



**California 2020 Milestone Compliance  
Demonstration for the 75 Parts per Billion  
National Ambient Air Quality Standard for  
Ozone**

March 30, 2021

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Appendix A: CARB Statewide Ozone SIP Emission Inventory 2019 CEPAM v1.02

## Background

California Air Resources Board (CARB or Board) staff prepared this 2020 Milestone Compliance Demonstration (MCD) to address state implementation plan (SIP) requirements of the federal Clean Air Act (Act) for nine nonattainment areas within the State that are classified as Serious or higher for the 75 ppb 8-hour ozone national ambient air quality standard (standard). These areas are required under section 182(g) of the Act to determine and demonstrate that the 2020 milestone has been met, by showing that emission reductions in the 2020 milestone year are sufficient to meet Reasonable Further Progress (RFP) requirements. The nonattainment areas (NAAs) included in this demonstration include:

- Coachella Valley
- Eastern Kern County
- Sacramento Metro
- San Diego County
- San Joaquin Valley
- South Coast Air Basin
- Ventura County
- Western Mojave Desert
- Western Nevada County

The Act requires that nonattainment areas classified as Moderate or above demonstrate RFP towards attainment through emission reductions phased in from the baseline year until the attainment date. RFP is defined in section 171(1) of the Act as "...such annual incremental reductions in emissions of the relevant air pollutant as are required...for the purpose of ensuring attainment of the applicable national ambient air quality standard by the applicable date." This requirement to demonstrate steady progress in emission reductions between the baseline year and attainment date ensures that areas will not delay implementation of control programs until immediately before the attainment deadline.

Act requirements for ozone RFP are described in sections 172(c)(2), 182(b)(1), and 182(c)(2)(B). Section 172(c)(2) of the Act requires that nonattainment area plans show ongoing annual incremental emissions reductions toward attainment, which is commonly expressed in terms of benchmark emissions levels or air quality targets to be achieved by certain interim milestone years. Section 182(b)(1) of the Act establishes a required percentage of emissions reductions required over the first 6 years of the planning period for nonattainment areas classified as Moderate or above. For ozone nonattainment areas classified as Serious or higher, section 182(c)(2)(B) of the Act requires reductions averaged over each consecutive 3-year period, beginning 6 years after the baseline year until the attainment date, of at least 3 percent of baseline emissions per year.

Section 182(g) of the Act describes requirements for milestones and MCDs. More specifically, section 182(g)(1) of the Act requires demonstrations of whether nonattainment areas classified Serious, Severe or Extreme have achieved the incremental RFP emission

reductions needed by the prescribed applicable time intervals. Further, section 182(g)(2) of the Act requires that states submit to the U.S. Environmental Protection Agency (U.S. EPA) a demonstration that an RFP milestone has been met, not later than 90 days after the applicable milestone date.

In 2016 and 2017, CARB submitted to U.S. EPA SIP revisions to address all applicable requirements under the 75 ppb 8-hour ozone standard for the various NAAs in the State. These revisions followed all applicable U.S. EPA guidance available at the time and included RFP demonstrations with a baseline year of 2012 for most areas classified as Moderate or above. Although the 2012 baseline year was allowed by the March 2015 Implementation Rule for the 75 ppb 8-hour ozone standard (80 FR 12264), courts determined in the February 2018 *South Coast Air Quality Management District v. U.S. Environmental Protection Agency* decision (*South Coast decision*) that the appropriate baseline year for RFP for the 75 ppb 8-hour ozone standard was 2011.<sup>1</sup> Following updated direction from U.S. EPA in response to the *South Coast decision*, CARB submitted revised RFP demonstrations for all applicable NAAs using a 2011 baseline year; in most cases, these were submitted as a part of the *2018 Updates to the California State Implementation Plan* (2018 SIP Update). Technical clarifications related to RFP demonstrations and other SIP elements were subsequently provided by CARB to U.S. EPA as needed.

For the 75 ppb 8-hour ozone standard, 2020 is a milestone year in the submitted RFP demonstrations. Serious and above NAAs must demonstrate they have met the required 27 percent reduction in precursor emissions, namely reactive organic gases (ROG) and oxides of nitrogen (NOx), compared with 2011 RFP baseline year emissions.

Emissions reductions are achieved in California through a collaborative effort to control emissions by U.S. EPA, CARB and local air districts. The difference between baseline year emissions in 2011 and subsequent years' emissions is a result of previously-adopted and new rules and regulations that were implemented between 2011 and 2020 by CARB and the air districts. The local air districts have principal authority to regulate stationary and areawide sources of emissions, while CARB has primary authority over mobile sources and fuels, as well as consumer products.

The mobile source control program in California is the most stringent in the nation due to the severity of California's air quality challenges, the need for ongoing emission reductions, and the unique authority allowed by the Act. Since 2011, the primary driver of emission reductions of ROG and NOx in most areas of California has been CARB's mobile source control program. More specifically, the *On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation* (Truck and Bus Regulation) and *In-Use Off-Road Diesel-Fueled Fleets Regulation* (Off-Road Regulation) have been two programs that have played major roles in reducing mobile source emissions. The Truck and Bus Regulation has phase-in requirements applicable to an increasingly larger percentage of the heavy-duty truck and bus fleet over time such

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<sup>1</sup> *South Coast Air Quality Management District v. U.S. Environmental Protection Agency*, (D.C. Cir. 2018)

that, by 2023, nearly all pre-2010 vehicles must be upgraded to have exhaust emissions meeting 2010 model year engine emissions levels. The Off-Road Regulation was adopted to reduce fine particulate matter and NO<sub>x</sub> emissions from in-use off-road, heavy-duty diesel vehicles in California used in such applications as construction, mining, and industrial operations, and requires 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 Implementation Rule for the 75 ppb 8-hour ozone standard interpreted requirements of the Act for the 75 ppb 8-hour ozone standard, but did not address the requirements for MCDs. The December 2018 U.S. EPA Implementation Rule for the more recent 2015 70 ppb 8-hour ozone standard (83 FR 62998) interpreted requirements for this subsequent standard, and for the first time, provided detail on the way in which U.S. EPA interpreted requirements for MCDs. While not explicitly called for in the implementation rule for the 75 ppb 8-hour ozone standard, U.S. EPA staff has conveyed to CARB staff that the requirement must also be met for the applicable areas under the 75 ppb 8-hour ozone standard, in addition to the 70 ppb 8-hour ozone standard.

This report fulfills these requirements by demonstrating that the nine nonattainment areas discussed above have met their milestones for the 2020 milestone year, and have verified that the emissions reductions needed to demonstrate RFP for 2020 have been achieved.

## RFP Requirements for 2020 Milestone Year

### Emission Inventory

A central element of the RFP demonstration and MCD is showing required emission reductions. Sections 172(c)(3), 182(a)(1), and 182(a)(3) of the Act require nonattainment areas to submit an emission inventory for the baseline year and every 3-year period thereafter until the attainment date. CARB's planning emission inventory is divided into 3 major categories: stationary, area-wide, and mobile sources. The summer season inventory is used for ozone planning because it reflects the activity levels and conditions present when higher ozone levels occur in California nonattainment areas.

The baseline year for the submitted RFP demonstrations for the 75 ppb 8-hour ozone standard is 2011, following U.S. EPA direction in response to the *South Coast* decision, which determined that the appropriate baseline year for RFP for the 75 ppb 8-hour ozone standard is 2011. Emissions in the baseline year of 2011 incorporate emission reductions from CARB, U.S. EPA, and District control measures that had entered their implementation phase in 2011 or earlier years.

The Act requires that the emissions inventory for ozone contain emissions data for the two precursors to ozone formation: NO<sub>x</sub> and volatile organic compounds (VOC). The inventory used in this document substitutes VOC with ROG, which, in general, represent a slightly broader group of compounds than those in U.S. EPA's list of VOCs.<sup>2</sup> The NO<sub>x</sub> and ROG emissions for the baseline year of 2011 and milestone year of 2020 used to demonstrate compliance with the 2020 RFP milestone are shown in **Table 1** below. The 2011 emissions reflect the emissions inventory values included in the SIP-approved RFP demonstrations for each nonattainment area; for certain areas where U.S. EPA has not yet proposed or finalized action to approve an RFP demonstration, 2011 emissions reflect the inventory values included in the final version of the submitted RFP demonstration. For most areas, the final version of the 75 ppb 8-hour ozone RFP demonstration used CARB's 2016 California Emission Projection Analysis Model (CEPAM) version 1.05 emissions inventory, as was included in CARB's 2018 SIP Update.

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<sup>2</sup> Section 182(a)(1) of the Act. <https://www.govinfo.gov/content/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapl-partD-subpart2-sec7511a.htm>

**Table 1: 2011 Baseline Year and 2020 Emissions Inventories**

*All emissions shown in tons per day (tpd)*

Nonattainment Area	ROG Emissions (tpd)		NOx Emissions (tpd)	
	2011	2020	2011	2020
Coachella Valley	16.9	15.1	29.8	17.5
Eastern Kern County	8.6	7.6	31.0	23.9
Sacramento Metro	111.6	94.9	107.7	58.6
San Diego County	136.6	111.1	110.7	66.8
San Joaquin Valley	378.7	312.3	375.6	199.6
South Coast Air Basin	522.0	401.4	534.3	287.7
Ventura County	38.1	30.6	26.0	15.4
Western Mojave Desert	48.7	38.1	98.4	59.9
Western Nevada County	5.5	5.3	5.7	2.7

In order to demonstrate compliance with the 2020 RFP milestone, the 2020 values are from CARB’s latest emissions inventory, 2019 CEPAM version 1.02 and reflect staff’s latest updates to the emissions inventory.<sup>3</sup> 2019 CEPAM uses a base year of 2017 and is consistent with the most recent triennial National Emissions Inventory (NEI) submittal by CARB to U.S. EPA, as well as the inventory included in the *70 ppb Ozone SIP Submittal* which fulfilled requirements of the Act under the 70 ppb 8-hour ozone standard for a base year emissions inventory. Appendix A provides detail on the components of 2019 CEPAM and the updates that have been included in version 1.02.

## RFP Calculation Methodology

RFP is defined in section 171(1) of the Act as “...such annual incremental reductions in emissions of the relevant air pollutant as are required...for the purpose of ensuring attainment of the applicable national ambient air quality standard by the applicable date.” The requirement for ozone nonattainment areas classified as Serious or higher (section 182(c)(2)(B)) is 3 percent per year cumulative reduction in both ozone precursors, ROG and NOx, averaged over the first 6 years, and then each consecutive 3-year period until attainment.

U.S. EPA has interpreted the RFP requirements such that areas classified as Serious or higher must meet the RFP requirements section 182(c)(2)(B) of the Act by providing an 18 percent reduction of ozone precursors in the first 6-year period, and an average ozone precursor emission reduction of 3 percent per year for all remaining 3-year periods thereafter until the

<sup>3</sup> CARB Mobile Source Emissions Inventory <https://www.arb.ca.gov/msei/categories.htm>

attainment year.<sup>4</sup> To meet Act sections 172(c)(2) and 182(c)(2)(B) RFP requirements, the state may substitute NO<sub>x</sub> emissions reductions for ROG reductions for all areas where the one-time 15 percent ROG-only rate of progress requirement has been met.<sup>5</sup> All nonattainment areas included in this report had met the 15 percent ROG-only rate of progress requirement prior to their demonstrations for the 75 ppb 8-hour ozone standard, and thus NO<sub>x</sub> substitution is used on a percentage basis to cover any percentage shortfall in ROG reduction as needed to meet the 2020 RFP milestone.

## Emission Reduction Targets

In accordance with the *South Coast* decision, the baseline year emission inventory for RFP demonstration is 2011. Nine years later, the emission reduction target for the 2020 milestone year is a 27 percent emission reduction, from 2011 levels.

*Emission reduction target in 2020 = (18%) + [(3% annually) x (3 years)] = 27%*

This calculation accounts for the required 18 percent reduction of ozone precursors in the first 6-year period (2011 – 2017), plus the additional 9 percent in emissions reductions that are required in the 2017 – 2020 period (3 percent per year).

## ROG Calculation Methodology

### Required ROG Reductions Since 2011

To establish the RFP target for ROG emissions, staff first identified the required emission reductions that are needed for each nonattainment area to meet the required 27 percent emission reductions. To do so, staff multiplied each nonattainment area's 2011 baseline year emissions included in the submitted RFP demonstrations by the 27 percent required reduction in ROG emissions that is associated with the 2020 milestone year. This provided the required emission reductions for ROG, in tons per day (tpd):

*Required emission reductions = (2011 baseline emissions) x (27% required reduction)*

### Target 2020 ROG Emission Level

To identify the targeted ROG emission levels (in tpd) in 2020, staff subtracted the required ROG emission reductions from the baseline 2011 emissions. This represents the level of ROG emissions in 2020 that are associated with a 27 percent reduction in ROG emissions, compared with the 2011 baseline:

*RFP target emission level = (2011 baseline emissions) – (Required emission reductions)*

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<sup>4</sup> Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements (U.S. EPA, 2015) [80 FR 12264](#), at 12271 (March 6, 2015)

<sup>5</sup> [40 CFR 51.1110\(a\)\(2\)\(i\)\(C\)](#) and [40 CFR 51.1110\(a\)\(2\)\(ii\)\(B\)](#); and [80 FR 12264](#), at 12271 (March 6, 2015).



## Comparing ROG Targets to 2020 ROG Emissions

This RFP targeted emissions level for ROG were then compared with the 2020 ROG emissions from 2019 CEPAM version 1.02, as is shown in **Table 2** below.

**Table 2: RFP 2020 Milestone Year Targets for ROG**

*All emissions shown in tons per day (tpd)*

Nonattainment Area	2011	2020				
	Baseline ROG Emissions (tpd)	RFP required % reduction	Required emission reductions (tpd)	RFP Target Emission Level (tpd)	CEPAM v1.02 2020 Emissions (tpd)	2020 ROG Shortfall (tpd)
Coachella Valley	16.9	27%	4.6	12.3	15.1	-2.8
Eastern Kern County	8.6	27%	1.5	4.0	7.6	-3.5
Sacramento Metro	111.6	27%	30.1	81.5	94.9	-13.4
San Diego County	136.6	27%	36.9	99.7	111.1	-11.4
San Joaquin Valley	378.7	27%	102.2	276.5	312.3	-35.9
South Coast Air Basin	522.0	27%	140.9	381.1	401.4	-20.3
Ventura County	38.1	27%	10.3	27.8	30.6	-2.8
Western Mojave Desert	48.7	27%	13.1	35.6	38.1	-2.5
Western Nevada County	5.5	27%	1.5	4.0	5.3	-1.3

If sufficient ROG emission reductions are not achieved to satisfy the entirety of the required 27 percent reduction for the 2020 RFP milestone year, as is the case with each of the nonattainment areas shown above, sections 172(c)(2) and 182(c)(2)(B) of the Act allow for NO<sub>x</sub> emission reductions substitutions for the ROG shortfall. The NO<sub>x</sub> substitution is used on a percentage basis to cover any percentage shortfall in ROG reduction. Each of the NAA discussed in this document utilize this provision in order to meet the 2020 RFP milestone, as are shown in the tables in the RFP Milestone Compliance Demonstration section.

## NO<sub>x</sub> Calculation Methodology

### NO<sub>x</sub> Reductions Needed to Cover Shortfall in ROG

For each of the nonattainment areas that did not have sufficient ROG emission reductions from 2011 to 2020 to cover the entirety of the required RFP milestone reduction of 27 percent, the unmet portion of the 27 percent (i.e. the ROG shortfall) is fulfilled by substituting NO<sub>x</sub> emission reductions over the same time period, as allowed under sections 172(c)(2) and 182(c)(2)(B) of the Act. Each of the nonattainment areas discussed in this report met their RFP milestone requirements using NO<sub>x</sub> substitution, which enabled them to fulfill the required 27 percent reduction in ozone precursor emissions by 2020

through cumulative reduction in both ozone precursors. In other words, the 2020 RFP milestone target achievement is demonstrated by showing that the percent of emission reductions from 2011 to 2020 for both ROG *plus* NOx cumulatively sums to at least 27 percent. Given the ROG shortfalls shown in Table 2 for each of the nonattainment areas, NOx substitutions are required to demonstrate achievement of the 2020 RFP milestone target of 27 percent reduction in emissions, relative to 2011. As the 27 percent target is a cumulative target for both ROG and NOx, the NOx targets are dependent on how much of the 27 percent target are fulfilled by ROG emission reductions; for this reason, the 2020 NOx targets vary for each nonattainment area.

Required NOx reductions are identified by first calculating the amount of the 27 percent RFP Milestone target that remains unmet after accounting for reductions in ROG. To do so, staff subtracted the percent reduction in ROG that was achieved from 2011 to 2020 from the 27 percent cumulative target:

$$\text{NOx reduction target, as \%} = (27\% \text{ Target}) - (\% \text{ change in ROG from 2011} - 2020)$$

Because NOx substitution is used on a percentage basis to cover any percentage shortfall in ROG reduction, the NOx reduction target (expressed as a percent) is thus the same as the percent ROG shortfall, as shown in **Table 3**.

**Table 3: 2020 NOx Reduction Targets**

Nonattainment Area	RFP 2020 Milestone Target	ROG emissions reductions (from 2011 - 2020)	2020 ROG shortfall		2020 NOx reductions needed
			%	tpd	
Coachella Valley	27%	10.6%	-16.4%	-2.8	16.4%
Eastern Kern County	27%	12.2%	-14.8%	-3.5	14.8%
Sacramento Metro	27%	15.0%	-12.0%	-13.4	12.0%
San Diego County	27%	18.7%	-8.3%	-11.4	8.3%
San Joaquin Valley	27%	17.5%	-9.5%	-35.9	9.5%
South Coast Air Basin	27%	23.1%	-3.9%	-20.3	3.9%
Ventura County	27%	19.7%	-7.3%	-2.8	7.3%
Western Mojave Desert	27%	21.8%	-5.2%	-2.5	5.2%
Western Nevada County	27%	3.7%	-23.3%	-1.3	23.3%

### Calculating Required NOx Emission Reductions

The required NOx emission reductions are calculated by applying the 2020 NOx reduction target to the 2011 baseline NOx emissions for each nonattainment area.

$$\text{Required NOx emission reductions} = (2020 \text{ NOx \% reduction target}) \times (2011 \text{ NOx emissions})$$

## Target 2020 NOx Emissions Level

To identify the targeted NOx emission levels in 2020, staff subtracted the required NOx emission reductions from the baseline 2011 emissions. This represents the level of NOx emissions in 2020 that would provide reductions sufficient to cover the shortfall in ROG emissions reductions needed to achieve a cumulative total of 27 percent reduction, compared with the 2011 baseline:

*Target 2020 NOx emissions level = (2011 baseline emissions) – (Required NOx emission reductions)*

## Comparing NOx Targets to 2020 NOx Emissions

To demonstrate achievement of the 2020 RFP Milestone target, the 2020 NOx targets are compared with 2020 NOx emissions from 2019 CEPAM version 1.02, in order to identify whether there are sufficient NOx reductions to cover the ROG shortfall. For each nonattainment area, the 2020 NOx emissions from 2019 CEPAM version 1.02 are below the NOx targets; if the 2020 emissions are less than the 2020 targets, then the difference between these two values are surplus NOx reductions that remain after ROG substitution. Surplus NOx reductions are additional to the amount needed to cover the ROG substitution and thus demonstrate the 2020 milestone targets have been met, as shown in **Table 4**.

**Table 4: Comparing NOx Targets with 2020 Emissions**

Nonattainment Area	2020 NOx reduction target	NOx reductions (2011 - 2020)	Surplus NOx Reductions	RFP Milestone Target Met?
Coachella Valley	16.4%	41.2%	24.9%	Yes
Eastern Kern County	14.8%	22.9%	8.1%	Yes
Sacramento Metro	12.0%	45.6%	33.6%	Yes
San Diego County	8.3%	39.7%	31.3%	Yes
San Joaquin Valley	9.5%	46.8%	37.4%	Yes
South Coast Air Basin	3.9%	46.2%	42.3%	Yes
Ventura County	7.3%	40.9%	33.6%	Yes
Western Mojave Desert	5.2%	39.1%	33.9%	Yes
Western Nevada County	23.3%	52.6%	29.3%	Yes

## RFP Milestone Compliance Demonstrations

### Coachella Valley 2020 RFP Milestone Compliance Demonstration

Effective on July 20, 2012, U.S. EPA designated the Coachella Valley as a nonattainment area with a Severe classification for the 75 ppb 8-hour ozone standard. CARB submitted the March 2017 *Final 2016 Air Quality Management Plan (2016 AQMP)* to U.S. EPA for inclusion in the SIP on April 27, 2017, which included an RFP demonstration for the Coachella Valley with a baseline year of 2012 and followed all applicable U.S. EPA guidance available at the time. On December 5, 2018, CARB submitted in the 2018 SIP Update a revised RFP demonstration for the Coachella Valley with a baseline year of 2011, following updated direction from U.S. EPA in response to the *South Coast* decision. On September 16, 2020, U.S. EPA approved the Coachella Valley RFP demonstration for the 75 ppb 8-hour ozone standard (85 FR 57714).

The applicable progress requirement for the 2020 milestone year is a 27 percent reduction in ROG emissions by 2020 compared with 2011 baseline year emissions, allowing for NO<sub>x</sub> substitution on a percentage basis when needed. The table below demonstrates that 2020 emissions in CARB's updated emissions inventory (2019 CEPAM version 1.02) are at the levels needed to show the required reductions from the 2011 emissions included in the SIP-approved RFP demonstration for the 75 ppb 8-hour ozone standard. CARB therefore determined that the Coachella Valley has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus, the 2020 RFP milestone has been met in the Coachella Valley.

Coachella Valley RFP Milestone Calculations: ROG	ROG		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	16.9		
Required ROG reductions since 2011			27%
Target 2020 ROG emissions level, tpd		12.3	
2020 Emissions (CEPAM v 1.02)		15.1	
Emission reductions since 2011		1.8	10.6%
Required ROG reductions		-4.6	-27%
ROG shortfall (-)/surplus (+), %		-2.8	-16.4%

Coachella Valley RFP Milestone Calculations: NOx	NOx		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	29.8		
NOx reductions needed to cover shortfall in ROG (substitution)			16.4%
Target 2020 NOx emissions level, tpd		22.4	
2020 Emissions (CEPAM v 1.02)		17.5	
Emission reductions since 2011		12.3	41.2%
Required NOx reductions needed for ROG substitution		-4.9	-16.4%
Remaining NOx reductions, surplus after meeting ROG substitution needs		7.4	24.9%
Total shortfall for RFP			0%
<b>2020 RFP milestone met?</b>			<b>Yes</b>

## Eastern Kern County 2020 RFP Milestone Compliance Demonstration

Effective on July 20, 2012, U.S. EPA designated Eastern Kern County as a nonattainment area with a Marginal classification for the 75 ppb 8-hour ozone standard. In May 2016, U.S. EPA found that Eastern Kern had failed to attain the 2008 ozone NAAQS by the applicable Marginal attainment date of July 2015, and classified the area as Moderate. In response to the classification to Moderate, the Eastern Kern Air Pollution Control District began to develop an ozone plan meeting the applicable ozone nonattainment area requirements; however, in light of the significant emission reduction needs for the area and different attainment years for Moderate versus Serious nonattainment areas, the revised ozone plan was developed to meet Serious, rather than Moderate, ozone nonattainment requirements. CARB submitted the Eastern Kern *2017 Ozone Attainment Plan for the 2008 Federal 75 ppb 8-Hour Ozone Standard* to U.S. EPA for inclusion in the SIP on October 25, 2017, which included an RFP demonstration with a baseline year of 2012 and followed all applicable U.S. EPA guidance available at the time. The October 25, 2017 SIP revision submittal included a request for reclassification of the Eastern Kern ozone nonattainment area, from Moderate to Serious, which U.S. EPA approved in 2018. On December 5, 2018, CARB submitted in the 2018 SIP Update a revised RFP demonstration for Eastern Kern County with a baseline year of 2011, following updated direction from U.S. EPA in response to the *South Coast* decision. On October 27, 2020, U.S. EPA proposed approval of the Eastern Kern County RFP demonstration for the 75 ppb 8-hour ozone standard (85 FR 68268).

The applicable progress requirement for the 2020 milestone year is a 27 percent reduction in ROG emissions by 2020 compared with 2011 baseline year emissions, allowing for NO<sub>x</sub> substitution on a percentage basis when needed. The table below demonstrates that 2020 emissions in CARB's updated emissions inventory (2019 CEPAM version 1.02) are at the levels needed to show the required reductions from the 2011 emissions included in the submitted RFP demonstration for the 75 ppb 8-hour ozone standard. CARB therefore determined that the Eastern Kern County has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus, the 2020 RFP milestone has been met in Eastern Kern County.

Eastern Kern County RFP Milestone Calculations: ROG	ROG		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	8.6		
Required ROG reductions			27%
Target 2020 ROG emissions level		6.3	
2020 Emissions (CEPAM v 1.02)		7.6	
Emission reductions since 2011		1.1	12.2%
Required ROG reductions		-2.3	-27%
ROG shortfall (-)/surplus (+)		-1.3	-14.8%

Eastern Kern County RFP Milestone Calculations: NOx	NOx		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	31		
NOx reductions needed to cover shortfall in ROG (substitution)			-14.8%
Target 2020 NOx emissions level, tpd		26.4	
2020 Emissions (CEPAM v 1.02)		23.9	
Emission reductions since 2011		7.1	22.9%
Required NOx reductions needed for ROG substitution		-4.6	-14.8%
Remaining NOx reductions, surplus after meeting ROG substitution needs		2.5	8.1%
Total shortfall for RFP			0%
<b>RFP milestone met?</b>			<b>Yes</b>

## Sacramento Metro 2020 RFP Milestone Compliance Demonstration

Effective on July 20, 2012, U.S. EPA designated Sacramento Metro as a nonattainment area with a Severe classification for the 75 ppb 8-hour ozone standard. CARB submitted the *2017 Sacramento Regional 2008 8-Hour Ozone Attainment and Further Reasonable Progress Plan* to U.S. EPA for inclusion in the SIP on December 18, 2017, which included an RFP demonstration with a baseline year of 2012 and followed all applicable U.S. EPA guidance available at the time. On December 5, 2018, CARB submitted in the 2018 SIP Update a revised RFP demonstration for Sacramento Metro with a baseline year of 2011, following updated direction from U.S. EPA in response to the *South Coast* decision. On October 28, 2020, U.S. EPA proposed approval of the Sacramento Metro RFP demonstration for the 75 ppb 8-hour ozone standard (83 FR 11198).

The applicable progress requirement for the 2020 milestone year is a 27 percent reduction in ROG emissions by 2020 compared with 2011 baseline year emissions, allowing for NO<sub>x</sub> substitution on a percentage basis when needed. The table below demonstrates that 2020 emissions in CARB's updated emissions inventory (2019 CEPAM version 1.02) are at the levels needed to show the required reductions from the 2011 emissions included in submitted RFP demonstration for the 75 ppb 8-hour ozone standard. CARB therefore determined that the Sacramento Metro nonattainment area has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus, the 2020 RFP milestone has been met in the Sacramento Metro nonattainment area.



Sacramento Metro RFP Milestone Calculations: ROG	ROG		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	111.6		
Required ROG reductions since 2011			27%
Target 2020 ROG emissions level, tpd		81.5	
2020 Emissions (CEPAM v 1.02)		94.9	
Emission reductions since 2011		16.7	15.0%
Required ROG reductions		30.1	27%
ROG <b>shortfall (-)/surplus (+), %</b>		<b>-13.4</b>	<b>-12.0%</b>
Sacramento Metro RFP Milestone Calculations: NOx	NOx		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	107.7		
NOx reductions needed to cover shortfall in ROG (substitution)			12.0%
Target 2020 NOx emissions level, tpd		94.8	
2020 Emissions (CEPAM v 1.02)		58.6	
Emission reductions since 2011		49.1	45.6%
Required NOx reductions needed for ROG substitution		<b>-12.9</b>	<b>-12.0%</b>
Remaining NOx reductions, surplus after meeting ROG substitution needs		36.2	33.6%
Total shortfall for RFP			0%
<b>RFP met?</b>			<b>Yes</b>

## San Diego County 2020 RFP Milestone Compliance Demonstration

Effective June 3, 2016, U.S. EPA designated San Diego County as a Moderate nonattainment area for the 75 ppb 8-hour ozone standard with an attainment date of July 18, 2018. Despite substantial air quality progress, the region did not attain the 75 ppb 8-hour ozone standard by the attainment deadline, and as a result, effective on September 23, 2019, U.S. EPA classified San Diego County as a Serious nonattainment area for that standard. In 2021, CARB submitted the *2020 Plan for Attaining the National Ambient Air Quality Standards for Ozone in San Diego County* to U.S. EPA for inclusion in the SIP, which included an RFP demonstration with a baseline year of 2011, following updated direction from U.S. EPA in response to the *South Coast* decision.

The applicable progress requirement for the 2020 milestone year is a 27 percent reduction in ROG emissions by 2020 compared with 2011 baseline year emissions, allowing for NO<sub>x</sub> substitution on a percentage basis when needed. The table below demonstrates that 2020 emissions in CARB's updated emissions inventory (2019 CEPAM version 1.02) are at the levels needed to show the required reductions from the 2011 emissions included in the submitted RFP demonstration for the 75 ppb 8-hour ozone standard. CARB therefore determined that San Diego County has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus, the 2020 RFP milestone has been met in San Diego County.

San Diego County RFP Milestone Calculations: ROG	ROG		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	136.6		
ROG reductions since 2011			27%
Target 2020 ROG emissions level, tpd		99.7	
2020 Emissions (CEPAM v 1.02)		111.1	
Emission reductions since 2011		36.9	27%
Required ROG reductions		-25.5	-18.7%
ROG shortfall (-)/surplus (+), %		-11.4	-8.3%

San Diego County RFP Milestone Calculations: NOx	NOx		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	110.7		
Required NOx reductions needed to cover shortfall in ROG (substitution)			8.3%
Target 2020 NOx emissions level, tpd		101.5	
2020 Emissions (CEPAM v 1.02)		66.8	
Emission reductions since 2011		43.9	39.7%
Required NOx reductions needed for ROG substitution		-9.2	-8.3%
Remaining NOx reductions, surplus after meeting ROG substitution needs		34.7	31.3%
Total shortfall for RFP			0%
<b>RFP met?</b>			<b>Yes</b>

## San Joaquin Valley 2020 RFP Milestone Compliance Demonstration

On May 21, 2012, U.S. EPA designated the San Joaquin Valley as a nonattainment area with an Extreme classification for the 75 ppb 8-hour ozone standard. On August 24, 2016, CARB submitted the *2016 Ozone Plan for the 2008 8-Hour Ozone Standard* for the San Joaquin Valley to U.S. EPA for inclusion in the SIP, which included an RFP demonstration with a baseline year of 2012 and followed all applicable U.S. EPA guidance available at the time. On December 5, 2018, CARB submitted in the 2018 SIP Update a revised RFP demonstration for the San Joaquin Valley with a baseline year of 2011, following updated direction from U.S. EPA in response to the *South Coast* decision. On March 25, 2019, U.S. EPA approved the San Joaquin Valley RFP demonstration for the 75 ppb 8-hour ozone standard (83 FR 11198).

The applicable progress requirement for the 2020 milestone year is a 27 percent reduction in ROG emissions by 2020 compared with 2011 baseline year emissions, allowing for NO<sub>x</sub> substitution on a percentage basis when needed. The table below demonstrates that 2020 emissions in CARB's updated emissions inventory (2019 CEPAM version 1.02) are at the levels needed to show the required reductions from the 2011 emissions included in the SIP-approved RFP demonstration for the 75 ppb 8-hour ozone standard. CARB therefore determined that the San Joaquin Valley has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus, the 2020 RFP milestone has been met in the San Joaquin Valley.

San Joaquin Valley RFP Milestone Calculations: ROG	ROG		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	378.7		
Required ROG reductions since 2011			27%
Target 2020 ROG emissions level, tpd		276.5	
2020 Emissions (CEPAM v 1.02)		312.3	
Emission reductions since 2011		102.2	27%
Required ROG reductions		-66.4	-17.5%
ROG shortfall (-)/surplus (+), %		-35.9	-9.5%

San Joaquin Valley RFP Milestone Calculations: NOx	NOx		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	375.6		
NOx reductions needed to cover shortfall in ROG (substitution)			9.5%
Target 2020 NOx emissions level, tpd		340.0	
2020 Emissions (CEPAM v 1.02)		199.6	
Emission reductions since 2011		176.0	46.8%
Required NOx reductions needed for ROG substitution		-35.6	-9.5%
Remaining NOx reductions, surplus after meeting ROG substitution needs		140.4	37.4%
Total shortfall for RFP			0%
<b>RFP met?</b>			<b>Yes</b>

## South Coast Air Basin 2020 RFP Milestone Compliance Demonstration

In 2012, U.S. EPA designated the South Coast Air Basin as a nonattainment area with an Extreme classification for the 75 ppb 8-hour ozone standard. CARB submitted the 2016 AQMP to U.S. EPA for inclusion in the SIP, which included an RFP demonstration for the South Coast Air Basin with a baseline year of 2012 and followed all applicable U.S. EPA guidance available at the time. On December 5, 2018, CARB submitted in the 2018 SIP Update a revised RFP demonstration for the South Coast Air Basin with a baseline year of 2011, following updated direction from U.S. EPA in response to the *South Coast* decision. On September 1, 2019, U.S. EPA approved the South Coast Air Basin RFP demonstration for the 75 ppb 8-hour ozone standard (84 FR 52005).

The applicable progress requirement for the 2020 milestone year is a 27 percent reduction in ROG emissions by 2020 compared with 2011 baseline year emissions, allowing for NO<sub>x</sub> substitution on a percentage basis when needed. The table below demonstrates that 2020 emissions in CARB's updated emissions inventory (2019 CEPAM version 1.02) are at the levels needed to show the required reductions from the 2011 emissions included in the SIP-approved RFP demonstration for the 75 ppb 8-hour ozone standard. CARB therefore determined that the South Coast Air Basin has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus, the 2020 RFP milestone has been met in the South Coast Air Basin.

South Coast Air Basin RFP Milestone Calculations: ROG	ROG		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	522		
Required ROG reductions since 2011			27%
Target 2020 ROG emissions level, tpd		381.1	
2020 Emissions (CEPAM v 1.02)		401.4	
Emission reductions since 2011		140.9	27%
Required ROG reductions		-120.7	-23.1%
ROG shortfall (-)/surplus (+), %		-20.3	-3.9%

South Coast Air Basin RFP Milestone Calculations: NOx	NOx		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	534.3		
NOx reductions needed to cover shortfall in ROG (substitution)			3.9%
Target 2020 NOx emissions level, tpd		513.5	
2020 Emissions (CEPAM v 1.02)		287.7	
Emission reductions since 2011		246.6	46.2%
Required NOx reductions needed for ROG substitution		-20.8	-3.9%
Remaining NOx reductions, surplus after meeting ROG substitution needs		225.9	42.3%
Total shortfall for RFP			0%
<b>RFP met?</b>			<b>Yes</b>

## Ventura County 2020 RFP Milestone Compliance Demonstration

Effective on July 20, 2012, U.S. EPA designated Ventura County as a nonattainment area with a Serious classification for the 75 ppb 8-hour ozone standard. CARB submitted the *2016 Ventura County Air Quality Management Plan* to U.S. EPA for inclusion in the SIP on April 11, 2017, which included an RFP demonstration with a baseline year of 2012 and followed all applicable U.S. EPA guidance available at the time. On December 5, 2018, CARB submitted in the 2018 SIP Update a revised RFP demonstration for Ventura County with a baseline year of 2011, following updated direction from U.S. EPA in response to the *South Coast* decision. On February 26, 2020, U.S. EPA approved the Ventura County RFP demonstration for the 75 ppb 8-hour ozone standard (85 FR 11814).

The applicable progress requirement for the 2020 milestone year is a 27 percent reduction in ROG emissions by 2020 compared with 2011 baseline year emissions, allowing for NO<sub>x</sub> substitution on a percentage basis when needed. The table below demonstrates that 2020 emissions in CARB's updated emissions inventory (2019 CEPAM version 1.02) are at the levels needed to show the required reductions from the 2011 emissions included in the SIP-approved RFP demonstration for the 75 ppb 8-hour ozone standard. CARB therefore determined that Ventura County has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus, the 2020 RFP milestone has been met in Ventura County.



Ventura County RFP Milestone Calculations: ROG	ROG		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	38.1		
Required ROG reductions since 2011			27%
Target 2020 ROG emissions level, tpd		27.8	
2020 Emissions (CEPAM v 1.02)		30.6	
Emission reductions since 2011		7.5	19.7%
Required ROG reductions		-10.3	-27%
ROG <b>shortfall (-)</b> /surplus (+), %		-2.8	-7.3%

Ventura County RFP Milestone Calculations: NOx	NOx		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	26.0		
NOx reductions needed to cover shortfall in ROG (substitution)			1.2%
Target 2020 NOx emissions level, tpd		24.1	
2020 Emissions (CEPAM v 1.02)		15.4	
Emission reductions since 2011		10.6	40.9%
Required NOx reductions needed for ROG substitution		-1.9	-1.2%
Remaining NOx reductions, surplus after meeting ROG substitution needs		8.7	33.6%
Total shortfall for RFP			0%
<b>2020 RFP milestone met?</b>			<b>Yes</b>

## Western Mojave Desert 2020 RFP Milestone Compliance Demonstration

Effective on July 20, 2012, U.S. EPA designated the Western Mojave Desert as a nonattainment area with a Severe classification for the 75 ppb 8-hour ozone standard. CARB submitted to U.S. EPA for inclusion in the SIP the *Federal 75 ppb Ozone Attainment Plan for the Western Mojave Desert Nonattainment Area*, which included an RFP demonstration with a baseline year of 2012 and followed all applicable U.S. EPA guidance available at the time. On December 5, 2018, CARB submitted a revised RFP demonstration for the Western Mojave Desert in the 2018 SIP Update with a baseline year of 2011, following updated direction from U.S. EPA in response to the *South Coast* decision.

The applicable progress requirement for the 2020 milestone year is a 27 percent reduction in ROG emissions by 2020 compared with 2011 baseline year emissions, allowing for NO<sub>x</sub> substitution on a percentage basis when needed. The table below demonstrates that 2020 emissions in CARB's updated emissions inventory (2019 CEPAM version 1.02) are at the levels needed to show the required reductions from the 2011 emissions included in the submitted RFP demonstration for the 75 ppb 8-hour ozone standard. CARB therefore determined that the Western Mojave Desert has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus, the 2020 RFP milestone has been met in the Western Mojave Desert.

Western Mojave Desert RFP Milestone Calculations: ROG	ROG		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	48.7		
Required ROG reductions since 2011			27%
Target 2020 ROG emissions level, tpd		35.6	
2020 Emissions (CEPAM v 1.02)		38.1	
Emission reductions since 2011		10.6	21.8%
Required ROG reductions		-13.1	-27%
ROG shortfall (-)/surplus (+), %		-2.5	-5.2%

Western Mojave Desert RFP Milestone Calculations: NOx	NOx		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	98.4		
NOx reductions needed to cover shortfall in ROG (substitution)			5.2%
Target 2020 NOx emissions level, tpd		93.3	
2020 Emissions (CEPAM v 1.02)		59.9	
Emission reductions since 2011		38.5	39.1%
Required NOx reductions needed for ROG substitution		-5.1	-5.2%
Remaining NOx reductions, surplus after meeting ROG substitution needs		33.4	33.9%
Total shortfall for RFP			0%
<b>RFP milestone met?</b>			<b>Yes</b>

## Western Nevada County 2020 RFP Milestone Compliance Demonstration

In 2012, U.S. EPA designated Western Nevada County as a nonattainment area with a Marginal classification for the 75 ppb 8-hour ozone standard. The area failed to attain the standard by the July 2015 Marginal attainment date, and U.S. EPA classified the area to Moderate in 2016. CARB submitted the *2018 Western Nevada County 8-hour Ozone Attainment Plan* to U.S. EPA for inclusion in the SIP which determined that Serious was the appropriate classification for the area. The plan included an RFP demonstration with a baseline year of 2011, following direction from U.S. EPA in response to the *South Coast* decision. On January 12, 2021, U.S. EPA proposed approval of the Western Nevada County RFP demonstration for the 75 ppb 8-hour ozone standard (86 FR 2318).

The applicable progress requirement for the 2020 milestone year is a 27 percent reduction in ROG emissions by 2020 compared with 2011 baseline year emissions, allowing for NO<sub>x</sub> substitution on a percentage basis when needed. The table below demonstrates that 2020 emissions in CARB's updated emissions inventory (2019 CEPAM version 1.02) are at the levels needed to show the required reductions from the 2011 emissions included in the submitted RFP demonstration for the 75 ppb 8-hour ozone standard. CARB therefore determined that the Western Nevada County has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus, the 2020 RFP milestone has been met in Western Nevada County.

Western Nevada County RFP Milestone Calculations: ROG	ROG		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	5.5		
Required ROG reductions since 2011			27%
Target 2020 ROG emissions level, tpd		4.0	
2020 Emissions (CEPAM v 1.02)		5.3	
Emission reductions since 2011		0.2	3.7%
Required ROG reductions		-1.5	-27%
ROG shortfall (-)/surplus (+), %		-1.3	-23.3%

Western Nevada County RFP Milestone Calculations: NOx	NOx		
	2011	2020	
	tpd	tpd	%
Baseline 2011 Emissions, tpd	5.7		
NOx reductions needed to cover shortfall in ROG (substitution)			23.3%
Target 2020 NOx emissions level, tpd		4.4	
2020 Emissions (CEPAM v 1.02)		2.7	
Emission reductions since 2011		3.0	52.6%
Required NOx reductions needed for ROG substitution		-1.3	-23.3%
Remaining NOx reductions, surplus after meeting ROG substitution needs		1.7	29.3%
Total shortfall for RFP			0%
<b>RFP milestone met?</b>			<b>Yes</b>

## Summary

For compliance with RFP milestones, areas classified as Serious and above must demonstrate achievement of the required cumulative 27 percent reduction in ROG and NO<sub>x</sub> emissions in the 2020 milestone year, relative to the 2011 baseline year emissions. This report demonstrates that the Coachella Valley, Eastern Kern County, Sacramento Metro, San Diego County, San Joaquin Valley, South Coast Air Basin, Ventura County, Western Mojave Desert and Western Nevada County nonattainment areas meet the 2020 milestone year Reasonable Further Progress requirements for the 75 ppb 8-hour ozone standard. CARB therefore determined that each of the nonattainment areas has achieved an incremental emissions reduction corresponding with the 2020 RFP milestone, and thus meet their RFP milestones for 2020.

# **Appendix A: CARB Statewide Ozone SIP Emission Inventory Write-Up**

**2019 CEPAM v1.02**

(March 2021)

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## Emission Inventory Background

Emissions inventories are one of the fundamental building blocks in the development of a State Implementation Plan (SIP or Plan). In other words, 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 appendix describes the emissions inventory included in the California Emission Projection Analysis Model (CEPAM), 2019 SIP Baseline Emission Projections, Version 1.02.

The development and maintenance of California's emission inventory is a multi-agency effort involving the California Air Resources Board (CARB), 35 local air pollution control and air quality management districts (Air District or District), metropolitan planning organizations, councils of governments, and the California Department of Transportation among others. Together, a comprehensive, accurate, and current emissions inventory consistent with the requirements set forth in Section 182(a)(1) of the federal Clean Air Act was developed. CARB and District staff conducted a thorough review of the inventory to ensure that the emission estimates reflect accurate emission reports for point sources, and that estimates for mobile and areawide sources are based on the most recent models and methodologies.

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

## Emissions Inventory Overview

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

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

The United States Environmental Protection Agency (U.S. EPA) regulations require that the emissions inventory for an Ozone SIP contain emissions data for the two precursors to ozone formation: oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOC). The inventory included in this plan substitutes VOC with reactive organic gases (ROG), which, in general, represent a slightly broader group of compounds than those in U.S. EPA's list of VOCs<sup>6</sup>.

## Inventory Base Year

Based on the final implementation rule, U.S. EPA requires that the base year shall be selected consistent with the baseline year for the reasonable further progress (RFP) plan. It states that at the time of designation as nonattainment for an ozone standard, the baseline emissions inventory shall be the emissions inventory for the most recent calendar year for which a complete triennial inventory is required to be submitted to the U.S. EPA. Alternatively, states may also use a baseline emissions inventory provided that the year selected corresponds with the year of the effective date of designation as nonattainment for that standard<sup>7</sup>. CARB selected 2017, which is the most recent triennial National Emissions Inventory (NEI) year required to be submitted to U.S. EPA, as the baseline inventory year.

## Forecasted Inventories

In addition to a base year inventory, U.S. EPA regulations also require future year inventory projections for specific 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

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<sup>6</sup> Section 182(a)(1) of the Act. <https://www.govinfo.gov/content/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapl-partD-subpart2-sec7511a.htm>

<sup>7</sup> Title 40, Code of Federal Regulations (CFR), Part 51, Subpart CC. <https://www.ecfr.gov/cgi-bin/text-idx?SID=97b82e1fdd43119eeed7c7405c00783e&mc=true&node=pt40.2.51&rgn=div5#sp40.2.51.cc>

from government entities with expertise in developing forecasts for specific sectors, or, in some cases, from econometric models. Control profiles, which account for emission reductions resulting from adopted rules and regulations, are derived from data provided by the regulatory agencies responsible for the affected emission categories.

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

## **Temporal Resolution**

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

## **Split Regions**

Of the nineteen ozone nonattainment areas, five were split into a region not defined by county, air basin, or district boundaries: Kern County (Eastern Kern), Sutter Buttes, Los Angeles-San Bernardino Counties (West Mojave Desert), Nevada County (Western part), and San Luis Obispo (Eastern part). For these areas, the portion of emissions in the nonattainment area was estimated using category-specific factors based on the spatial distribution of population, employment, vehicle miles traveled, and other activity parameters within the nonattainment region. These fractions were developed by CARB and the local air districts.

## **Quality Assurance and Quality Control**

CARB has established a quality assurance and quality control (QA/QC) process to ensure the integrity and accuracy of the emission inventories used in the development of air quality plans. QA/QC occurs at the various stages of SIP emission inventory development. Baseline emissions are assembled and maintained in the California Emission Inventory Development and Reporting System (CEIDARS). CARB inventory staff works with air districts, which are responsible for developing and reporting point source emission estimates, to verify these data are accurate. The locations of point sources, including stacks, are checked to ensure they are valid. Area-wide source emission estimates are developed by CARB staff as well as some air districts. The methodologies are reviewed by CARB and District staff before their inclusion in the emission inventory. Mobile categories are verified with CARB mobile source staff for consistency with the on-road and off-road emission models. Additionally, CEIDARS is designed with automatic system checks to prevent errors, such as double counting of emission sources. The system also makes various reports available to assist staff in their efforts to identify and reconcile anomalous emissions.

## Emission Inventory Components

A summary of the components that make up the SIP baseline emission inventory is presented in the following sections. These include mobile (on- and off-road) sources, stationary point sources, and areawide sources. Natural sources are not included in a SIP emission inventory.

### Mobile Source Emissions

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

#### On-Road Mobile Source Emissions

Emissions from on-road mobile sources, which include passenger vehicles, buses, and trucks, were estimated using outputs from CARB's EMFAC2017 model. The on-road emissions were calculated by applying EMFAC2017 emission factors to the transportation activity data provided by the local' MPO.

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

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

Additional information and documentation on the EMFAC2017 model is available at:

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

#### EMFAC2017 SAFE Vehicles Rules Off-Model Adjustment

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

National Program.”<sup>8</sup> The Part One Rule revokes California’s authority to set its own greenhouse gas emissions standards and set zero-emission vehicle mandates in California. The SAFE Vehicle Rule Part One impacts some of the underlying assumptions in CARB’s EMFAC2017 model, which was used to assess emissions from on-road mobile sources. Therefore, CARB developed off-model adjustment factors in order for future transportation emissions estimates using EMFAC2017 to reflect SAFE Vehicle Rule Part One. These adjustments, provided in the form of multipliers, were applied to emissions outputs from the EMFAC2017 model to account for the impact of this rule. The off-model adjustment factors were only applied to emissions from gasoline light duty vehicles (LDA, LDT1, LDT2 and MDV).

Additional information on the SAFE Rule adjustment factors is available at:

[https://ww3.arb.ca.gov/msei/emfac\\_off\\_model\\_adjustment\\_factors\\_final\\_draft.pdf](https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf)

### **EMFAC2017 ACT Off-Model Adjustment**

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

The ACT regulation impacts some of the underlying assumptions in CARB’s EMFAC2017 model, which was used to assess emissions from on-road mobile sources. Therefore, CARB developed off-model adjustment factors in order to reflect the regulation. Adjustment factors were based on the percentage of California-certified ZEV sales for each EMFAC category and model year. More information on inventory modelling methods can be found in the ACT Initial Statement of Reasons (ISOR) [Appendix F](#). These adjustments, provided in the form of multipliers, were applied to emissions outputs from the EMFAC2017 model to account for the impact of the ACT regulation.

The ACT off-model adjustment factors were only applied to the medium-and heavy-duty truck sectors. Off-model calculations were done in the Mobile Emissions Toolkit for Analysis ([META](#)).

Additional information on ACT is available at:

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

### **EMFAC2017 Heavy-Duty Omnibus Off-Model Adjustment**

On August 27, 2020, CARB adopted the Heavy-Duty Omnibus regulation, which would establish NOx engine emission standards 90 percent lower than today's. The Omnibus

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<sup>8</sup> 84 FR 51310. <https://www.govinfo.gov/content/pkg/FR-2019-09-27/html/2019-20672.htm>

Regulation will dramatically reduce NOx emissions by comprehensively overhauling exhaust emission standards, test procedures, and other emissions-related requirements for 2024 and subsequent model year California-certified heavy-duty engines.

The Low NOx Omnibus regulation impacts some of the underlying assumptions in CARB's EMFAC2017 model, which was used to assess emissions from on-road mobile sources. Therefore, CARB developed off-model adjustment factors in order to reflect the regulation. These adjustments, provided in the form of multipliers, were applied to emissions outputs from the EMFAC2017 model to account for the impact of the Low NOx Omnibus regulation. The adjustment factors reflect the impact of all components of the HD Omnibus regulation on in-use (i.e. real-world) NOx emissions and deterioration-related emissions. More details on the inventory analysis for this regulation can be found in Appendix D of the Heavy-Duty Omnibus Initial Statement of Reasons (ISOR) [Appendix D](#).

The Low NOx Omnibus off-model adjustment factors were only applied to on-road heavy-duty engines. Off-model calculations were done in the Mobile Emissions Toolkit for Analysis ([META](#)).

Additional information on the Low NOx Omnibus regulation is available at:

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

## **Off-Road Mobile Source Emissions**

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

### [Ocean Going Vessels](#)

CARB staff updated the ocean-going vessel (OGV) activity growth rates and NOx emission calculations in December 2016. These were based on 2014 data on vessel visits, 2014 data from the Ports of Los Angeles/Long Beach on vessel power, and U.S. EPA sources for emission rates. Growth factors are based on the Freight Analysis Framework.

Additional information on CARB's general OGV methodology is available online for the 2019 update at:

[https://ww3.arb.ca.gov/msei/offroad/pubs/2019\\_ogv\\_inventory\\_writeup\\_ver\\_oct\\_18\\_2019.pdf](https://ww3.arb.ca.gov/msei/offroad/pubs/2019_ogv_inventory_writeup_ver_oct_18_2019.pdf)

or the 2014 update at:

<https://ww3.arb.ca.gov/msei/2014-updates-to-the-carb-ogv-model.docx>

## Commercial Harbor Craft

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

Vessel and engine activity data were obtained from reported data by vessel operators to CARB in March 2019 (hereinafter referred to as CARB reporting 2019). Vessel population data were collected from various sources, including the CARB reporting 2019, U.S. Coast Guard, and estimates by Port of Los Angeles, Long Beach, and Oakland. Population and activity growth factors were inferred from historical growth trends in the past decade. Survival and purchasing rates were developed from the age distribution of CHC from CARB reporting 2019. Load factors were updated using CARB reporting 2019 and engine control module data from industry. Emission factors were updated based on U.S. EPA marine and off-road engine certification data.

Additional information on this methodology is available at:

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

## Pleasure Crafts and Recreational Vehicles

Pleasure craft, or recreational watercraft (RW), is a broad category of marine vessels that includes gasoline-powered spark-ignition marine watercraft (SIMW) and diesel-powered marine watercraft. Off-highway recreational vehicles (OHRV) include off-highway motorcycles (OHMC), all-terrain vehicles (ATV), off-road sport vehicles, off-road utility vehicles, sand cars, and golf carts. A new model was developed in 2014 to estimate emissions from pleasure craft and another new model was developed in 2018 to estimate emissions from recreational vehicles. In both cases, population, activity, and emission factors were re-assessed using new surveys, DMV registration information, and emissions testing.

Additional information is available at:

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

## Locomotives

Line-Haul (Class I): The line-haul locomotive model population and activity is based primarily on line-haul population, activity and fuel use data reported to CARB by the two primary Class I freight locomotive companies that operate in California. To estimate emissions and forecast future Tier mix, CARB used activity, rail visit, fuel consumption, and remanufacturing behavior data obtained for the calendar year from 2010 to 2018. Emission factors are based on U.S. EPA published reports for emission inventory development, updated in 2016.

Additional information is available at:

[https://ww2.arb.ca.gov/sites/default/files/2021-02/2021\\_line\\_haul\\_locomotive\\_emission\\_inventory\\_final.pdf](https://ww2.arb.ca.gov/sites/default/files/2021-02/2021_line_haul_locomotive_emission_inventory_final.pdf)

Short-Haul (Class III): Short-haul locomotive emissions were developed directly from voluntary reporting data provided by the 22 short-haul companies, and included engine population, age, activity, and fuel use. Forecasting was based on discussions with industry, which reflected few plans to turn over engines or grow activity or population. Emission factors are based on U.S. EPA published reports, updated in 2016.

More information is available at:

<https://ww3.arb.ca.gov/msei/ordiesel/locoshortline2017ei.docx>

Passenger: Passenger locomotive emissions were developed based on voluntary reporting by all of the passenger locomotive agencies and companies, with 2017 base year. This data included interstate operations such as Amtrak, as well as smaller regional operations. The reporting data included population, age, fuel use that were incorporated into the inventory. Forecasting was based on discussions with industry, and included public funding of locomotives to newer, cleaner engines where contracts were in place. Emission factors are based on U.S. EPA published reports, updated in 2014 for passenger locomotives.

More information is available at:

<https://ww3.arb.ca.gov/msei/ordiesel/locopassenger2017ei.docx>

### **Fuel Storage and Handling**

Emissions from portable fuel containers (gas cans) were estimated based on past surveys and CARB in-house testing. Additionally, emissions from outboard marine tanks were developed based on a survey and the pleasure craft population as well as CARB in-house testing.

Additional information is available at:

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

### **Diesel Agricultural Equipment**

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



results were reasonable and compared well against outside data sources. Agricultural growth rates through 2050 were developed through a contract with URS Corp.

Additional information is available at:

<https://ww3.arb.ca.gov/msei/ordiesel/ag2011invreport.pdf>

### **In-Use Off-Road Equipment**

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

Additional information is available at:

<https://ww3.arb.ca.gov/regact/2010/offroadlsi10/offroadappd.pdf>

### **Cargo Handling Equipment**

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

Background and supporting documents for the Cargo Handling Equipment Regulation are available at:

<https://ww3.arb.ca.gov/regact/2011/cargo11/cargoappb.pdf>

### **Transportation Refrigeration Units (TRU)**

This model reflects updates to activity, population, growth and turn-over data, and emission factors developed to support the 2021 TRU rule amendments. The population is based on 2020 ARBER reporting data (reporting database, required for all California TRUs), as well as dataloggers for TRUs for activity, certification data specific to TRU engines for new emission factors. Forecasting was based on IBIS world reports forecast for related industries, and turnover was forecast based on 2011 to 2020 equipment population trends.

Additional information is available at:

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

### **Small Off-Road Engines (SORE)**

Small off-road engines (SORE) are spark-ignition engines rated at or below 19 kilowatts (i.e., 25 horsepower). Typical engines in this category are used in lawn and garden equipment as well as other outdoor power equipment and specialty vehicles and cover a broad range of

equipment. The majority of this equipment belongs to the Lawn & Garden (e.g., lawnmower, leaf blower, trimmer) and Light Commercial (e.g., compressor, pressure washer, generator) categories of CARB's SORE emissions inventory model.

The newly developed, stand-alone SORE2020 Model reflects the recovering California economy from the 2008 economic recession and incorporates emission results from CARB's recent in-house testing as well as CARB's most recent Certification Database. CARB also has conducted an extensive survey of SORE operating within California through the Social Science Research Center (SSRC) at the California State University, Fullerton (CSUF). Data collected through this survey provides the most up-to-date information regarding the population and activity of SORE equipment in California.

Additional information is available at:

[https://ww2.arb.ca.gov/sites/default/files/2020-09/SORE2020\\_Technical\\_Documentation\\_2020\\_09\\_09\\_Final\\_Cleaned\\_ADA.pdf](https://ww2.arb.ca.gov/sites/default/files/2020-09/SORE2020_Technical_Documentation_2020_09_09_Final_Cleaned_ADA.pdf)

## **Stationary Point Sources**

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

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

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

NOTE: The estimates for some categories were developed several years prior to the current baseline. In those cases, CARB staff grew the original estimates according to growth and control factors. The growth factors CARB relied upon are described below, with the exception of the Bay Area Air Quality Management District (AQMD), and Southern California Association of Governments districts (Antelope Valley AQMD, Mojave Desert AQMD, Ventura County Air Pollution Control District (APCD), Imperial County APCD, and South Coast AQMD), whose growth factors were provided by the districts.

### **Stationary Nonagricultural Diesel Engines**

This category includes emissions from backup and prime generators and pumps, air compressors, and other miscellaneous stationary diesel engines that are widely used

throughout the industrial, service, institutional, and commercial sectors. The emission estimates, including emission forecasts, are based on a 2003 CARB methodology derived from the OFFROAD2007 model.

Additional information on this methodology is available at:

<https://ww3.arb.ca.gov/ei/areasrc/arbfuelcombothr.htm>

### **Agricultural Diesel Irrigation Pumps**

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

Additional information on this category is available at:

<https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full1-1.pdf>

### **Wine Fermentation and Aging**

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

An emission factor for brandy was derived by Hugh Cook of the Wine Institute. Emissions were initially estimated for 1992 then grown to 2012 using economic output for food manufacturing. Emissions were grown from 2012 to 2017 using beverage manufacturing economic output per Regional Economic Models, Inc. (REMI). Growth for future years is based on REMI forecast version 2.4.3.

Additional information on this methodology is available at:

<http://www.arb.ca.gov/ei/areasrc/arbndprofandag.htm>

### **Laundering**

This category includes emissions from perchloroethylene (perc) dry cleaning establishments. The emission estimates are based on a 2002 CARB methodology that used nationwide perc consumption rates allocated to the county level based on population and an emission factor of 10.125 pounds per gallon used. Emissions were grown based on the California Department of Finance (DOF) population forecasts, 2020.

Additional information on this methodology is available at:

<https://ww3.arb.ca.gov/ei/areasrc/arbcleanlaund.htm>

## **Degreasing**

This category includes emissions from solvents in degreasing operations in the manufacturing and maintenance industries. The emissions estimates are based on a 2000 CARB methodology using survey and industry data, activity factors, emission factors and a user's fraction. Emissions were grown based on CARB/REMI industry-specific economic output, version 2.4.3.

Additional information on this methodology is available at:

<https://ww3.arb.ca.gov/ei/areasrc/arbcleandegreas.htm>

## **Coatings and Thinners**

This category includes emissions from coatings and related process solvents. Auto refinishing emissions estimates are based on a CARB methodology using production data and a composite emission factor derived from a 2002 survey. These estimates were grown based on CARB's on-road mobile sources model (EMFAC2017). Estimates for industrial coatings emissions are based on a 1990 CARB methodology using production and survey data, and emission factors derived from surveys. Estimates for thinning and cleaning solvents are based on a 1991 CARB methodology, census data and a default emission factor developed by CARB. These estimates were grown based on REMI county economic forecasts, version 2.4.3.

Additional information on these methodologies is available at:

<https://ww3.arb.ca.gov/ei/areasrc/arbcleancoatproc.htm>

## **Adhesives and Sealants**

This category includes emissions from solvent-based and water-based solvents contained in adhesives and sealants. Emissions are estimated based on a 1990 CARB methodology using production data and default emission factors. Estimates were grown based on REMI county economic forecasts, version 2.4.3.

Additional information on this methodology is available at:

<https://www.carb.ca.gov/ei/areasrc/arbcleanadhseal.htm>

## **Gasoline Dispensing Facilities**

This category uses a 2015 CARB methodology to estimate emissions from fuel transfer and storage operations at gasoline dispensing facilities (GDFs). The methodology addresses emissions from underground storage tanks, vapor displacement during vehicle refueling, customer spillage, and hose permeation. The updated methodology uses emission factors developed by CARB staff that reflect more current in-use test data and also accounts for the emission reduction benefits of onboard refueling vapor recovery (ORVR) systems. The emission estimates are based on 2012 statewide gasoline sales data from the California Board of Equalization that were apportioned to the county level using fuel consumption estimates from EMFAC 2014. Emissions were grown based on EMFAC2017.

Additional information on this category is available at:

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

### **Gasoline Cargo Tank**

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

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

Additional information on this methodology is available at:

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

### **Marine Petroleum Loading**

These categories are used to inventory 1987 hydrocarbon emissions associated with loading crude oil, residual oil, gasoline, and jet fuel into marine tankers and gasoline into barges. Emissions result from the displacement of vapors existing in the tank before loading and those generated as new product is loaded.

The amounts of crude oil, gasoline, jet fuel, and residual oil shipped off from California ports were obtained from a United States Army Corps of Engineers report "Waterborne Commerce of the United States, Calendar Year 1986" Part 4.

The emission factor for crude oil loading into tankers was obtained from the report "Hydrocarbon Emissions During Marine Loading of Crude Oils" from Western Oil and Gas Association (1977). The gasoline emission factors for loading into tankers and barges and jet fuel into tankers were obtained from CARB's "Report to the Legislature on Air Pollutant Emissions from Marine Vessels" (1984). The emission factor for residual oil loading into tankers was obtained from the "Inventory of Emissions from Marine Operations within California Coastal Waters, Preliminary Draft" report by Scott Environmental Technology, Inc. (1980). No growth was assumed for these emissions.

Additional information on this methodology is available at:

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

### **Marine Petroleum Unloading**

These categories are used to estimate hydrocarbon emissions associated with lightering crude oil and ballasting marine vessels after unloading crude oil or gasoline.

The amounts of crude oil and gasoline unloaded at California ports were obtained from the United States Army Corps of Engineers report "Waterborne Commerce of the United States, Calendar Year 1986" Part 4.

Crude oil lightering data was obtained from the Bay Area AQMD for 1987. Crude oil and gasoline ballasting data for San Luis Obispo for 1987 was obtained from the Army Corps of Engineers. The volume of water used for ballasting following a cargo discharge was obtained from CARB's "Report to the Legislature on Air Pollutant Emissions from Marine Vessels" (1984).

The crude oil lightering emission factor was obtained from "Hydrocarbon Emissions During Marine Loading of Crude Oils," Western Oil and Gas Association (1977).

Ballasting crude oil and gasoline vessels emission factors were obtained from "Inventory of Emissions from Marine Operations within the California Coastal waters," by Scott Environmental Technology, Inc. (1981). No growth is assumed for this category.

Additional information on this methodology is available at:

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

### **Oil and Gas Production**

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

2.9 percent annual decline, which reflects the statewide CalGEM trend from 2000 through 2016.

Additional information on this methodology is available at:

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

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

## **Area-Wide Sources**

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

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

NOTE: The estimates for some categories were developed several years prior to the current baseline. In those cases, CARB staff grew the original estimates according to growth and control factors. The growth factors CARB relied upon are described below, with the exception of the Bay Area Air Quality Management District (AQMD), and Southern California Association of Governments districts (Antelope Valley AQMD, Mojave Desert AQMD, Ventura County Air Pollution Control District (APCD), Imperial County APCD, and South Coast AQMD), whose growth factors were provided by the districts.

### **Consumer Products and Aerosol Coatings**

The Consumer Product emission estimates utilized sales and formulation data from the CARB's mandatory survey of all consumer products sold in California for calendar years 2013 through 2015. The aerosol coatings estimates utilized sales and formulation data from a survey conducted by CARB in 2010. Based on the survey data, CARB staff determined the total product sales and total VOC emissions for the various product categories. Growth for personal care products are based on real disposable personal income projections per REMI version 2.4.3. No growth is assumed for aerosol coatings. Growth for all other personal care products are based on DOF population projections, 2020.

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

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

### **Architectural Coatings**

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 2007

CARB Suggested Control Measures. These emissions are grown based on DOF population forecasts, 2020.

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

<https://ww2.arb.ca.gov/solvent-evaporation-methodologies>

### **Pesticides**

The California Department of Pesticide Regulation (DPR) develops month-specific emission estimates for agricultural and structural pesticides. Each calendar year, DPR updates the inventory based on the Pesticides Use Report, which provides updated information from 1990 through the 2017 calendar year. Agricultural pesticide emission forecasts for years 2018 and beyond are based on the average of the most recent five years. Growth for agricultural pesticides is based on CARB projections of farmland acres per FMMP, 2016. Growth for structural pesticides is based on DOF population growth projections, 2020.

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

<https://ww2.arb.ca.gov/solvent-evaporation-methodologies>

### **Residential Wood Combustion**

Residential Wood Combustion estimates are based off a 2011 CARB methodology. It reflects recent survey data on types of wood burning devices and wood consumption rates, updates to the 2002 U.S. EPA National Emission Inventory (NEI) emission factors, and improved calculation approaches. The update reflects wood combustion surveys conducted by several districts including Bay Area AQMD in 2007, South Coast AQMD in 2003 and 2006, Placer County APCD in 2007, San Joaquin Valley APCD in 2014, and Sacramento Metropolitan AQMD in 2007.

CARB assumes no growth for this category based on the relatively stagnant residential wood fuel use over the past decade (according to the American Community Survey and US Energy Information Administration).

Additional information on this methodology is available at:

<https://ww2.arb.ca.gov/miscellaneous-process-methodologies>

### **Residential Natural Gas Combustion**

CARB staff updated the methodology to reflect 2017 fuel use from the California Energy Consumption Database. The emissions estimates reflect the most recent emissions factors from U.S. EPA's AP-42 for residential natural gas combustion. Growth is based on California Energy Commission (CEC) projections for natural gas consumption, 2014.

Additional information on this methodology is available at:

<https://ww2.arb.ca.gov/miscellaneous-process-methodologies>



## **Residential Distillate Oil and Liquefied Petroleum Gas**

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

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

This category uses emission factors from U.S. EPA's AP-42. The emissions were initially calculated in 1993 then grown to 2012 using housing unit data from the DOF, 2013. Emissions were grown from 2012 to 2017 using a 'no growth' profile developed by Pechan (2012).

Additional information on this methodology is available at:  
<https://ww2.arb.ca.gov/miscellaneous-process-methodologies>

## **Farming Operations**

CARB staff updated the non-cattle Livestock Husbandry methodology to reflect livestock population data based on the USDA's 2017 Census of Agriculture. Cattle emissions are primarily based on the 2012 Census of Agriculture. A seasonal adjustment was added to account for the suppression of dust emissions in months in which rainfall occurs. Growth profiles are based on CARB's projections of Census of Agriculture's historical livestock population trends, 2012. No growth is assumed for dairy and feedlots.

Additional information on CARB's methodology is available at:  
<https://ww2.arb.ca.gov/miscellaneous-process-methodologies>

## **Fires**

Emissions from structural and automobile fires were estimated based on a 1999 CARB methodology using the number of fires and the associated emission factors. Estimates for structural fires are calculated using the amount of the structure that is burned, the amount and content of the material burned, and emission factors derived from test data. Estimates for automobile fires are calculated using the weight of the car and components and composite emission factors derived from AP-42 emission factors. Growth is based on DOF population forecasts, 2020.

Additional information on this methodology is available at:  
<https://ww2.arb.ca.gov/miscellaneous-process-methodologies>

## **Managed Burning & Disposal**

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

Additional information on managed burning is available at:

<https://ww2.arb.ca.gov/miscellaneous-process-methodologies>

## **Commercial Cooking**

Commercial Cooking emission estimates are based on methodologies developed by the local air districts. The 2017 baseline inventory includes an update for the San Joaquin Valley based on 2008 activity data that includes the number of restaurants, the number and type of cooking equipment, the food type, and emission factors from US EPA's 2002 NEI. Emissions for this category were grown based on population projections provided by the DOF, 2020.

Additional information on this survey is available at:

<https://ww2.arb.ca.gov/miscellaneous-process-methodologies>

## **Point and Areawide Source Emissions Forecasting**

Emission forecasts (2018 and subsequent years) are based on growth profiles that in many cases incorporate historical trends up to the base year or beyond. The growth surrogates used to forecast the emissions from these categories are presented below in Table A-1. The emissions inventory also reflects emission reductions from point and areawide sources subject to District rules and CARB regulations.

**Table A-5: Growth Surrogates for Point and Areawide Sources**

Source Category	Subcategory	Growth Surrogate
Electric Utilities	Natural Gas	California Energy Commission (CEC) Integrated Energy Policy Report forecast, 2017
	Other Fuels	Energy Information Administration (EIA) Annual Energy Outlook, 2019
Cogeneration	All	CEC forecast, 2017
Oil and Gas Production (Combustion)	All	Assumed 2.9% annual decline reflecting CalGEM historical trend, 2000 through 2016
Petroleum Refining (Combustion)	All	No growth assumption
Manufacturing and Industrial	Natural Gas	CEC forecast, 2014
	Other Fuels	EIA forecast, 2018
Food and Agricultural Processing	Ag Irrigation I. C. Engines	FMMP irrigated farmland acreage, 2008
	Natural Gas	CEC forecast, 2014
	Others	REMI economic forecast, version 2.4.3; EIA forecast, 2018
Service and Commercial	Natural Gas	CEC forecast, 2014
	Other Fuels	EIA forecast, 2018
Other (Fuel Combustion)	Diesel	Modeled estimate, 2003
	Other than diesel	EIA forecast, 2018
Waste Disposal	All	DOF population forecast, 2020
Laundering	Dry Cleaning	DOF population forecast, 2020
Degreasing	All	CARB/REMI economic forecast, version 2.4.3
Coatings & Thinners	Auto Refinishing	Vehicles from CARB EMFAC2017 model
	Others	REMI economic forecast, version 2.4.3
Printing	All	REMI economic forecast, version 2.4.3
Adhesives & Sealants	All	REMI economic forecast, version 2.4.3
Oil and Gas Production	All	Assumed 2.9% annual decline reflecting CalGEM historical trend, 2000 through 2016
Petroleum Refining	All	No growth assumption
Petroleum Marketing	Natural Gas Transmission	CEC forecast, 2014

Source Category	Subcategory	Growth Surrogate
	Gas Dispensing Facilities and Cargo Tanks	Fuel use from CARB EMFAC2017 model
	Other Point Sources	REMI economic forecast, version 2.4.3
Chemical	All	REMI economic forecast, version 2.4.3
Food & Agriculture	All	REMI economic forecast, version 2.4.3
Mineral Processes	All	REMI version 2.4.3; EIA forecast, 2018
Metal Processes	All	REMI economic forecast, version 2.4.3
Glass and Related Products	Container Glass, Other Glass	No growth assumption
	Flat Glass	Modeled estimate, 2012
Other Industrial Processes	All	REMI economic forecast, version 2.4.3
Consumer Products	Personal Care Products	Real Disposable Personal Income per REMI, version 2.4.3
	Other Consumer Products	DOF population forecast, 2020
	Aerosol Coatings	No growth
Architectural Coatings & Related Process Solvents	All	DOF population forecast, 2020
Pesticides & Fertilizers	Agricultural Pesticides	CARB projection of farmland acres per FMMP, 2016
	Structural Pesticides	DOF population forecast, 2020
Asphalt Paving & Roofing	All	DOF construction jobs forecast, 2020; CARB projection
Residential Fuel Combustion	Natural Gas	CEC forecast, 2014
	Other Fuels	No growth
Farming Operations	Dairy / Feedlots	No growth

Source Category	Subcategory	Growth Surrogate
	Other Livestock	CARB projection of livestock population per Census of Agriculture, 2012
Fires	All	DOF population forecast, 2020
Managed Burning and Disposal	Agricultural Burning, Prunings & Field Crops	FMMP farmland acreage projection, 2016
	Non-Agricultural Open Burning	Rural counties: DOF population forecast, 2020. Urban counties: no growth.
	Unspecified Waste Burning	DOF population forecast, 2020
	Others	No growth
Cooking	All	DOF population forecast, 2020