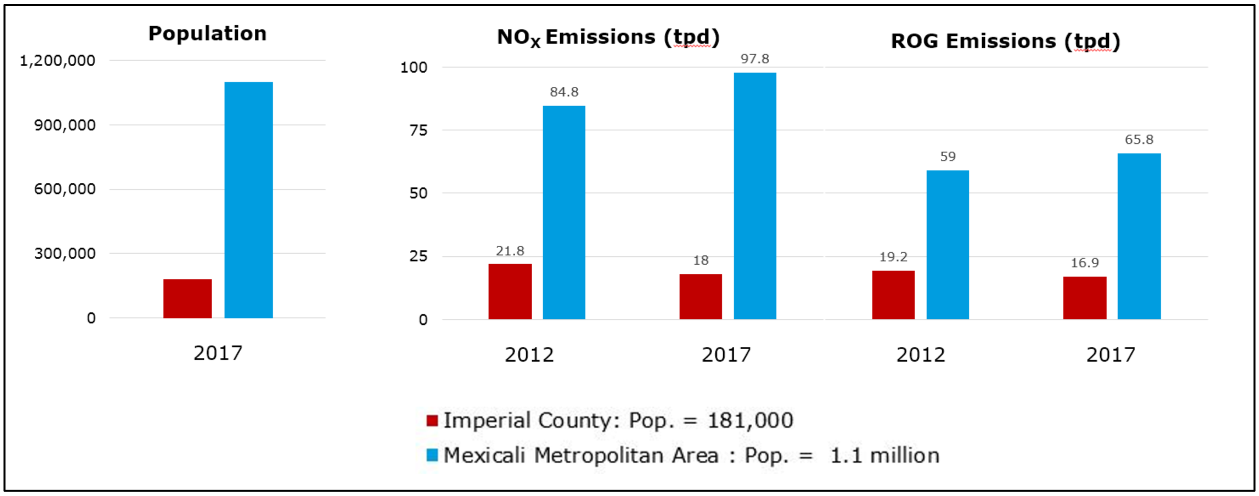


Figure 16. Correlation between Population and Ozone Precursor Emissions

IV. Photochemical Modeling

The USEPA's Section 179B guidance also identifies air dispersion and/or receptor modeling as a way to evaluate the relative impacts on the nonattainment area of sources located within the United States verses international sources. Photochemical modeling was used in this SIP to estimate the future year 2017 ozone design values (DVs) at each monitoring site in the IFNA in order to show attainment of the standard by the 2017 ozone season. Additional future year sensitivity modeling was conducted to assess the contribution that emissions from Mexico have on future year DVs in the IFNA, and whether the region would attain the ozone standard in the absence of Mexico emissions. The findings of the IFNA'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 Attainment Demonstration Appendix (Appendix F) and Modeling Protocol Appendix (Appendix G).

The current modeling platform draws on the products of large-scale scientific studies, collaboration among technical staff from state, local, and federal regulatory agencies (see Appendix G for further details). In this modeling work, the Weather Research and Forecasting (WRF) numerical model version 3.6 was utilized to generate meteorological fields, while the Community Multiscale Air Quality (CMAQ) Model version 5.0.2 was used for modeling ozone in the IFNA. Other relevant information, including the modeling domain definition, chemical mechanism, initial and boundary conditions, and emissions preparation can be found in Appendix G and Modeling Emissions Inventory Appendix (Appendix H).

Based on USEPA modeling guidance,[6] modeling was used in a relative sense to project observed DVs to the future. The year 2012 was chosen as the starting point for the modeling and reference (or baseline) DV calculation based on analysis regarding the conduciveness of recent years' meteorological conditions to enhanced ozone formation and the availability of the most detailed emissions inventory. These reference DVs serve as the anchor point for estimating future year projected design values. An additional future year sensitivity simulation was conducted to assess the impact of Mexico emissions on 2017 DVs in the IFNA.

In order to use the modeling in a relative sense, three sets of simulations were conducted: 1) base year simulation for 2012, which was used to verify that the model reasonably reproduced the observed air quality; 2) reference year simulation for 2012, which was the same as the base year simulation, but excluded exceptional event emissions such as wildfires; 3) future year simulations for 2017 (with and without Mexico emissions), which were the same as the reference year simulation, except that projected anthropogenic emissions for 2017 were used in lieu of the 2012 emissions. Emissions used in the modeling are shown in Table 1.

Consistent with USEPA 179B guidance, the future year DVs were estimated with and without Mexico emissions in order to evaluate the impact of Mexicali emissions on Imperial County air quality. Table 2 shows that two of the three ozone monitoring sites in the IFNA were projected to attain the 8-hour ozone standard of 0.075 ppm or 75 parts per billion (ppb) by 2017 as a result of local Imperial County emission controls alone. However, the El Centro monitor was still

6 USEPA. 2014. Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5 and Regional Haze. Available at: https://www.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf. Accessed: March 2017.

projected to exceed the standard with a future DV of 79 ppb. To assess the impact of Mexico emissions on the 2017 DVs in Imperial County, a second future year simulation was conducted per USEPA guidance, which excluded emissions from Mexico. When Mexico emissions were excluded, future year DVs dropped significantly at all Imperial County monitors, resulting in projected attainment of the ozone standard at all three monitors. The largest decrease in DV occurred at the Calexico monitor, located adjacent to the United States-Mexico border, which was projected to exhibit a decrease of 13 ppb in the DV, from 75 ppb to 62 ppb. The next closest monitor to the United States-Mexico border, El Centro, was projected to have an 11 ppb drop in the DV from 79 ppb down to 68 ppb. The Niland monitor, which is located next to the Salton Sea and furthest from the United States-Mexico border (more than 35 miles away), was projected to have a decrease in DV of only 3 ppb, from 67 ppb to 64 ppb. These results are consistent with previous work by Wang et al. (2009) that suggests the contribution of Mexico emissions to peak summertime 8-hour ozone in Imperial County is on the order of 10 ppb or greater.[7] These results also indicate that foreign emissions from Mexico have a significant impact on the ambient air quality in the IFNA, up to 13 ppb.

Table 2. Baseline Design Value, Modeled RRF, and Projected Future Year (2017 with and without Mexico Emissions) Design Value for Sites in the IFNA

Site	Base Year 2012	Future Year 2017		Future Year 2017 without Mexico Emission Inventory	
	Average DV (ppb)	Relative Response Factor	Average DV (ppb)	Relative Response Factor	Average DV (ppb)
Niland	70.3	0.9578	67	0.9238	64
El Centro	81.0	0.9749	79	0.8405	68
Calexico	76.3	0.9834	75	0.8231	62

It's important to note that the above conclusions would not change with the implementation of additional reasonable controls had they been determined feasible to implement prior to the attainment date. In the control measure analysis, ICAPCD identified certain additional reasonable measures (e.g., new rules to limit NOx emissions from boilers, steam generators, and process heaters rated 0.075 to 5 million British thermal units per hour [MMBTU/hr] as well as from new and replacement residential water heaters rated less than 0.075 MMBTU/hr), that, over time, would achieve reductions in NOx emissions equivalent to approximately 0.27 tpd. The rules were not proposed under this SIP as the timeframe between final reclassification of the area on June 3, 2016 and the modeled attainment year, 2017, was too short to achieve even partial implementation of the rules prior to the attainment year.[8] However, one can use the results from the sensitivity analysis performed for the photochemical modeling to understand the potential impact of similar reductions on the future year DV at the El Centro monitoring station, which would require a 4 ppb reduction to come into attainment. As discussed previously, the

7 Wang, H., Jacob, D.J., Le Sager, P., Streets, D. G., Park, R. J., Gilliland, A. B., and van Donkelaar, A. (2009). Surface ozone background in the United States: Canadian and Mexican pollution influences. *Atmospheric Environment*, 43, 1310-1319.

8 ICAPCD is proposing to adopt these rules in conjunction with the 2017 $PM_{2.5}$ SIP.

complete removal of the Mexican emission inventory[9] from the photochemical modeling domain reduces the future year DV at the Calexico station (the closest station to the Mexican emission sources) by 13 ppb. A simplified analysis based on a linear relationship between the Mexican emission inventory and the modeled reduction in the future year DV, one could say that a 1.0 tpd reduction in NOx emissions or ROG emissions would at most decrease the future year DV by 0.2 ppb.[10] While this is a simplified way to view the relationship between emissions and the future year DV, the projected shortfall between the estimated decrease in the DV and the required decrease in DV is enough to make a definitive conclusion that the implementation of additional reasonable controls, had it been feasible to implement them by the attainment year, would not bring the area into attainment due to the impact of emissions emanating from Mexicali.

A similar analysis can be used to determine whether the inclusion of the Imperial County Emission Reduction Credit (ERC) balances in the modeling inventory would have changed the conclusions of the photochemical modeling. As shown in Table 4-10 in the main text of the SIP, the estimated ERC balances in 2017 were 0.03 tpd and 0.56 tpd for ROG and NOx, respectively. Similar to the discussion above, these emissions are orders of magnitude too small to have affected the “but for” attainment in 2017.

[9] 97.8 tpd NOx; 65.8 tpd ROG

[10] Even if the area were to be considered NOx limited, this value was conservatively calculated by taking the ratio of 1.0 tpd to 65.8 tpd ROG (the estimated 2017 ROG emissions for the Mexicali metropolitan area) and multiplying this value by 13 ppb. Using the NOx emissions estimate of 97.8 tpd NOx for this calculation would result in an even smaller value.

V. Conclusion

The proximity of the IFNA to the Mexicali metropolitan area and the common air shed allow for mixing of emissions between the two entities. Historical measurements of ambient air quality show that peak daily 8-hour ozone concentrations are greater near the United States-Mexico border. This is further supported by the emissions inventories along the border region, which show that ozone precursor emissions are 3 to 5 times greater in the Mexicali metropolitan area than in all of Imperial County. Modeling results achieved and explained in the attainment demonstration for this SIP demonstrate that Imperial County has attained the 2008 ozone NAAQS when emissions sources originating in Mexico are excluded.

Therefore, but for emissions emanating from Mexico, the control measures discussed in the SIP are adequate to attain the 2008 ozone standard and maintain this status through the July 20, 2018 attainment date. While ICAPCD's analysis of existing and potential control measures identified additional reasonable controls that could result in a small improvement in air quality, those measures could not be adopted and implemented in the time between final reclassification and the attainment year. This documentation provides evidence for approval of the 2017 Imperial County SIP for the 2008 8-hour Ozone Standard under Section 179B of the Clean Air Act.

Table A-4. Ozone Precursor Emissions by Major Source Category in Imperial County, 2017

Source Category	ROG (tons/day)	% Total	NO_X (tons/day)	% Total
Stationary Sources				
Fuel Combustion	0.09	0.55%	1.44	7.98%
Electric Utilities	*0.04*	*0.24%*	*0.39*	*2.17%*
Cogeneration	*0.00*	*0.00%*	*0.04*	*0.22%*
Manufacturing and Industrial	*0.03*	*0.16%*	*0.56*	*3.10%*
Food and Agricultural Processing	*0.01*	*0.05%*	*0.14*	*0.78%*
Service and Commercial	*0.01*	*0.07%*	*0.31*	*1.70%*
Other (Fuel Combustion)	*0.00*	*0.03%*	*0.00*	*0.01%*
Waste Disposal	0.00	0.00%	0.00	0.00%
Other (Waste Disposal)	*0.00*	*0.00%*	*0.00*	*0.00%*
Cleaning and Surface Coatings	0.59	3.51%	0.00	0.00%
Laundering	*0.01*	*0.06%*	*0.00*	*0.00%*
Degreasing	*0.30*	*1.76%*	*0.00*	*0.00%*
Coatings and Related Process Solvents	*0.20*	*1.16%*	*0.00*	*0.00%*
Adhesives and Sealants	*0.09*	*0.53%*	*0.00*	*0.00%*
Petroleum Production and Marketing	0.66	3.94%	0.00	0.00%
Petroleum Refining	*0.00*	*0.01%*	*0.00*	*0.00%*
Petroleum Marketing	*0.66*	*3.92%*	*0.00*	*0.00%*
Other (Petroleum Production and Marketing)	*0.00*	*0.01%*	*0.00*	*0.00%*
Industrial Processes	0.01	0.04%	0.08	0.44%
Food and Agriculture	*0.00*	*0.00%*	*0.02*	*0.10%*
Mineral Processes	*0.01*	*0.03%*	*0.04*	*0.23%*
Other (Industrial Processes)	*0.00*	*0.00%*	*0.02*	*0.11%*
Total Stationary Sources	**1.36**	**8.04%**	**1.52**	**8.42%**
Areawide Sources				
Solvent Evaporation	4.07	24.17%	0.00	0.00%
Consumer Products	*1.14*	*6.74%*	*0.00*	*0.00%*
Architectural Coatings and Related Process Solvents	*0.55*	*3.29%*	*0.00*	*0.00%*
Pesticides/Fertilizers	*2.21*	*13.12%*	*0.00*	*0.00%*
Asphalt Paving/Roofing	*0.17*	*1.03%*	*0.00*	*0.00%*
Miscellaneous Processes	3.66	21.69%	0.59	3.28%
Residential Fuel Combustion	*0.01*	*0.05%*	*0.06*	*0.31%*
Farming Operations	*2.53*	*15.00%*	*0.00*	*0.00%*
Fires	*0.00*	*0.01%*	*0.00*	*0.00%*
Managed Burning and Disposal	*1.10*	*6.55%*	*0.54*	*2.97%*
Cooking	*0.01*	*0.08%*	*0.00*	*0.00%*
Total Areawide Sources	**7.73**	**45.86%**	**0.59**	**3.28%**
Mobile Sources				
On-Road Vehicles	3.13	18.60%	6.52	36.17%
Off-Road Vehicles	4.63	27.50%	9.40	52.13%
Total Mobile Sources	**7.77**	**46.10%**	**15.93**	**88.29%**
Total for Imperial County	**16.85**	**100.00%**	**18.04**	**100.00%**

Note:
Emissions for Imperial County were queried from the California Emissions Projection Analysis Model (CEPAM), Version 1.04.
Totals may not add up due to rounding.