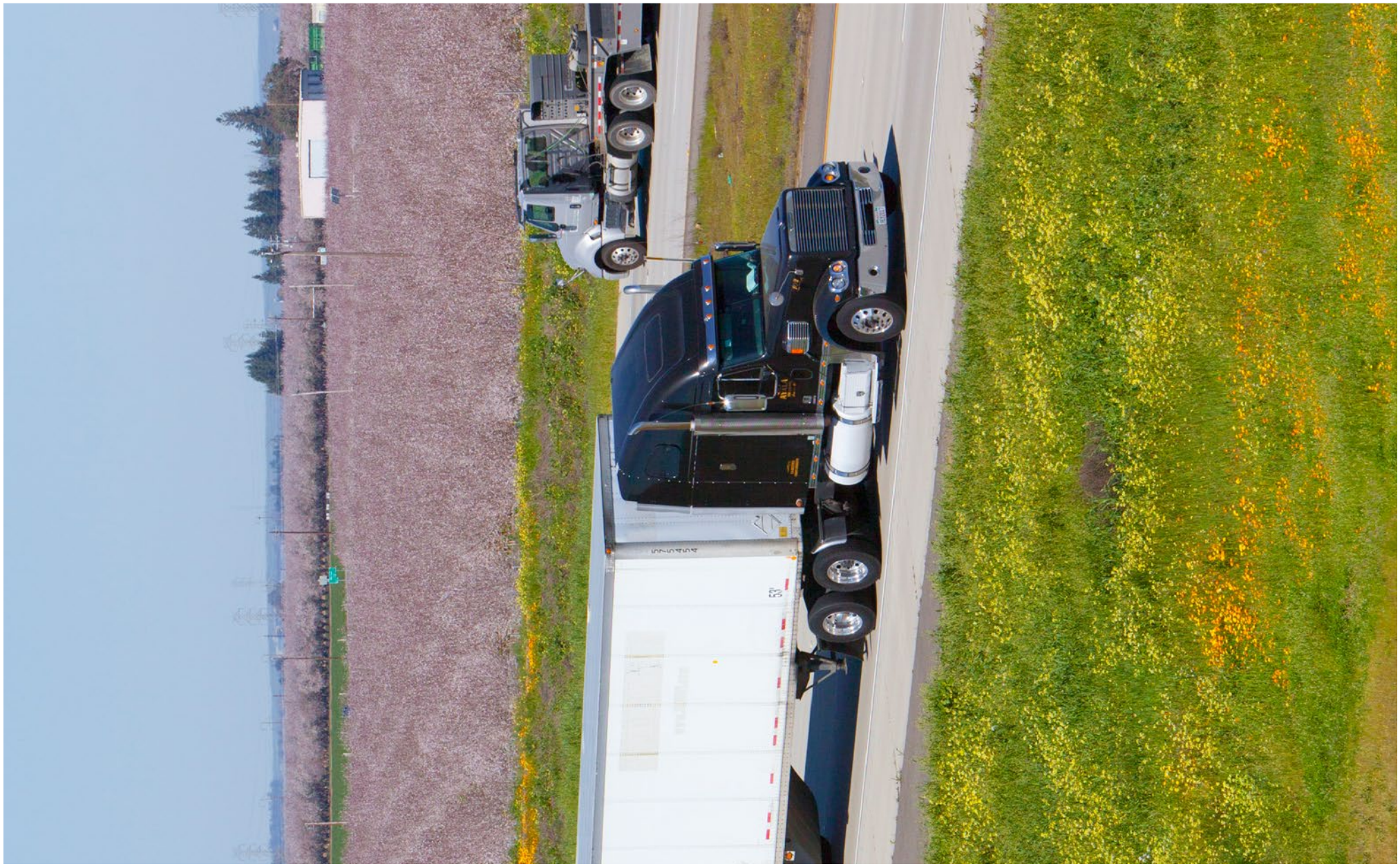
Appendix D

Mobile Source Control Measure Analyses



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Best Available Control Measures (BACM) and Most Stringent Measures (MSM) Analysis of Mobile Source Control Programs for the San Joaquin Valley's 2016 Comprehensive PM2.5 SIP

[This chapter provided by the California Air Resources Board]

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

D. EXECUTIVE SUMMARY

The Clean Air Act (the Act) specifies required levels of emission controls in a State Implementation Plan (SIP), depending upon the severity of the air quality problem and amount of time a nonattainment area needs to meet the PM2.5 standard. The State has conducted this analysis for each mobile source category in the San Joaquin Valley (SJV or Valley). The suite of control measures that is currently being implemented by California Air Resources Board (CARB or Board) – both the current control program and new measures proposed for the Valley – satisfy the applicable control requirements for Best Available Control Measures (BACM) and Most Stringent Measures (MSM) for the four PM2.5 standards addressed in this plan. This analysis finds that California's mobile source control program is the most stringent and far-reaching suite of mobile source control measures that is currently implemented in the nation, and meets the required levels of emissions controls.

In conducting this analysis, CARB staff followed a four-step process of assessing California's mobile source program. First, staff identified mobile source emissions as a significant contributor to ambient PM2.5 emissions. Next, staff identified potential control measures for each mobile source sector, including an analysis of California's mobile source control program, other control measures in practice throughout the nation, and reconsideration of control measures that were previously considered to be infeasible. Staff then assessed the stringency and feasibility of the potential control measures that were identified. And finally, while many of the measures identified in this analysis are already measures in the California SIP, additional control measures have been included as commitments in the Valley's proposed SIP.

In aggregate, California's comprehensive suite of new vehicle and engine emission standards, in-use control measures, fuel specifications, and incentive programs for mobile sources represent the most stringent level of controls in the nation, and achieve the maximum feasible emission reductions for this category:

- California's control measures for the passenger vehicle fleet includes new vehicle emission standards, fuel specifications, and the most rigorous in-use inspection program for on-road light-and medium-duty vehicles in the country. The suite of on-road light-duty vehicle control measures included in the Valley's plan is anticipated to achieve the maximum feasible emission reductions possible, and is comprised of the most stringent level of control measures for this category in the nation.

- California's heavy-duty on-road vehicle and engine control program is comprised of the most stringent emission standards for new engines in the nation (i.e. new vehicle tailpipe emission and evaporative emission standards; certification, testing, and verification requirements; warranty and useful life requirements, and OBD system requirements). Additionally, to reduce in-use emissions and accelerate fleet turnover to cleaner engines, California's in-use control measures include the most stringent inspection and maintenance program, idling requirements, and legacy fleet requirements for on-road heavy-duty fleets in the

nation. Finally, California's clean diesel regulations provide the most stringent emission controls in the nation for conventional and renewable diesel fuels and diesel substitute fuels. In aggregate, the suite of on-road heavy-duty control measures included in the Valley's plan is anticipated to achieve the maximum feasible emission reductions possible, and is comprised of the most stringent level of control measures for this category in the nation.

- California's off-road engine and equipment control program includes the most stringent emission standards for new engines in the nation, comprehensive in-use fleet requirements to address emissions from the legacy fleets, and the cleanest off-road diesel fuel specifications in the nation. California's in-use control measures are national models for aggressive and successful efforts to reduce in-use emissions and accelerate fleet turnover to cleaner engines. In aggregate, the suite of off-road mobile source control measures included in the Valley's plan is anticipated to achieve the maximum feasible emission reductions possible, and is comprised of the most stringent level of control measures for this category in the nation.

D.1 Chapter I. Clean Air Act Requirements for Emission Control Measures

The particulate matter provisions in the Act establish a step-wise process for classifications and attainment dates:

- The first step is a Moderate area SIP, with an initial attainment date six years after the area is designated nonattainment;
- If attainment within six years is impracticable given the severity of the PM2.5 challenge in that area, then U.S. EPA re-classifies the area to Serious, and establishes requirements for a second SIP submittal that must show attainment within 10 years after the area was originally designated nonattainment.

Likewise, the Act specifies a step-wise process for the required level of emission controls in a SIP, depending upon the severity of the air quality problem and amount of time a nonattainment area needs to meet the PM2.5 standard:

- For a Moderate nonattainment area, the required level of control is Reasonably Available Control Measures (RACM).[1]
- For a Serious PM2.5 nonattainment area, BACM is the required level of control. U.S. EPA defines BACM to be the maximum degree of emission reductions achievable from a source or source category determined on a case-by-case basis considering energy, economic, and environmental impacts.[2]
- For a Serious PM2.5 nonattainment area for which air quality modeling demonstrates that the area cannot practicably attain by the end of the tenth calendar year (i.e. designated as "Serious with Extension"), MSM is the required level of control.[3] U.S. EPA defines MSM as, "the maximum degree of emission reductions that has been required or achieved from a source or source category in any other attainment plans or in practice in any other states and that can feasibly be implemented in the area."[4] MSM is also inclusive of BACM requirements.
- For a Serious PM2.5 nonattainment area that has not attained by the applicable attainment date (i.e. designated as "Serious – 5% Plan"), the required level of control is also MSM.[5]

The Valley is a Serious nonattainment area for each of the four PM2.5 standards discussed in this plan.

[1] RACM requirements are addressed in the Moderate SIP for the Valley. For further information see https://www.arb.ca.gov/planning/sip/planarea/sanjqnvllysip.htm

[2] U.S. EPA 1994 Addendum to the General Preamble p. 42010

[3] 40 CFR 51.1010(b)(2)(i)

[4] See U.S. EPA "Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements" pp. 326 July 2016 https://www.epa.gov/sites/production/files/2016-07/documents/pm25-naaqs-implementation-final-preamble-rule-signature.pdf

[5] 40 CFR 51.1003(c)(2)(i)

D.1.1 Required Stringency of Control Measures: Defining BACM and MSM

Based on the Valley's current classification for each standard, Table 1 describes the level of control measures required for each of the applicable four PM2.5 standards.

Table 1: Stringency of Control Measures Required[6]

Standard	Classification	Type of Plan	Control Measure Requirements
12 µg/m3 Annual (2012)	Moderate with Request to Serious	Serious	**Best Available Control Measures** "The state shall identify, adopt, and implement best available control measures, including control technologies, on sources of direct PM2.5 emissions and sources of emissions of PM2.5 plan precursors." 40 CFR 51.1010(a)
35 µg/m^3 24-Hour (2006)	Serious with Extension	Most Stringent Measures (MSM)	**Most Stringent Measures** "The state shall identify, adopt, and implement the most stringent control measures that… can be feasibly implemented in the area." 40 CFR 51.1010(b)
15 µg/m^3 Annual (1997) 65 µg/m^3 24-Hour (1997)	Serious, failed to attain by attainment date	5% Plan*	**Most Stringent Measures** "For the sources and source categories represented in the emission inventory for the nonattainment area, the state shall identify the most stringent measures for reducing direct PM2.5 and PM2.5 plan precursors." 40 CFR 51.1010(c)(2)(i)

* 5% plan means than a 5% reduction in directly emitted PM2.5/precursor emissions per year in the nonattainment area is required until attainment (which must be achieved as expeditiously as possible).

For areas like that Valley that are nonattainment for multiple PM2.5 standards that have become more stringent over time, classification is influenced by the timing of when the standards were finalized. Due to the step-wise nature of reclassification for PM2.5 standards, the Valley's control measures for this plan must satisfy U.S. EPA's requirements for both BACM and MSM.

The variance in the required levels of control measure stringency among the four standards shown in Table 1 is due to timing differences in when the standards were finalized, as this – along with the severity of its air quality – influences the Valley's classification status. Although the older standards are less stringent in value, the emission control requirements are most stringent for the 1997 standards because they were finalized earlier than the other standards (which were finalized in 2006 and 2012, respectively). Therefore, the Valley is furthest along in the step-wise process for the 1997 standards, relative to the more recent 2006 and 2012 standards.

D.1.1.1 Best Available Control Measures

BACM is the level of stringency required for the 2012 Annual Standards of 12 µg/m^3. The Act defines BACM as, "any technologically and economically feasible control measure that can be implemented in whole or in part within four years after the date of reclassification of a Moderate PM2.5 nonattainment area to Serious and that generally

[6] The Valley's Comprehensive PM2.5 SIP has been developed to provide the necessary elements for each of the PM2.5 standards for which the Valley is classified as nonattainment. This appendix has been developed to meet a subset of these requirements; namely the requirement that staff demonstrate that the mobile source control strategies used to model the Valley's attainment demonstration for the PM2.5 standards listed in Table 2 satisfy U.S. EPA's requirements for Serious area attainment plan control strategy requirements, as set forth in § 51.1010.

can achieve greater permanent and enforceable emissions reductions in direct PM2.5 emissions and/or emissions of PM2.5 plan precursors from sources in the area than can be achieved through the implementation of RACM on the same source."[7] U.S. EPA has further clarified that BACM-level of controls are:[8]

- The maximum degree of emissions reductions achievable from a source or source category, which is determined on a case-by-case basis considering energy, economic and environmental impacts;
- More stringent than RACM, but less stringent than the lowest achievable emission rate (LAER), which doesn't take into consideration the cost effectiveness of implementing a particular control measure;
- Additive to RACM, as BACM will generally consist of a more extensive implementation of RACM measures; and
- Inclusive of Best Available Control Technology (BACT).

U.S. EPA defines BACT similarly to BACM as an emission limitation based on the, "maximum degree of reduction of each pollutant emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques." [9] BACT is also at least as stringent as new source performance standards (NSPS) and national emissions standards for hazardous air pollutants (NESHAPs)[10]

D.1.1.2 Most Stringent Measures

MSM is the level of stringency required for the 2006 24-Hour Standard of 35 µg/m^3, the 1997 Annual Standard of 15 µg/m^3, and the 24-Hour Standard of 65 µg/m^3. The Act defines MSM as, "any permanent and enforceable control measure that achieves the most stringent emissions reductions in direct PM2.5 emissions and/or emissions of PM2.5 plan precursors from among those control measures which are either included in the SIP for any other National Ambient Air Quality Standard (NAAQS), or have been achieved in practice in any state, and that can feasibly be implemented in the relevant PM2.5 NAAQS nonattainment area."[11]

U.S. EPA indicates that MSM is inclusive of the requirements and process for determining BACM, but with one additional step of comparing the potentially MSM against the measures already adopted in the area to determine if the existing measures are the most stringent.[12] Further U.S. EPA guidance defined MSM as "the maximum degree of emission reduction that has been required or achieved from a source or source category in any other attainment plans or in practice in any other states and that

[7] Code of Federal Regulations (CFR) Title 40 – Protection of Environment § 51.1000 – Definitions https://www.gpo.gov/fdsys/pkg/CFR-2017-title40-vol2/xml/CFR-2017-title40-vol2-sec51-1000.xml

[8] U.S. EPA 1994 "Addendum to the General Preamble" pp. 42009 -42013

[9] 42 U.S. Code § 7479 – Definitions https://www.gpo.gov/fdsys/pkg/USCODE-2011-title42/html/USCODE-2011-title42-chap85-subchapI-partC-subparti-sec7479.htm See § 7479(3) BACT

[10] U.S. EPA 1994 "Addendum to the General Preamble" pp. 42009 -42013

[11] Code of Federal Regulations (CFR) Title 40 – Protection of Environment § 51.1000 – Definitions https://www.gpo.gov/fdsys/pkg/CFR-2017-title40-vol2/xml/CFR-2017-title40-vol2-sec51-1000.xml

[12] U.S. EPA 2001 *Final TSD for Maricopa County PM10 Nonattainment Area*. Available at https://www3.epa.gov/region9/air/phoenixpm/pdf/tsd0901.pdf

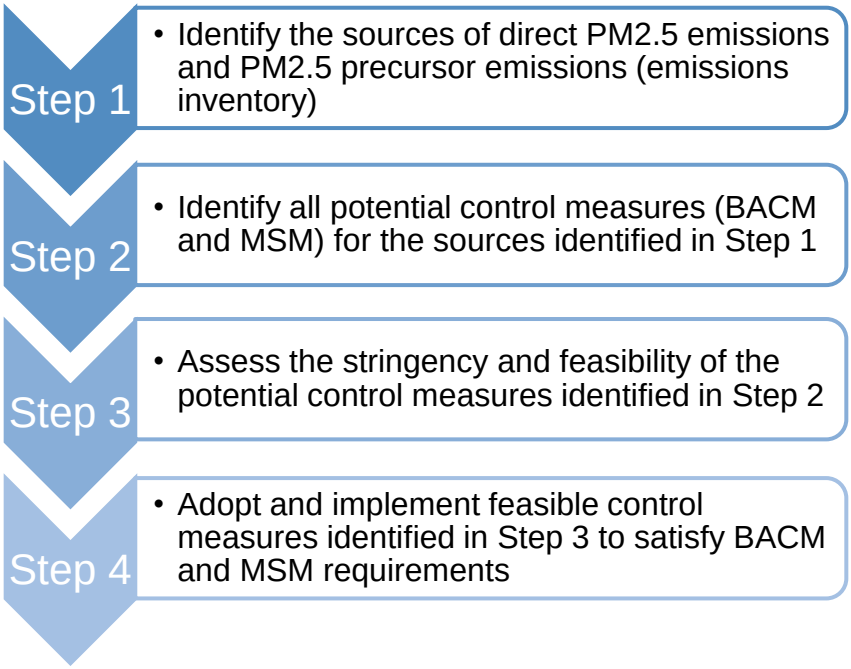
can feasibly be implemented in the area seeking the extension, such as what LAER represents for new or modified sources under the New Source Review permit program."[13]

[13] U.S. EPA 1994. *Addendum to the General Preamble*, 59 FR 41998 page 42010

D.2 CHAPTER II. PROCESS FOR DETERMINING BACM AND MSM

U.S. EPA prescribes a four-step process for the identification and determination of whether the control measures satisfy the Serious area attainment plan control strategy requirements.

Figure 1 Process for Determining BACM and MSM



This process starts with identifying the sources of PM2.5 emissions (both direct and precursor emissions; then expands the analysis to identify all potential BACM/MSM control measures to reduce emissions. Step 3 begins to narrow the scope of analysis by refining the list of all potential BACM/MSM control measures to determine which of the control measures are sufficiently stringent to meet the applicable BACM and MSM requirements, and that are technically and economically feasible. The final step to adopt any control measures identified through this process, if they are feasible to implement in the Valley.

The process for identifying MSM generally follow the same steps as the process for identifying BACM.[14] This is because the Serious area attainment plan control strategy requirements described in § 51.1010 are additive as the plans become more stringent. That is to say, the MSM requirements are inclusive of the requirements for BACM, with additional requirements added to reflect the increased stringency in control levels that result from a bump-up in classification.[15] Table 2 delves more deeply into this process, showing each required element in the steps listed above for each of the four applicable PM2.5 Standards.

[14] In accordance with U.S. EPA's prescribed process described in the *TSD for the Maricopa County Serious Area PM10 Plan – 24-Hour Standard* (U.S. EPA 2001), which states, "Given this similarity between the BACM requirement and the MSM requirement, we believe that determining MSM should follow a process similar to determining BACM, but with one additional step, to compare the potentially most stringent measure against the measures already adopted in the area to determine if the existing measures are most stringent." Document is available at: https://www3.epa.gov/region9/air/phoenixpm/pdf/tsd0901.pdf

[15] § 51.1003(b)(2)(iii) requires that a submittal requesting a Serious area attainment date extension that is simultaneous with the Serious area attainment plan shall meet the most stringent measure (MSM) requirements set forth at § 51.1010(b), in addition to the BACM and BACT and additional feasible measure requirements set forth at § 51.1010(a)". For more details, see the Serious area attainment plan control strategy requirements identified in 40 CFR § 51.1010(a)(5), § 51.1010(b)(5), and § 51.1010(c)(5)

Table 2: BACM/BACT and MSM Requirements

Standard	12 ug/m3 Annual (2012)	35 ug/m3 24-Hour (2006)	15 ug/m3 Annual (1997) 65 ug/m3 24-Hour (1997)
Classification	Serious	Serious with Extension	Serious - 5% Plan
Control Strategy	BACM/BACT	MSM	MSM
Step 1: Identify sources of direct PM2.5 and precursor emissions (emissions inventory)	Required "The state shall identify all sources of direct PM2.5 emissions and all sources of emissions of PM2.5 precursors in the nonattainment area in accordance with the emissions inventory requirements…" § 51.1010(a)(1)	Required "The state shall identify all sources of direct PM2.5 emissions and sources of emissions of PM2.5 precursors in the nonattainment area in accordance with the emissions inventory requirements…" § 51.1010(b)(1)	Required "The state shall identify all sources of direct PM2.5 emissions and sources of emissions of PM2.5 precursors in the nonattainment area in accordance with the emissions inventory requirements…" § 51.1010(c)(1)
Step 2: Identify all potential control measures	Required "The State shall identify all potential control measures to reduce emissions from all sources of direct PM2.5 emissions and sources of emissions of PM2.5 plan precursors" § 51.1010(a)(2)	Required "The State shall identify all potential control measures to reduce emissions from all sources of direct PM2.5 emissions and sources of emissions of PM2.5 plan precursors" § 51.1010(b)(2)	Required "The State shall identify all potential control measures to reduce emissions from all sources of direct PM2.5 emissions and sources of emissions of PM2.5 plan precursors" § 51.1010(c)(2)
Step 2(a): Begin with the area's current control measures	Recommended Begin identification of potential control measures by updating list of control measures already in the nonattainment area	Recommended[16] "A state… should be able to start its process using the work already undertaken for the nonattainment area's RACM and BACM demonstrations and to make updates to the list of potential control measures"	Recommended "A state… should be able to start its process using the work already undertaken for the nonattainment area's RACM and BACM demonstrations and to make updates to the list of potential control measures"
Step 2(b): Survey other states and nonattainment areas for additional potential control measures	Required "The state shall survey other NAAQS nonattainment areas in the U.S. and identify any measures for direct PM2.5 and PM2.5 plan precursors not previously identified" § 51.1010(a)(2)(i)	Required "The state shall identify the most stringent measures for reducing direct PM2.5 and PM2.5 plan precursors adopted into any SIP or used in practice to control emissions in any state" § 51.1010(b)(2)(i)	Required "The state shall identify the most stringent measures for reducing direct PM2.5 and PM2.5 plan precursors adopted into any SIP or used in practice to control emissions in any state" § 51.1010(c)(2)(i)
Step 2(c): Reconsider and reassess any measures previously rejected	Not required for BACM/BACT	Required "The state shall reconsider and reassess any measures previously rejected by the state during the development of any previous Moderate area or Serious area attainment plan control strategy" § 51.1010(b)(2)(ii)	Required "The state shall reconsider and reassess any measures previously rejected by the state during the development of any Moderate area or Serious area attainment plan control strategy for the area" § 51.1010(c)(2)(ii)
Step 3: Assess potential control measures' stringency and feasibility	Required	Required	Required
Step 3(a): Evaluate stringency	Required BACT/BACM control levels required	Required MSM control levels required	Required MSM control levels required
Step 3(b): Assess technological and economic feasibility	Required "The state may make a demonstration that any measure identified… is not technologically or economically feasible to implement in whole or in part by the end of the tenth calendar year following the effective date of designation of the area, and may eliminate such whole or partial measure from further consideration" § 51.1010(a)(3)	Required "The state may make a demonstration that a measure identified… is not technologically or economically feasible to implement in whole or in part by 5 years after the applicable attainment date for the area, and may eliminate such whole or partial measure from further consideration" § 51.1010(b)(3)	Required "The state may make a demonstration that a measure identified… is not technologically or economically feasible to implement in whole or in part within 5 years or such longer period as the EPA may determine is appropriate after the EPA's determination that the area failed to attain by the Serious area attainment date, and may eliminate such whole or partial measure from further consideration" § 51.1010(c)(3)
Step 4: If found to be economically and technologically feasible, adopt control measures	Required "The state shall identify, adopt, and implement best available control measures, including control technologies, on sources of direct PM2.5 emissions and sources of emissions of PM2.5 plan precursors	Required "The state shall identify, adopt, and implement the most stringent control measures that are included in the attainment plan for any state or are achieved in practice in any state, and can be feasibly implemented in the area"	Required "Except as provided under paragraph (c)(3) of this section, the state shall adopt and implement all control measures …that collectively achieve attainment of the standard as

[16] See U.S. EPA "Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements" July 2016 https://www.epa.gov/sites/production/files/2016-07/documents/pm25-naaqs-implementation-final-preamble-rule-signature.pdf

	located in any Serious PM2.5 nonattainment area“ § 51.1010(a)	§ 51.1010(b)	expeditiously as practicable” § 51.1010(c)(4)

D.2.1 Step 1: Mobile Source Emissions of Direct PM2.5 and NOx

The first step required in the Act's specified BACM and MSM evaluation process is to identify and quantify the sources of PM2.5, including direct PM2.5 emissions and emissions of precursor pollutants.

In the Valley, air quality measurements and modeling have shown that emissions from mobile sources – cars, trucks, and a myriad of off-road equipment – are a significant contributor to ambient PM2.5 levels. Overall, mobile sources contribute to approximately 50 to 60 percent of the particles that make up PM2.5 in the Valley. These contributions come through both directly emitted PM2.5 and gaseous precursors such as NOx, the key precursor to atmospheric formation of PM2.5 in the Valley.

D.2.2 Steps 2 and 3: Identification and Evaluation of Potential BACM/MSM Control Measures

The second and third steps required in the Act's BACM / MSM evaluation process have been grouped together in this appendix so that the control measures for each mobile sector (i.e. passenger vehicles, on-road heavy-duty trucks and buses, off-road mobile sources, and fuels) canbe more cohesively identified and evaluated.

D.2.2.1 Step 2: Identification of Potential BACM/MSM Control Measures

Step 2 calls for the identification of all possible control measures for each of the mobile sources of PM2.5 and NOx identified in Step 1.[17] To satisfy the Act's MSM requirements, this is a three-part process.[18]

D.2.2.2 Step 2(a): California's Control Measures

The identification of all potential mobile source control measures begins with an analysis of California's mobile control program. Due in part to the severity of its air quality needs, and in part to unique authority provided under the Act, California's mobile source controls go far beyond other states' and even national programs, and thus provides an excellent starting place in identifying a comprehensive range of control measures as required by the Act. This approach also aligns with U.S. EPA guidance, which suggests starting the identification process with any controls previously identified in prior Moderate or Serious SIPs for the nonattainment area.[19]

Section 209(b) Waiver Authority

In recognition of California's early efforts and extent of air quality challenges, the State has unique authority to regulate emissions from some source categories more stringently than the federal government under the Act's §209(b) waiver provision. While U.S. EPA has primary authority for interstate trucks, aircraft, ships, locomotives,

[17] In a departure from previous SIP guidance, EPA guidance indicates that are no *de minimis* source categories for this plan. Thus, emissions of direct PM2.5 and PM2.5 precursors (i.e. NOx) from all mobile source categories must be controlled in the Valley, and meet the applicable BACM/BACT and MSM requirements. See U.S. EPA April 2016 "SIP Requirements Rule" 81 FR 58010 https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf

[18] Step 2(c), the identification of any control measures that were previously rejected as infeasible in prior Moderate or Serious SIPs for the Valley is a requirement for MSM, not BACM. See 40 CFR § 51.1010(b)(2)(ii) and § 51.1010(c)(2)(ii)

[19] U.S. EPA "Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements" July 2016

and some farm and construction equipment, this waiver provision also allows California to seek a waiver from U.S. EPA to enact more stringent emission standards for passenger vehicles, heavy-duty trucks, and certain off-road vehicles and engines.

Over nearly five decades, CARB has consistently sought waivers and authorizations for its new motor vehicle regulations and has received waivers and authorizations for over 100 regulations. CARB's history of progressively strengthening standards as technology advances, coupled with the waiver process requirements, ensures that California's regulations remain the most stringent in the nation, and that necessary emission reductions from the mobile sector continue.

This provision preserves a critical role for California in the control of emissions from new motor vehicles, recognizing that California plays an important leadership role and serves as a "laboratory" state for more stringent motor vehicle emission standards. For example, CARB's LEV I and LEV II, and the ZEV Programs have resulted in the production and sales of hundreds of thousands of ZEVs in California since first adopted in 1990.

D.2.2.3 Step 2(b): Other States' and Nonattainment Areas' Control Measures

The second component required to identify all potential BACM/MSM control measures is the identification of any additional control measures used in other states or nonattainment areas, and an assessment of their stringency relative to the control measures in the Valley's attainment plan and demonstration.[20, 21] The purpose is to identify whether there are additional potential BACM/MSM control measures used to control mobile emissions of direct PM2.5 and/or NOx in other states or nonattainment areas that are more stringent than the measures included in the Valley's attainment plan and demonstration. If this assessment finds that there are more stringent measures in use elsewhere – and if they are found to be sufficiently stringent and technically and economically feasible to implement in the Valley (see Step 3) – statute requires that any such measures are adopted and implemented in the Valley's plan (see Step 4), in order to meet the requirements that the area, "attain the standard as expeditiously as practicable."[22]

Identification

U.S. EPA guidance provides recommendations for possible resources to assist in the search for other control measures used in other states or nonattainment areas, including:[23]

- Other states' control programs (including those measures identified in U.S. EPA's list of national, state and/or local air quality agencies' control measures);[24]
- U.S. EPA's "Menu of Control Measures" for PM2.5; [25] and

[20] § 51.1010(a)(2)(i), § 51.1010(b)(2)(i), and § 51.1010(c)(2)(i)

[21] U.S. EPA "Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements" July 2016

[22] For the 35 µg/m3 24-Hour PM2.5 Standard (2006), see § 51.1010(b)(4). For the 15 µg/m3 Annual PM2.5 Standard (1997) and 65 µg/m3 24-Hour PM2.5 Standard (1997), see § 51.1004(a)(3)

[23] U.S. EPA April 2016 "SIP Requirements Rule" 81 FR 58010 https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf

[24] U.S. EPA https://www.epa.gov/pm-pollution/epa-summaries-and-reports-several-state-and-local-pm-control-measures. Accessed April 24, 2018

[25] U.S. EPA 2016 "*Menu of Control Options"* Accessed April 2018 at https://www.epa.gov/air-quality-implementation-plans/menu-control-measures-naaqs-implementation

- U.S. EPA's mobile-specific control measures for PM2.5.[26]

Beyond these suggested resources, CARB staff has also taken additional steps to identify any additional mobile source control measures currently in use in jurisdictions outside of California. This process included inquiries to U.S. EPA staff in Region 9, as well as inquiries to CARB technical staff that are engaged in developing control strategies across a wide range of mobile sources throughout the agency, including passenger vehicles, heavy-duty trucks and buses, off-road equipment, and fuels. Furthermore, CARB staff has performed internet searches of other jurisdictions' mobile control measures to ensure that our research process for this appendix identifies any control programs that have been more recently developed and which therefore may not otherwise be reflected in the abovementioned resources specified by U.S. EPA.

Assessment

In order to identify the most stringent suite of control measures currently, "adopted into any SIP or used in practice to control emissions in any state,"[27] staff has identified in the tables included in Chapter IV Step 2(b) the most stringent suite of control measures in the nation, for each mobile source category. Staff has assessed the relative stringency of measures based on the efficiency of a given measure or control technology to reduce the level of emissions from category of the mobile source fleet – for example, by comparing the technical capacity for a given control measure to reduce in-use emissions from the on-road heavy-truck fleet, relative to other potential control measures that target the same emission source(s) for reductions. This assessment demonstrates that, for each mobile source category, the suite of control measures included in the Valley's attainment plan and demonstration are the most stringent that are in use in any state or adopted into any SIP.

D.2.2.4 Step 2(c) Reconsideration and reassessment of any control measures previously rejected as infeasible

The final component required to identify all potential BACM/MSM control measures is to reconsider and reassess any control measures proposed in prior Moderate or Serious SIPs for the Valley that were previously rejected as infeasible.[28]

CARB staff reviewed all previous Valley PM2.5 SIPs[29] and found that there are no mobile source control measures that were proposed in previous Moderate or Serious attainment plan control strategies for the Valley but which were not adopted by CARB. Thus, there are no applicable control measures previously rejected as infeasible that would need to be reconsidered for the purposes of this BACM/MSM demonstration process.

[26] U.S. EPA https://www.epa.gov/advance/control-measures-programs-pm. Accessed April 24, 2018

[27] Per MSM requirements in 40 CFR § 51.1010(b)(2)(i) and § 51.1010(c)(2)(i), which call for the identification of the most stringent suite of control measures in any state or nonattainment area.

[28] Identification of any control measures that were previously rejected as infeasible in prior Moderate or Serious SIPs for the area is a requirement for MSM, not BACM. See 40 CFR § 51.1010(b)(2)(ii) and § 51.1010(c)(2)(ii)

[29] See CARB's list of San Joaquin Valley Air Quality Management Plans at https://www.arb.ca.gov/planning/sip/planarea/sanjqnvllysip.htm

D.2.3 STEP 3: EVALUATION OF STRINGENCY AND FEASIBILITY

While the focus of Step 2 is on expanding the scope of analysis to ensure that all possible control measures are identified and incorporated into a list of potential BACM/MSM control measures, Step 3 focuses on narrowing that list to identify and discard from further consideration any measures that do not satisfy the applicable requirements for stringency and feasibility. Step 3 therefore calls for an evaluation of each of the potential BACM/MSM control measures identified in Step 2, in order to evaluate first whether they satisfy the level of stringency of each control measure (i.e. do they meet the definition of BACM or MSM); and secondly, whether they are technically and economically feasible to implement in the Valley.

Step 3(a): Evaluating Stringency

For a potential control measure to meet the definition of BACM and/or MSM as identified in Chapter I, staff must demonstrate that the measure satisfies stringency requirements in terms of both:

(i) the efficiency of a given measure or control technology to reduce the level of emissions from a specific mobile source, relative to emission controls in place in other states and nonattainment areas; and
(ii) the timing of when each control measure will begin to be implemented, relative to each plan's timing milestones and deadlines.

Much of the assessment required to evaluate the efficiency of the level of control provided by a given control measure or technology is included in Step 2(b), wherein staff analyzes the control measures in the Valley's plan relative to those in other states and nonattainment areas. In order to evaluate the stringency of implementation schedule requirements relative to the attainment deadline, staff has identified in Step 3(a) when each control measure has begun to be implemented or is anticipated to begin to be implemented, and compared that timeframe to the applicable timing milestones and deadlines for each of the four PM2.5 standards discussed in this plan.

As was discussed in the introduction, the Act requires differing levels of stringency in control measures, depending on the severity of the area's classification for each standard and status of where the plan falls in the step-wise process called for in the Act's particulate matter provisions.

For BACM, a measure must be implemented in whole or in part by the end of the fourth year following the date of reclassification of the area to Serious.[30] BACM measures fall within one of two sub-categories, depending on implementation timeframes:

- BACT a BACM measure is considered BACT if it can be implemented in whole or in part by the end of the fourth year following the date of reclassification of the area to Serious."[31]
- Additional Feasible Measure (AFM) a BACM measure is considered AFM if it can be implemented in whole or in part between the end of the fourth year following

[30] 40 CFR § 51.1010(a)(3)(i)
[31] 40 CFR § 51.1010(a)(3)(i)

the date of reclassification of the area to Serious and the applicable attainment date for the area."[32]

Unlike BACM, the Act does not specify an implementation deadline for MSM; U.S. EPA states that MSM should be implemented, "as expeditiously as practicable".[33]

For each of the applicable four PM2.5 standards discussed in this plan, Table 3 summarizes the required levels of control measures and the required timeframe for implementation in order to meet the definition of BACM and/or MSM.

Table 3: Implementation and Timing Requirements for BACM and MSM

Standard	12 ug/m3 Annual (2012)	35 ug/m3 24-Hour (2006)	15 ug/m3 Annual (1997) 65 ug/m3 24-hour (1997)
Classification Status	Moderate with request to Serious	Serious with Extension	Serious (5% plan)
Type of Plan Required	Serious	MSM	5% Plan
Control Measure Requirements	BACM	MSM	MSM
Definition of BACM and MSM (regarding timing)	BACM**:** implemented in whole or in part by the end of the fourth year following the date of reclassification of the area to Serious.[34] BACM has two sub-categories: • BACT: implemented in whole or in part by the end of the fourth year following the date of reclassification of the area to Serious[35] • AFM: implemented in whole or in part between the end of the fourth year following the date of reclassification of the area to Serious and the applicable attainment date for the area[36]	MSM: implemented in whole or in part by 5 years after the applicable attainment date for the area[37]	MSM: implemented in whole or in part within 5 years or such longer period as the EPA may determine is appropriate after the EPA's determination that the area failed to attain by the Serious area attainment date[38]
Attainment deadline	2025	2024	2020
Timeframe for Implementation to be Considered BACM/MSM	BACM if implemented ≤ 2025 Either: • BACT if ≤2019 • AFM if 2020 - 2025	MSM if implemented ≤ 2029	MSM if implemented ≤ 2021

[32] 40 CFR § 51.1010(a)(3)(ii)
[33] U.S. EPA, 2001 *Final TSD for Maricopa County PM10 Nonattainment Area* (page 31). Available at https://www3.epa.gov/region9/air/phoenixpm/pdf/tsd0901.pdf
[34] 40 CFR § 51.1010(a)(3)(i)
[35] 40 CFR § 51.1010(a)(3)(i)
[36] 40 CFR § 51.1010(a)(3)(ii)
[37] 40 CFR § 51.1010(b)(3)
[38] 40 CFR § 51.1010(c)(3)

Given the timing of when each control measure has begun or is anticipated to begin implementation, staff has assessed each control measure in order to categorized each as falling into MSM or BACM 'bins' (the BACM bin is further subdivided into BACT or ADF). It is important to note that the variance in timing of each standard's attainment date means that the definition of which control measures fall into the MSM or BACM bin may differ among the standards. In other words, a measure may fall into different bins for each standard, due to the timing differences in when the standards were finalized. This is because the requirements to determine of feasibility for each measure also vary among the standards, depending on when the control measures are anticipated to be implemented relative to the standards' attainment dates.[39]

In addition to timing considerations, the bin into which each potential control measure falls into correlates with how hard each measure pushes to control emissions. The determination of whether each control measure falls into the BACM/BACT, BACM/ADF, or MSM bin thus indicates both the control measure' stringency and the control measures' implementation schedule, relative to the varying attainment dates among the Valley's four PM2.5 SIPs. Generally speaking, the control measures included in CARB's current control program meet the definition of BACM, and the new measures included in the Valley SIP Strategy satisfy MSM requirements. The new measures have been identified to push beyond the stringency of controls required in the current control program and have been developed to achieve "the maximum degree of emission reduction… that can be feasibly implemented in the area."[40] This is also in keeping with U.S. EPA's interpretation of BACM as, "more stringent than reasonably available control measure (RACM), but less stringent than the lowest achievable emission rate (LAER), which doesn't take into consideration the cost effectiveness of implementing a particular control measure,"[41] while MSM has been defined as, "what LAER represents for new or modified sources under the New Source Review permit program."[42]

Comparing the Stringency of the Valley's Plan to the Current Control Program

The final step called for in U.S. EPA's process to demonstrate that the suite of control measures included in the Valley's attainment plan satisfy the stringency definition for MSM is to compare the measures included in the Valley's plan against the measures already adopted in the Valley's SIP to determine if the existing control measures alone are more stringent.[43] Staff has compared the current control program to the control

[39] For the 2012 Annual Standard of 12 ug/m3, the Valley has not yet been reclassified to Serious. In order to proceed with the assessment and determination of whether control measures satisfy the timing requirements for BACM, BACT and/or AFM for this standard, CARB staff has inferred an effective date of 2015 as the redesignation year: per § 51.1010(a)(5), the attainment deadline for a Serious plan is ten years from date of designation as Serious. Because staff's air quality modeling shows that the Valley's projected attainment date for this plan is 2025, CARB staff has assigned 2015 as the proxy date of redesignation to Serious for purposes of identifying BACM/BACT. Continuing with this assumption, a control measure would therefore be considered BACT if implemented before or during 2019, and would be considered an AFM if implemented between 2020 and 2025.

[40] U.S. EPA definition of MSM from the 2001 *Final TSD for Maricopa County PM10 Nonattainment Area* (page 31). Available at https://www3.epa.gov/region9/air/phoenixpm/pdf/tsd0901.pdf

[41] U.S. EPA 1994 "Addendum to the General Preamble" (*59 FR 41998* pages 42009 -42013) Available at https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19940816_59fr_41998-42017_addendum_general_preamble.pdf

[42] U.S. EPA 1994 "Addendum to the General Preamble" (*59 FR 41998* pages 42009 -42013) Available at https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19940816_59fr_41998-42017_addendum_general_preamble.pdf

[43] U.S. EPA's 2001 *Final TSD for Maricopa County PM10 Nonattainment Area* see page 32. Available at https://www3.epa.gov/region9/air/phoenixpm/pdf/tsd0901.pdf

measures included in the Valley's attainment plan and demonstration, and has found that:

- The suite of control measures in the Valley's attainment plan and demonstration include all of the potential BACM and MSM measures identified through the processes described above, including measures in the current control program.
- The suite of control measures in the Valley's attainment plan is more stringent than the existing control program alone because the plan encompasses both the existing suite of control programs and the new measures from the State SIP Strategy and the Valley SIP Strategy. The new measures exceed the stringency of the current control program for control requirements applying to all mobile source categories, including the passenger vehicle fleet, the on-road heavy-duty fleet, and off-road equipment and engines.
- The Valley's attainment demonstration provides further evidence that the additional stringency of the control measures included in the Valley's plan, relative to the current control program: the additional emission reductions provided by the new measures in the plan (i.e. those from the State SIP Strategy and Valley SIP Strategy) are needed for the Valley to attain its PM2.5 targets.

Step 3(b): Determination of Technical and Economic Feasibility

The second half of the required process for evaluating the potential BACM/MSM measures is an assessment of their economic and technical feasibility. As part of this process, statute directs that the State may eliminate any control measures identified in Step 2 from further consideration if it is demonstrated to be technologically or economically infeasible to implement in the Valley within the specified timeframes.

Per U.S. EPA's guidance and precedence, this requirement is not required to be applied unless a potential BACM/MSM control measure is rejected from inclusion in the SIP on the grounds of feasibility.[44] For this appendix, staff's proposed SIP and attainment demonstration for the Valley do not recommend eliminating any of the potential BACM/MSM control measures identified in Step 2 on the basis of technical or economic infeasibility. Thus, the assessment of technological and economic feasibility for purposes of eliminating such measures in whole or part from further consideration (i.e. Step 3(b)) is not applicable for this plan, and is not substantively addressed in this appendix beyond this section.

Nonetheless, staff has conducted an initial assessment of technical feasibility for the proposed control measures in the State SIP Strategy and Valley SIP Strategy through the ongoing technology assessments that CARB staff has been conducting in collaboration with U.S. EPA and the National Highway Traffic Safety Administration. These Technology Assessments have identified the current technological potential for more stringent emission control measures for on- and off-road heavy-duty applications,

[44] See page 400 of U.S. EPA's 2001 *Technical Support Documentation for Maricopa County PM10 Nonattainment Area* https://www3.epa.gov/region9/air/phoenixpm/pdf/tsd30102.pdf where EPA staff explain that they are applying to Maricopa County's SIP the decision from a Phoenix Serious SIP not to apply this requirement if no potential control measures are rejected.

together with the fuels necessary to power them, along with ongoing review of advanced vehicle technologies for the light-duty sector.[45]

Additionally, an economic impact analysis was conducted for many of the newly proposed measures that were first identified in the Mobile Source Strategy.[46] Furthermore, all control measures that are regulatory in nature must also undergo a rule-specific, rigorous public review process when proposed by staff and/or approved by the Board, as specified by the Administrative Procedures Act (APA). These requirements include an Initial Statement of Reasons (ISOR) prepared for each proposed CARB regulation, an Environmental Analysis to satisfy California Environmental Quality Act (CEQA) requirements, and an Economic Analysis, including a Standardized Regulatory Impact Assessment (SRIA) for any proposed regulation has an economic impact exceeding $50 million.

While these processes occur beyond the requirements addressed in this plan, these requirements ensure there will be further opportunity for public and stakeholder input, as well as ongoing technology review and a more refined assessment of costs and environmental impacts as the measures move through CARB's public process for development into proposed regulations.

D.2.4 STEP 4: ADOPT AND IMPLEMENT FEASIBLE CONTROL MEASURES

The final step required by the Act's step-wise process is to adopt and implement the feasible control measures identified in Step 3, in order to satisfy BACM and MSM requirements. Staff's proposed SIP for the Valley to attain all four of the PM2.5 standards this document discusses includes all of the measures identified as BACM and/or MSM in Step 3. The process for adoption and implementation of these control measures is discussed in more detail in the body of the main document to which this analysis is appended.

[45] Technology and Fuel Assessments http://www.arb.ca.gov/msprog/tech/tech.htm
[46] CARB 2016 "Mobile Source Strategy Appendix A: Economic Impact Analysis" https://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm

D.3 Chapter III. Step 1: Mobile Source Emissions of Direct PM2.5 and NOx

Tables 4 and 5 show the mobile emissions of direct PM2.5 and NOx, the key precursor to secondary formation of PM2.5 in the Valley.[47] It is important to note that, as this appendix is an assessment of mobile sources control measures, these tables reflect only a subset of the total emissions in the Valley, and do not reflect emissions from stationary and areawide sources.

Table 4: Direct PM2.5 Emissions (tpd) from Mobile Sources in the Valley

	2013	2020	2024	2025	2030
On-Road Light-Duty Vehicles	1.9	2.1	2.2	2.2	2.4
On-Road Heavy-Duty Vehicles	4.5	1.3	1.0	1.0	1.0
Off-Road Federal and International Sources	1.5	1.8	1.8	1.8	1.8
Aircraft	1.2	1.7	1.7	1.7	1.7
Railroad	0.2	0.1	0.1	0.1	0.1
Off-Road Equipment	4.3	3.2	2.6	2.4	1.8
Total Direct PM2.5 from Mobile Sources	**12**	**8**	**8**	**7**	**7**

**Numbers may not add up due to rounding.*

Table 5: NOx Emissions (tpd) from Mobile Sources in the Valley

	2013	2020	2024	2025	2030
On-Road Light-Duty Vehicles	34	16	11	10	7
On-Road Heavy-Duty Vehicles	149	81	45	44	40
Off-Road Federal and International Sources	15	15	13	13	11
Aircraft	2	5	5	5	5
Railroad	13	10	8	8	6
Off-Road Equipment	72	55	45	42	33
Total NOx from Mobile Sources	**270**	**167**	**114**	**109**	**91**

**Numbers may not add up due to rounding.*

[47] Data from CEPAM 2016 Ozone SIP Version 1.05 with external adjustments http://outapp.arb.ca.gov/cefs/2016ozsip/index.php

D.4 Chapter IV. Steps 2 and 3: Identification and Evaluation of Potential Mobile Source Control Measures

The second and third steps required in the Act's BACM / MSM evaluation process have been grouped together in this appendix so that staff can more cohesively identify and analyze control measures for each mobile sector (i.e. passenger vehicles, on-road heavy-duty trucks and buses, and off-road mobile sources).

D.4.1 On-Road Light-Duty Vehicles

On-road light-duty vehicles, often referred to as passenger vehicles, include motorcycles, passenger cars, and light to mid-sized trucks and SUVs. The vast majority of these vehicles currently have gasoline powered internal combustion engines, however this sector is projected to increasingly rely on electric drive vehicles of varying types (e.g. battery electric, plug-in hybrid, or fuel cell electric vehicles).

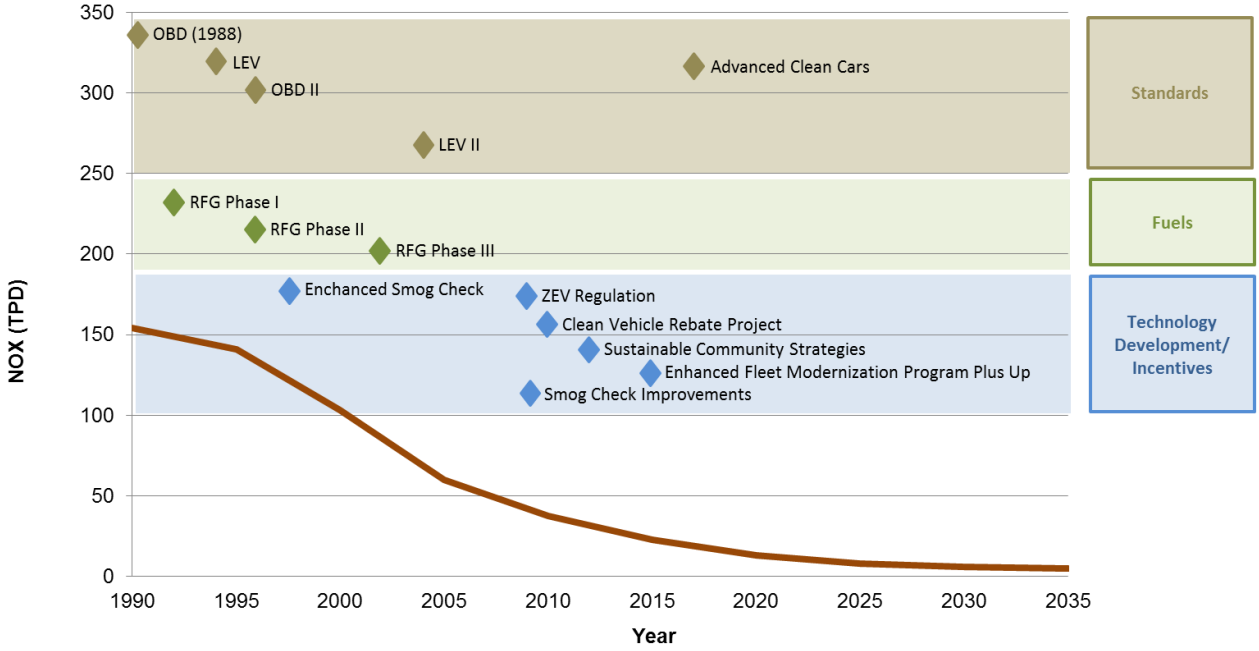
D.4.1.1 Step 2(a): California's Light-Duty Control Measures

Since setting the nation's first motor vehicle exhaust emission standards in 1966 that led to the first pollution controls, California has dramatically tightened emission standards for light-duty vehicles. Through CARB regulations, today's new cars pollute 99 percent less than their predecessors did thirty years ago. In 1970, CARB required auto manufacturers to meet the first standards to control NOx emissions along with hydrocarbon emissions. The simultaneous control of emissions from motor vehicles and fuels led to the use of cleaner-burning gasoline that has removed the emissions equivalent of 3.5 million vehicles from California's roads. Since first adopted in 1990, CARB's LEV I and LEV II, and the ZEV Programs have resulted in the production and sales of hundreds of thousands of ZEVs in California.

In the light-duty sector, the maturity of advanced technologies required under currently adopted control programs results in NOx emission reductions of over 70 percent between 2013 and 2025, as shown in Figure 2.

The historical improvement in NOx emissions largely is the result of new engine standards that have significantly reduced emissions from conventionally fueled vehicles (LEV programs). Alongside these programs, Zero-Emission Vehicle (ZEV) technologies have achieved commercial status, and sales mandates are increasing ZEV penetration. The major regulatory and programmatic control measures that provide for the needed emission reductions in the on-road light-duty mobile source category are described subsequently.

Figure 2 Adopted Control Programs Reducing NOx Emissions from the Light-Duty Vehicle Fleet in the Valley



D.4.1.2 New Vehicle Standards

Emission Standards

California is the only state with the authority to adopt and enforce emission standards for new motor vehicle engines that differ from the federal emission standards, which enables CARB to develop more stringent motor vehicle control measures than other states. Adopted in 2012, the ***Advanced Clean Car (ACC)*** program is a suite of regulations that ensure emission reductions from the State's passenger vehicle fleet. In 2013, U.S. EPA issued a waiver for the ACC Program.[48]

CARB's (ACC) program has in recent years been a major driver of turnover to and zero and near-zero emission vehicles in the light-duty sector, providing significant emission reduction benefits. The ACC brought together three major regulations that were previously separate, combining the control of criteria pollutants and greenhouse gas emissions into a single coordinated set of requirements for light-duty vehicles of model years 2015 through 2025.

- Two of these regulations, the ***LEV III GHG*** and ***LEV III Criteria Emission*** rules, are fleet average performance standards for new vehicles that provide for continued annual emission reductions as the stringency increases through 2025. When fully phased-in, these requirements will achieve near-zero emission levels from new light-duty vehicles. These programs apply to the entire light-duty fleet

[48] U.S. EPA 2013 "California State Motor Vehicle Pollution Control Standards; Advanced Clean Car Program; Final Notice of Decision" Federal Register January 9, 2013 Volume 78, Number 6 pp. 2211 – 2145. https://www.gpo.gov/fdsys/pkg/FR-2013-01-09/pdf/2013-00181.pdf

by setting an average emissions requirement across all new vehicles that creates inherent market flexibility for compliance.

- The third regulation, the ***ZEV Regulation***, focuses on advanced technology development and fleet penetration of ZEVs (i.e. battery electric vehicles and hydrogen fuel cell vehicles), and plug-in hybrid electric vehicles (PHEVs) in order to enable manufacturers to successfully meet 2018 and subsequent model year requirements. The ZEV regulation ensures that advanced electric drive technology is commercialized and brought to production scale for cost reductions by 2025, in order to ensure that these low-emission technology vehicles transition from demonstration phase to full commercialization in a reasonable timeframe to meet long-term emission reductions goals. The ZEV amendments for 2018 and subsequent model years in the ACC program are intended to achieve commercialization through simplifying the regulation and pushing technology to higher volume production in order to achieve cost reductions.

The ACC Program will continue produce increasing benefits over time as new cleaner cars enter the fleet, displacing older and dirtier vehicles. In this manner, the benefits in 2023 will be realized through the cumulative reduction in emissions achieved by new cars entering the fleet in 2017 through 2023. This program will continue to provide benefits well after 2023 as vehicles meeting the new standards replace older, higher-emitting vehicles and continue to provide ongoing emission reduction benefits over their lifecycle, relative to the older, dirtier vehicles replaced.

Pushing beyond those requirements, the State SIP Strategy also included a commitment to develop the next generation of requirements for the passenger vehicle fleet through the ***Advanced Clean Cars 2*** measure. CARB will consider expanded California-specific standards for new light-duty vehicles to increase the number of new ZEVs and PHEVs sold in California, with the goal to make sure that near-zero and zero-emission technology options continue to be commercially available. The Advanced Clean Cars 2 measure is designed to ensure that near-zero and zero-emission technology options continue to be commercially available, with electric driving range improvements to address consumer preferences and maximize electric vehicle miles travelled (eVMT). The regulation may include lowering fleet emissions further beyond the super-ultra-low-emission vehicle standard for the entire light-duty fleet through at least the 2030 model year, and look at ways to improve real world emissions through implementation programs. As these vehicles continue to be commercially available, the new technologies they employ, including regenerative braking and lower rolling resistance tires, can reduce criteria pollutant emissions from brake and tire wear. CARB would quantify these previously unaccounted-for criteria pollutant co-benefits of ACC 2 in order to better inform future planning. Additionally, new standards would be considered to further increase the sales of zero-emission vehicles (ZEV) and plug-in hybrid electric vehicles (PHEVs) beyond the levels required in 2025.

Additionally, under the ***Reduced ZEV Brake and Tire Wear*** measure, CARB will quantify the emission reductions that will accrue from new technologies employed in fuel cell and plug-in electric vehicles, including regenerative braking and lower rolling resistance tires, which can reduce emissions from brake and tire wear. As increasing

numbers of zero-emission vehicles enter the fleet over the coming decade, these technologies offer opportunities to reduce PM2.5 emissions from the passenger vehicle fleet.

On-Board Diagnostic (OBD) Systems

In addition to emission standards for the light-duty fleet, CARB's suite of control measure requirements for new vehicles also includes actions to ensure that vehicles continues to operate as cleanly as possible once they are part of the in-use fleet. These measures include requirements that new vehicles come equipped with in-use inspections and on-board self-diagnostic equipment. On-Board Diagnostics (OBD) systems are designed to identify when a vehicle's emission control systems or other emission-related computer-controlled components are malfunctioning, causing emissions to be elevated above the vehicle manufacturer's specifications. Studies show that the highest emitting 20 percent of the light-duty fleet contribute well over 50 percent of the fleet's total emissions, emphasizing the need to identify and repair these high emitting vehicles.[49]

On-Board Diagnostics II (OBD II) is the second generation of requirements for on-board, self-diagnostic equipment that monitors a passenger vehicle's control components to ensure they are functioning correctly. California's first OBD regulation required manufacturers to monitor some of the emission control components on vehicles starting with the 1988 model year. In 1989, CARB adopted OBD II, which required 1996 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles and engines to be equipped with second generation OBD systems. CARB subsequently strengthened OBD II requirements and added OBD II specific enforcement requirements for 2004 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles and engines. U.S. EPA granted CARB a waiver of preemption for the OBD II regulation in 2016.[50]

Emissions Standards for Motorcycles

While representing a relatively small fraction of the emissions coming from the passenger vehicle fleet, CARB has also taken a comprehensive control approach for emissions from motorcycles. For the most part, motorcycles are on-road two-wheeled, self-powered vehicles with engine displacements of 50 cubic centimeters (cc) or greater. First adopted in 1975, ***California's on-road motorcycle regulation*** obtained its first waiver of preemption from U.S. EPA in 1976. The 1975 regulation set emission standards for all motorcycles with engine displacements of at least 50 cc. The 1998 amendments affected only Class 3 motorcycles (280 cc or greater) and set a Tier I and Tier II standard for 2004 and 2008 model years, respectively. While CARB has the same emission standard as the federal standard, the California standard applies to engines starting in 2008 rather than 2010 under the federal requirement. The California Motorcycle Regulation controls both exhaust emission standards and test procedures

[49] CARB 2015 https://www.arb.ca.gov/msprog/obdprog/obdfaq.htm

[50] U.S. EPA 2016 "California State Motor Vehicle Pollution Control Standards; Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines; Final Notice of Decision" https://www.gpo.gov/fdsys/pkg/FR-2016-11-07/pdf/2016-26861.pdf November 7, 2016 Federal Register Volume 81, Number 215 pp. 78143-78149

for on-road motorcycles and motorcycle engines. U.S. EPA granted CARB a waiver of preemption for the 1998 amendments in August 2006.[51]

D.4.1.3 Reducing In-Use Emissions

Inspection and Maintenance (I/M) Program

Although new vehicles sold in California are the cleanest in the world, the millions of passenger vehicles on California roads, and the increasing miles they travel each day make them our single greatest source of NOx emissions. While the new vehicles in California may start out with very low emissions, improper maintenance or faulty components can cause vehicle emission levels to sharply increase. Studies estimate that approximately 50 percent of the total emissions from late-model vehicles are excess emissions, meaning that they are the result of emission-related malfunctions. California's ***Smog Check Program*** works to ensure that the vehicles remain as clean as possible over their entire life. The Bureau of Automotive Repair (BAR) is the State agency charged with administration and implementation of the Smog Check Program. The Smog Check Program is designed to reduce air pollution from California registered light-duty vehicles by requiring periodic inspections for emission control system problems, and by requiring repairs for any problems found. Technicians are required to perform an OBD II check (visual and functional) during the Smog Check inspection.

Additionally, CARB has committed in the State SIP Strategy to work with BAR staff to perform a joint agency, ***comprehensive evaluation*** of California's in-use performance-focused inspection procedures and, if necessary, make ***improvements to increase the Smog Check Program's effectiveness***. Assembly Bill (AB) 2289 (Eng, Chapter 258, Statutes of 2010) required BAR to implement a new protocol for testing 2000 and newer model-year vehicles, effective in 2015. This new test, which relies primarily on the vehicle's OBD system, provides for a faster and more cost effective inspection compared to tailpipe testing. To facilitate state-of-the-art OBD-based testing, BAR developed equipment specifications for a new OBD communications device, referred to as the Data Acquisition Device (DAD), which is a component of the new OBD Inspection System (OIS) that replaces the EIS. These changes are aimed at providing for quicker and potentially less costly Smog Check inspections for consumers, and lower Smog Check station operating costs, all while preserving, or even enhancing the emission benefits associated with the Smog Check Program. However, because the OBD inspection procedure does not provide for direct measurement of vehicle emission levels, CARB believes it is prudent to monitor the effectiveness of the new procedure in identifying vehicles in need of emission repairs, and to implement changes necessary to address any issues that are uncovered. As part of the comprehensive evaluation, CARB will conduct a study to further evaluate California's in-use performance inspection procedures through analysis of the Smog Check database and vehicle sampling obtained through BAR's Random Roadside Inspection Program to improve inspection test procedures as necessary, address program fraud, improve the

[51] https://www.epa.gov/state-and-local-transportation/vehicle-emissions-california-waivers-and-authorizations See Code of Federal Regulations Volume 71, Number 149 pp. 44027-44029

effectiveness and durability of emission-related repair work, and to improve the regulations governing the design of in-use performance systems on motor vehicles.

Additionally, the ***Lower In-Use Emission Performance Assessment*** committed to in the State SIP Strategy is designed to ensure that in-use passenger vehicles continue to operate at their cleanest possible level by evaluating California's in-use performance-focused inspection procedures and, if necessary, making improvements to further the program's effectiveness. Results from the assessment may be used to improve inspection test procedures, address program fraud, improve the effectiveness and durability of emission-related repair work, and to improve the regulations governing the design of in-use performance systems on motor vehicles to the extent necessary.

Finally, CARB staff's discovery of Volkswagen's (VW's) use of illegal defeat devices—software designed to cheat on emissions tests—in certain 2009 to 2016 model year diesel cars that were sold in California illustrates the success and stringency of California's program to control emissions from the in-use passenger vehicle fleet, and to identify excess in-use emissions. Due to the discovery of VW's emissions cheating scandal and subsequent actions to remediate the environmental damages caused by these vehicles' excess emissions, the VW Environmental Mitigation Trust provides about $423 million for California to fund projects that accelerate the turnover of mobile sources to cleaner, lower-emitting vehicles and engines.

D.4.1.4 Fuels

Cleaner fuel has an immediate impact in reducing emissions from the mobile source, and thus represent an important component in reducing NOx and VOC emissions from the passenger vehicle fleet. California's stringent air quality programs treat motor vehicles and their fuels holistically (as a system, rather than as separate components). As a result, CARB's fuels programs achieve significant reductions in criteria emissions from gasoline-fueled vehicles used in California.

California's Reformulated Gasoline program (CaRFG) sets stringent standards for California gasoline that produced cost-effective emission reductions from gasoline-powered vehicles. Reformulated gasoline (RFG) is gasoline blended to burn more cleanly than conventional gasoline and to reduce smog-forming and toxic pollutants in the air we breathe. Since the Valley was reclassified to a Serious ozone nonattainment in December 2001, the use of cleaner-burning gasoline that is at least as stringent as federal RFG requirements has been required since December 2002. The CaRFG program has been implemented in three phases.

- Phase 1, which was implemented in 1991, eliminated lead from gasoline and set regulations for deposit control additives and reid vapor pressure (RVP).
- Phase 2 CaRFG (CaRFG2 in 1994) set specifications for sulfur, aromatics, oxygen, benzene, T50, T90, Olefins, and RVP and established a Predictive Model.
- The final and current phase, Phase 3 CaRFG, eliminated in 1996 the use of methyl-tertiary-butyl-ether in California gasoline.

Phase 3 CaRFG also revised specifications for Phase 3 gasoline that reduces ozone precursor emissions (including aromatic hydrocarbons and olefins) by ~15 percent and toxic air contaminant emissions by about 40 percent, compared with CaRFG2. The regulation strengthened specification requirements for cleaner-burning gasoline, including:

- Reduced sulfur content. Sulfur inhibits the effectiveness of catalytic converters. Cleaner-burning gasoline enables catalytic converters to work more effectively and further reduce tailpipe emissions.
- Reduced benzene content. Benzene is known to cause cancer in humans. Cleaner-burning gasoline has about one-half the benzene of earlier gasoline, thus reducing cancer risks.
- Reduced levels of aromatic hydrocarbons (ozone precursor)
- Reduced levels of olefins (ozone precursor)
- Reduced vapor pressure, which ensures that gasoline evaporates less readily.
- Two specifications for reduced distillation temperatures, which ensure the gasoline burns more completely, and
- Use of an oxygen-containing additive, such ethanol, which also helps the gasoline burn more cleanly.

More recently, CARB developed ***the LCFS and ADF regulations,*** which work together to reduce emissions from renewable fuels, including criteria emissions, and further incentivizes the use of ZEV technologies. The LCFS and ADF regulations (as amended in 2014) reduce the carbon intensity of the California fuel supply while requiring limits on criteria emissions from alternative fuels and/or alternative fuel mix blends (a mix of fuels made from renewable feedstocks, which are then blended with conventional gasoline or diesel).

D.4.1.5 Step 2(b): Other States' and Nonattainment Areas' Light-Duty control Measures

Table 6 summarizes the most stringent control measures currently in use in any state or nonattainment that have been identified and discussed for on-road light-duty vehicles. Each of the measures identified in this table are discussed in more detail in this section, below.

Table 6: Summary of Most Stringent Light-Duty Control Measures Identified

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
On-Road Light-Duty Vehicles			
New Vehicle Standards			
New Vehicle Standards • Emission standards	LEV III program (CARB) *(part of Advanced Clean Cars program)* CARB anticipated to propose to further increase stringency *(ACC 2 measure)*	12 states have matched California's Low Emission Vehicle III (LEV III) program, which set fleet average performance standards for new passenger vehicles. CARB may further increase the stringency of CARB's emission standards beyond SULEV. *(NOTE: CARB has committed to develop the ACC 2 measure but it has not yet been proposed to the Board for approval/adoption.)*	12 Section 177 states (LEV III): • CT, DE, ME, MD, MA, NJ, NY, OR, PA, RI, WA, and VT
New Vehicle Standards • ZEV regulation	ZEV program (CARB) *(part of Advanced Clean Cars program)* CARB anticipated to propose to further increase stringency *(ACC 2 measure)*	9 states have matched California's ZEV Regulation for battery electric vehicles (BEVs), hydrogen fuel cell vehicles (FCEVs), and plug-in hybrid electric vehicles (PHEVs). CARB may further increase the stringency of sales requirements for ZEVs and PHEVs beyond the levels required in 2025. *(NOTE: CARB has committed to develop the ACC 2 measure but it has not yet been proposed to the Board for approval/adoption.)*	9 Section 177 states (ZEV Regulation): • CT, ME, MD, MA, NJ, NY, OR, RI, and VT
New Vehicle Standards • On-Board Diagnostic (OBD) systems requirements	California OBD II Requirements (CARB)	CARB's On-Board Diagnostic II (OBD II) Systems Requirements exceed Federal requirements in stringency. OBD II ensures that the in-use fleet continues to operate as cleanly as possible.	In practice, virtually all vehicles sold in the U.S. are designed and certified to meet California's OBD II requirements, regardless of where in the U.S. they are sold.
New Vehicle Standards • Motorcycle emission standards	On-Road Motorcycle Regulation (CARB)	CARB's emission standards and in-use testing for on-road motorcycles exceeds the stringency of any other in the nation.	California is the only state with emission control requirements for exhaust emission standards and test procedures for on-road motorcycles that exceed the stringency of U.S. EPA requirements.
In-Use Emission Controls			
In-Use Emissions Controls • Inspection and maintenance program (I/M program)	Smog Check Program (CARB & Bureau of Automotive Repair)	The Inspection / Maintenance (I/M) Program testing and in-use emission controls in the San Joaquin Valley are consistent with the most stringent of any other I/M program in the nation. Biennial SmogCheck inspections ensure that the in-use passenger vehicle fleet continues to operate as cleanly as possible.	• 33 State and local areas (including CA) require vehicle emissions tests. • 30 other states and local areas have an I/M program in at least a portion of their state (AK, AZ, CO, CA, CT, DE, GA, ID, IL, IN, KY, LA, ME, MD, MA, NV, NH, NJ, NM, NC, OH, OR, PA, RI, UT, TN, TX, VT, WA, WI, and DC); the majority use U.S. EPA OBD Requirements. • Three more states will require OBD checks in the future (MS, NY, VA).

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
On-Road Light-Duty Vehicles			
Fuel Controls			
Fuels Standards Gasoline Standards	CaRFG Phase 3 (CARB)	The CaRFG Phase III program requires that California gasoline is the lowest-emitting and cleanest-burning in the nation. It includes more stringent requirements for emission controls than the applicable federal standard (U.S. EPA's RFG Phase II).	U.S. EPA RFG Phase II is currently required in nonattainment areas in 17 states and the District of Columbia (including the Valley) • Areas of CA, CT, DE, the District of Columbia, IL, IN, MD, NJ, NY, PA, TX, VA, WI Other "opt in" areas for Federal RFG Phase II • Entire states: CT and DE • Portions of states: IL, KT, MD, ME, MA, MS, NH, NJ, NY, RI, TX, VA
Fuels Standards Alternative Fuel Standards (Gasoline substitutes)	LCFS and ADF (CARB)	The LCFS and ADF regulations work together to reduce the carbon intensity of the California fuel supply while requiring limits on criteria emissions from alternative fuels and/or alternative fuel mix blends.	No other state has set as stringent of criteria emission requirements on alternative fuels and alternative fuel blends than California.

D.4.1.6 New vehicle standards

Emission standards and ZEV Regulation

CARB's new vehicle standards for on-road light-duty vehicles are consistent with the most stringent of any other area in the nation. Due to constraints in the Act, California is the only state that can set new vehicle standards (including control measures such as emission standards, ZEV sales mandates, warranty provisions, and on-board diagnostic (OBD) requirements) that are more stringent than U.S. EPA's national standards.

As a result of CARB's efforts, and as provided for in the Act, a number of other states have now adopted CARB's LEV III and ZEV programs, as listed below in Table 7. Other states can adopt California programs for which U.S. EPA has provided California with waivers.[52] These states are also known as the "Section 177 States" in reference to this provision of the Act.

Table 7: Section 177 States: LD Emission Standards and ZEV Regulation

Section 177 States	2012 ZEV	2012 LEVIII
Connecticut	X	X
Delaware		X
Maine	X	X
Maryland	X	X
Massachusetts	X	X
New Jersey	X	X
New York	X	X
Oregon	X	X
Pennsylvania		X
Rhode Island	X	X
Washington		X
Vermont	X	X

On-Board Diagnostics (OBD) Requirements

California's OBD requirements for on-road light-duty vehicles are consistent with the most stringent of any other area in the nation. CARB's OBD II program requires that all 1996 and newer model year gasoline and alternate fuel passenger cars and trucks are required to be equipped from the factory with an OBD II system. All 1997 and newer model year diesel fueled passenger cars and trucks are required to meet the OBD II requirements.

U.S. EPA also requires all 1996 and newer model year passenger cars and trucks sold

[52] The Clean Air Act allows other states to adopt California's on- and off-road vehicle or engine emission standards under section 209(e)(2)(B). Section 209(e)(2)(B) requires, among other things, that such standards be identical to the California standards for which an authorization has been granted. States are not required to seek U.S. EPA approval to adopt standards identical to the California standards that have received a waiver authorization.

in any state to meet the U.S. EPA OBD requirements.[53] While U.S. EPA's OBD requirements differ slightly from California's OBD II requirements, virtually all vehicles sold in the U.S. are designed and certified to meet the more stringent California's OBD II requirements, regardless of where in the U.S. they are sold.[54] U.S. EPA issued a waiver for California's OBD II program in November 2016, indicating that the California OBD II system requirements are at least as protective of public health as U.S. EPA's OBD requirements.[55]

New vehicle standards and in-use emissions testing for motorcycles

CARB's emission standards and in-use testing for on-road motorcycles exceeds the stringency of any other in the nation. California is the only state with emission control requirements for exhaust emission standards and test procedures for on-road motorcycles that exceed the stringency of U.S. EPA requirements.

D.4.1.7 Reducing In-Use emissions

The Inspection / Maintenance (I/M) Program testing and in-use emission controls in the Valley are consistent with the most stringent of any other I/M program in the nation. California's Smog Check Program is designed to reduce air pollution from California-registered passenger vehicles by requiring periodic inspections for emission control system problems, and by requiring repairs for any problems found. In California, technicians are required to perform an OBD II check (visual and functional) during the Smog Check inspection. On board, self diagnostic equipment monitors a passenger vehicle's control components to ensure they are functioning correctly. Specifically, the technician visually checks to make sure the warning light is functional, and then the Smog Check test equipment communicates with the on-board computer for fault information. If a fault is currently causing the light to be on, the malfunctioning component must be repaired in order to pass the inspection.

- Stringency of I/M Program

  Thirty-three states and local jurisdictions have an I/M program in at least a portion of their state that require vehicle emissions tests.[56] Thirty other states and local areas have an I/M program in at least a portion of their state; the majority use U.S. EPA Requirements, which are less stringent than California's.[57,58]

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[53] CARB 2015 "On-Board Diagnostic II (OBD II) Systems - Fact Sheet / FAQs" https://www.arb.ca.gov/msprog/obdprog/obdfaq.htm
[54] CARB 2009 https://www.arb.ca.gov/msprog/smogcheck/march09/transitioning_to_obd_only_im.pdf
[55] U.S. EPA 2016 "California State Motor Vehicle Pollution Control Standards; Malfunction and Diagnostic System Requirements and Enforcement for 2004 and Subsequent Model Year Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles and Engines; Notice of Decision" https://www.gpo.gov/fdsys/pkg/FR-2016-11-07/pdf/2016-26861.pdf Federal Register Vol. 81, No. 215 pp. 78143
[56] U.S. EPA "On-Board Diagnostics (OBD): Status of State and Local (OBD) Inspection/Maintenance (I/M) Programs" https://www.epa.gov/state-and-local-transportation/board-diagnostics-obd-status-state-and-local-obd Accessed 4/25/2018
[57] U.S. EPA "On-Board Diagnostics (OBD): Status of State and Local (OBD) Inspection/Maintenance (I/M) Programs" https://www.epa.gov/state-and-local-transportation/board-diagnostics-obd-status-state-and-local-obd Accessed 4/25/2018
[58] U.S. EPA 2016 "California State Motor Vehicle Pollution Control Standards; Malfunction and Diagnostic System Requirements and Enforcement for 2004 and Subsequent Model Year Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles and Engines; Notice of Decision" https://www.gpo.gov/fdsys/pkg/FR-2016-11-07/pdf/2016-26861.pdf Federal Register Vol. 81, No. 215 pp. 78143

- Effectiveness of Inspection and Testing Methodology

  Nearly every state besides California that has an I/M program currently relies exclusively on vehicle OBD II system inspections as the basis for its emission inspections of 1996 and newer vehicles.[59] Only California and Colorado still use tailpipe testing: Colorado relies on tailpipe testing exclusively; California's Smog Check program currently includes two overlapping inspection procedures. Under California's SmogCheck program, each 1996 and newer model year vehicles vehicle is subjected to a tailpipe emission test, and also to an inspection of its On-Board Diagnostic II (OBD II) system, which independently monitors the performance of the vehicle's emission control systems and related components during everyday driving.

  U.S. EPA acknowledges the viability of OBD II inspections by providing full emission credits to state I/M programs that are based on OBD II only inspections. While U.S. EPA and CARB have generally found that OBD II systems are more effective in detecting emission-related malfunctions on in-use vehicles compared to existing tailpipe testing procedures, the SmogCheck program utilizes both approaches – erring on the side of increased stringency – to ensure each vehicle passes both tests.[60]

  Furthermore, to ensure that California's I/M program remains as effective as possible, CARB has committed in the State SIP Strategy to work with BAR staff to perform a joint agency, comprehensive evaluation of California's in use performance focused inspection procedures and, if necessary, make improvements to increase the Smog Check Program's effectiveness. CARB will conduct a study to further evaluate California's in-use performance inspection procedures through analysis of the Smog Check database and vehicle sampling obtained through BAR's Random Roadside Inspection Program. This will, as necessary: inform improvements in inspection test procedures; address program fraud; improve the effectiveness and durability of emission related repair work; and improve the regulations governing the design of in-use performance systems on motor vehicles.

- Frequency of I/M

  The Valley nonattainment area requires biennial SmogCheck, which is as frequent as SmogCheck requirements as any other part of California. This is consistent with the most stringent of any other area in the nation, and is the same frequency as the only other Extreme nonattainment area for PM2.5 in the country, the South Coast.

D.4.1.8 Fuels

Since 1995, U.S. EPA has required federal reformulated gasoline (RFG) to be used in the nine worst-polluted areas in the nation – including the Valley and other California

[59] CARB 2009 https://www.arb.ca.gov/msprog/smogcheck/march09/transitioning_to_obd_only_im.pdf

[60] California's Smog Check data indicates that vehicles are more than twice as likely to fail an OBD II-based inspection than the required tailpipe emissions test. CARB 2009 https://www.arb.ca.gov/msprog/smogcheck/march09/transitioning_to_obd_only_im.pdf

nonattainment areas (Federal RFG Phase I 1995 requirements). Effective in 2000, U.S. EPA increased the stringency of the federal RFG requirements under the RFG II program. In 2014, U.S. EPA adopted its most recent amendments, Tier 3 Fuel standards, which require lower sulfur content in gasoline to a maximum of 10ppm beginning in 2017 on an annual average basis, and lower Reid Vapor Pressure to zero, reducing fuel vapor emissions to near zero levels. The program also reduces PM emissions by approximately 70 percent, and NOx and VOCs emissions by approximately 80 percent, relative to the former federal Phase II levels (which were set in 1995). Sulfur content in gasoline is reduced from 30 parts per million (ppm) to 10 ppm on average.

In aggregate, the Phase III RFG requirements bring federal gasoline fuel controls in line with those already in place in California. However, CARB's gasoline specifications under the CaRFG requirements are still more stringent than the Federal Phase III program. CARB significantly controls NOx emissions under requirements in CaRFG Phase III that are not mirrored by comparably stringent controls on NOx emissions under the federal RFG Phase III requirements. Additionally, CARB requires sulfur contents to be capped at 10 ppm, rather than an annual average of 10 ppm as required federally.

Beyond the Federal Phase III requirements described above, the Act also allows states to adopt unique fuel programs to meet local air quality needs, which are referred to as Boutique Fuel Programs. Most of these programs set lower gasoline volatility requirements than the federal standards, and most are effective for only part of the year. As of January 19, 2017 U.S. EPA provided as snapshot of these programs that had been approved in SIPs,[61] which are listed below in Table 8 below. Table 8 also compares the stringency of the boutique fuel requirements in these areas to CARB's CaRFG Phase III. This comparison shows that the CaRFG Phase III program requires that California gasoline is the lowest-emitting and cleanest-burning in the nation.

Table 8: Boutique Gasoline Fuel Programs in the U.S.

Type of Fuel Control	State	Comparison to CaRFG Phase III
Reid Vapor Pressure (RVP) of 7.8 psi	PA and IN (year-round) TX (May 1 – Oct 1)	CaRFG Phase III sets flat limits of RVP of 7.0 psi (oxygenated fuels) and 6.9 psi (non-oxygenated fuels)
RVP of 7.0 psi	KS, MI, MO, TX	CaRFG Phase III sets flat limits of RVP of 7.0 psi (oxygenated fuels) and 6.9 psi (non-oxygenated fuels)
Cleaner Burning Gasoline (Summer)	AZ	As of 2005, AZ requires CARB's CaRFG Phase III in certain areas
Cleaner Burning Gasoline (non-Summer)	AZ	As of 2005, AZ requires CARB's CaRFG Phase III in certain areas
Winter Gasoline (aromatics & sulfur)	NV	In 1999, Clark County (Las Vegas) adopted California sulfur and aromatics limits

[61] U.S. EPA, 2017 https://19january2017snapshot.epa.gov/gasoline-standards/state-fuels_.html

D.4.2 STEP 3(A): EVALUATION OF STRINGENCY: LIGHT-DUTY CONTROL MEASURES

Step 3(a) calls for an evaluation of each of the control measures identified in Step 2, in order to evaluate their stringency and determine whether they meet all applicable requirements to satisfy the definitions of BACM and/or MSM discussed in Chapter I and Chapter II.

in order to determine whether each potential MSM/BACM measure meets the definition of MSM and/or BACM, staff has assessed each potential MSM/BACM on-road light-duty vehicle control measure identified in Steps 2(a) and 2(b). Based on this assessment, staff then characterized each potential MSM / BACM measure as falling into 'bins' representing whether it meets the definition of MSM or BACM for each of the four PM2.5 standards covered in this document (note that the BACM bin is further subdivided into BACT or ADF). The determination of which bin each control measure falls into thus indicates both the control measure' stringency and the control measures' implementation schedule, relative to the varying attainment dates among the Valley's four PM2.5 SIPs. In other words, the bin into which each control measure falls correlates with how hard each measure pushes to control emissions, given the implementation timeframes associated with each standards' plan. Generally speaking, the control measures included in CARB's current control program meet the definition of BACM; the new measures included in the Valley SIP Strategy satisfy MSM requirements.
Figure 3 shows the timing for implementation of each potential MSM / BACM on-road light-duty vehicle control measure identified in the prior sections (i.e. Steps 2(a) and 2(b)), for each of the four PM2.5 standards discussed in this SIP.

Figure 3: Timeline for Implementation of BACM / MSM Light-Duty Control Measures

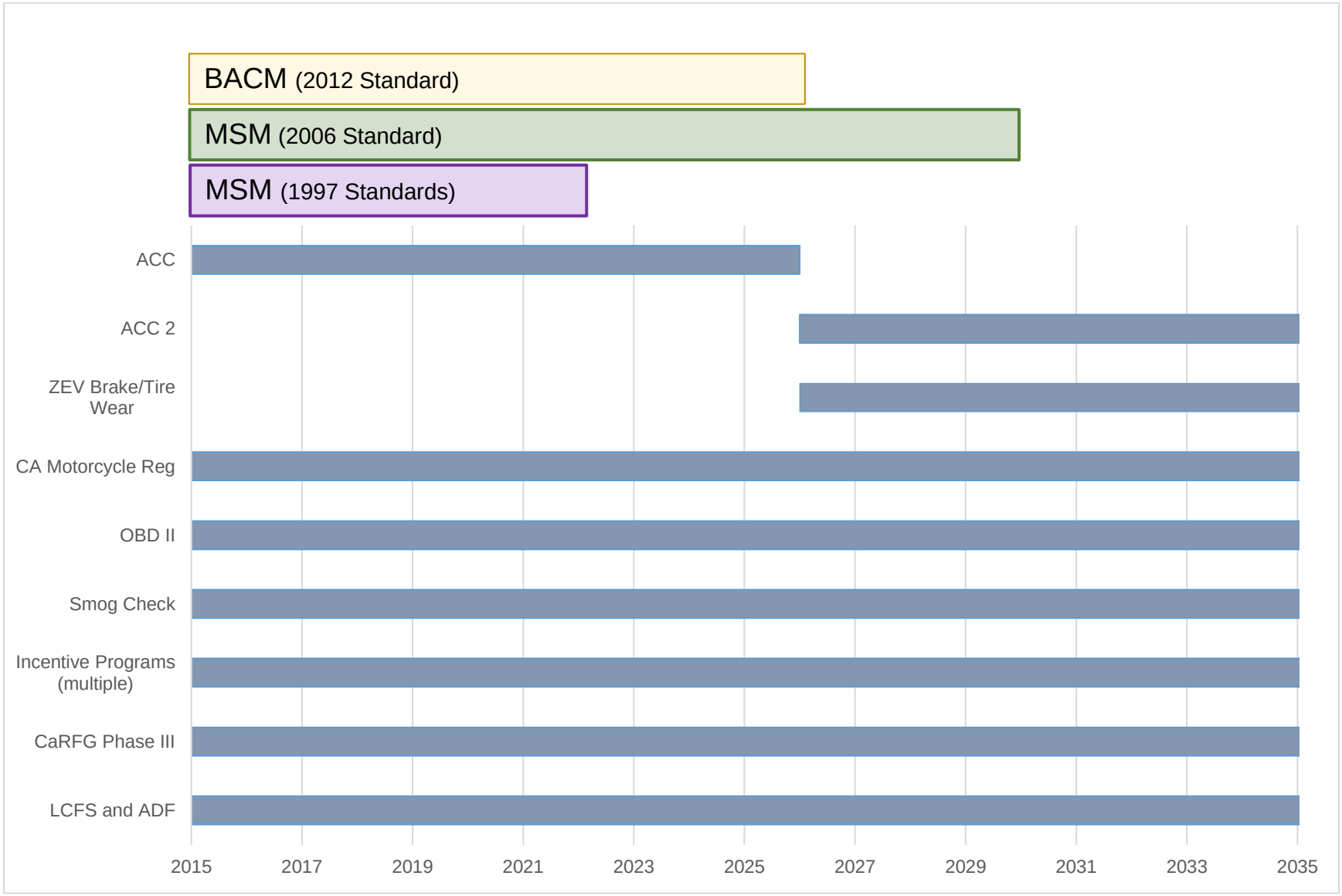


Table 9 summarizes which of the categories of stringency (i.e. BACM/BACT, BACM/ADF, or MSM) that each light-duty control measure falls into, for each PM2.5 standard. It is important to note that some measures CARB has committed to in the State SIP Strategy and proposed in the Valley SIP Strategy have anticipated implementation dates that exceed the timeframe thresholds of this analysis for some standards. Specifically, implementation of the Advanced Clean Cars 2 and Zero-Emission Vehicle Brake and Tire Wear measures is anticipated to begin in 2026, which falls after the 2025 threshold of the analysis for the 2012 Annual Standard, and the 2021 threshold of the analysis for the 1997 Annual and 24-Hour Standards. While these measures may not meet the timeline requirements to fall into the strict definition of MSM for these standards, the intent behind these measures is nonetheless to continue pushing for additional emission reductions to ensure that attainment is achieved as expeditiously as possible, which aligns with the broader purpose of MSM.

Table 9: Identification of Light-Duty Control Measures as BACM and/or MSM

Measures	Implementation Begins	12 ug/m3 Annual (2012)	35 ug/m3 24-Hour (2006)	15 ug/m3 Annual (1997)	65 ug/m3 24-hour (1997)
Current Control Measures					
Advanced Clean Cars (ACC) (Includes both LEV III and ZEV Program)	ongoing	BACM - BACT	MSM	MSM	MSM
California Motorcycle Regulation	ongoing	BACM - BACT	MSM	MSM	MSM
On-Board Diagnostics II (OBD II)	ongoing	BACM - BACT	MSM	MSM	MSM
Smog Check	ongoing	BACM - BACT	MSM	MSM	MSM
Light-Duty Incentive Programs	ongoing	BACM - AFM	MSM	MSM	MSM
California's Reformulated Gasoline (CaRFG) Phase III	ongoing	BACM - AFM	MSM	MSM	MSM
Low Carbon Fuel Standard (LCFS) and Alternative Diesel Fuel (ADF)	ongoing	BACM - BACT	MSM	MSM	MSM
State SIP Strategy Measures (with Commitment)					
Advanced Clean Cars 2	2026	--	MSM	--	--
Reduced ZEV Brake and Tire Wear		--	MSM	--	--

D.4.3 STEP 3(B): EVALUATION OF FEASIBILITY: LIGHT-DUTY CONTROL MEASURES

Step 3(b) calls for an assessment of the feasibility of implementing any measure that is not included in the Valley's proposed SIP and attainment demonstration, but which is identified as a potential BACM/MSM control measure in Step 2. For this plan, staff's proposed SIP and attainment demonstration do not recommend eliminating any of the potential BACM/MSM control measures identified in Step 2 on the basis of technical or economic infeasibility. Thus, a feasibility assessment for purposes of eliminating such measures from further consideration (i.e. Step 3(b)) is not applicable.

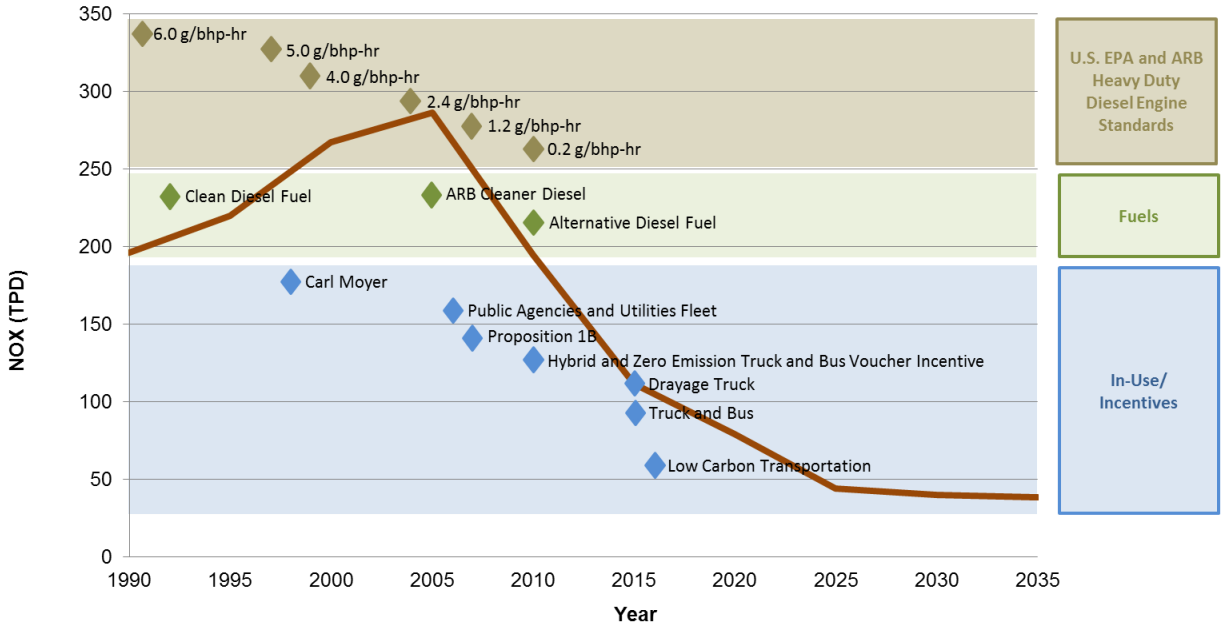
D.4.4 On-Road Heavy-Duty Vehicles

On-road heavy-duty vehicles include buses and trucks over 8,500 pounds gross vehicle weight rate (GVWR). The majority of these vehicles operate on diesel-cycle engines, especially in the higher weight classes. Gasoline and natural gas Otto-cycle spark-ignited engines are also used in heavy-duty trucks, primarily in the lower weight classifications.

D.4.4.1 Step 2(a): California's Current Heavy-Duty Control Program

Through ongoing efforts, CARB has developed the most stringent and successful heavy-duty vehicle emission control program in the world. Regulatory programs include requirements for increasingly tighter new engine standards, address vehicle idling, certification procedures, on-board diagnostics, emission control device verification, and requires accelerated turnover of the in-use fleet to cleaner, lower-emitting emission control and engine technologies. Ongoing implementation of CARB's current heavy-duty control programs is anticipated to result in a 70 percent reduction in NOx emissions from the on-road heavy-duty sector between 2013 and 2025, as shown in Figure 4.

Figure 4: Programs reducing NOx emissions from heavy-duty trucks in the Valley



The major regulatory and programmatic control measures that provide emission reductions in the on-road heavy-duty mobile source category are described below.

D.4.4.2 New Vehicle and Engine Standards

Heavy-duty engine emission standards (mandatory standards)

California is the only state with the authority to adopt and enforce emission standards for new motor vehicle engines that differ from the federal emission standards. A central element of CARB's heavy-duty diesel vehicle program is requiring that new trucks, buses and on-road diesel engines meet increasingly stringent engine emission standards. CARB has phased-in implementation of these increasingly stringent ***new heavy-duty vehicle and engine emission standards*** since the mid 1980's, resulting in significant emission reductions.

As shown in Table 10, California PM and NOx engine emission standards have historically been more stringent than applicable federal standards on several occasions, as indicated in the darker shaded portions of the table. In these instances, California has, functioning as a 'laboratory' state, paved the way for later federal increases in the stringency of PM and NOx emission standards. These standards reflect the increased efficiency in control technologies over time, as innovations in vehicles, engines, and emission-capturing technology progress. Since 1990***,*** heavy-duty engine NOx emission standards have become dramatically more stringent, dropping from 6 grams per brake horsepower-hour (g/bhp-hr) in 1990 down to the current 0.2 g/bhp-hr NOx standard, which took effect in 2010. Due to these requirements, new heavy-duty trucks sold since 2010 emit 98 percent less NOx and PM2.5 than new trucks sold in 1986.

On August 26, 2005, CARB obtained a waiver from the federal preemption for the Engine Standards for 2007 and Subsequent Model Year Heavy-Duty Diesel Engines/Vehicles regulation, which generally aligned California's mandatory heavy-duty emission exhaust standards with the federal standards for 2007 and subsequent model year vehicles and engines. Subsequent mandatory exhaust emission standards for heavy-duty engines CARB has developed and adopted have aligned with federal standards.

Beyond the requirements currently in place for heavy-duty engine emission standards, the State SIP Strategy includes a commitment for CARB to develop the next generation of even more stringent Low-NOx Engine Standards for On-Road Heavy-Duty Trucks. CARB began development of new heavy-duty low-NOx emission standards in 2016, and Board action is expected in 2019. CARB staff will continue to coordinate as much as possible with U.S. EPA and urge U.S. EPA to develop a similar federal standard. A ***California low-NOx standard*** would apply to vehicles with new heavy-duty engines sold in California starting in 2023. While CARB's Truck and Bus Regulation will ensure that nearly every heavy-duty vehicle operated in California by 2023 will meet 2010 heavy-duty engine emission standards, even this a highly aggressive full-fleet

Table 10: Adopted California and Federal Heavy-Duty Engine Emission Standards (for compression-ignition engines, shown in g/bhp-hr)

Model Year	California NOx		Federal NOx	California PM		Federal PM	
	General	Urban Buses		General	Urban Buses	General	Urban Buses
1985 - 86	10.7		10.7	n/a		n/a	
1987	6.0		10.7	0.60		n/a	
1988 - 89	6.0		10.7	0.60		0.60	
1990	6.0		6.0	0.60		0.60	
1991 - 92	5.0		5.0	0.25	0.10	0.25	
1993	5.0		5.0	0.25	0.10	0.25	0.10
1994 - 95	5.0	5.0 3.50 - 0.50 Optional (1995+)	5.0	0.10	0.07	0.10	0.07
1996 - 97	5.0	4.0 2.50 - 0.50 Optional	5.0	0.10	0.05* *(*0.07 in-use)*	0.10	0.05* *(*0.07 in-use)*
1998 - 03	4.0 2.50 - 0.50 Optional		4.0	0.10 0.03 – 0.01 Optional (2002+)	0.05* *(*0.07 in-use)*	0.10	0.05* *(*0.07 in-use)*
2004 - 06	2.0	0.50 - 0.01	2.0	0.10 0.03 – 0.01 Optional	0.01	0.10	0.05* *(*0.07 in-use)*
2007 - 09	0.20* *phased-in* *(*fleet avg ~1.2)*	0.20	0.20* *phased-in* *(*fleet avg ~1.2)*	0.01		0.01	
2010 - 14	0.20		0.20	0.01		0.01	
2015+	0.20 0.10 – 0.02 Optional		0.20	0.01		0.01	

penetration of 2010-compliant engines would not provide sufficient NOx reductions to attain the standards in the timeframe required. This drives the need for progressively more stringent heavy-duty engine NOx emission standards. For this reason, the adoption of a more stringent engine performance standard reflecting technology that is effectively 90 percent cleaner than today's standards (i.e. a 0.02 g/bhp-hr low-NOx standard) is a key component of the control strategy for mobile sources in the Valley.

Due to the preponderance of interstate trucking's contribution to in State VMT, federal action would be far more effective at reducing in-State emissions than a California only standard**.** Federal low-NOx standards could apply to all new heavy-duty trucks sold nationwide starting in 2024 or later. This would ensure that mobile source control measures that are under federal control also satisfy the same BACT/MSM requirements that are discussed in this SIP, and ensure that all trucks traveling within California would eventually be equipped with an engine meeting the lower NOx standard. Federal action is critical to implement this emission standard, since emission reductions from a California-only CARB regulation would come mostly from Class 4-6 vehicles (as most

Class 7 and 8 vehicles operating in California were originally purchased outside the State).

To facilitate this effort, CARB staff has been working with U.S. EPA to support the development of federal low-NOx requirements. The San Joaquin Valley District, in partnership with 18 other states and local jurisdictions, submitted petitions to U.S. EPA requesting federal action.[62, 63] As a result of this ongoing engagement, in their final rulemaking on the Phase 2 Greenhouse Gas (GHG) Standards in August of 2016[64], U.S. EPA signaled their intent to begin developing more stringent federal low-NOx emission requirements. Moreover, on December 20, 2016, U.S. EPA responded to the petitions, acknowledging the need for federal action to achieve further NOx reductions from on-road heavy-duty vehicles, and announcing it would initiate the work necessary to begin rulemaking efforts, targeting standards going into effect in the 2024 timeframe.[65] CARB will continue to call on U.S. EPA to move expeditiously in developing these requirements in recognition of the critical public health benefits it will provide.

Optional heavy-duty engine emission standards

In addition to mandatory NOx standards, CARB has also adopted several generations of ***optional lower NOx standards*** over the past 15 years. The optional standards allow local air districts and CARB to preferentially provide incentive funding to buyers of cleaner trucks, which encourages the development of cleaner engines.

- From 1998 to 2003, optional NOx standards ranged from 0.5 g/bhp-hr to 2.5 g/bhp-hr, at 0.5 g/bhp-hr increments, which was much lower than the mandatory 4 g/bhp-hr limit.
- Starting in 2004, engine manufacturers could choose to certify to optional NOx + non--methane hydrocarbon (NMHC) standards ranging from 0.3 g/bhp-hr to 1.8 g/bhp-hr, at 0.3 g/bhp-hr increments, which was significantly below the mandatory 2.4 g/bhp-hr NOx+NMHC standard.
- Most recently, in ongoing efforts to go beyond federal standards and achieve further reductions, CARB adopted in 2014 the ***Optional Reduced Emissions Standards for Heavy-Duty Engines*** regulation, which established the new generation of optional NOx emission standards for heavy-duty engines, and a certification pathway for a new generation of requirements for heavy-duty engines. Starting in 2015, engine manufacturers could certify to three optional NOx emission standards of 0.1 g/bhp-hr, 0.05 g/bhp-hr, and 0.02 g/bhp-hr (i.e., 50 percent, 75 percent, and 90 percent lower than the current mandatory

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[62] SJVAPCD, 2016 *Petition Requesting that EPA Adopt New National Standards for On-Road Heavy-Duty Trucks and Locomotives under Federal Jurisdiction* is available at https://www.epa.gov/sites/production/files/2016-11/documents/san_joaquin_valley_petition_for_hd_and_locomotive.pdf

[63] South Coast AQMD et al, 2016 *Petition to U.S. EPA for Rulemaking to Adopt Ultra-Low NOx Exhaust Emission Standards for On-Road Heavy-Duty Trucks and Engines* is available at https://www.epa.gov/sites/production/files/2016-09/documents/petition_to_epa_ultra_low_nox_hd_trucks_and_engines.pdf

[64] U.S. EPA Phase 2 Greenhouse Gas Standards available at: https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-greenhouse-gas-emissions-and-fuel-efficiency.

[65] https://www.epa.gov/regulations-emissions-vehicles-and-engines/petitions-revised-nox-standards-highway-heavy-duty

standard of 0.2 g/bhp-hr). This optional standard has resulted in substantial investments in California's heavy-duty fleets over the past decade in order to adopt modern, lower-emitting vehicles and equipment.

Warranty Requirements and Useful Life

In 1978, CARB adopted ***emission warranty regulations*** to clarify the rights and responsibilities of individual motor vehicle and engine owners, motor vehicle and engine manufacturers, and the service industry. The emission warranty is used to cover any repairs needed to correct defects in materials or workmanship which would cause an engine or vehicle not to meet its applicable emission standards. In 1982, CARB adopted regulations that established California's first in-use recall program. These regulations were intended to reduce vehicular emissions by ensuring that noncompliant vehicles are identified, recalled, and repaired to comply with the applicable emission standards and regulations during customer use, and to encourage manufacturers to improve the design and durability of emission control components to avoid the expense of a recall. In 1982 and 1984, U.S. EPA promulgated heavy-duty vehicle useful life and warranty requirements identical to those adopted in California. Both U.S. EPA and CARB require that heavy-duty vehicles meet emission standards throughout their useful life periods. The current heavy-duty vehicle emission warranty period is 100,000 miles for all categories of heavy-duty vehicles with GVWR greater than 14,000 lbs.

Beyond the current California requirements described above, the Valley's plan also includes a proposed commitment to ensure that trucks continue to operate as cleanly as possible over their entire useful life. The ***Amended Warranty Requirements for On-Road Heavy-Duty Vehicles*** measure proposes developing lengthened warranty period requirements for on-road heavy-duty vehicles with gross vehicle weight rating (GVWR) greater than 14,000 lbs. The primary goal of this proposed measure is to reduce NOx and PM emissions by encouraging vehicle owners to make emission-related repairs. This measure may also incentivize manufacturers to design more durable components. The current heavy-duty vehicle emission warranty period is 100,000 miles for all categories of heavy-duty vehicles with GVWR greater than 14,000 lbs. This mileage is typically reached relatively early in vehicle lives, especially for vehicles with GVWR greater than 33,000 lbs., and well before the mileage at which rebuild typically occurs. Furthermore, recent CARB studies have identified some heavy-duty vehicles with NOx emission levels significantly above their applicable certification standards while still within the vehicles' useful lives. For this proposed measure, CARB staff would propose lengthening the 100,000 mile emissions warranty, potentially to the useful life for each classification of heavy-duty vehicle type. For example, the new warranty mileage period for Class 8 heavy-duty diesel vehicles could become 435,000 miles, ensuring that emission-related parts are warranted throughout a greater portion of the vehicles' service life.

OBD Requirements

In addition to new vehicle emission standards for the heavy-duty fleet, CARB's suite of control measures also includes actions to ensure that the in-use fleet continues to operate as cleanly as possible through requiring that new vehicles come equipped with in-use inspections and on-board self-diagnostic equipment. On-Board Diagnostics

(OBD) systems are designed to identify when a vehicle's emission control systems or other emission-related computer-controlled components are malfunctioning, causing emissions to be elevated above the vehicle manufacturer's specifications.

CARB adopted ***heavy-duty specific OBD requirements (HD OBD)*** in 2005, which applies to 2010 and subsequent model year heavy-duty engines and vehicles (i.e., vehicles with a gross vehicle weight rating greater than 14,000 pounds). This regulation required by 2013 that all heavy-duty engines offered for sale in California come equipped with OBD systems. U.S. EPA issued a waiver of preemption for the California 2010 Model Year Heavy-Duty Vehicle and Engine On-Board Diagnostic Standards in 2008, and has also issued two subsequent waivers for amendments CARB has made to the heavy-duty OBD requirements in later years to increase the stringency of these requirements.[66]

D.4.4.3 Reducing In-Use Emissions

While increasingly stringent standards for new vehicles and engines collectively ensure that new vehicles are as clean as possible, older, higher-emitting heavy-duty vehicles with long useful lifecycles can remain on the road for many years. To address this legacy fleet, CARB has adopted heavy-duty vehicle in-use control measures to significantly reduce PM2.5 and NOx emissions from existing diesel vehicles operating in California. These measures fall within three categories: measures that utilize inspections and maintenance programs in order to improve in-use emission performance levels; truck idling requirements; and fleet turnover rules.

Inspection and Maintenance (I/M) Program

CARB also adopted a suite of control measures to lower in-use emission performance levels to ensure that the heavy-duty vehicles in the in-use fleet continue to operate at their cleanest possible level.

Opacity Limits

The ***Heavy-Duty Vehicle Inspection Program (HDVIP)***, adopted into law in 1988, requires heavy-duty vehicles to be inspected for smoke opacity (i.e., excessive smoke), tampering, and engine certification label compliance. Any heavy-duty vehicle operating in California, including vehicles registered in other states and foreign countries, may be inspected. Inspections are performed by CARB inspection teams at border crossings, California Highway Patrol weigh stations, fleet facilities, and randomly selected roadside locations. Currently, under HDVIP, vehicles equipped with a 1991 model year (MY) or newer engine must meet a 40 percent opacity limit, while vehicles operating with a 1990 MY or older engine must meet a 55 percent opacity limit.

To ensure that in-use heavy-duty vehicles continue to operate at their cleanest possible level, the Valley's plan also includes new, supplemental actions to address in-use emissions. The ***Lower Opacity Limits for Heavy-Duty Vehicles*** measure would ensure that in-use, heavy-duty vehicles continue to operate at their cleanest possible

[66] U.S. EPA 2012 "California State Motor Vehicle Pollution Control Standards; Amendments to the California Heavy-Duty Engine On-Board Diagnostic Regulation; Waiver of Preemption; Final Notice of Decision" Federal Register Volume 77, Number 237 pp. 73459-73461 https://www.gpo.gov/fdsys/pkg/FR-2012-12-10/pdf/2012-29792.pdf

level. CARB staff would develop and propose new, supplemental actions to lower the opacity limits for on-road heavy-duty trucks. The current HDVIP and PSIP opacity limits (40 and 55 percent) are no longer adequate to identify and require repairs of vehicles operating with damaged PM emission control components. Even vehicles with heavily damaged and malfunctioning emission control systems emit exhaust at opacity levels below the current, out-of-date, opacity limits. Because of this, many HD vehicles operating in California are emitting excess PM emissions. For this measure, CARB staff would develop and propose lower opacity limits which reflect the current emission control technology equipped on today's HD diesel vehicles. The proposed amendments are intended to improve the identification and repair of malfunctioning PM emission control components on HD diesel vehicles in California. Lowering the opacity limits to the proposed levels would ensure that the opacity limits are more representative of current PM emission control technology and that vehicles operating with malfunctioning PM emission control components are more readily identified and repaired.

I/M Testing

All heavy-duty vehicles in California are subject to in-use inspections in order to control excessive smoke emissions and tampering. The ***Periodic Smoke Inspection Program (PSIP)***, adopted into law in 1990, requires heavy-duty vehicle fleet owners to conduct annual smoke opacity inspections of their vehicles, and have them repaired if excessive smoke emissions are observed. In addition, CARB has the authority to randomly audit these fleets, by reviewing the owners' maintenance and inspection records, and conducting opacity inspections on a representative sample of the vehicles. The current PSIP opacity limits are the same as for HDVIP (40 and 55 percent).

To ensure that in-use heavy-duty vehicles continue to operate at their cleanest possible level, the Valley's plan also includes new, supplemental actions to address in-use emissions and compliance. The ***Lower In-Use Performance*** measure will ensure that in-use, heavy-duty vehicles' emission control components and systems are properly functioning so that these vehicles continue to operate at their cleanest possible levels for the duration of their on-road operation. For this measure, CARB staff would develop and propose a regulatory program that reflects the current state of advanced engine and exhaust emission control technologies, including on-board diagnostics (OBD). For this proposed measure, CARB staff would develop and propose a comprehensive, multi-pollutant HD I/M program that that may be based largely on the extensive capabilities of OBD systems in newer engines (2013 and later model year engines) for monitoring the performance of nearly every engine and emission control component. Under the staff's current concept for the HD I/M program, heavy-duty vehicles would be required to demonstrate annual compliance with HD I/M program requirements in order to register with the Department of Motor Vehicles. This program concept also includes the use of telematics for OBD data transmittal to provide ease-of-of access to truckers, as well as an inspection component at physical locations,

primarily for program validation and directed vehicle testing, for out-of-State vehicles entering California, or for older vehicles with pre-OBD engines.

Idling Requirements

To reduce idling emissions from new heavy-duty diesel vehicles and emissions from auxiliary power units used as alternatives to heavy-duty vehicle idling, the Airborne Toxic Control Measure (ATCM) to Limit Diesel-Fueled Commercial Motor Vehicle Idling ***(Heavy-Duty Diesel Vehicle Idling Reduction Program)*** requires, among other things, that drivers of diesel-fueled commercial motor vehicles with gross vehicle weight ratings greater than 10,000 pounds, including buses and sleeper berth equipped trucks, not idle the vehicle's primary diesel engine longer than five minutes at any location. First adopted in July 2004 and subsequently amended, the regulation consists of new engine and in-use truck requirements and emission performance requirements for technologies used as alternatives to idling the truck's main engine. Under the new engine requirements, 2008 and newer model year heavy-duty diesel engines need to be equipped with a non-programmable engine shutdown system that automatically shuts down the engine after five minutes of idling. In 2012, U.S. EPA issued a waiver of preemption for the most recent amendments made to the Idling Reduction Program in 2006, beginning in model year 2008.[67]

The ***School Bus Idling Airborne Toxic Control Measure*** (School Bus ATCM) limits bus and commercial motor vehicle idling near schools or at school bus destinations to only when necessary for safety or operational concerns. It has been in effect since July 16, 2003 and reduces emissions from more than 26,000 school buses that operate daily at or near schools. The program targets school buses, school pupil activity buses, youth buses, paratransit vehicles, transit buses, and heavy-duty commercial motor vehicles that operate at or near schools. In 2009, Senate Bill 124, Oropeza (SB 124) acknowledged and codified CARBs ATCM limiting school bus idling raising the minimum penalty for a violation of this rule from $100 to $300. The bill also clarifies local peace officer and air district authority to enforce the state's school bus idling program. SB 124 became effective on January 1, 2010, and the existing regulation was revised to reflect this change.

Fleet rules

CARB's ***Cleaner In-Use Heavy-duty Truck Regulation (Truck and Bus Regulation)*** is the largest measure of this type of control measures, in terms of emission reductions achieved. The Truck and Bus Regulation impacts approximately one million inter- and intra-state vehicles, and requires privately and federally owned diesel fueled trucks and buses and privately and publicly owned school buses to fully upgrade to newer, cleaner engines by 2023. This measure leverages the benefits provided by new truck emission standards by accelerating introduction of the cleanest trucks. The Truck and Bus Regulation was adopted in December 2008, and was amended in both December 2010 and December 2014. The rule represents a multi-year effort to turn over the legacy fleet of engines and replace them with the cleanest technology available. While heavy-duty

[67] U.S. EPA 2012 "California State Motor Vehicle and Nonroad Engine Pollution Control Standards; Truck Idling Requirements; Final Notice of Decision" Federal Register Volume 77, Number 32, pp. 9239-9250 http://www.gpo.gov/fdsys/pkg/FR-2012-02-16/pdf/2012-3690.pdf

engine technology has become significantly cleaner in the past few decades, the long useful lives of some heavy-duty engines means that older, higher-emitting trucks remain on the road for many years after newer generations of engine standards have gone into effect.

Starting in 2012, the Truck and Bus Regulation phases in requirements so that by 2014, nearly all vehicles operating in California will have PM emission controls, and by 2023 nearly all vehicles will meet 2010 model year engine emissions levels. The regulation applies to nearly all diesel fueled trucks and buses with a GVWR greater than 14,000 pounds that are privately or federally owned, including on-road and off-road agricultural yard goats, cargo handling equipment, drayage trucks, solid waste collection vehicles, and school buses. Moreover, the regulation applies to any person, business, school district, or federal government agency that owns, operates, leases or rents affected vehicles. The regulation also establishes requirements for any in-State or out-of-State motor carrier, California-based broker, or any California resident who directs or dispatches vehicles subject to the regulation. Finally, California sellers of a vehicle subject to the regulation must disclose the regulation's potential applicability to buyers of the vehicles. In January 2017, U.S. EPA granted a waiver of preemption for the portions of the Truck and Bus Regulation for which a waiver was required.[68]

The remainder of CARB's in-use heavy-duty truck regulations focus on fleets by trade vocations. These regulations control in-use emissions, and were developed with the unique duty cycles of vehicles and engines engages in these vocational applications in mind.

- The ***2007 Drayage Truck (Port or Yard) Regulation*** accelerates PM and NOx emission reductions from diesel fueled engines involved in moving goods into and out of California's ports, railyards, and intermodal facilities. This regulation requires drayage trucks to utilize engine Model Year 2007 or newer emission controls until December 31, 2022 for ports and rail yards in California, and requires 2010 Model Year or newer engines to continue entering ports and rail yards starting on January 1, 2023. Additionally, drayage trucks are subject to requirements under the Truck and Bus regulation.

- The ***Solid Waste Collection Vehicle Regulations*** were adopted in 2003 to reduce toxic diesel particulate matter (diesel PM) from approximately 12,000 diesel-fueled commercial and residential solid waste collection vehicle (SWCV) and recycling collection vehicles operated in California. The rule applies to all SWCVs of 14,000 pounds or more that run on diesel fuel, have engines in model years (MY) from 1960 through 2006, and collect waste for a fee. Additionally, SWCVs are subject to requirements under the Truck and Bus regulation.

- California's ***Diesel Particulate Matter Control Measure for Municipality or Utility On-Road Heavy-Duty Diesel Fueled Vehicles*** (***Public Agency and Utility Regulation***) requires a municipality or utility that owns, leases or operates

[68] U.S. EPA 2017 "Final Notice of Decision - On-Highway Heavy-Duty Vehicle and Engine Regulations for 2007 and Subsequent Model Years" Accessed April 30, 2017 at https://www.gpo.gov/fdsys/pkg/FR-2017-01-17/pdf/2017-00940.pdf Federal Register / Vol. 82, No. 10 / Tuesday, January 17, 2017 pp. 4867

on-road diesel fueled vehicles with engine model year 1960 or newer and GVWR greater than 14,000 pounds to reduce PM2.5 emissions to 0.01 g/bhp-hr. This can be done by repowering, retrofitting, or retiring the vehicle. Implementation of the rule started in 2007, with a compliance schedule based on the engine model year. Additionally, public agencies and utilities' fleets may be subject to requirements under the Truck and Bus regulation.

- Adopted in 2000, the ***Fleet Rule for Transit Agencies (Transit Fleet Rule)*** requires reductions in diesel PM and NOx emissions from urban buses and transit fleet vehicles, and required future zero-emission bus purchases. Urban bus fleets were required to select either the diesel path or the alternative-fuel path. Transit agencies on the diesel path needed to demonstrate zero-emission buses, and to meet the zero-emission bus purchase requirements sooner, while agencies on the alternative-fuel path had to ensure that 85 percent of urban bus purchases were alternative fueled without a demonstration requirement. The Transit Fleet Rule was amended in 2004, and again in 2006. The 2006 amendments temporarily postponed the zero-emission bus purchase requirement (until 2011 and 2012, depending on the compliance path) and expanded the initial demonstration with a subsequent advanced technology demonstration phase. In 2009, CARB staff provided a technology update to the Board on the commercial readiness of zero-emission buses, and received Board direction to research and develop commercial readiness metrics to be used as criteria to initiate the zero-emission bus purchase requirement, and to conduct a technology assessment on the readiness of zero-emission bus technologies. U.S. EPA granted CARB a waiver of preemption for the Fleet Rule for Transit Agencies in 2013.[69] Additionally, transit fleets are subject to requirements under the Truck and Bus regulation.

Although ZEV and PHEV technologies are not as mature for heavy-duty trucks as they are in the passenger vehicle sector, Class 3 - 7 delivery trucks and urban buses provide opportunities for introducing ZEV technologies. Several control measures committed to in the State SIP Strategy therefore focus on the deployment of zero-emission technologies in targeted applications, due to their duty cycle, are well-suited to the initial introduction of heavy-duty zero-emission engines, beginning in 2018 to 2020. For example, transit buses, last mile delivery vehicles, and airport shuttle buses are typically operated on short-distance fixed routes and are centrally housed, and may be captive to the District – characteristics that make these applications ideally suited to deploying zero-emission vehicles in targeted heavier applications preceding broader penetration in the heavy-duty engine market. These initial deployments provide a foundation for subsequent migration of zero-emission technology to other heavier platforms, in order to continue to expand heavy-duty ZEV requirements in the long term, especially in certain vocational classes and fleets that are under California regulatory authority.

[69] U.S. EPA 2013, "California State Motor Vehicle Pollution Control Standards; Urban Buses; Request for Waiver of Preemption; Final Notice of Decision" Federal Register July 23, 2013 Volume 78, Number 141 pp. 44112-44117 https://www.gpo.gov/fdsys/pkg/FR-2013-07-23/pdf/2013-17700.pdf

- The ***Innovative Clean Transit*** measure will support the transition to a suite of cleaner transit options and reduce emissions from transit fleets. Under this measure, CARB staff will develop mechanisms to support the transition to a suite of innovative clean transit options, achieving emission reductions by supporting timely implementation of advanced technologies and improving efficiencies of the transit system.
- To reduce emissions from Classes 3-7 heavy-duty delivery trucks predominately used in urban areas to deliver freight from warehouses and distribution centers to its final point of sale or use, the ***Advanced Clean Local Trucks*** measure will increase the use of low-NOx engines and accelerate the deployment of zero-emission trucks. Experience gained from demonstrating the viability of advanced technologies in these fleets will benefit the market and enable the same technologies to be used in other heavy-duty vehicle applications.
- The ***Zero-Emission Airport Shuttle Bus*** measure is also designed to achieve NOx emission reductions through deployment of zero-emission airport shuttles. Airport shuttle buses transport passengers between car parking lots, airport terminals, and airport car rental facilities. Like transit buses and last mile delivery trucks, the inclusion of zero-emission airport shuttles would serve as a stepping stone to encourage broader deployment of zero-emission technologies in the on-road sector.

D.4.4.4 Fuels

In addition to new engine and in-use standards, cleaner burning fuels represent an important component in reducing emissions from on-road heavy-duty diesel trucks and buses. Cleaner fuel has an immediate impact in reducing emissions from the mobile source, and thus represent an important component in reducing NOx and diesel PM emissions from the on-road heavy-duty fleet. California's stringent air quality programs treat motor vehicles and their fuels holistically (as a system, rather than as separate components). As a result, CARB's fuels programs achieve significant reductions in criteria emissions from motor vehicles used in California.

CARB Diesel Fuel Regulations

The California diesel fuel program sets stringent standards for diesel fuel sold in California, and ensures that in-use diesel engines continue to operate as cleanly as possible. CARB's Diesel Fuel Regulations have, over time, phased in more stringent requirements for fuel mixture specifications for aromatic hydrocarbons and sulfur (a precursor to formation of secondary PM), and have establish a lubricity standard which apply fuels used in on- and off-road applications in California. ***"CARB diesel" Specifications*** adopted in 1988 limited the allowable sulfur content of diesel fuel 500 parts per million by weight (ppmw), and the aromatic hydrocarbon content to 10 percent, and became effective in 1993.

In 2003, ***CARB's Ultra Low Sulfur Diesel (ULSD) Regulation*** increased the stringency of the sulfur content limits in to 15 ppm, which harmonized with the 1993 U.S. EPA regulation that also limited sulfur in on-road diesel fuels to the same level.

Both the California and federal ULSD regulations began implementation in 2006. CARB's ULSD Regulation had an immediate impact in reducing emissions from the in-use on-road heavy-duty fleet, while also enabling the use of advanced emissions control technologies, including the use of catalyzed diesel particulate filters (DPF), NOx after-treatment, and other advanced after-treatment based emission control technologies that higher sulfur levels would have inhibit the performance of (at the time of CARB's ULSD rulemaking, the average sulfur content of California diesel was approximately 140 ppmw).

Controlling Criteria Emissions from Renewable Fuels

The ***Low Carbon Fuel Standard (LCFS) and Alternative Diesel Fuel (ADF) Regulations,*** as amended in 2014, work together to reduce the carbon intensity of the California fuel supply. The regulations also limit criteria emissions from alternative fuels and/or alternative fuel mix blends (a mix of fuels made from renewable feedstocks, which are then blended with conventional gasoline or diesel).
Beyond the current fuels control program, CARB committed to develop a ***Low Emission Diesel*** Measure that will require diesel fuel providers to steadily decrease criteria pollutant emissions from their diesel products. The use of low-emission diesel in on-road vehicles and off-road equipment will reduce tailpipe NOx and PM emissions, in addition to other criteria pollutants. Some studies carried out to date on hydrotreated vegetable oil have reported NOx emission reductions of 6 percent to 25 percent and PM emission reductions of 28 percent to 46 percent, depending on the types of fuels, drive cycles tested, and diesel engines used. This standard is anticipated to both increase consumption of low-emission diesel fuels, and to reduce emissions from conventional fuels. This measure is anticipated to provide NOx benefits predominately from legacy (pre-2010) on-road heavy-duty vehicles, off-road engines, stationary engines, portable engines, marine vessels and locomotives, as well as NOx and diesel PM benefits in potentially all model year off-road engines, stationary engines, portable engines, marine vessels and locomotives. Interstate vehicles, even those registered out-of-State but operating on CARB diesel blended with low-emission diesel, are also anticipated to provide emission reduction benefits.

D.4.4.5 Step 2(b): Other States' and Nonattainment Areas' on-road Heavy-Duty Control Measures

Table 11 summarizes the most stringent control measures currently in use in any state or nonattainment that have been identified and discussed for on-road heavy-duty vehicles. Each of the measures identified in this table are discussed in more detail in this section, below.

Table 11: Summary of Most Stringent Heavy-Duty Control Measures Identified

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
On-Road Heavy-Duty Vehicles			
New Engine Standards			
New Vehicle and Engine Standards • Heavy-duty engine emission standards (mandatory standards)	Current CARB and U.S. EPA limit exhaust emissions to same levels: • NOx: 0.2 g/bhp-hr • PM: 0.01 g/bhp-hr CARB anticipated to propose to further increase stringency to ~0.02 g/bhp-hr (NOx). • *(Low-NOx Truck measure)*	CARB's current emission standards for heavy-duty engines (NOx and PM) are set at the same level of stringency as Federal standards. CARB is anticipated to further increase the stringency of controls by proposing California NOx standards that are effectively 90 percent cleaner than today's federal NOx standards (i.e. 0.02 g/bhp-hr) *(NOTE: CARB has committed to develop the Low-NOx Truck measure but it has not yet been proposed to the Board for approval/adoption.)*	No other state has more stringent exhaust emission standards than California.
New Vehicle and Engine Standards • Optional heavy-duty engine emission standards	Optional Low NOx Emission Standard (CARB) • 0.1 g/bhp hr, 0.05 g/bhp-hr, or 0.02 g/bhp-hr	CARB's optional standards accelerate the pace of innovation and development of cleaner engine technologies by certifying engines that go beyond the stringency of federal standards. Starting in 2015, engine manufacturers could choose to certify to three optional NOx emission standards of 0.1 g/bhp hr, 0.05 g/bhp-hr, and 0.02 g/bhp-hr (i.e., 50 percent, 75 percent, and 90 percent lower than the current mandatory standard of 0.2 g/bhp-hr). Together with the mandatory standards that harmonize with federal emission requirements, this program makes California's suite of HD engine emission controls the most stringent in the nation.	California is the only state with optional exhaust emission standards for heavy-duty engines that exceed the stringency of U.S. EPA requirements.
New Vehicle and Engine Standards • Warranty Requirements and Useful Life	CARB's warranty requirements are currently set at the same level of stringency as Federal standards. CARB anticipated to propose to further increase stringency *(Amended Warranty Requirements for On-Road HD Vehicles measure)*	Both U.S. EPA and CARB currently require that heavy-duty vehicles meet emission standards throughout their useful life periods of 5 years / 100,000 miles (GVWR > 14,000 lbs.) CARB is anticipated to further increase the stringency of controls by proposing lengthened warranty period requirements, potentially up to >400,000 miles. *(NOTE: CARB has not yet been proposed the Amended Warranty Requirements for On-Road HD Vehicles measure to the Board for approval/adoption.)*	No other state has more stringent warranty requirements than California.
New Vehicle and Engine Standards • OBD Requirements	Heavy-Duty OBD (CARB) and OBD II (CARB)	CARB and federal OBD regulations for heavy-duty vehicles generally align for MY2013 and newer engines, although CARB's program has been amended to be more stringent than U.S. EPA's for certain vehicle types. California OBD requirements are at least as stringent as applicable federal requirements.	No other state has more stringent OBD requirements than California.

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
On-Road Heavy-Duty Vehicles			
In-Use Emission Controls			
In-Use Emissions Controls • I/M program (opacity limits)	New Jersey (NJ) has more stringent opacity limits than CARB's currently adopted regulations. However, the Valley's plan proposes to increase the stringent of CARB's opacity limits, which would it the most stringent in the nation. *(Lower Opacity Limits measure)*	CARB's current HVIP program sets opacity limits at 40% (for MY1991 and newer) and 55% (MY1990 and older). CARB is anticipated to further increase the stringency of controls by proposing to lower the opacity limits for non-DPF-equipped vehicles to a range equivalent to NJ's program (20% – 40%), and to 5% for DPF-equipped engines. *(NOTE: CARB has committed to develop the Lower Opacity Limits measure but it has not yet been proposed to the Board for approval/adoption.)*	New Jersey's opacity limits range from 40% - 20%
In-Use Emissions Controls • I/M program (Testing)	California's current I/M program for heavy-duty vehicles is the most stringent in the nation. CARB anticipated to propose to further increase stringency. *(Lower In-Use Performance Level measure)*	CARB's I/M program (including the HDVIP and PSIP regulations) is the most stringent in the nation, with further increases in stringency anticipated to be proposed. *(NOTE: CARB has committed to develop the Heavy-Duty Vehicle Inspection and Maintenance Program measure, but it has not yet been proposed to the Board for approval/adoption.)*	Three other states also test OBD in heavy-duty vehicles (MA, NJ, and WI), but none aside from California are currently enforcing on OBD scans for vehicles >14,000 lb. GVWR. Additionally, they do not control emissions from out-of-state trucks, or include the potential use of telematics like CARB.
In-Use Emissions Controls • Idling requirements	Heavy-Duty Diesel Vehicle Idling Reduction Program (CARB)	CARB's program the most stringent in the nation. It limits idling time to five minutes, and requires that MY 2008 and newer engines are equipped to automatically shut down after five minutes of idling. While other jurisdictions have adopted similar idling time limits requirements – some with more stringent time limits than CARB – none surpassed the stringency of California's program in effect, because emission performance requirements for idle reduction technologies are unique to California's program.	Areas with more stringent time limits: • 2 minute restrictions, no exemptions: Philadelphia, PA • 2 minute restrictions, some exemptions: Salt Lake City and Salt Lake County, UT • 3 minute restrictions, some exemptions: CT, DC, City of Ketchum (ID), New York City (NY), the Village of Larchmont (NY), the Village of Mamaroneck (NY), the County of Westchester (NY), Park City (UT), and the City of Birmingham (VT) Areas with less stringent time limits: • 3 minute restrictions, some exemptions DE, Chicago (IL), NJ, Town of Mamaroneck (NY), and Rockland County (NY)

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
On-Road Heavy-Duty Vehicles			
In-Use Emissions Controls • Fleet Rules (Truck and Bus)	Truck and Bus Regulation (CARB)	CARB's Truck and Bus regulation is the most comprehensive and stringent mandatory heavy-duty fleet turnover rule in the nation, affecting approximately one million inter- and intra-state on-road diesel vehicles. The regulation applies to nearly all privately or federally owned diesel-fueled trucks and buses > 14,000 lbs., GVWR, including on-road and off-road agricultural yard goats, cargo handling equipment, drayage trucks, solid waste collection vehicles, and school buses. Its phased-in requirements mandate diesel particulate filters in early years, eventually requiring vehicles to fully upgrade to newer, cleaner engines that meet MY 2010 engine equivalent emissions levels when fully implemented in 2023.	No other state requires diesel particulate filters (DPF) and MY 2010 + equivalent engines as a mandatory fleet rule affecting nearly the entire on-road diesel fleet
In-Use Emissions Controls • Fleet Rules (Drayage Trucks)	Drayage Truck (Port or Yard) Regulation and Truck and Bus Regulation (CARB)	California's emission controls for drayage trucks are the most stringent in the country. The Drayage Truck (Port or Yard) Regulation requires 2010 Model Year or newer engines at ports and rail yards starting in 2023.	No other jurisdiction mandates more stringent fleet requirements for drayage trucks.
In-Use Emissions Controls • Fleet Rules (Solid Waste Collection Vehicles)	Solid Waste Collection Vehicle Regulations and Truck and Bus Regulation (CARB)	California's solid waste collection vehicles (SWCVs) fleet control program is the most stringent in the nation. Compared to New York City's program, CARB's Solid Waste Collection Vehicles regulation limits PM emissions at approximately the same level of stringency; because these vehicles are also subject to more stringent requirements under Truck and Bus, however, the overall level of emission controls are more stringent in California than any other jurisdiction.	New York City (NY) requires that at least 90 percent of the ~8,300 qualifying privately and publicly-owned SWCVs meet the U.S. EPA's 2007 diesel standard for PM. Comparatively, CARB controls ~12,000 SWCVs (MYs 1960 through 2006) at approximately the same level of PM control (i.e. equivalent to the 2007 MY standard of 0.01 g/bhp-hr).
In-Use Emissions Controls • Fleet Rules (Public fleets)	Public Agency and Utility Regulation and Truck and Bus Regulation (CARB)	California's public fleet controls are the most stringent in the nation. CARB's Public Agency and Utility Regulation requires similar stringency in PM emissions limits as the Boston, MA program; because these fleets are also subject to more stringent requirements under Truck and Bus, the overall level of emission controls are more stringent in CA than any other jurisdiction.	The city of Boston (MA) requires by 2018 all pre-2007 diesel vehicles and equipment not previously retrofit to be controlled to achieve emission reductions of at least 85 percent (approximately equivalent to the 2007 PM standard of 0.01 g/bhp-hr). Comparatively, CARB limits are set equivalent to the 2007 MY standard of 0.01 g/bhp-hr for engine MY 1960 or newer, GVWR > 14,000 lbs.
In-Use Emissions Controls • Fleet Rules (Transit fleets)	Transit Fleet Rule (CARB) CARB anticipated to propose to further increase stringency. *(Innovative Clean Transit measure)*	California's emission controls for transit vehicles are the most stringent in the country. The Transit Fleet Rule requires emission reductions (PM and NOx) from urban buses and transit fleet vehicles, and required future zero-emission bus purchases. Further increases in the stringency of public fleet controls are anticipated under the Innovative Clean Transit measure.	No other jurisdiction mandates more stringent fleet requirements for transit fleets.

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
On-Road Heavy-Duty Vehicles			
		(NOTE: CARB has committed to develop Innovative Clean Transit measure, but it has not yet been proposed to the Board for approval/adoption.)	
In-Use Emissions Controls • Fleet Rules (Last mile delivery trucks)	Truck and Bus Regulation (CARB) CARB anticipated to propose to further increase stringency. *(Advanced Clean Local Trucks measure)*	California's emission controls for last mile delivery vehicles (Class 3-7 heavy-duty delivery trucks used to deliver freight from warehouses and distribution centers to the final point of sale or use) are the most stringent in the country. Truck and Bus requires MY 2010 or equivalent engines by 2023. Further increases in the stringency of last mile delivery fleets are anticipated under the Advanced Clean Local Trucks measure. *(NOTE: CARB has committed to develop the Advanced Clean Local Trucks measure, but it has not yet been proposed to the Board for approval/adoption.)*	No other jurisdiction mandates more stringent fleet requirements for last mile delivery trucks.
In-Use Emissions Controls • Fleet Rules (Airport shuttle buses)	Truck and Bus Regulation (CARB) CARB anticipated to propose to further increase stringency. *(Zero-Emission Airport Shuttle Bus measure)*	California's emission controls for airport shuttle buses (vehicles used to transport passengers between car parking lots, airport terminals, and airport car rental facilities) are the most stringent in the country. Truck and Bus requires MY 2010 or equivalent engines by 2023. Further increases in the stringency of airport shuttle buses and similar fleets are anticipated under the Zero-Emission Airport Shuttle Bus measure. *(NOTE: CARB has committed to develop Zero-Emission Airport Shuttle Bus measure, but it has not yet been proposed to the Board for approval/adoption.)*	No other jurisdiction mandates more stringent fleet requirements for airport shuttle buses.
In-Use Emissions Controls • Fleet Rules (School Buses)	Truck and Bus Regulation (CARB)	California's emission controls for school buses are the most stringent in the nation. The Truck and Bus regulation requires that all school buses fully upgrade by 2023 to engines that meet MY 2010 engine emissions levels. Since 2003, California also limits bus and vehicle idling time near schools or at school bus destinations through the School Bus ATCM, reducing emissions from >26,000 school buses operating daily at or near schools.	Colorado (CO) controls emissions from school buses through a School Bus Retrofit Program funded by DERA Grants from U.S. EPA. This voluntary program began in 2009, and controls PM emissions through retrofits. CARB staff is unaware of any other jurisdictions that mandate retrofits or turnover of the school bus fleet to ensure engines meet MY2010-equivalent level of controls.
Fuels Programs			
Fuels Standards • Diesel Standards	CARB Diesel Fuel Regulations and Ultra Low Sulfur Diesel (CARB)	CARB Diesel Fuel Regulations include stringent requirements for fuel mixture specifications for aromatic hydrocarbons and sulfur, and have establish a lubricity standard and applies to sales of fuel used in on-road vehicles and off-road vehicles and locomotives in California	No state requires cleaner burning diesel than California. The California diesel fuel regulations exceed federal requirements in stringency.

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
On-Road Heavy-Duty Vehicles			
		CARB's Ultra-Low Sulfur Diesel (ULSD) program reduces ozone precursor emissions significantly relative to U.S. EPA requirements (providing approximately 7 percent more NOx reductions and 25 percent more dPM reductions than federal diesel).	
Fuels Standards • Alternative Fuel Standards (Diesel substitutes)	LCFS and ADF (CARB) CARB is anticipated to propose to further increase stringency. *(Low Emission Diesel measure)*	The LCFS and ADF regulations work together to reduce the carbon intensity of the California fuel supply while requiring limits on criteria emissions from alternative fuels and/or alternative fuel mix blends. CARB is anticipated to further increase the stringency of controls on criteria pollutant emissions diesel products. *(NOTE: CARB has committed to develop the Low Emission Diesel measure, but it has not yet been proposed to the Board for approval/adoption.)*	No other state has set as stringent of criteria emission requirements on alternative fuels and alternative fuel blends than California.

D.4.4.6 New heavy-duty vehicle and engine standards

Heavy-duty engine emission standards

CARB's truck engine standards for on-road heavy-duty engines are consistent with the most stringent of any other area in the nation. Due to constraints in the Act, California is the only state that can set new engine standards (including control measures such as emission standards, warranty provisions, and on-board diagnostic (OBD) requirements) that are more stringent than U.S. EPA's national standards. Other states may adopt California programs for which U.S. EPA has provided California with waivers (under provisions specified in Section 177). These states are also known as the "Section 177 States" in reference to this provision of the Act. The ability to set more stringent controls than U.S. EPA, however is unique to California, and thus ensures that the California control measures for new engine and truck standards are at least equal in stringency to the most stringent controls in the nation.

Similar to the light-duty sector, as provided for in the Act, a number of other states have historically followed California's lead and adopted at least one of California's heavy-duty regulations. These states are listed below in Table 12.

Table 12: Section 177 for CARB's Heavy-Duty Engine Emission Standards

Section 177 States	Heavy-Duty Diesel Engine Regulation
Connecticut	X
Delaware	X
Georgia	X
Maine	X
Massachusetts	X
New Jersey	X
New York	X
North Carolina	X
Pennsylvania	X

CARB's current heavy-duty engine emission standards sets exhaust emission standards for PM2.5 at 0.01 g/bhp-hr and NOx at 0.2 g/bhp-hr. This aligns with the applicable federal standards set by U.S. EPA, which are also set at the same levels of stringency.[70]

With the adoption and implementation of the proposed Low-NOx Standards for Heavy-Duty Vehicles, CARB will further increase the stringency of these requirements to reduce NOx exhaust emissions standards to 0.02 g/bhp-hr (i.e. 90 percent lower than the current mandatory standard).

Optional engine emission standards

To achieve further reductions and incentivize ongoing development of increasingly more efficient engine technologies, CARB has also provided certification to optional emission

[70] U.S. EPA 2016 "Heavy-Duty Highway Compression-Ignition Engines and Urban Buses: Exhaust Emission Standards" https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100O9ZZ.pdf accessed May 1, 2018.

standards at levels 50 percent, 75 percent, and 90 percent cleaner than currently mandated emission standards. This allows CARB and local air districts to preferentially incentivize and fund the purchase of cleaner trucks and engines than would have otherwise met the mandatory standard. CARB staff is unaware of any other state with a similar control program.

Certification and Warranty Requirements

CARB's certification and warranty requirements for new on-road heavy-duty vehicles exceeds the stringency of any other in the nation. California is the only state with certification and warranty requirements for new on-road heavy-duty engines that exceed the stringency of U.S. EPA requirements.

Lower In-Use Emission Performance Standards and Test Procedures

CARB's in-use emission performance standards and test procedures for new on-road heavy-duty engines and vehicles exceeds the stringency of any other in the nation. California is the only state with emission performance standards and test procedures for new on-road heavy-duty engines and vehicles that exceed the stringency of U.S. EPA requirements.

OBD Requirements

CARB's OBD requirements for new on-road heavy-duty vehicles exceeds the stringency of any other in the nation. California is the only state with OBD requirements for new on-road heavy-duty engines that exceed the stringency of U.S. EPA requirements.

D.4.4.7 In-use emission controls for heavy-duty vehicles

In-Use Inspection Program

The Inspection / Maintenance (I/M) Program testing and in-use emission controls in the Valley for on-road heavy-duty trucks and buses are consistent with the most stringent of any other I/M program in the nation.

Opacity Limits

During the current year of 2018, New Jersey has more stringent opacity limits than California[71], but this differential will be fully addressed through the ***Lower Opacity Limits for Heavy-Duty Vehicles*** measure as described in the Valley's plan; when implemented in 2019, California opacity limits will once again become the most stringent in the nation.

I/M Testing

CARB's HDVIP program requires heavy-duty trucks and buses to be inspected for excessive smoke and tampering, and engine certification label compliance, including all applicable OBD requirements. Any heavy-duty vehicle traveling in California, including vehicles registered in other states and foreign countries, may be tested. Tests are performed by CARB inspection teams at border crossings, weigh stations, fleet facilities, and randomly selected roadside locations. Owners of trucks and buses found in violation are subject to minimum penalties starting at $300 per violation. The PSIP

[71] For more information on the New Jersey Opacity Limits, please see http://www.nj.gov/dep/bmvim/bmvim_emisStds.htm

program requires that diesel and bus fleet owners conduct annual smoke opacity inspections of their vehicles and repair those with excessive smoke emissions to ensure compliance. CARB randomly audits fleets, maintenance and inspection records and tests a representative sample of vehicles. All vehicles that do not pass the test must be repaired and retested. A fleet owner that neglects to perform the annual smoke opacity inspection on applicable vehicles is subject to a penalty of $500.00 per vehicle, per year.

Comparatively, three other states have efforts to include OBD testing on heavy-duty vehicles, which are summarized below:

- Massachusetts currently requires opacity testing for diesel engines over 14,000 lbs., GVWR, and OBD testing starting at 2007, with plans to develop a more stringent OBD testing program that will include OBD testing on vehicles 14,000 lbs., GVWR and above.
- New Jersey currently requires opacity testing for diesel engines over 18,000 lbs., GVWR, and has announced the award of a new program to include OBD testing on all diesels over 18,000 lbs., GVWR
- Wisconsin currently requires OBD testing for diesel engines up to 14,000 lbs., GVWR, which began in 2007. Wisconsin is considering an option to move toward testing OBD on 14,000 lbs., GVWR and above in the future.

While Massachusetts and New Jersey are developing similar I/M programs as California (all three states are collecting OBD test data for vehicles over 14,000 lbs., GVWR) no jurisdictions aside from California are currently enforcing on OBD scans for vehicles over 14,000 lb. GVWR. Furthermore, none include the potential use of telematics or are trying to also capture out-of-State trucks in the program as California's control program does. Thus, CARB's I/M testing controls are the most stringent in the nation.

Idling Requirements

The idling requirements in the Valley's plan are aligned with the most stringent in the nation. California has a 5-minute idling time restriction. In addition, it has emission performance requirements for alternative idle reduction technologies such as auxiliary power units (APU) and fuel-fired heaters. While other states have adopted similar HD idling requirements as California, none have surpassed the stringency of California requirements in effect, due to the unique exemptions provided California under the CAA that enables CARB to set emissions performance requirements that exceed the stringency of those required by U.S. EPA. The following states, counties and cities have more stringent timing requirements for idling time restrictions. However, they do not set performance requirements for idle reduction technologies to reduce the intensity of emissions emitted over a given amount of time.

- The City of Philadelphia (PA) has the most stringent idling restriction of 2-minutes with no exemptions.

- Salt Lake City and Salt Lake County in Utah have also idling restrictions of 2 minutes with some exemptions but still more stringent than California idling restrictions.
- Connecticut, the District of Columbia, City of Ketchum (Idaho), New York City (NY), the Village of Larchmont (NY), the Village of Mamaroneck (NY), the County of Westchester (NY), Park City (Utah), and the City of Birmingham (Vermont) have idling time restriction of 3 minutes with some exemptions.
- Delaware, Chicago (Illinois), New Jersey, Town of Mamaroneck (NY), and Rockland County (NY) also have 3-minute idling restrictions, but their exemptions make their rules less stringent than California idling rule.

Only California has emission performance requirements for idle reduction technologies. Therefore, even if another jurisdiction has an idle time restriction shorter than California's 5-minute idling restriction, for sleeper cabs that use APUs as an alternative technology, California's regulation is more stringent because of the differences in APU emissions. Thus, all other state, county, or city idling rules are less stringent than California's idling restriction.

Heavy-Duty Fleet Rules

California's fleet rules for heavy-duty trucks and buses are the most stringent of any in the nation. The Truck and Bus regulation requires that by 2014, nearly all vehicles operating in California will have PM emission controls, and by 2023 nearly all vehicles will meet 2010 model year engine emissions levels. The regulation applies to nearly all diesel fueled trucks and buses with a gross vehicle weight rating greater than 14,000 pounds that are privately or federally owned, including on-road and off-road agricultural yard goats, and privately and publicly owned school buses. Moreover, the regulation applies to any person, business, school district, or federal government agency that owns, operates, leases or rents affected vehicles.

Additionally, California has adopted and implemented fleet-specific rules that are consistent with the most stringent in the nation.

- Public Fleet Rules
  The city of Boston (MA) requires that all pre-2007 City-owned or operated vehicles to have equipment that reduces diesel emissions by at least 20 percent by the end of 2015, and that all pre-2007 diesel vehicles and equipment not previously retrofit would be required to have retrofits achieving at least 85-percent—or best available—pollution reductions by the end of 2018.

  Comparatively, California's statewide Public Agency and Utility Regulation requires any municipality or utility that owns, leases or operates on-road diesel fueled vehicles with engine model year 1960 or newer and GVWR greater than 14,000 pounds to reduce PM2.5 emissions to 0.01 g/bhp-hr. This can be done by repowering, retrofitting, or retiring the vehicle. Implementation of the rule started in 2007, with a compliance schedule based on the engine model year.
- Solid Waste Vehicles
  New York City (NY) is implementing a control measure that began in 2017 to

modernize the city's fleet of diesel-powered solid waste vehicles of approximately 2,000 trucks used for picking up residential waste and recyclables with newer, less-polluting models. This program requires that at least 90 of qualifying vehicles must meet the tougher emission control standards for diesel trucks that the federal Environmental Protection Agency set in 2007.[72] A newly proposed control measure would strengthen those requirements to apply to approximately 8,300 private collection trucks to meet the same federal emissions standards by 2020, three years after the deadline for the municipal fleet. This new proposal has not been adopted by the City Council, whose vote is required.[73]

Comparatively, California's Solid Waste Collection Vehicle Regulation was adopted in 2003 to reduce toxic diesel PM from approximately 12,000 diesel fueled commercial and residential SWCV and recycling collection vehicles operated in California. The rule applies to all SWCVs of 14,000 pounds or more that run on diesel fuel, have engines in MYs from 1960 through 2006, and collect waste for a fee.

- School Buses
  Colorado controls emissions from school buses through a School Bus Retrofit Program funded by DERA Grants from U.S. EPA. This program began in 2009, and reduces emissions of diesel exhaust by retrofitting school buses with proven emissions-reduction technologies, including diesel-oxidation catalysts, engine preheaters and closed-crankcase filtration systems.

  Comparatively, California's Truck and Bus regulation requires that all privately and publicly owned school buses to fully upgrade by 2023 to newer, cleaner engines that meet 2010 model year engine emissions levels. California also limits bus and vehicle idling time near schools or at school bus destinations through the School Bus ATCM. It has been in effect since 2003 and reduces emissions from more than 26,000 school buses that operate daily at or near schools. The program targets school buses, school pupil activity buses, youth buses, paratransit vehicles, transit buses, and heavy-duty commercial motor vehicles that operate at or near schools.

D.4.4.8 Fuels

Diesel Fuel Regulations

U.S. EPA began regulating sulfur content in diesel in 1993. At that time, uncontrolled fuels (i.e. non-CARB diesel) contained approximately 5,000 parts per million (ppm) of sulfur. In 2006, U.S. EPA began to phase-in more stringent requirements under the federal Ultra-Low Sulfur Diesel (ULSD) regulations, which lowered the amount of sulfur in on-road diesel fuel to 15 ppm. The Onroad (Highway) Diesel Fuel Standard was phased-in from 2006 to 2010, and since 2011 have required that all highway diesel fuel supplied to the market be ULSD, and that all highway diesel vehicles must use ULSD.

[72] https://www.nytimes.com/2016/08/19/opinion/how-garbage-trucks-can-drive-a-green-future.html
[73] ibid

CARB's ultra-low sulfur diesel program limits sulfur content at the same levels as U.S. EPA's on-road ULSD program (i.e. at 15 ppm); however, due to other specifications that uniquely apply to CARB diesel, the California program reduces emissions significantly relative to federal diesel, about 7 percent reduction in NOx and 25 percent in diesel PM.[74]

Beyond the federal diesel requirements described above, the Act also allows states to adopt unique fuel programs to meet local air quality needs, which are referred to as Boutique Fuel Programs. As of January 19, 2017 U.S. EPA identified only one boutique fuel programs that had been approved in a SIP,[75] the Low Emission Diesel Program in Texas (TxLED). The fuel specifications for the TxLED are based on CARB diesel requirements,[76] and fuel formulations approved by CARB are also considered approved by the Texas Commission on Environmental Quality (TCEQ), and may be used to comply with the TxLED regulations.[77] Additionally, independent analysis of TxLED, CARB ULSD and federal ULSD shows that the TxLED fuel emissions performance does not provide as significant of emission reduction benefits as the California specifications,[78] although U.S. EPA credited the TxLED program with providing approximately a 5% NOx emission reduction benefit over federal ULSD fuels.[79] Furthermore, the stringency of Texas' testing requirements are based on the federal Complex Model, which is less stringent and nuanced than the California Predictive Model that is used to determine compliance with California fuel requirements.

Controlling Criteria Emissions from Renewable Fuels

The Low Carbon Fuel Standard (LCFS) and Alternative Diesel Fuel (ADF) regulations work together to limit criteria emissions from alternative fuels. While other states have adopted or are considering adopting similar programs to the California LCFS, no other state has set criteria emission requirements on alternative fuels. U.S. EPA's Renewable Fuel Standard (RFS II) does not specify criteria emission requirements for alternative fuels. Furthermore, CARB is anticipated to further increase the stringency of controls on criteria pollutant emissions diesel products under the Low Emission Diesel measure. No other state or nonattainment area controls criteria emissions from renewable fuels more stringently than CARB.

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[74] Beyond sulfur limits at 15 ppm, CARB's program also requires the aromatic hydrocarbon content of the diesel fuel sold in the state not to exceed 10 percent by volume. Alternative diesel fuel formulations can be used to demonstrate equivalent compliance without actually meeting the aromatic limit.

[75] U.S. EPA, 2017 https://19january2017snapshot.epa.gov/gasoline-standards/state-fuels_.html

[76] Texas Administrative Code Title 30 Part I Chapter 114 Subchapter H, Division 2 Rule §114.312 http://texreg.sos.state.tx.us/public/readtac%24ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=114&rl=312

[77] Texas Commission on Environmental Quality https://www.tceq.texas.gov/assets/public/implementation/air/sip/texled/List%20of%20TCEQ-Approved%20Alternative%20Diesel%20Formulations.pdf

[78] American Transportation Research Institute (ATRI) 2008 "Energy and Other Fuel Property Changes with On-Road Ultra-Low Sulfur Diesel Fuel" http://www.atri-online.org/research/results/environmentalfactors/2008ATRIDiesel.pdf

[79] U.S. EPA 2001, "Approval and Promulgation of Air Quality State Implementation Plans (SIP); Texas: Low Emission Diesel Fuel" https://www.federalregister.gov/documents/2001/11/14/01-27581/approval-and-promulgation-of-air-quality-state-implementation-plans-sip-texas-low-emission-diesel Federal Register Vol. 66, No. 220 pages 57196-57219

D.4.5 STEP 3(A): EVALUATION OF STRINGENCY: ON-ROAD HEAVY-DUTY CONTROL MEASURES

Step 3(a) calls for an evaluation of each of the control measures identified in Step 2, in order to evaluate their stringency and determine whether they meet all applicable requirements to satisfy the definitions of BACM and/or MSM discussed in Chapter 1 and Chapter 2.

in order to determine whether each potential MSM/BACM measure meets the definition of MSM and/or BACM, staff has assessed each potential MSM/BACM on-road heavy-duty vehicle control measure identified in Steps 2(a) and 2(b). Based on this assessment, staff then characterized each potential MSM / BACM measure as falling into 'bins' representing whether it meets the definition of MSM or BACM for each of the four PM2.5 standards covered in this document (note that the BACM bin is further subdivided into BACT or ADF). The determination of which bin each control measure falls into thus indicates both the control measure' stringency and the control measures' implementation schedule, relative to the varying attainment dates among the Valley's four PM2.5 SIPs. In other words, the bin into which each control measure falls correlates with how hard each measure pushes to control emissions, given the implementation timeframes associated with each standards' plan. Generally speaking, the control measures included in CARB's current control program meet the definition of BACM; the new measures included in the Valley SIP Strategy satisfy MSM requirements.

Figure 5 shows the timing for implementation of each potential MSM / BACM on-road heavy-duty vehicle control measure identified in the prior sections (i.e. Steps 2(a) and 2(b)), for each of the four PM2.5 standards discussed in this SIP.

Figure 5: Timeline for Implementation of BACM / MSM Heavy-Duty Control Measures

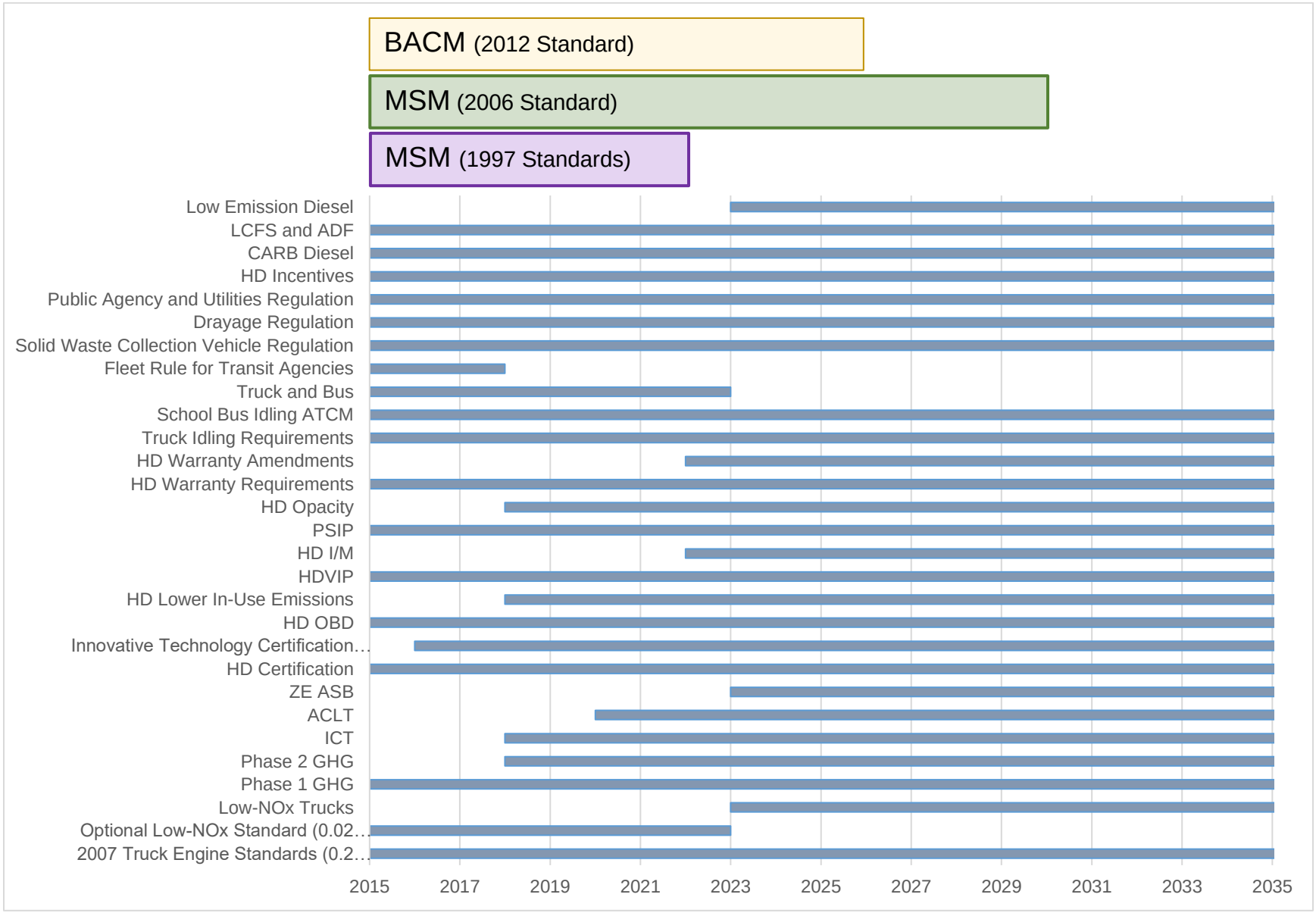


Table 13 summarizes which of the categories of stringency (i.e. BACM/BACT, BACM/ADF, or MSM) that each heavy-duty control measure falls into, for each PM2.5 standard. It is important to note that some measures CARB has committed to in the State SIP Strategy have anticipated implementation dates that exceed the timeframe thresholds of this analysis for some standards. Specifically, implementation of the Low-NOx Engine Standard, Zero-Emission Airport Shuttle Bus, and Low-Emission Diesel measures is anticipated to begin in 2023, which falls after the 2021 threshold of the analysis for the 1997 Annual and 24-Hour Standards. While these measures may not meet the timeline requirements to fall into the strict definition of MSM for these standards, the intent behind their development is nonetheless to continue pushing for additional emission reductions to ensure that attainment is achieved as expeditiously as possible, which aligns with the broader purpose of MSM.

Table 13: Identification of On-Road Heavy-Duty Control Measures as BACM and/or MSM

Measures	Implementation Begins	12 ug/m3 Annual (2012)	35 ug/m3 24-Hour (2006)	15 ug/m3 Annual (1997)	65 ug/m3 24-Hour (1997)
Adopted Heavy-Duty Vehicle Control Measures					
HD Exhaust Emission Standards for MY 2007+ Diesel Engines and Vehicles (0.2 g/bhp-hr)	ongoing	BACM - BACT	MSM	MSM	MSM
Optional Reduced Emission Standards for Heavy-Duty Engines (0.02 g/bhp-hr)	ongoing	BACM - AFM	MSM	MSM	MSM
HD On-Board Diagnostics (HD OBD)	ongoing	BACM - BACT	MSM	MSM	MSM
HD Diesel Vehicle Inspection Program (HD VIP)	ongoing	BACM - BACT	MSM	MSM	MSM
Periodic Smoke Inspection Program	ongoing	BACM - BACT	MSM	MSM	MSM
HD Emissions Warranty Requirements	ongoing	BACM - BACT	MSM	MSM	MSM
School Bus Idling ATCM	ongoing	BACM - BACT	MSM	MSM	MSM
ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling (Diesel Idling Reduction Program)	ongoing	BACM - BACT	MSM	MSM	MSM
On-Road Heavy-Duty Diesel Vehicle In-Use Regulation (Truck and Bus)	ongoing	BACM - AFM	MSM	MSM	MSM
Fleet Rule for Transit Agencies	ongoing	BACM - BACT	MSM	MSM	MSM
Solid Waste Collection Vehicle Regulation	ongoing	BACM - BACT	MSM	MSM	MSM
Drayage (Port or Rail Yard) Regulation	ongoing	BACM - BACT	MSM	MSM	MSM
Diesel PM Control Measure for Municipality or Utility On-Road HD Diesel Fueled Vehicles (Public Agency and Utility Regulation)	ongoing	BACM - BACT	MSM	MSM	MSM
CARB Ultra Low Sulfur Diesel	ongoing	BACM - BACT	MSM	MSM	MSM
Low Carbon Fuel Standard (LCFS) and Alternative Diesel Fuel (ADF)	ongoing	BACM - BACT	MSM	MSM	MSM
State SIP Strategy Measures (with Commitment)					
Lower In-Use Emission Performance Level:	2018 +	BACM - BACT	MSM	MSM	MSM
Lower Opacity Limits for Heavy-Duty Vehicles	2018 – 2024	BACM - BACT	MSM	MSM	MSM
Amended Warranty Requirements for Heavy-Duty Vehicles	2022	BACM - AFM	MSM	MSM	MSM
Inspection and Maintenance Program for Heavy-Duty Vehicles	2022 +	BACM - AFM	MSM	MSM	MSM
Low-NOx Engine Standard – California Action	2023	BACM - AFM	MSM	--	--
Innovative Clean Transit	2018	BACM - BACT	MSM	MSM	MSM

Table 13: Identification of On-Road Heavy-Duty Control Measures as BACM and/or MSM

Measures	Implementation Begins	12 ug/m3 Annual (2012)	35 ug/m3 24-Hour (2006)	15 ug/m3 Annual (1997)	65 ug/m3 24-Hour (1997)
Advanced Clean Local Trucks (Last Mile Delivery)	2020	BACM - AFM	MSM	MSM	MSM
Zero-Emission Airport Shuttle Buses	2023	BACM - AFM	MSM	--	--
Zero-Emission Off-Road Forklift Regulation Phase 1	2023	BACM - AFM	MSM	--	--
Zero-Emission Airport Ground Support Equipment	2023	BACM - AFM	MSM	--	--
Small Off-Road Engines	2022	BACM - AFM	MSM	--	--
Transport Refrigeration Units Used for Cold Storage	2020 +	BACM - AFM	MSM	MSM	MSM
Low-Emission Diesel Requirement	2023	BACM - AFM	MSM	MSM	MSM

D.4.6 STEP 3(B): EVALUATION OF FEASIBILITY: HEAVY-DUTY CONTROL MEASURES

Step 3(b) calls for an assessment of the feasibility of implementing any measure that is not included in the Valley's proposed SIP and attainment demonstration, but which is identified as a potential BACM/MSM control measure in Step 2. For this plan, staff's proposed SIP and attainment demonstration do not recommend eliminating any of the potential BACM/MSM control measures identified in Step 2 on the basis of technical or economic infeasibility. Thus, a feasibility assessment for purposes of eliminating such measures from further consideration (i.e. Step 3(b)) is not applicable.

D.4.7 OFF-ROAD SOURCES

Off-road mobile sources include a wide variety of engines ranging from locomotives, ships, and aircraft, to equipment used in the agricultural, construction, mining, and freight / goods movement industries. This category is composed of off-road compression ignition (diesel) engines and equipment, small spark ignition off-road engines and equipment less than 25 hp (including lawn and garden equipment, and small industrial equipment), off-road large spark ignition (gasoline and liquefied petroleum gas) engines and equipment 25 hp and greater (including industrial equipment, forklifts, and portable generators), airport ground support equipment, and cargo handling equipment used at railyards, warehouses, and the Port of Stockton.

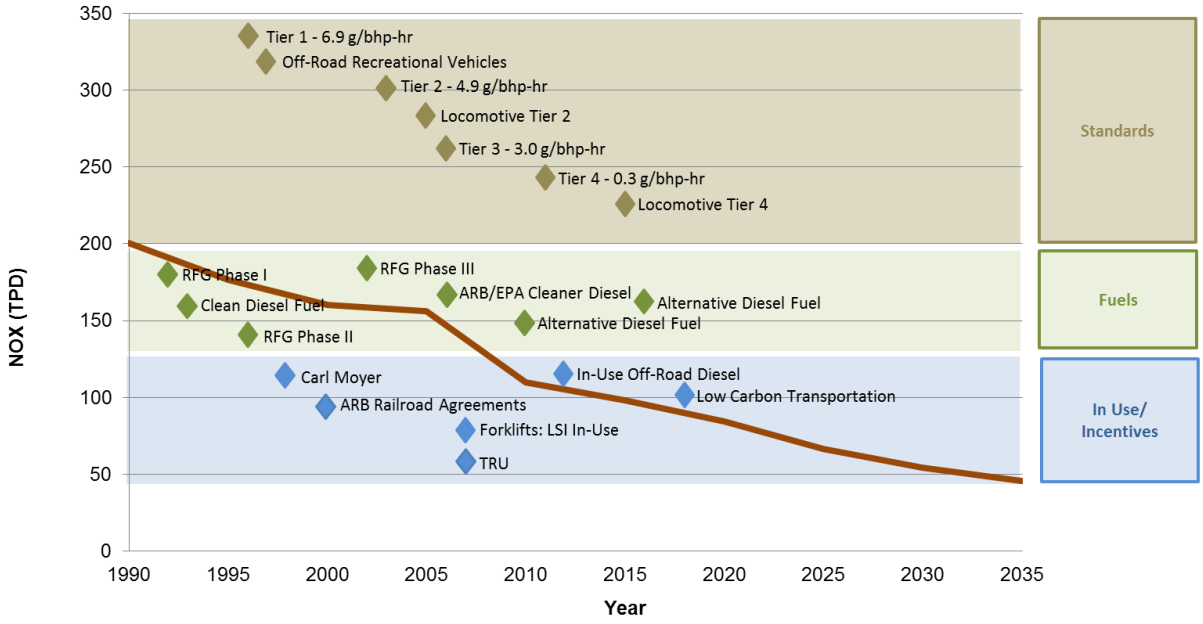
As the Valley is home to one of the most productive agricultural regions in the world, farm equipment is also an important off-road source category for the Valley. The farm equipment category is composed of agricultural equipment that includes tractors, agricultural tractor-trailers, harvesting equipment, sprayers, and other agricultural equipment and engines. Similar to the on-road sectors, California has a comprehensive program for reducing emissions from off-road equipment that goes well beyond current requirements in place elsewhere in the nation.

While emission standards for locomotives are set by U.S. EPA, CARB has accelerated reductions from these sources through efforts that have focused on cleaner fuel requirements, and increasing use of cleaner locomotives. Regulations requiring cleaner diesel fuel requirements for intrastate locomotives have reduced NOx and diesel PM emissions from these sources. CARB staff and the Class I railroads have also been implementing a memorandum of understanding to accelerate the introduction of cleaner locomotives. Further emission reductions from combustion engines beyond current engine standards for locomotives are feasible with the use of aftertreatment technologies such as oxidation or three-way catalysts, diesel particulate filters, or selective catalytic reduction.

D.4.8 STEP 2(A): CALIFORNIA'S CURRENT OFF-ROAD CONTROL PROGRAM

Emission reductions from ongoing implementation of the current control program are projected to reduce NOx emissions from the off-road sector by approximately 40 percent between 2013 and 2025. Achieving reductions in the off-road sectors remains a greater challenge than in the on-road sector due to the diverse nature of these sources, regulatory authority that rests outside of CARB in many cases, and the length of time sources remain in the fleet.

Figure 6: Current Control Programs Reducing NOx Emissions from Off-road Sources



The major regulatory and programmatic control measures that provide these emissions reductions are described below.

D.4.8.1 New Vehicle, Equipment, and Engine Standards

Off-Road Equipment (General)

To control emissions from off-road equipment, CARB adopted in 2004 a fourth tier of increasingly stringent PM and NOx standards based on the use of advanced aftertreatment emission controls. U.S. EPA also adopted the Tier 4 standards in 2004. California's current standards are equal in stringency to current federal standards. These ***"Tier 4" standards*** apply to new off-road compression-ignition engines, and were phased-in across product lines from 2008 through 2015 and reduced exhaust emission levels by up to 95 percent compared to previous control strategies. New engine standard requirements vary according to the power rating of engines. Table 14 shows the schedule for phasing in tiered requirements for new off-road engines with a power rating between 175 and 300 hp. Beginning in 2014, new Tier 4 construction equipment must emit about 96 percent less NOx and PM than new Tier 1 equipment sold in the year 2000.

Table 14: Phase-in of Off-Road Engine Standards

Model year	Level of Control	Applicable Emission Standard for New Off-road Engines 175<hp<300 g/bhp-hr	
		NOx	PM
1996-2002	Tier 1	6.9	0.4
2003-2005	Tier 2	4.9*	0.15
2006-2010	Tier 3	3.0*	0.15
2011-2013	Tier 4 interim	1.5	0.015
2014+	Tier 4 final	0.3	0.015

*Reflects combined limit for non-methane hydrocarbons and NOx

Given the diversity of types of engines, vehicles, and equipment used in the off-road sector, CARB's control strategy includes multiple requirements that are specific to categories of sources within the off-road sector. This includes:

Agricultural Equipment

In 2004, U.S. EPA and California adopted equivalent standards that require additional reductions from off-road engines, including engines used in mobile agricultural equipment. These new ***Tier 4 Engine Standards*** will achieve substantial reductions in PM2.5 and NOx as new farm equipment is introduced into the fleet.

Airport Ground Support Equipment (GSE)

Engines used in newly manufactured GSE operating on gasoline, LPG, and CNG are required to meet California's new engine emission standards for LSI. The ***LSI engine standard*** for engines greater than 1.0 liter (typical for GSE) is 0.6 g/bhp-hr of hydrocarbons (HC) and NOx. Engines meeting this standard are 70 percent cleaner than LSI engines produced as recent as 2009. Additionally, fleets operating LSI GSE must meet the in-use LSI engine fleet requirements. Adopted in 2006, the LSI fleet rule requires GSE fleets to maintain an average emission level of no more than 2.5 g/bhp hr HC+NOx, starting January 1, 2013. Diesel engines in newly manufactured GSE must meet the ***Tier 4 emission standards*** applicable to off-road compression-ignition engines. These standards vary by horsepower and are more than 90 percent cleaner than the emissions levels of engines produced twenty years ago. Lastly, non-mobile GSE such as portable air-start units, ground power units and air conditioners may be subject to the ***Portable Diesel-Engines Air Toxic Control Measure*** (ATCM). The ATCM reduces PM emissions by requiring engine replacement in a schedule based on a fleet's weighted PM emission average.

Cargo Handling Equipment (CHE)

Cargo handling equipment (CHE) is used to transfer goods or perform maintenance and repair activities and includes equipment such as yard trucks (hostlers), rubber-tired gantry cranes, top handlers, side handlers, forklifts, and loaders at ports and intermodal rail yards. California's ***Cargo Handling Equipment regulation*** was adopted in 2005 and amended in 2011. CARB obtained authorization for the 2005 version of the regulation in 2012. CARB's CHE regulations set performance standards for engines in

newly acquired, as well as in-use, mobile CHE at ports or intermodal rail yards in California.

Commercial Harbor Craft (CHC)

There are several types of commercial harbor craft (CHC) used in California, including crew and supply boats, charter fishing vessels, commercial fishing vessels, ferry/excursion vessels, pilot vessels, towboats or push boats, tug boats, and work boats. The ***Commercial Harbor Craft regulation*** pertains to the reduction of diesel PM and NOx. The Board adopted the first CHC regulation in 2007 that implemented in-use limits and upgraded engine requirements. For this regulation, CARB obtained an authorization of preemption in 2011 from U.S. EPA.

In addition, the Board approved an amended CHC regulation in 2010, which extended the in-use engine requirements to other types of CHC, deleting certain exemptions, defining swing engines, clarifying certain in-use requirements, adding replacement engine exemptions, expanding compliance extension options, and allowing continued use of existing engines in certain circumstances. On January 19, 2017, U.S. EPA issued a final notice of rulemaking for these amendments.[80]

Forklifts

Forklifts operate in many different industry sectors but are most prevalent in manufacturing and at locations such as warehouses, distribution centers, and ports. Forklift fleets can be subject to either the LSI fleet regulation, if fueled by gasoline or propane, or the off-road diesel fleet regulation if fueled by diesel.[81] Both regulations require fleets to retire, repower, or replace higher-emitting equipment in order to maintain fleet average standards. Diesel-fueled forklifts were first subject to engine standards and durability requirements in 1996. The ***off-road diesel regulation*** was adopted by the Board in 2007 with implementation beginning in 2010. It is applicable to all diesel-fueled, self-propelled off-road equipment with at least 25 HP. Forklifts are included in the fleet average along with other equipment. The most recent ***Tier 4 Final emission standards*** were phased in starting in 2013. Tier 4 emission standards are based on the use of advanced after-treatment technologies such as diesel particulate filters and selective catalytic reduction. Forklifts powered by LSI engines have been subject to new engine standards that include both criteria pollutant and durability requirements since 2001 with the cleanest requirements phased-in starting in 2010. Additionally, the ***LSI fleet regulation*** (which was originally adopted with requirements beginning in 2009) requires fleets with four or more LSI forklifts to meet fleet average emission standards. While the LSI fleet regulation applies to forklifts, tow tractors, sweeper/scrubbers, and airport ground support equipment, it maintains a separate fleet average requirement specifically for forklifts.

[80] U.S. EPA 2017 "California State Nonroad Engine Pollution Control Standards; Diesel Engines on Commercial Harbor Craft; Notice of Decision" https://www.gpo.gov/fdsys/pkg/FR-2017-01-19/pdf/2017-01261.pdf Federal Register Volume 82, Number 12, pp. 6500-6506

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

Beyond the requirements of the current control program, the ***Zero-Emission Off-Road Forklift Regulation Phase 1*** measure as described in the State SIP Strategy will accelerate the deployment of zero-emission technologies in off-road equipment types that are already primed for the technologies that exist today, and will facilitate further technology development and infrastructure expansion by demonstrating its viability. Under this measure, CARB has committed to develop a regulation that focuses on forklifts with lift capacities equal to or less than 8,000 pounds, for which zero-emission technologies have already gained appreciable customer acceptance and market penetration.[82] There are approximately 100,000 forklifts operating in California, most of which are battery-electric, propane, diesel, or gasoline-fueled. Although battery-electric forklifts offer reduced maintenance requirements, lifetime cost savings, and cleaner tailpipe emissions, electric forklift usage has not changed significantly relative to internal combustion forklift usage over the past 20 years. This regulation is intended to send a market signal to technology manufacturers and investors that zero-emission technologies will be strongly supported moving forward. This proposed measure would advance ZEV commercialization by increasing the penetration of zero-emission technologies. Experience gained from demonstrating the viability of advanced technologies in heavier-duty applications will spur market development and enable the technologies to be transferred to larger, higher power-demand off-road equipment types, such as high lift-capacity forklifts and other equipment types in the construction, industrial, and mining sectors.

Locomotives

Under the Act, U.S. EPA has the sole authority to establish emissions standards for new locomotives.[83] U.S. EPA has previously promulgated two sets of national locomotive emission regulations (1998 and 2008). In 1998, U.S. EPA approved national regulations that primarily emphasized NOx reductions through Tier 0, 1, and 2 emission standards. Tier 2 NOx emission standards reduced older uncontrolled locomotive NOx emissions by up to 60 percent, from 13.2 to 5.5 g/bhp-hr.

In 2008, U.S. EPA approved a second set of national locomotive regulations. Older locomotives, upon remanufacture, are required to meet more stringent particulate matter (PM) emission standards, which are about 50 percent cleaner than Tier 0-2 PM emission standards. U.S. EPA refers to the PM locomotive remanufacture emission standards as Tier 0+, Tier 1+, and Tier 2+. The new Tier 3 PM emission standard (0.1 g/bhp-hr), for model years 2012-2014, is the same as the Tier 2+ remanufacture PM emission standard. The 2008 regulations also included new ***Tier 4 locomotive NOx and PM emission standards*** (2015 and later model years). U.S. EPA Tier 4 NOx and PM emission standards further reduced emissions by approximately 90 percent from uncontrolled levels.

Beyond the currently adopted levels of controls, CARB staff has petitioned U.S. EPA to

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

[83] 42 United States Code (U.S.C.) §7547, (a)(5)

promulgate by 2020 both Tier 5 national emission standards for newly manufactured locomotives, and more stringent national requirements for remanufactured locomotives, as committed to in the ***More Stringent National Locomotive Emission Standards*** measure. This would reduce emissions of criteria and toxic pollutants, fuel consumption, and GHG emissions. CARB staff estimates that U.S. EPA could require manufacturers to implement the new locomotive emission regulations by as early as 2023 for remanufactures and 2025 for newly manufactured locomotives. As documented in the Final Technology Assessment for Freight Locomotives,[84] CARB staff believes the most technologically feasible advanced technology for near-term deployment is the installation of a compact aftertreatment system (e.g., combination of selective catalytic reduction (SCR) and diesel oxidation catalyst (DOC)) onto new and remanufactured diesel-electric freight interstate line haul locomotives. Newly manufactured locomotives can also be augmented with on-board batteries to provide an additional 10-25 percent reduction in diesel fuel consumption and GHG emissions to achieve the Tier 5 emission levels. On board batteries could also provide zero emission track mile capabilities in and around railyards to further reduce diesel PM and the associated health risks.

A new federal standard could also facilitate development and deployment of zero-emission track mile locomotives and zero-emission locomotives by building incentives for those technologies into the regulatory structure. The compact SCR and DOC aftertreatment system could also be retrofitted to existing Tier 4 locomotives to be able to achieve a Tier 4+ emissions standard, when Tier 4 locomotives are scheduled for remanufacture (every 7 to 10 years). Based on the typical remanufacture schedule, all Tier 4 locomotives could potentially be retrofitted with aftertreatment between 2025 and 2037. Existing locomotives originally manufactured to meet Tier 2 or Tier 3 standards could also be upgraded with the same compact aftertreatment system upon remanufacture to achieve emissions equal to Tier 4 levels.

Off-Highway Recreational Vehicles (OHRV)

Off-road recreation vehicles, also known as off-highway recreational vehicles (OHRV), primarily include off-highway motorcycles, all-terrain vehicles (ATVs), and utility-terrain vehicles, off-road sport and utility vehicles, sand cars, and golf carts. In 1994, CARB adopted ***exhaust emission standards for OHRVs***. At that time, there were no equivalent federal standards regulating exhaust emissions from the vehicles and engines covered by California's OHRV regulations (U.S. EPA first set exhaust emission limits for OHRVs in 2002). U.S. EPA granted authorization for CARB's 1994 OHRV regulations in 1996. CARB subsequently amended the regulations to increase the stringency of controls and expand the categories of OHRVs controlled under the program; first in 1999, subsequently in 2003, and finally in 2007. All three OHRV Engine Emission Standard amendments were granted authorization concurrently by U.S. EPA in 2014.[85]

[84] Final Technology Assessment for Freight Locomotives available at: https://www.arb.ca.gov/msprog/tech/report.htm

[85] U.S. EPA, 2014. "California State Nonroad Engine Pollution Control Standards; Off-Highway Recreational Vehicles and Engines; Notice of Decision" https://www.gpo.gov/fdsys/pkg/FR-2014-02-04/pdf/2014-02297.pdf Federal Register, Vol. 79, No. 23

The 2007 amendments to CARB's OHRV program also set ***evaporative emission standards*** beginning in MY 2008, establishing a fuel tank permeation limit of 1.5 grams per square meter per day (g/m^2/day) of total organic gas (TOG) for a 3-day diurnal period, and a fuel hose permeation limit of 15 g/m^2/day. At the time, these limits were identical to the national limits set by U.S. EPA. In July 2013, CARB adopted more stringent evaporative emission control standards for OHRVs that established a new test procedure and reduced evaporative emission limits to 1.0 g/m^2/day. Authorization was granted by U.S. EPA in 2017.[86]

Recreational Boats

The recreational boat (marine) engine program is another important element in CARB's efforts to address emissions from all mobile source sectors. In 1998, CARB approved ***exhaust emission regulations for spark-ignition marine engines*** that accelerated implementation of the federal standards for 2006 engines for personal watercraft (PWC) and outboard (OB) marine engines in California to 2001. In 2001, CARB adopted Tier I and ***Tier II emission standards for inboard and stern-drive marine engines***. In 2007, U.S. EPA granted California authorization to enforce CARB's regulations for OB/PWC engines and Tier I of the California inboard and stern-drive marine engine emissions standards. In 2011, U.S. EPA granted California authorization to enforce CARB's Tier II exhaust emission standards for spark ignited inboard and stern-drive marine engines. While CARB has the same exhaust emission standard as the federal standard, the California standard applies to engines starting in 2008 rather than 2010 under the federal requirement.

In February 2015, CARB Board approved more stringent ***Evaporative Emission Control Standards*** than those set forth by the U.S. EPA's 2008 rule for gasoline-fueled spark-ignition marine watercraft configured with engines greater than 30 kilowatts.

Small Off-Road Equipment (SORE)

SORE are spark-ignited engines rated at or below 19 kilowatts. This category includes handheld and non-handheld lawn and garden and industrial equipment such as string trimmers, leaf blowers, walk-behind lawn mowers, generators, and lawn tractors. They are used in applications such as lawn and garden, industrial, construction and mining, logging, airport ground support, commercial utility, and farm equipment, golf carts, and specialty vehicles. Staff estimates that there are approximately 16.5 million pieces of SORE equipment in California, the majority of which are spark-ignition (SI) engines used in residential and commercial lawn and garden applications, together with other utility and small industrial applications.

CARB first adopted ***SORE Exhaust Emission Standards and Test Procedures*** in 1990, with amendments in 1998 that increased the stringency and extended the types of engines and equipment applicable to the standard. In September 2003, CARB adopted more stringent exhaust emission standards***,*** and set the first ***Evaporative Emission Standards*** for SORE. Prior to the adoption of these standards, evaporative

[86] U.S. EPA, 2017. "California State Nonroad Engine Pollution Control Standards; Evaporative Emission Standards and Test Procedures for Off-Highway Recreational Vehicles (OHRVs); Notice of Decision" https://www.gpo.gov/fdsys/pkg/FR-2017-01-19/pdf/2017-01259.pdf Federal Register, Vol. 82, No. 12

emissions were uncontrolled. U.S. EPA granted full authorization for this suite of waivers in 2006, and these more stringent standards were phased-in for model-years 2006 through 2013.[87]

In 2010, CARB set ***Standards for Zero-Emission SORE Equipment***.[88] In 2011, CARB again amended the regulation, modifying CARB's existing test procedures and aligned California procedures to be consistent with U.S. EPA's amendments to the federal certification and exhaust emission testing requirements (see Title 40 CFR Parts 1054 and 1065.11). The 2011 Amendments also set ***Exhaust Emission Certification Test Fuel Amendments*** for using ethanol blends of up to 10 percent (E10) in Off-Road SI SORE Engines, if it is certified by U.S. EPA. U.S. EPA approved the full suite of 2011 Amendments in 2015.[89] In 2016, CARB amended its evaporative emission standards for the entire category of SORE to increase stringency.[90]

Beyond the measures included in the current control program, the ***Small Off-Road Engines*** measure committed to in the State SIP Strategy will reduce emissions through actions to promote increased use of zero-emission equipment, propose tighter exhaust and evaporative emission standards, and enhance enforcement of current emission standards for SORE. Additionally, high failure rates have been observed in evaporative emissions testing of SORE, preventing previously-claimed emission reductions from being realized. Exhaust and evaporative emissions from SORE would be reduced through enhanced enforcement of the current emission standards, adoption of tighter exhaust and evaporative emission standards, and increased use of zero-emission equipment. Strategies will be developed for transitioning to zero-emission technologies, including an initial focus on incentives for use of zero-emission equipment, coupled with increasingly stringent emission standards for criteria pollutants.

D.4.8.2 Reducing In-Use Emissions

Fleet Rules

Off-Road Equipment (General)

Large diesel off-road equipment typically remains in use for long periods of time. As with heavy-duty trucks, this long life means that newer, lower-emitting engines would be introduced into fleets relatively slowly. To address this, ***the Cleaner In-use Off-Road Equipment Regulation (Off-Road Regulation)*** was adopted in 2007, and amended in 2010. The Off-Road Regulation requires off-road fleets to reduce their emission by retiring, replacing or repowering older engines. This regulation expanded the penetration of existing clean technology to ensure that the engines and vehicles used today are as clean as possible. U.S. EPA provided their authorization for this regulation

[87] U.S. EPA, 2006. "California State Non-road Engine and Vehicle Pollution Control Standards; Decision of the Administrator" https://www.gpo.gov/fdsys/pkg/FR-2006-12-15/pdf/E6-21378.pdf Federal Register / Vol. 71, No. 241

[88] CARB 2010. "Final Regulations Order" accessed June 2018 https://www.arb.ca.gov/regact/2008/sore2008/soreresubfro.pdf?_ga=2.218709145.1039751104.1528225837-29497060.1519676686

[89] U.S. EPA 2015. "California State Non-road Engine Pollution Control Standards; Small Off-Road Engines Regulations; Notice of Decision

[90] CARB 2016. "Final Regulations Order" accessed June 2018 https://www.arb.ca.gov/regact/2016/sore2016/finalreg.pdf?_ga=2.102358145.1039751104.1528225837-29497060.1519676686

in 2013. The types of off-road equipment controlled by this regulation are used in construction, manufacturing, the rental industry, road maintenance, airport ground support, and landscaping. In December 2011, the Off-Road Regulation was modified to include on-road trucks with two diesel engines.

The Off-Road Regulation is an extensive program designed to accelerate the penetration of the cleanest equipment into California's fleets. This regulation will significantly reduce emissions of diesel PM and NOx from the over 150,000 in-use off-road diesel vehicles that operate in California by requiring their owners to modernize their fleets and install exhaust retrofits. In 2015, this extensive program will have affected 10,447 vehicles used in 838 fleets by requiring owners to modernize their fleets by replacing older engines or vehicles with newer, cleaner models, retiring older vehicles or using them less often, or by applying retrofit exhaust controls. The Off-Road Regulation imposes idling limits on off-road diesel vehicles, requires a written idling policy, and requires a disclosure when selling vehicles. The regulation also requires that all vehicles be reported to CARB and labeled, restricts the addition of older vehicles into fleets, and requires fleets to reduce their emissions by retiring, replacing, or repowering older engines, or installing verified exhaust retrofits. The requirements and compliance dates of the Off-Road Regulation vary by fleet size.

Additionally, CARB has developed and implemented control measures that target specific to categories of sources within the off-road sector, which are described below.

Agricultural Equipment

The 2007 SIP included the ***2007 Cleaner In-Use Agricultural Equipment Measure*** (Ag Measure) to achieve 5 to 10 tpd of NOx reductions in 2017 by modernizing agricultural equipment in the Valley. The Valley agricultural industry immediately began working on implementing this SIP measure by leveraging federal and local incentives to provide farmers assistance to replace their older, higher polluting equipment with the cleanest available technology. Specifically, new incentive funds were secured through the federal Farm Bill to be used alongside funds from existing programs. Since 2009, over 400 million dollars in private and public funding has been invested in the Valley for the replacement of older agricultural tractors with newer, cleaner models, with significant continued investments ongoing. Through 2016, the U.S. Department of Agriculture's Natural Resource Conservation Service's grant program and the District has provided over $129 million replacing over 5,000 tier 0 and tier 1 tractors to implement the Ag Measure and meet the 2017 SIP goal. The incentives targeted the largest and most used tractors in addition to other types of farm equipment.

To push beyond the 2007 Ag Equipment Measure, CARB staff is proposing in the Valley SIP Strategy the ***Cleaner In-Use Agricultural Equipment*** measure, which would electrify agricultural equipment less than 25 horsepower, such as utility quads and small yard tractors used on farms and ranches. CARB will develop a SIP measure designed to identify the agricultural equipment that is well suited for electrification with requirements in place by 2024.

In parallel with electrifying agricultural equipment less than 25 horsepower, CARB staff is also proposing in the Valley SIP Strategy an incentive measure to accelerate the turnover of large tier 0, tier 1 and tier 2 agriculture tractors to tier 4 through existing projects and new projects. Incentives are cost-effective in replacing old high-polluting tractors on most farms. However, there are many of these high-polluting tractors still in service on small farms in which the cost of the new tractor is not feasible even with incentives. To provide cleaner tractors to small farms, CARB staff along with the District and the agricultural industry are working to implement a new tractor trade up program through funding provided by a CARB grant. The trade-up program is designed to assist small farmers overcome potential financial barriers to accessing cleaner mobile agricultural technologies, and is intended to accelerate emission reductions by replacing the oldest tractors with cleaner used models. This is accomplished through a multi-step transaction in which an owner of an older, high-emitting piece of mobile agricultural equipment agrees to scrap that equipment in exchange for a previously used and reconditioned piece of equipment with a cleaner diesel engine at little or no out-of-pocket cost. The owner of the used equipment is provided incentive funding to assist in the purchase of new equipment that employs the cleanest, commercially available technology.

While identifying and securing incentive funding will be an important element going forward, the Cleaner In-Use Agricultural Equipment measure is designed to function as a backstop rule, serving as an overall emission reduction target, while at the same time acting as a catalyst for attracting early replacement of agricultural equipment using incentives. The backstop rule could require that by 2030 all agricultural equipment operating in the Valley be Tier 2 or cleaner. In combination, the backstop rule, tractor trade-up, incentives and significant lead time, ensures cleaner agricultural equipment will be used in the Valley through 2030.

Airport Ground Support Equipment (GSE)

In addition to adopting regulations limiting emissions from new engines used in GSE, California has adopted regulations to reduce emissions from existing, in-use GSE. On 2007, California adopted the ***In-Use Off-Road Diesel-Fueled Fleets Regulation,*** which requires fleets operating in-use diesel equipment to meet an annual fleet average emissions target that decreases over time. For example, for equipment over 175 and under 750 HP, the final 2023 NOx fleet average target is 1.5 g/bhp hr, which is equivalent to the interim Tier 4 NOx standard for newly produced engines. Fleets that do not meet the required annual fleet average must meet the BACT requirements that require turnover, repower or retrofit of a specific percent of a fleet's total HP. These requirements are currently being phased in.

Cargo Handling Equipment (CHE)

As described earlier, the ***Cargo Handling Equipment regulation*** (adopted in 2005, amended in 2011) includes performance standards for in-use, mobile CHE at ports or intermodal rail yards in California.

Commercial Harbor Craft (CHC)

As described earlier, the ***Commercial Harbor Craft regulation*** (adopted in 2007) includes in-use limits that require diesel PM and NOx emission controls. The 2010 amendments extended the types of CHC for which in-use engine requirements apply.

Forklifts

As described earlier, forklift fleets subject to both the ***LSI Fleet Regulation*** (if powered by gasoline or propane), and the ***Off-Road Diesel Fleet Regulation*** (if powered by diesel) are required to retire, repower, or replace higher-emitting equipment in order to maintain fleet average standards.

Off-Highway Recreational Vehicles (OHRV)

In 1999, CARB's amendments to the OHRV program added a new control measure by requiring in-use controls for OHRV that do not meet the applicable exhaust emission standards, known as the ***"Red Sticker" program***. These amendments established a new compliance category beginning with the 2003 model year, and designates OHRVs as either "green sticker" or "red sticker", depending on whether the engine meets or exceeds the applicable emission standard. Non-emission compliant OHRVs are identified with a red registration sticker issued from the Department of Motor Vehicles (DMV), while emission-compliant OHRVs are identified with a green sticker. Red sticker OHRVs are subject to in-use restrictions that do not apply to green sticker OHRVs; namely, the red sticker limits operation at certain off-highway recreational vehicle parks located in non-attainment areas during peak ozone season.

Transport Refrigeration Units (TRU)

TRUs are refrigeration systems powered by an internal combustion engine (inside the unit housing), designed to control the environment of temperature sensitive products that are transported in refrigerated trucks, trailers, railcars, and shipping containers. TRUs operate in large numbers at distribution centers, food manufacturing facilities, packing houses, truck stops, and intermodal facilities, and are used to haul perishable products including food, beverages, pharmaceuticals, flowers, medical products, industrial chemicals, and explosives. TRUs may be capable of both cooling and heating. They deliver perishable goods to retail outlets, such as grocery stores, restaurants, cafeterias, convenience stores, etc. Although TRU engines are relatively small (ranging from 9 to 36 hp) significant numbers of these engines congregate at distribution centers, truck stops, and other facilities, exacerbating air quality challenges and resulting in potential for health risks to those that live and work nearby. The growth rate of TRUs is tied to population, since food is the main product type that is hauled.

CARB adopted its ***ATCM for In-Use Diesel-Fueled TRUs and TRU Generator Sets*** in 2004. The TRU regulations establish in-use performance standards for diesel-fueled TRUs and TRU generator sets which operate in California, and facilities where TRUs operate. The regulation is designed to reduce the diesel particulate matter (PM) emissions from in-use TRU and TRU generator set engines that operate in California, using a phased-in implementation approach over about 12 years by requiring engines to meet in-use emission standards by the end of the seventh year after manufacture. Implementation of the TRU ATCM began in 2009, and applies to in-use diesel-fueled

TRUs and TRU generator sets that operate in California, whether they are registered in or outside the State. U.S. EPA issued a waiver of preemption for the TRU regulation in 2009.[91] CARB subsequently amended the TRU ATCM in 2010 and again in 2011 to provide owners of TRU engines with certain flexibilities to facilitate compliance, clarify recordkeeping requirements, and establish requirements for businesses that arrange, hire, contract, or dispatch the transport of goods in TRU-equipped trucks, trailers, or containers. U.S. EPA approved waivers for the 2010 Amendments in 2013 and the 2011 Amendments in 2017, respectively.[92, 93]

Beyond the emission controls included in the current control program, the Valley's plan also includes the ***Transport Refrigeration Units Used for Cold Storage*** measure, which will reduce NOx and PM emissions by reducing the amount of time TRUs operate using internal combustion engines while refrigerated trucks, trailers, and shipping containers are parked (stationary) at certain California facilities and other locations. The time limit would decrease on a phased compliance schedule. Compliance options include the use of commercially available hybrid electric TRUs, TRUs equipped with electric standby motors, and cryogenic transport refrigeration systems. Hybrid electric and electric standby-equipped TRUs would plug into electric power plugs while stationary and use diesel engine power while on the road. Facilities may be required to provide the necessary electric infrastructure to support this action. CARB is currently offering funding through the Proposition 1B Goods Movement Emission Reduction Program to support both purchase of TRUs that can plug in and the stationary electric infrastructure. Cryogenic transport refrigerators use liquid nitrogen and liquid carbon dioxide to provide cooling. Development and use of zero-emission technologies, such as all-electric plug-in / advanced battery transport refrigeration systems would be encouraged, as well as adequately sized cold storage facilities, and more efficient inbound delivery appointment and outbound dispatch scheduling.

Other In-Use Emission Controls for Locomotives

In addition to the fleet rules described above, CARB has worked closely with the major railroads in California, together with other stakeholders, to develop innovative measures to reduce in-use emissions from locomotives, a major source of NOx and PM emissions in the Valley, but a source category over which CARB has limited regulatory authority. While emission standards for locomotives are set by U.S. EPA, CARB has accelerated reductions from these sources through efforts that have focused on cleaner fuel requirements, and increasing use of cleaner locomotives. CARB staff and the Class I railroads have also been implementing through the ***Statewide Rail Yard Agreement for California Rail Yards,*** a Memorandum of Understanding (MOU) to accelerate the

[91] U.S. EPA, 2009. "California State Nonroad Engine and Vehicle Pollution Control Standards; Authorization of Transport Refrigeration Unit Engine Standards; Notice of Decision" Federal Register Volume 74, Number 11, pp. 3030-3033

[92] U.S. EPA, 2013. "California State Nonroad Engine Pollution Control Standards; Within-the-Scope Determination for Amendments to California's ''Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets and Facilities Where TRUs Operate''; Notice of Decision" https://www.gpo.gov/fdsys/pkg/FR-2013-06-28/pdf/2013-15437.pdf Federal Register Vol. 78, No. 125

[93] U.S. EPA, 2017. "California State Nonroad Engine Pollution Control Standards; In-Use Diesel-Fueled Transport Refrigeration Units (TRUs) and TRU Generator Sets and Facilities Where TRUs Operate; Notice of Decision" https://www.gpo.gov/fdsys/pkg/FR-2017-01-19/pdf/2017-01225.pdf Federal Register Vol. 82, No. 12

introduction of cleaner locomotives since 2010.[94] This agreement obligates the railroads to significantly reduce emissions in and around rail yards in California, and established a statewide visible emissions reduction and repair program, provided a detailed evaluation of advanced control measures, and an assessment of remote sensing technology (RST) to identify high-emitting locomotives.

D.4.8.3 Fuels

In addition to new engines and in-use standards, cleaner burning fuels represent an important component in reducing emissions from the off-road mobile fleet. Cleaner fuel has an immediate impact in reducing emissions from the mobile source, and thus represent an important component in reducing NOx and PM emissions from off-road engines. California's stringent air quality programs treat mobile sources and their fuels holistically (as a system, rather than as separate components). As a result, CARB's fuels programs achieve significant reductions in criteria emissions from vehicles and mobile engines used in California.

CARB Diesel Fuel Regulations

The California diesel fuel program sets stringent standards for diesel fuel sold in California and produces cost-effective emission reductions from diesel-powered vehicles. More stringent fuel requirements further ensure that diesel engines are operating as cleanly as possible. ***CARB Diesel Fuel Regulations*** have, over time, phased in more stringent requirements for fuel mixture specifications for aromatic hydrocarbons and sulfur, and have establish a lubricity standard. The program applies to sales of fuel used in on-road vehicles and off-road vehicles and locomotives in California. . ***"CARB diesel" Specifications*** adopted in 1988 limited the allowable sulfur content of diesel fuel 500 parts per million by weight (ppmw), and the aromatic hydrocarbon content to 10 percent, and became effective in 1993.

In 2003, ***CARB's Ultra Low Sulfur Diesel (ULSD) Regulation*** increased the stringency of the sulfur content limits in to 15 ppm, which harmonized with the 1993 U.S. EPA regulation that also limited sulfur in on-road diesel fuels to the same level. Both the California and federal ULSD regulations began implementation in 2006. CARB's ULSD Regulation had an immediate impact in reducing emissions from the in-use on-road heavy-duty fleet, while also enabling the use of advanced emissions control technologies, including the use of catalyzed diesel particulate filters (DPF), NOx after-treatment, and other advanced after-treatment based emission control technologies that higher sulfur levels would have inhibit the performance of (at the time of CARB's ULSD rulemaking, the average sulfur content of California diesel was approximately 140 ppmw).

Controlling Criteria Emissions from Renewable Fuels

The ***Low Carbon Fuel Standard (LCFS) and Alternative Diesel Fuel (ADF) Regulations,*** as amended in 2014, work together to reduce the carbon intensity of the California fuel supply. The regulations also limit criteria emissions from alternative fuels

[94] CARB 2005 "ARB/Railroad Statewide Agreement: Particulate Emissions Reduction Program at California Rail Yards" https://www.arb.ca.gov/railyard/ryagreement/083005mouexecuted.pdf

and/or alternative fuel mix blends (a mix of fuels made from renewable feedstocks, which are then blended with conventional gasoline or diesel).

Beyond the current fuels control program, CARB committed to develop a ***Low Emission Diesel*** Measure that will require diesel fuel providers to steadily decrease criteria pollutant emissions from their diesel products. The use of low-emission diesel in on-road vehicles and off-road equipment will reduce tailpipe NOx and PM emissions, in addition to other criteria pollutants. Some studies carried out to date on hydrotreated vegetable oil have reported NOx emission reductions of 6 percent to 25 percent and PM emission reductions of 28 percent to 46 percent, depending on the types of fuels, drive cycles tested, and diesel engines used. This standard is anticipated to both increase consumption of low-emission diesel fuels, and to reduce emissions from conventional fuels. This measure is anticipated to provide NOx benefits predominately from legacy (pre-2010) on-road heavy-duty vehicles, off-road engines, stationary engines, portable engines, marine vessels and locomotives, as well as NOx and diesel PM benefits in potentially all model year off-road engines, stationary engines, portable engines, marine vessels and locomotives. Interstate vehicles, even those registered out-of-State but operating on CARB diesel blended with low-emission diesel, are also anticipated to provide emission reduction benefits.

Cleaner Burning Fuels Requirements (for Locomotives)

While emission standards for locomotives are set by U.S. EPA, CARB has accelerated reductions from these sources through efforts that have focused on cleaner fuel requirements, and increasing use of cleaner locomotives. The Railroud MOU includes a control measure that maximizes the use of lower emitting fuels (i.e. CARB and U.S. EPA low sulfur diesel) in locomotives fueled in California. ***Requiring cleaner diesel fuel requirements for intrastate locomotives*** have reduced NOx and diesel PM emissions from these sources.

D.4.9 Step 2(b): Other States' and Nonattainment Areas' Off-Road Control Measures

Table 15 summarizes the most stringent control measures currently in use in any state or nonattainment that have been identified and discussed for on-road heavy-duty vehicles. Each of the measures identified in this table are discussed in more detail in this section, below.

Table 15: Summary of Most Stringent Off-Road Mobile Control Measures Identified

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
Off-Road Mobile Sources			
New Engine Standards			
New Engine Standards • Off-road diesel engine emission standards (general)	Currently CARB and U.S. EPA limit exhaust emissions to same "Tier 4" levels: • NOx: 0.3 g/bhp-hr • PM: 0.015 g/bhp-hr	CARB's current emission standards for new off-road engines with a power rating between 175 and 300 hp are set at the same level of stringency as Federal standards, and requires Tier 4 emission standards (which use advanced after treatment technologies such as diesel particulate filters and selective catalytic reduction). This regulation is applicable to all diesel-fueled, self-propelled off road equipment with at least 25 HP.	No other state has more stringent exhaust emission standards for off-road equipment than California.
New Engine Standards • Agricultural equipment	Tier 4 Engine Standards (U.S. EPA and CARB)	U.S. EPA and California adopted equivalent Tier 4 standards in 2004 that require additional emission reductions from off-road engines, including those used in mobile agricultural equipment.	No state has more stringent requirements for new emission performance standards for agricultural equipment engines than California.
New Engine Standards • Airport Ground Support Equipment (GSE)	Large Spark Ignition (LSI) Fleet Regulation and Tier 4 Engine Standards (CARB) CARB anticipated to propose to further increase stringency. *(Zero-Emission Airport Ground Support Equipment measure)*	NOx limits for the LSI Engine Standard for engines > 1.0 liter (the typical engine size for GSE) is 0.6 g/bhp-hr. Engines meeting this standard are 70 percent cleaner than LSI engines produced as recent as 2009. Additionally, diesel engines in newly manufactured GSE must meet the Tier 4 emission standards applicable to off-road compression ignition engines. CARB is anticipated to further increase the stringency of emission controls with the Zero-Emission Airport Ground Support Equipment measure. *(NOTE: CARB has committed to develop the Zero-Emission Airport Ground Support Equipment measure, but it has not yet been proposed to the Board for approval/adoption.)*	No other state has more stringent exhaust emission standards for airport ground support equipment than California.
New Engine Standards • Cargo Handling Equipment (CHE)	Cargo Handling Regulation (CARB)	CARB's Cargo Handling Equipment regulation sets performance standards for newly acquired engines, as well as in-use mobile CHE at ports or intermodal rail yards.	No other state has more stringent exhaust emission standards for cargo handling equipment than California.
New Engine Standards • Commercial Harbor Craft (CHC)	Commercial Harbor Craft Regulation (CARB)	CARB's CHC Regulation controls NOx and PM emissions from crew and supply boats, charter fishing vessels, commercial fishing vessels, ferry/excursion vessels, pilot vessels, towboats or push boats, tug boats, and work boats. U.S. EPA has granted a waiver of preemption under §209(b).	No other state has more stringent exhaust emission standards for commercial harbor craft than California.

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
Off-Road Mobile Sources			
New Engine Standards • Forklifts	Off-road Diesel Regulation, Tier 4 Engine Standards, and LSI Fleet Regulation (CARB) CARB anticipated to propose to further increase stringency. *(Zero-Emission Off-Road Forklift Regulation Phase 1 measure)*	Forklifts powered by LSI engines (gasoline and natural gas) are subject to new engine standards that include both criteria pollutant and durability requirements since 2001 with the cleanest requirements phased-in starting in 2010. Diesel Forklifts > 25 HP are subject to fleet average emission requirements under the Off-Road Diesel Regulation starting in 2010 and Tier 4 Final emission standards (based on the use of advanced after-treatment technologies such as diesel particulate filters and selective catalytic reduction) starting in 2013. CARB is anticipated to further increase the stringency of emission controls with a measure designed to accelerate the deployment of zero-emission forklift technologies. *(NOTE: CARB has committed to develop the Heavy-Duty Vehicle Inspection and Maintenance Program measure, but it has not yet been proposed to the Board for approval/adoption.)*	No state has more stringent requirements for new emission performance standards for forklifts engines than California.
New Engine Standards • Locomotives	U.S. EPA Tier 4 NOx and PM emission standards CARB has petitioned U.S. EPA to further increase stringency. *(More Stringent National Locomotive Emission Standards measure)*	U.S. EPA has the sole authority to establish emissions standards for locomotives. CARB petitioned U.S. EPA in 2017 to increase stringency by developing Tier 5 national emission standards for newly manufactured locomotives, and more stringent national requirements for remanufactured locomotives (by ~2020) *(NOTE: CARB has petitioned U.S. EPA for more stringent locomotive standards given the needs in California's nonattainment areas, but approval/adoption of this MSM rests exclusively with U.S. EPA and is thus beyond the purview of CA.)*	No state has emission standards for locomotives that differ from U.S. EPA's.
New Engine Standards • Off-Highway Recreational Vehicles (OHRVs)	Exhaust Emission Standards for OHRVs and Evaporative Emission Standards (CARB)	CARB's exhaust emission standards (2006) and evaporative emission standards (2007) control emissions from motorcycles, all-terrain vehicles, and utility-terrain vehicles at more stringent levels than applicable national standards set by U.S. EPA.	No other state has the authority to set exhaust emission and/or evaporative emission standards that exceed the stringency of U.S. EPA's national standards.
New Engine Standards • Recreational Boats	Exhaust Emission Regulations for Spark-Ignition Marine Engines, Tier II Emission Standards for Inboard and Stern-Drive Marine Engines, and Evaporative Emission Control Standards (CARB)	CARB's recreational boats and marine engine program exceeds the stringency of U.S. EPA's federal standards: • The Exhaust Emission Regulations for Spark-Ignition Marine Engines (1998) controls emissions at the same level of stringency as national regulations; • The Tier II Emission Standards for Inboard and Stern-Drive Marine Engines (2001) controls	No other state has the authority to set exhaust emission and/or evaporative emission standards that exceed the stringency of U.S. EPA's national standards.

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
Off-Road Mobile Sources			
		emissions at the same level of stringency as national regulations; and • The Evaporative Emission Control Standards (2015) exceeds the stringency of applicable national regulations set by U.S. EPA in 2008 for gasoline-fueled spark-ignition marine watercraft >30 kilowatts.	
New Engine Standards • Small Off-Road Equipment (SORE)	Exhaust and Evaporative Standards for Small Off-Road Engines (CARB) CARB is anticipated to propose to further increase stringency. *(Small Off-Road Equipment (SORE) measure)*	CARB's SORE program sets more stringent exhaust and evaporative standards for SORE than applicable federal standards (Exhaust and Evaporative Emission Standards for Small Off-Road Engines (2003)), and sets requirements for Zero-Emission SORE equipment. CARB is anticipated to further increase the stringency of emission controls with a measure designed to accelerate the deployment of zero-emission technologies, set tighter exhaust and evaporative emission standards, and enhance enforcement of current emission standards for SORE. *(NOTE: CARB has committed to develop the Small Off-Road Equipment (SORE) measure, but it has not yet been proposed to the Board for approval/adoption.)*	No other state has the authority to set exhaust emission and/or evaporative emission standards that exceed the stringency of U.S. EPA's national standards.
In-Use Emission Controls			
In-Use Emissions Controls • Fleet Rules (Off-Road Equipment – General)	Cleaner In-use Off Road Equipment Regulation (Off-Road Regulation) (CARB)	CARB's off-road regulation controls diesel PM and NOx emissions from >150,000 in-use off-road engines by requiring their owners to retire, replace, or repower older engines, and/or installing verified exhaust retrofit control technologies. Additionally, all vehicles are reported and labeled, and older, dirtier vehicles are restricted from entering fleets.	While Chicago (IL) and New York City (NY) have in-use fleet controls for construction equipment, no other state or nonattainment area controls in-use off-road equipment fleets more stringently than CARB.
In-Use Emissions Controls • Fleet Rules (Agricultural Equipment)	Cleaner In-Use Agricultural Equipment Measure (CARB) CARB is anticipated to proposed to further increase stringency (*Cleaner In-Use Agricultural Equipment measure)*	The Valley's 2007 SIP included the Cleaner In-Use Agricultural Equipment (Ag Equipment) measure; under this program, the District has replaced over 5,000 tier 0 and tier 1 tractors to meet the targeted NOx emission reductions of 5 to 10 tpd by 2017. CARB is anticipated to further increase the stringency of in-use emission controls a measure designed to accelerate emission reductions from the in-use ag equipment fleet. *(NOTE: CARB is proposing the Cleaner In-Use Agricultural Equipment measure, but this measure has yet to be proposed to the Board for approval/adoption.)*	CARB's agricultural equipment fleet controls are among the most stringent in the nation.

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
Off-Road Mobile Sources			
In-Use Emissions Controls • Fleet Rules (Airport Ground Support Equipment)	In-Use Off Road Diesel-Fueled Fleets Regulation (CARB)	The In-Use Off Road Diesel-Fueled Fleets Regulation requires fleets to meet fleet average NOx emission targets equivalent to the interim Tier 4 standards for newly produced engines (i.e. equivalent to MSM).	No other state or nonattainment area controls airport GSE more stringently than CARB.
In-Use Emissions Controls • Fleet Rules (Cargo Handling Equipment)	Cargo Handling Equipment Regulation (CARB)	The Cargo Handling Equipment regulation (adopted in 2005, amended in 2011) includes performance standards for in-use, mobile CHE at ports or intermodal rail yards in California.	No other state or nonattainment area has more stringent in-use fleet requirements for CHE than California.
In-Use Emissions Controls • Fleet Rules (Commercial Harbor Craft)	Commercial Harbor Craft Regulation (CARB)	The Commercial Harbor Craft regulation (adopted in 2007) includes in-use limits that require diesel PM and NOx emission controls. The 2010 amendments extended the types of CHC for which in-use engine requirements apply.	No other state or nonattainment area controls in-use CHC emissions more stringently than CARB.
In-Use Emissions Controls • Fleet Rules (Forklifts)	Off-road Diesel Regulation, Tier 4 Engine Standards, and LSI Fleet Regulation (CARB)	Forklift fleets subject to both the LSI fleet regulation (if powered by gasoline or propane), and the off-road diesel fleet regulation (if powered by diesel) are required to retire, repower, or replace higher-emitting equipment in order to maintain fleet average standards.	No other state or nonattainment area has more stringent fleet requirements for in-use forklifts than CARB.
In-Use Emissions Controls • Fleet Rules (Off-Highway Recreational Vehicles)	OHRV "Red Sticker" program (CARB)	CARB's "Red Sticker" program requires in-use Off-Highway Recreational Vehicles (OHRVs) that do not meet the applicable exhaust emission standards display a red registration sticker that limits operation at certain off-highway recreational vehicle parks located in non-attainment areas during peak ozone season.	No other state or nonattainment area controls in-use emissions from OHRV more stringently than CARB.
In-Use Emission Controls (Fleet Standard) • Transport Refrigeration Units (TRU)	Air Toxic Control Measure (ATCM) for Transport Refrigeration Units (TRU) and TRU Generator Sets (CARB) CARB is anticipated to propose to further increase stringency. *(Transport Refrigeration Units (TRU) Used for Cold Storage measure)*	CARB's ATCM for In-Use Diesel-Fueled TRUs requires engines to meet in-use diesel PM emission standards by the end of the seventh year after manufacture, and applies to TRUs that operate in California, regardless of whether they are registered in or outside of the State. CARB's program is the most stringent of its type in the nation. CARB is anticipated to further increase the stringency of emission controls with a measure designed to limit NOx and PM emissions by reducing the amount of time TRUs operate while stationary. *(NOTE: CARB has committed to develop the Transport Refrigeration Units (TRU) Used for Cold Storage measure, but it has not yet been proposed to the Board for approval/adoption.)*	No other state or nonattainment area controls in-use emissions from TRUs more stringently than CARB.
In-Use Emission Controls (Locomotives) • Memorandum of Understanding	Statewide Rail Yard Agreement for California Rail Yards (CARB)	CARB has developed a Statewide Rail Yard Agreement for California Rail Yards, a Memorandum of Understanding (MOU) with the Class I Railroads to accelerate the introduction of cleaner locomotives.	No other state has an agreement with Class I railroads to accelerate the introduction of cleaner locomotive engines.
Fuels			

Type of Control Measure	Most Stringent Control Program Identified	Summary of Findings from Analysis	Other Jurisdiction(s) Analyzed
Off-Road Mobile Sources			
Fuels Standards • Diesel Standards	CARB Diesel Fuel Regulations and Ultra Low Sulfur Diesel (CARB)	CARB Diesel Fuel Regulations include stringent requirements for fuel mixture specifications for aromatic hydrocarbons and sulfur, and have establish a lubricity standard and applies to sales of fuel used in on-road vehicles and off-road vehicles and locomotives in California CARB's Ultra-Low Sulfur Diesel (ULSD) program reduces ozone precursor emissions significantly relative to U.S. EPA requirements (providing approximately 7 percent more NOx reductions and 25 percent more PM reductions than federal diesel standards).	No state requires cleaner burning diesel than California. The California diesel fuel regulations exceed federal requirements in stringency.
Fuels Standards • Alternative Fuel Standards (Diesel substitutes)	LCFS and ADF (CARB) CARB is anticipated to propose to further increase stringency. *(Low Emission Diesel measure)*	The LCFS and ADF regulations work together to reduce the carbon intensity of the California fuel supply while requiring limits on criteria emissions from alternative fuels and/or alternative fuel mix blends. CARB is anticipated to further increase the stringency of controls on criteria pollutant emissions diesel products. *(NOTE: CARB has committed to develop the Low Emission Diesel measure, but it has not yet been proposed to the Board for approval/adoption.)*	No other state has set criteria emission requirements on alternative fuels and alternative fuel blends. The Federal Renewable Fuel Standard (RFS II) does not specify criteria requirements for alternative fuels.
In-Use Emission Controls (Locomotives) Cleaner Burning Fuels Requirement	Statewide Rail Yard Agreement for California Rail Yards (CARB)	The Railroad MOU includes requirements to maximize the use of lower emitting diesel fuels for locomotives fueled in California.	No other state or nonattainment has an agreement with Class I railroads to burn cleaner fuels in their jurisdictional boundaries.

D.4.9.1 Emission standards for new engines and equipment

Off-Road Equipment (General)

CARB Tier 4 Off-Road Equipment Standards that are nearly identical to those finalized by U.S. EPA in its Clean Air Nonroad Diesel Rule. These regulations require engine manufacturers to meet aftertreatment-based exhaust standards for PM and NOx starting in 2011 that are over 90 percent lower than the previous engine generation's emission levels. CARB's new engine standards for off-road equipment is thus aligned with most stringent control program of any in the nation.

Due to constraints in the Act, California is the only state that can set new engine standards (including control measures such as emission standards, sales mandates, warranty provisions, and on-board diagnostic (OBD) requirements) that are more stringent than U.S. EPA's national standards. Other states can adopt California programs for which U.S. EPA has provided California with waivers. While the Act allows other states to adopt CARB's regulations for off-road engine or off-road vehicles (provided that such standards are identical to the CARB standards for which an authorization has been obtained), other states have not yet adopted off-road engine emission standards equivalent to the California off-road regulation, although there are some states currently considering doing so.

Agricultural Equipment

CARB's new engine standards for off-road agricultural equipment (ag equipment) is consistent with the most stringent of any in the nation. In 2004, U.S. EPA and California adopted equivalent Tier 4 Off-Road Engine Emission Standards, which includes requirements for ag equipment engines.

Airport Ground Support Equipment (GSE)

CARB's new engine standards for airport GSE is the most stringent of any in the nation. New airport GSE is subject to emission standards under CARB's Large Spark Ignition (LSI) Fleet Regulation (natural gas and gasoline engines), and under CARB's Tier 4 Engine Standards (diesel engines). NOx limits for the LSI Engine Standard for engines > 1.0 liter (the typical engine size for GSE) is 0.6 g/bhp-hr. Engines meeting this standard are 70 percent cleaner than LSI engines produced as recent as 2009. Additionally, diesel engines in newly manufactured GSE must meet the Tier 4 emission standards applicable to off-road compression ignition engines. Non-mobile GSE such as portable air-start units, ground power units and air conditioners may be subject to the Portable Diesel-Engines Air Toxic Control Measure (ATCM). The ATCM reduces PM emissions by requiring engine replacement in a schedule based on a fleet's weighted PM emission average. No other state has more stringent exhaust emission standards for airport GSE than CARB. Furthermore, CARB is anticipated to further increase the stringency of emission controls under the the Zero-Emission Airport Ground Support Equipment measure committed to in the State SIP Strategy.

Cargo Handling Equipment (CHE)

CARB's Cargo Handling Regulation established engine performance standards for new CHE used to transfer goods or perform maintenance and repair activities and includes

equipment such as yard trucks (hostlers), rubber-tired gantry cranes, top handlers, side handlers, forklifts, and loaders at ports and intermodal rail yards. CARB CHE emission standards are the most stringent of any in the nation. CARB obtained U.S. EPA authorization for a waiver in 2012. No other state or nonattainment area has more stringent exhaust emission standards for CHE than California.

Commercial Harbor Craft (CHC)

CARB's new engine standards for CHC is the most stringent of any in the nation. The Commercial Harbor Craft Regulation controls NOx and PM emissions from crew and supply boats, charter fishing vessels, commercial fishing vessels, ferry/excursion vessels, pilot vessels, towboats or push boats, tug boats, and work boats. U.S. EPA has granted a waiver of preemption under §209(b). No other state has more stringent exhaust emission standards for commercial harbor craft than California.

Forklifts

CARB's new engine standards for forklifts are the most stringent of any in the nation. Forklifts powered by LSI engines (gasoline and natural gas) are subject to new engine standards that include both criteria pollutant and durability requirements since 2001 with the cleanest requirements phased-in starting in 2010. Diesel Forklifts > 25 HP are subject to fleet average emission requirements under the Off-Road Diesel Regulation starting in 2010 and Tier 4 Final emission standards (based on the use of advanced after-treatment technologies such as diesel particulate filters and selective catalytic reduction) starting in 2013. Furthermore, the stringency of these requirements is anticipated to increase under the Zero-Emission Off-Road Forklift Regulation Phase 1 measure committed to in the State SIP Strategy. No other state has more stringent forklift emission standards than CARB.

Locomotives

U.S. EPA sets nationwide emission standards for locomotives. No state, including California, has the authority to regulate emission standards for locomotives. Thus, CARB's locomotive controls are equivalent to the controls used in all other nonattainment areas in the nation. Nonetheless, further increases in stringency of locomotive emission controls are needed for California nonattainment areas, including the Valley, to attain federal ambient air quality standards. For this reason, CARB has petitioned U.S. EPA to set more stringent emission controls for locomotives.

Off-Highway Recreational Vehicles (OHRVs)

CARB's new engine standards for OHRV are the most stringent of any in the nation. CARB's program sets exhaust emissions standards (2006) and evaporative emission standards (2007) for OHRV, together with amendments to the testing procedures to ensure the most stringent level of emission reductions are achieved (2007). U.S. EPA has issued waivers of authorization for CARB's OHRV regulations. No other state or nonattainment area controls emissions from new OHRV more stringently than CARB.

Recreational Boats

CARB's new engine standards for recreational boats are the most stringent of any in the nation, and exceed the stringency of U.S. EPA federal standards:

- The Exhaust Emission Regulations for Spark-Ignition Marine Engines (1998) controls emissions at the same level of stringency as national regulations;
- The Tier II Emission Standards for Inboard and Stern Drive Marine Engines (2001) controls emissions at the same level of stringency as national regulations; and
- The Evaporative Emission Control Standards (2015) exceeds the stringency of applicable national regulations set by U.S. EPA in 2008 for gasoline-fueled spark-ignition marine watercraft >30 kilowatts.

No other state has the authority to set exhaust emission and/or evaporative emission standards that exceed the stringency of U.S. EPA's national standards.

Small Off-Road Engines (SORE)

CARB's new engine standards for SORE are the most stringent of any in the nation. CARB's Exhaust and Evaporative Standards for SORE set more stringent exhaust and evaporative standards than applicable federal standards, and includes requirements for Zero-Emission SORE equipment. Furthermore, CARB is anticipated to further increase the stringency of emission controls with a measure designed to accelerate the deployment of zero-emission technologies, set tighter exhaust and evaporative emission standards, and enhance enforcement of current emission standards for SORE. No other state has the authority to set exhaust emission and/or evaporative emission standards that exceed the stringency of U.S. EPA's national standards.

D.4.9.2 In-Use emission controls for off-road engines and equipment

Fleet Rules

Off-Road Equipment (General)

In aggregate, CARB's fleet requirements for off-road equipment are the most stringent in the nation. CARB's Cleaner In-Use Off-Road Equipment Regulation (Off-Road Regulation) controls diesel PM and NOx emissions from >150,000 in-use off-road engines by requiring their owners to retire, replace, or repower older engines, and/or installing verified exhaust retrofit control technologies to BACT-equivalent engines. Additionally, all vehicles are reported and labeled, and older, dirtier vehicles are restricted from entering fleets.

CARB's off-road equipment controls emissions from aerial lifts, aircraft tugs, backhoes, baggage tugs, belt loaders, cargo loaders, crawler tractors (such as bulldozers), excavators, forklifts, graders, loaders, mowers, rollers, rough terrain forklifts, rubber tired loaders, scrapers, skid steer loaders, snow blowers, tractors, trenchers, as well as several types of on-road vehicles, such as two-engine vehicles, and workover rigs. Some nonattainment areas have fleet requirements that also require BACT-equivalent levels of controls for some off-road equipment (i.e. construction equipment), which are described below.

- New York City's Local Law 77 requires use of ultra-low sulfur diesel fuel and BACT for reducing emissions from non-road equipment above 37 kW used on city construction projects.
- Chicago (IL) Clean Diesel Construction Ordinance bans high-polluting diesel equipment from City construction sites. While the California program requires

fleets to turnover to Tier 4 or equivalent control levels, the Chicago ordinance only requires fleets to turnover to Tier 2 or equivalent control levels (on-road vehicles MY 1998 and earlier and pre-US Environmental Protection Agency Tier 1 equipment will be banned under the Chicago ordinance.)

No other state or nonattainment area controls in-use off-road equipment fleets more stringently than CARB. Neither of these programs cover the full suite of off-road equipment engine types and applications that are regulated under CARB's program. Additionally, they do not have as stringent of labeling and reporting requirements as CARB. Finally, the use of ULSD in off-road equipment in New York provides significantly less emission reductions than the use of ULSD inside of California (as is required – see fuels section for more information), as federal USLD specifications allow significantly less stringent caps on sulfur and aromatic hydrocarbon content in fuels than CARB diesel specifications.

Beyond the Off-Road Regulation, CARB also controls sub-categories of off-road equipment through specific fleet requirements, as described below.

Agricultural Equipment

CARB's agricultural equipment fleet controls are among the most stringent in the nation. The 2007 Cleaner In-Use Agricultural Equipment Measure modernizes agricultural equipment in the Valley; under this program, the District has, since 2009, replaced over 5,000 tier 0 and tier 1 tractors to meet the targeted NOx emission reductions of 5 to 10 tpd by 2017. CARB is anticipated to further increase the stringency of in-use emission controls with the Cleaner In-Use Ag Equipment measure proposed in the Valley SIP Strategy, which is designed to accelerate emission reductions from the in-use ag equipment fleet.

Airport Ground Support Equipment (GSE)

CARB's airport GSE fleet requirements are the most stringent in the nation. CARB's In-Use Off-Road Diesel-Fueled Fleets Regulation requires fleets operating in-use diesel equipment to meet an annual fleet average emissions target that decreases over time to become equivalent to the interim Tier 4 NOx standard for newly produced engines. No other state or nonattainment area controls airport GSE more stringently than CARB.

Cargo Handling Equipment (CHE)

CARB's Cargo Handling Equipment Regulation includes in-use limits that require diesel PM and NOx emission controls for mobile CHE at ports or intermodal rail yards. No other state or nonattainment area has more stringent in-use fleet requirements for CHE than California.

Commercial Harbor Craft (CHC)

The Commercial Harbor Craft regulation (adopted in 2007) includes in-use limits that require diesel PM and NOx emission controls. The 2010 amendments extended the types of CHC for which in-use engine requirements apply. No other state or nonattainment area controls in-use CHC emissions more stringently than CARB.

Forklifts

California forklifts are subject to either the LSI Fleet Regulation (if powered by gasoline or propane), and the Off-Road Diesel Fleet Regulation (if powered by diesel). Under both regulations, forklift fleets are required to retire, repower, or replace higher-emitting equipment in order to maintain fleet average standards. No other state or nonattainment area has more stringent fleet requirements for in-use forklifts than CARB.

Off-Highway Recreational Vehicles (OHRV)

CARB's In-Use controls for OHRV under the "Red Sticker" program controls in-use emissions from OHRV more stringently than any other state or nonattainment area in the nation. Under this program, engines that do not meet the applicable emission standard for new engines are subject to in-use restrictions that limits operation at certain off-highway recreational vehicle parks located in non attainment areas during peak ozone season. No other state or nonattainment area controls in-use emissions from OHRV more stringently than CARB.

Transport Refrigeration Units (TRU)

The Air Toxic Control Measure (ATCM) for Transport Refrigeration Units (TRU) and TRU Generator Sets (CARB's ATCM for In-Use Diesel-Fueled TRUs) requires engines to meet in-use diesel PM emission standards by the end of the seventh year after manufacture, and applies to TRUs that operate in California, regardless of whether they are registered in or outside of the State. CARB's program is the most stringent of its type in the nation. Furthermore, CARB is anticipated to further increase the stringency of emission controls under the TRU measure committed to in the State SIP Strategy, which is anticipated to increase NOx and PM emission reductions by reducing the amount of time TRUs operate while stationary. No other state or nonattainment area controls in-use emissions from TRUs more stringently than CARB.

Other In-Use Emission Controls for Locomotive Emissions

While emission standards for locomotives are set by U.S. EPA, CARB has accelerated reductions from these sources through efforts that have focused on cleaner fuel requirements, and increasing use of cleaner locomotives. The Statewide Rail Yard Agreement for California Rail Yards (Railroad MOU) accelerates the introduction of cleaner locomotives, obligates the railroads to significantly reduce emissions in and around rail yards in California, and established a statewide visible emissions reduction and repair program. No other state or nonattainment area has achieved similarly significant levels of emission reductions from in-use locomotives than CARB.

D.4.9.3 Fuels

CARB Diesel Fuel Regulations

U.S. EPA began regulating sulfur content in diesel in 1993. At that time, uncontrolled fuels (i.e. non-CARB diesel) contained approximately 5,000 parts per million (ppm) of sulfur. In 2006, U.S. EPA began to phase-in more stringent requirements under the federal Ultra-Low Sulfur Diesel (ULSD) regulations, which lowered the amount of sulfur allowed in federal diesel fuels. U.S. EPA's Nonroad Diesel Fuel Standards were phased in from 2007 to 2014, and require that all off-road engines, including those used in locomotives and off-road equipment, use ULSD fuel (with some exemptions for older

locomotives and marine engines). The Nonroad Standards also require that diesel fuel sold into the market for off-road use must be ULSD. It is important to note that while U.S. EPA defines ULSD as ≤ 15 ppm for on-road applications, the definition of off-road ULSD is significantly less stringent, defined as ≤ 500 ppm standard.
For the off-road fleet, CARB's current ULSD regulation is significantly more stringent than the applicable current federal ULSD standards (Phase III):

- Whereas the federal ULSD program differs in requirements for on- and off-road fuels, CARB's ultra-low sulfur diesel program sets the same requirements for fuels burned in on- and off-road applications. CARB limits sulfur content at 15 ppm rather than the federal limit of 500 ppm for off-road ULSD. Compared with CARB ULSD standards, federal off-road ULSD allows 33 times the sulfur content.
- CARB's ULSD significantly reduces emissions relative to federal on-road ULSD, which is much cleaner than federal off-road ULSD. Both federal on-road ULSD and CARB ULSD limit sulfur content (a precursor to secondary atmospheric formation of PM2.5) to 15 ppm, yet CARB's fuel emits ~25 percent less PM. Given that federal off-road ULSD sulfur content is capped at levels 3,000 percent higher than CARB's ULSD, the California program is significantly more stringent in terms of its ability to control emissions of sulfur oxide emissions.
- In addition, CARB controls hydrocarbons and aromatics, unlike U.S. EPA requirements.

As was discussed in the on-road diesel fuel section, only one other state has a boutique fuel program with requirements that differ from federal specifications, the Low Emission Diesel Program in Texas (TxLED). CARB diesel specifications are more stringent than federal and other states' programs.

Controlling Criteria Emissions from Renewable Fuels

The Low Carbon Fuel Standard (LCFS) and Alternative Diesel Fuel (ADF) regulations work together to reduce the carbon intensity of the California fuel supply while requiring limits on criteria emissions from alternative fuels and/or alternative fuel mix blends. While other states have adopted or are considering adopting similar programs to the California LCFS, no other state has set criteria emission requirements on alternative fuels and alternative fuel blends. The Federal Renewable Fuel Standard (RFS II), which is the most equivalent program type at the federal level, increases the renewable content of the fuel mix nationally (as the LCFS does in California), however it does not specify criteria requirements for alternative fuels. Furthermore, CARB is anticipated to further increase the stringency of controls on criteria pollutant emissions diesel products under the Low Emission Diesel measure committed to in the State SIP Strategy. No other state or nonattainment area controls criteria emissions from renewable fuels more stringently than CARB.

Cleaner Burning Fuels Requirements (for Locomotives)

While emission standards for locomotives are set by U.S. EPA, CARB has accelerated reductions from these sources through efforts that have focused on cleaner fuel requirements, and increasing use of cleaner locomotives. The Railroad MOU includes a control measure that maximizes the use of lower emitting fuels (i.e. CARB and U.S.

EPA low sulfur diesel) in locomotives fueled in California. ***Requiring cleaner diesel fuel requirements for intrastate locomotives*** have reduced NOx and diesel PM emissions from these sources.

D.4.10 STEP 3(A): EVALUATION OF STRINGENCY: OFF-ROAD CONTROL MEASURES

Step 3(a) calls for an evaluation of each of the potential BACM/MSM control measures identified in Step 2, in order to evaluate their stringency and determine whether they meet all applicable requirements to satisfy the definitions of BACM and/or MSM discussed in Chapter 1 and Chapter 2.

in order to determine whether each potential MSM/BACM measure meets the definition of MSM and/or BACM, staff has assessed each potential MSM/BACM off-road mobile source control measure identified in Steps 2(a) and 2(b). Based on this assessment, staff then characterized each potential MSM / BACM measure as falling into 'bins' representing whether it meets the definition of MSM or BACM for each of the four PM2.5 standards covered in this document (note that the BACM bin is further subdivided into BACT or ADF). The determination of which bin each control measure falls into thus indicates both the control measure' stringency and the control measures' implementation schedule, relative to the varying attainment dates among the Valley's four PM2.5 SIPs. In other words, the bin into which each control measure falls correlates with how hard each measure pushes to control emissions, given the implementation timeframes associated with each standards' plan. Generally speaking, the control measures included in CARB's current control program meet the definition of BACM; the new measures included in the Valley SIP Strategy satisfy MSM requirements.

Figure 7 shows the timing for implementation of each potential MSM / BACM off-road control measure identified in the prior sections (i.e. Steps 2(a) and 2(b)), for each of the four PM2.5 standards discussed in this SIP.

Figure 7: Timeline for Implementation of BACM / MSM Off-Road Control Measures

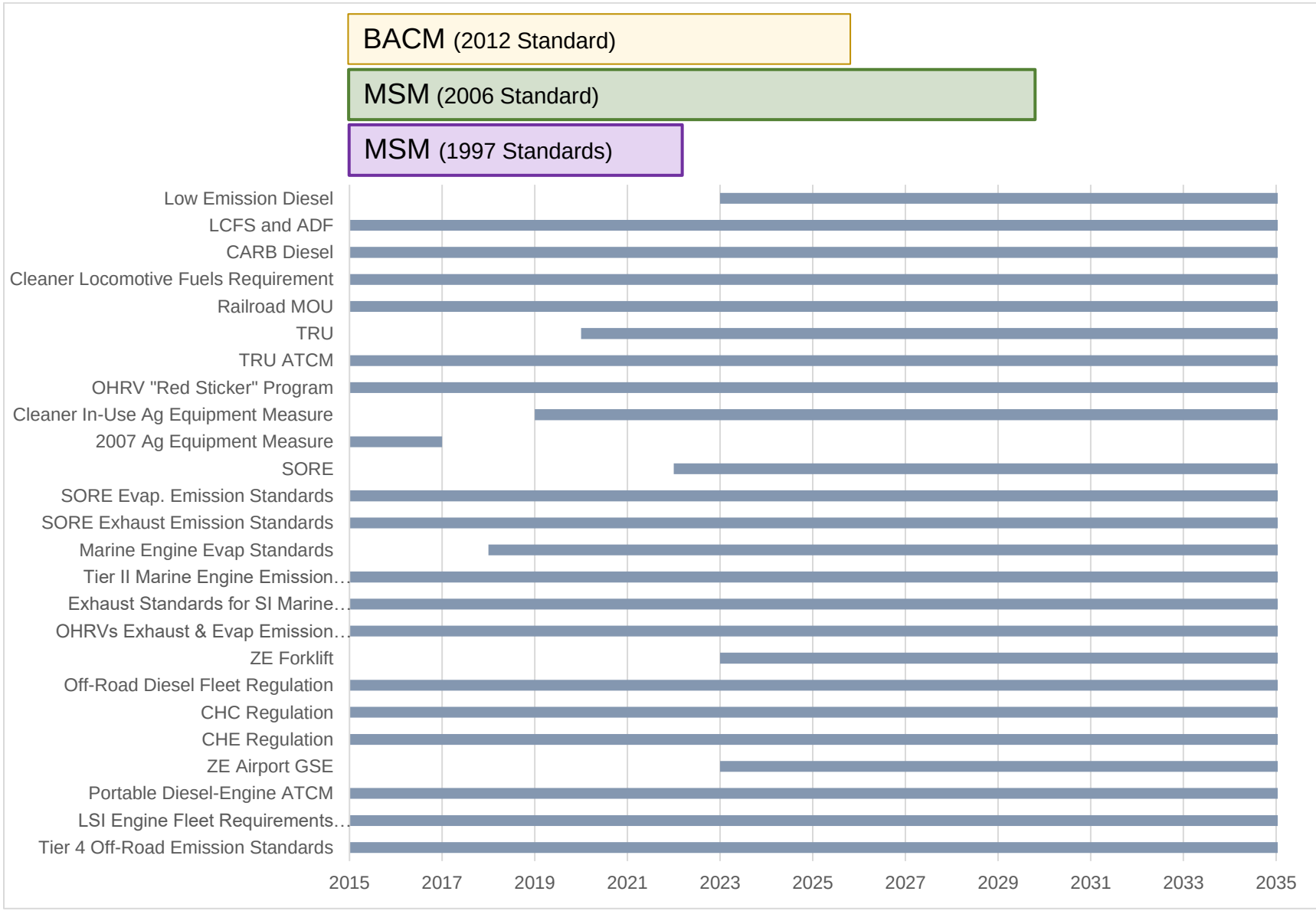


Table 16 summarizes which of the categories of stringency (i.e. BACM/BACT, BACM/ADF, or MSM) that each off-road mobile source control measure falls into, for each PM2.5 standard. It is important to note that some measures CARB has committed to in the State SIP Strategy and proposed in the Valley SIP Strategy have anticipated implementation dates that exceed the timeframe thresholds of this analysis for some standards. Specifically, implementation of the SORE measure is anticipated to begin in 2022, while implementation of the Zero-Emission Airport Ground Support Equipment (GSE) measure, Zero-Emission Forklift Regulation Phase I measure, and the Low-Emission Diesel measure is anticipated to begin in 2023, after the 2021 threshold of the analysis for the 1997 Annual and 24-Hour Standards. While these measures may not meet the timeline requirements to fall into the strict definition of MSM for these standards, the intent behind these measures is nonetheless to continue pushing for additional emission reductions to ensure that attainment is achieved as expeditiously as possible, which aligns with the broader purpose of MSM.

Table 16: Identification of Off-Road Control Measures as BACM and/or MSM

Measures	Implementation Begins	12 ug/m3 Annual (2012)	35 ug/m3 24-Hour (2006)	15 ug/m3 Annual (1997)	65 ug/m3 24-Hour (1997)
Adopted Off-Road Control Measures					
Tier 4 Off-Road Emission Standards	ongoing	BACM - BACT	MSM	MSM	MSM
Large Spark Ignition (LSI) Engine Fleet Standards	ongoing	BACM - AFM	MSM	MSM	MSM
Portable Diesel-Engine ATCM	ongoing	BACM - BACT	MSM	MSM	MSM
Cargo Handling Equipment (CHE) Regulation	ongoing	BACM - BACT	MSM	MSM	MSM
Commercial Harbor Craft (CHC) Regulation	ongoing	BACM - BACT	MSM	MSM	MSM
Off-Road Diesel-Fueled Fleets Regulation (Off-Road Regulation)	ongoing	BACM - BACT	MSM	MSM	MSM
Exhaust and Evaporative Emission Standards for OHRVs	ongoing	BACM - BACT	MSM	MSM	MSM
Exhaust Standards for Spark-Ignition Marine Engines	ongoing	BACM - BACT	MSM	MSM	MSM
Tier II Emission Standards for Inboard and Stern-Drive Marine Engines	ongoing	BACM - BACT	MSM	MSM	MSM
Marine Engine Evaporative Emission Control Standards	ongoing	BACM - BACT	MSM	MSM	MSM
SORE Exhaust Emission Standards and Test Procedures	ongoing	BACM - AFM	MSM	MSM	MSM
Evaporative Emission Standards for SORE	ongoing	BACM - BACT	MSM	MSM	MSM
2007 Cleaner In-Use Agricultural Equipment Measure	ongoing	BACM - BACT	MSM	MSM	MSM
Off-Highway Recreational Vehicle (OHRV) "Red Sticker" Program	ongoing	BACM - BACT	MSM	MSM	MSM
ATCM for In-Use Diesel-Fueled Transport Refrigeration Units (TRUs) and TRU Generator Sets	ongoing	BACM - BACT	MSM	MSM	MSM
Statewide Rail Yard Agreement for California Rail Yards (Railroad MOU)	ongoing	BACM - BACT	MSM	MSM	MSM
Cleaner Burning Fuels Requirements for Locomotives	ongoing	BACM - BACT	MSM	MSM	MSM
CARB Ultra Low Sulfur Diesel (ULSD)	ongoing	BACM - BACT	MSM	MSM	MSM
Low Carbon Fuel Standard (LCFS) and Alternative Diesel Fuel (ADF)	ongoing	BACM - BACT	MSM	MSM	MSM

Table 16: Identification of Off-Road Control Measures as BACM and/or MSM

Measures	Implementation Begins	12 ug/m3 Annual (2012)	35 ug/m3 24-Hour (2006)	15 ug/m3 Annual (1997)	65 ug/m3 24-Hour (1997)
State SIP Strategy Off-Road Measures (with Commitment)					
Zero-Emission Airport Ground Support Equipment (GSE)	2023	BACM - AFM	MSM	--	--
Zero-Emission Off-Road Forklift Regulation Phase 1	2023	BACM - AFM	MSM	--	--
Small Off-Road Engines (SORE)	2022	BACM - BACT	MSM	--	--
Transport Refrigeration Units Used for Cold Storage	2020	BACM - AFM	MSM	MSM	MSM
Low-Emission Diesel Requirement	2023	BACM - AFM	MSM	--	--
Valley SIP Strategy Off-Road Measures (Proposed in Valley SIP)					
Cleaner In-Use Agricultural Equipment Measure	2019	BACM - AFM	MSM	MSM	MSM

D.4.11 STEP 3(B): EVALUATION OF FEASIBILITY: OFF-ROAD CONTROL MEASURES

Step 3(b) calls for an assessment of the feasibility of implementing any measure that is not included in the Valley's proposed SIP and attainment demonstration, but which is identified as a potential BACM/MSM control measure in Step 2. For this plan, staff's proposed SIP and attainment demonstration do not recommend eliminating any of the potential BACM/MSM control measures identified in Step 2 on the basis of technical or economic infeasibility. Thus, a feasibility assessment for purposes of eliminating such measures from further consideration (i.e. Step 3(b)) is not applicable.

D.4.12 SUMMARY OF STEPS 2 AND 3

D.4.12.1 Step 2: Potential Mobile Source Control Measures Identified

The purpose of Step 2 is to identify all potential BACM/MSM control measures for the emission sources identified Step 1. Per U.S. EPA guidance, staff began to identify the list of all potential BACM/MSM control measures by starting with California's control program (Step 2(a)), which includes:

- Control measures adopted in the SIP for the Valley (i.e. the current control program)
- Control measures committed to in the State SIP Strategy; and
- Control measures proposed in the Valley State SIP Strategy.

In Step 2(b), staff expanded the scope of focus beyond California's controls to identify any additional potential BACM/MSM control measures that are in use in other nonattainment areas and states, and which exceed the stringency of California's controls identified in Step 2(a). The analysis undertaken for Step 2(b) found that, while there are some measures in use in other jurisdictions that are more stringent than the currently adopted mobile source control programs in California, the stringency of similar control measures committed to in the State SIP Strategy and proposed in the Valley State SIP Strategy meets and/or exceeds the stringency of the controls in use in other jurisdictions. Thus, Step 2(b) did not identify any additional potential BACM/MSM control measures in use in other jurisdictions that are more stringent than the California control measures previously identified in Step 2(a).

To meet statutory requirements for the MSM plans, staff also reviewed all previous Valley PM2.5 SIPs in Step 2(c), and found no mobile source control measures that were proposed in previous Moderate or Serious attainment plan control strategies for the Valley that were not subsequently adopted.

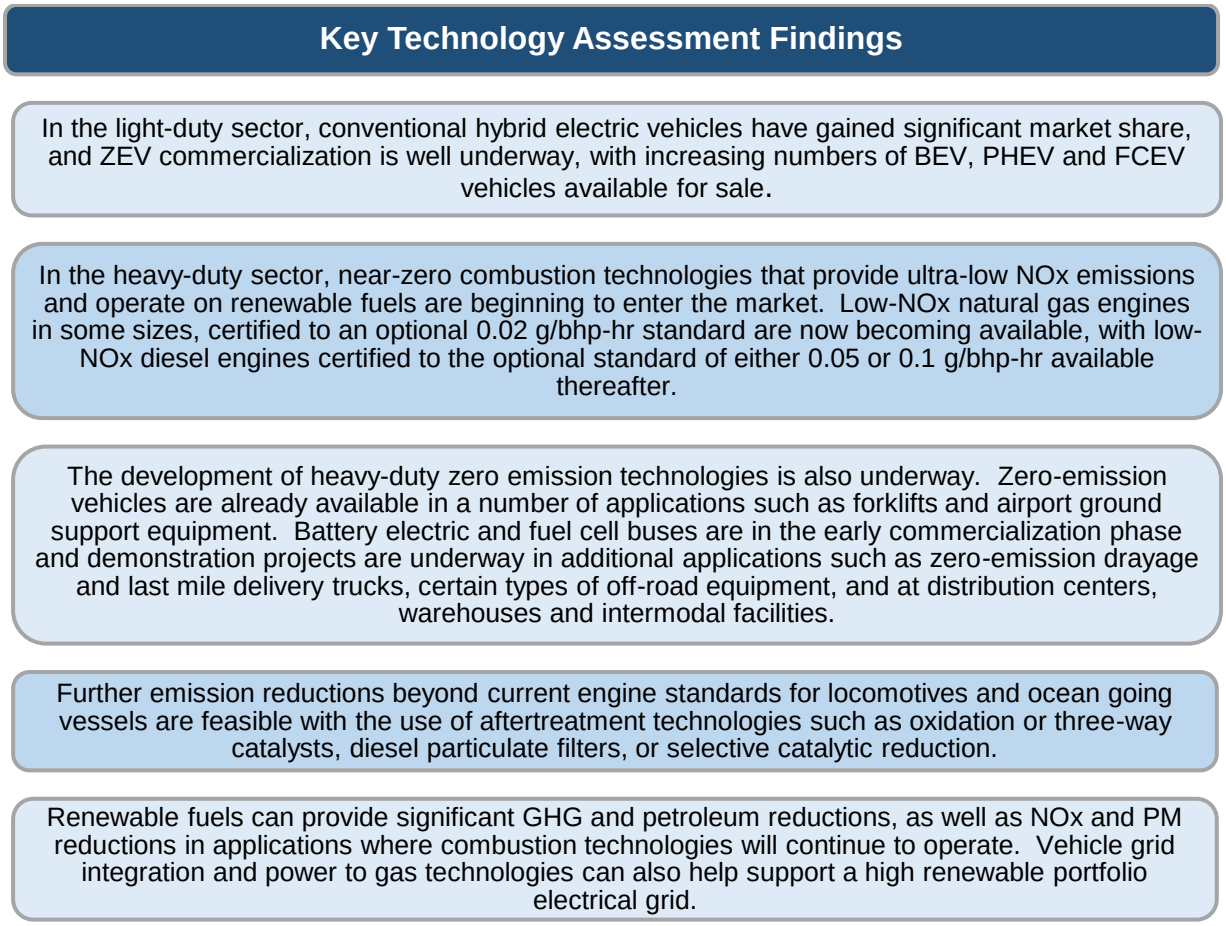
As there are no applicable control measures previously rejected as infeasible for the Valley's BACM/MSM demonstration process, Step 2(c) did not identify any additional potential BACM/MSM control measures beyond the control measures identified in Steps 2(a) and 2(b).

D.4.12.2 Step 3: Analysis of Stringency and Feasibility

The analysis of stringency and feasibility for each possible BACM/MSM control measure identified in Step 2 has shown that California's mobile source control program is at least consistent with the most stringent of any nonattainment area or state in the nation, with the majority of California control measures exceeding the stringency of controls in use in

the rest of the nation. These findings generally correlate with the ongoing technology assessments CARB staff has been conducting in collaboration with U.S. EPA and the National Highway Traffic Safety Administration. These Technology Assessments have been undertaken in order to identify the next generation of technologies and fuels that will need to comprise California's transition to a cleaner, more efficient transportation system.[95] This effort has enabled CARB to identify the types of technologies that will be needed as part of a cleaner, more efficient transportation system that meets California's multiple air quality, and climate goals, including attainment of U.S. EPA's health-based ambient air quality standards for PM2.5 and other criteria air pollutants. The major findings of the Technology Assessments are shown in Figure 8.

Figure 8: Key Technology Assessment Findings



The Technology Assessment findings illustrate that the control measures included in the Valley's attainment plan and demonstration represent the suite of emission control approaches align with the most stringent levels of control feasible, given the current status of technology and its potential in the near future. Furthermore, CARB staff has not received any public comments to date indicating that more stringent control technologies than those identified in the Technology Assessments would be

[95] Technology and Fuels Assessments can be found at: https://www.arb.ca.gov/msprog/tech/tech.htm

commercially available and/or technologically and economically feasible to implement in the Valley in the timeframe required for the area's PM2.5 SIPs.

D.5 Chapter V. Step 4: Adoption of Mobile Source Control Measures

The final step required by the Act's step-wise process is to adopt and implement feasible control measures identified in Step 3 to satisfy BACT/BACM and MSM requirements.

Staff's proposed SIP for the Valley recommends adoption and implementation all of the measures identified as BACM and MSM in Step 3 that have not already been adopted and/or implemented. The control measures included in the Valley's attainment demonstration and shown to meet the required BACM/MSM requirements in this appendix are in varying stages of the adoption and implementation process at CARB.

- Many of the measures identified as BACM and/or MSM have already been adopted by the Board, submitted into the SIP, and are currently being implemented as part of CARB's current control program.
- Additional control measures have been committed to in the State SIP Strategy, which the Board adopted in March 2017, yet many of these control measures themselves have not yet been adopted by the Board. The Board's adoption of the State SIP Strategy created a commitment to adopt measures according to a defined schedule, an initial commitment to achieve specified emission reductions in the Valley, and a commitment to return to the Board with a comprehensive plan to attain the PM2.5 standards in the Valley.
- Finally, the Valley State SIP Strategy proposes additional control measures which the Board has not yet considered.

Board adoption of the proposed SIP – including the proposed new mobile source control measures described in the Valley SIP Strategy – will satisfy the requirements of Step 4. The process for adoption and implementation of these control measures is discussed in more detail in the body of the main document to which this analysis is appended.

D.6 CHAPTER VI. CONCLUSION: FINDINGS OF MSM AND BACM ANALYSIS

California's long history of comprehensive and innovative emissions control has resulted in the strongest mobile source control program in the nation. U.S. EPA has acknowledged the strength of these programs in their approval of CARB's regulations and through the waiver process. In addition, U.S. EPA has provided past determinations that CARB's mobile source control programs meet BACM and MSM requirements as part of their 2004 approval of the Valley's 2003 PM10 Plan:

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

Since then, CARB has continued to substantially enhance and accelerate reductions from our mobile source control programs through the implementation of more stringent engine emissions standards, in-use requirements, incentive funding, and other policies and initiatives as described in the preceding sections. These efforts not only ensure that all source sectors continue to achieve maximum emission reductions through implementation of the cleanest current technologies, but also promote the ongoing development of more advanced zero and near-zero technologies. As a result, California's mobile source control programs reflect the most stringent and feasible level of emissions control in the nation and fully meet the requirements for BACM/BACT and MSM.

In conclusion, CARB followed the procedures outlined by U.S. EPA for determining BACM and MSM, and have determined that California's mobile source program satisfies the applicable requirements for each PM2.5 standard in this analysis.

The attached table lists all of CARB's regulatory control measures since 1985.

Table 17: CARB Regulatory Mobile Source Control Measures since 1985

Board Action	Hearing Date
Public Hearing to Consider Proposed Amendments to the Airborne Toxic Control Measure For Diesel Particulate Matter from Portable Engines Rated at 50 Horsepower and Greater – and to the Statewide Portable Equipment Registration Program Regulation: The proposed amendments will provide more time for cleaner engine replacement while preserving the expected emission reductions, and make other improvements to the ATCM. PERP will have corresponding amendments and make other improvements to the program.	11/16/17
Public Hearing to Consider the Proposed Amendments to California's Evaluation Procedures for New Aftermarket Catalytic Converters: The proposed amendments are for procedures used to evaluate and approve aftermarket catalytic converters designed for use on California passenger cars and trucks to allow them to be used for Low Emission Vehicle III emission standards.	9/28/17

Public Meeting to Consider Proposed Revisions to the Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines: The updated Carl Moyer Memorial Air Quality Standards Attainment Program 2017 Guidelines implement changes directed by Senate Bill 513 and redesign the Program to meet California's need to transition to the very low and zero-emission technologies of the future.	4/27/17
Public Meeting to Consider the Proposed Amendments to the Evaporative Emission Requirements for Small Off-Road Engines: The proposed amendments will address to non-compliance of small off-road engines (SORE) with existing evaporative emission standards, as well as amendments to streamline the certification process by harmonizing where feasible with federal requirements.	11/17/16
Notice of Public Hearing to Consider Proposed Regulation to Provide Certification Flexibility for Innovative Heavy-Duty Engine and California Certification and Installation Procedures for Medium and Heavy-Duty Vehicle Hybrid Conversion Systems: This proposed regulation's certification flexibility is tailored to encourage development and market launch of heavy-duty engines meeting California's optional low oxides of oxides of nitrogen emission standards, robust heavy-duty hybrid engines, and high-efficiency heavy-duty engines.	10/20/16
Public Hearing to Consider Proposed Amendments to the Large Spark-Ignition Engine Fleet Requirements Regulation: The proposed amendment will establish new reporting and labeling requirements and extend existing recordkeeping requirements. The proposed regulatory amendments are expected to improve the reliability of the emission reductions projected for the existing LSI Fleet Regulation by increasing enforcement effectiveness and compliance rates.	7/21/16
Public Hearing to Consider Proposed Evaluation Procedure for New Aftermarket Diesel Particulate Filters Intended as Modified Parts for 2007 through 2009 Model Year On-Road Heavy-Duty Diesel Engines: The proposed amendment would establish a path for exempting aftermarket modified part DPFs intended for 2007 through 2009 on-road heavy-duty diesel engines from the prohibitions of the current vehicle code. Staff is also proposing to incorporate a new procedure for the evaluation of such DPFs.	4/22/16
Amendments to the Portable Fuel Container Regulation Amendments to the Portable Fuel Container (PFC) regulation, which include requiring certification fuel to contain 10 percent ethanol, harmonizing aspects of the Board's PFC certification and test procedures with those of the U.S. EPA, revising the ARB's certification process, and streamlining, clarifying, and increasing the robustness of ARB's certification and test procedures.	2/18/16
Technical Status and Proposed Revisions to On-Board Diagnostic System Requirements and Associated Enforcement Provisions for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II) Amendments to the OBD II regulations that update requirements to account for LEV III applications and monitoring requirements for gasoline and diesel vehicles, and clarify and improve the regulation; also, updates to the associated OBD II enforcement regulation to align it with the proposed amendments to the OBD II regulations and a minor amendment to the definition of "emissions-related part" in title 13, CCR section 1900.	9/25/15
2015 Low Carbon Fuel Standard (LCFS) Amendments (2 of 2) Re-adoption of the Low Carbon Fuel Standard, which includes updates and revisions to the regulation now in effect. The proposed regulation was first presented to the Board at its February 2015 public hearing, at which the Board directed staff to make modifications to the proposal.	9/24/15
Proposed Regulation on the Commercialization of Alternative Diesel Fuels (2 of 2) Regulation governing the introduction of alternative diesel fuels into the California commercial market, including special provisions for biodiesel.	9/24/15
Intermediate Volume Manufacturer Amendments to the Zero Emission Vehicle Regulation (2 of 2) Amendments regarding intermediate volume manufacturer compliance obligations under the Zero Emission Vehicle regulation.	5/21/15

2015 Amendments to Certification Procedures for Vapor Recovery Systems at Gasoline Dispensing Facilities—Aboveground Storage Tanks and Enhanced Conventional Nozzles Amendments would establish new performance standards and specifications for nozzles used at fleet facilities that exclusively refuel vehicles equipped with onboard vapor recovery systems, would provide regulatory relief for owners of certain existing aboveground storage tanks, and would ensure that mass-produced vapor recovery equipment matches the specifications of equipment evaluated during the ARB certification process.	4/23/15
Proposed Regulation for the Commercialization of Alternative Diesel Fuels (1 of 2) Regulation governing the introduction of alternative diesel fuels into the California commercial market, including special provisions for biodiesel. This is the first of two hearings on the item, and the Board will not take action to approve the proposed regulation.	2/19/15
Evaporative Emission Control Requirements for Spark-Ignition Marine Watercraft Regulation for controlling evaporative emissions from spark-ignition marine watercraft. The proposed regulation will harmonize, to the extent feasible, with similar federal requirements, while adding specific provisions needed to support California's air quality needs.	2/19/15
2015 Low Carbon Fuel Standard (LCFS) Amendments (1 of 2) Regulation for a Low Carbon Fuel Standard that includes re- adoption of the existing Low Carbon Fuel Standard with updates and revisions. This is the first of two hearings on the item, and the Board will not take action to approve the proposed regulation.	2/19/15
2014 Amendments to ZEV Regulation Additional compliance flexibility to ZEV manufacturers working to bring advanced technologies to market.	10/23/14
LEV III Criteria Pollutant Requirements for Light- and Medium-Duty Vehicles the Hybrid Electric Vehicle Test Procedures, and the HD Otto-Cycle and HD Diesel Test Procedures Applies to the 2017 and subsequent model years.	10/23/14
Low Carbon Fuel Standard 2014 Update As a result of a California Court of Appeal decision, ARB will revisit the LCFS rulemaking process to meet certain procedural requirements of the APA and CEQA. Following incorporation of any modifications to the regulation, the Board will consider the proposed regulation for adoption at a second hearing held in the spring of 2015.	7/24/14
Revisions to the Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines for On-Road Heavy-Duty Trucks Revisions to 1) reduce surplus emission reduction period, 2) reduce minimum CA usage requirement, 3) prioritize on-road funding to small fleets, 4) include light HD vehicles 14000-19500 libs, and 5) clarify program specifications.	7/24/14
Amendments to Enhanced Fleet Modernization (Car Scrap) Program Amendments consistent with SB 459 which requires ARB to increase benefits for low-income California residents, promote cleaner replacement vehicles, and enhance emissions reductions.	6/26/14
Truck and Bus Rule Update Amendments to the Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen, and Other Criteria Pollutants From In-Use On-Road Diesel-Fueled Vehicles: increasing low-use vehicle thresholds, allowing owners to newly opt-in to existing flexibility provisions, adjusting "NOx exempt" vehicle provisions, and granting additional time for fleets in certain areas to meet PM filter requirements.	4/24/14

Heavy-Duty GHG Phase I: On-Road Heavy-Duty GHG Emissions Rule, Tractor-Trailer Rule, Commercial Motor Vehicle Idling Rule, Optional Reduced Emission Standards, Heavy-Duty Hybrid-Electric Vehicles Certification Procedure New GHG standards for MD and HD engines and vehicles identical to those adopted by the USEPA in 2011 for MYs 2014-18.	12/12/13
Agricultural equipment SIP credit rule Incentive-funded projects must be implemented using Carl Moyer Program Guidelines; must be surplus, quantifiable, enforceable, and permanent, and result in emission reductions that are eligible for SIP credit.	10/25/13
Zero emission vehicle test procedures Existing certification test procedures for plug-in hybrid vehicles need to be updated to reflect technology developments. The ZEV regulation will require minor modifications to address clarity and implementation issues.	10/24/13
Alternative fuel certification procedures Amendments to current alternative fuel conversion certification procedures for motor vehicles and engines that will allow small volume conversion manufacturers to reduce the upfront demonstration requirements and allow systems to be sold sooner with lower certification costs than with the current process, beginning with MY 2018.	9/26/13
Vapor Recovery for Gasoline Dispensing Facilities Amendments to certification and test procedures for vapor recovery equipment used on cargo tanks and at gasoline dispensing facilities.	7/25/13
Off-highway recreational vehicle evaporative emission control Staff proposes to set evaporative emission standards to control hydrocarbon emissions from Off-Highway Recreational Vehicles. The running loss, hot soak, and diurnal performance standards can be met by using proven automobile type control technology.	7/25/13
Gasoline and diesel fuel test standards Adopted amendments to add test standards for the measurement of prohibited oxygenates at trace levels specified in existing regulations.	1/25/13
LEV III and ZEV Programs for Federal Compliance Option Adopted amendments to deem compliance with national GHG new vehicle standards in 2017-2025 as compliance with California GHG standards for the same model years.	11/15/12 12/6/12 EO
Amendments to Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines Approved amendments to the verification procedure used to evaluate diesel retrofits through emissions, durability, and field testing. Amendments will lower costs associated with required in-use compliance testing, streamline the in-use compliance process, and will extend time allowed to complete verifications.	8/23/2012 EO 07/02/13
Amendments to On-Board Diagnostics (OBD I and II) Regulations Approved amendments to the light- and medium-duty vehicle and heavy-duty engine OBD regulations.	8/23/2012 EO 06/26/13
Vapor recovery defect list Adopted amendments to add defects and verification procedures for equipment approved since 2004, and make minor changes to provide clarity	6/11/12 EO
Advanced Clean Cars (ACC) Regulation: Low-Emission Vehicles and GHG Adopted more stringent criteria emission standards for MY 2015-2025 light and medium duty vehicles (LEV III), amended GHG emission standards for model year 2017-2025 light and medium duty vehicles (LEV GHG), amended ZEV Regulation to ensure the successful market penetration of ZEVs in commercial volumes, amended hydrogen fueling infrastructure mandate of the Clean Fuels Outlet regulation, and amended cert fuel for light duty vehicles from an MTBE-containing fuel to an E10 certification fuel.	1/26/12

Zero Emission Vehicle (ZEV) Adopted amendments to increase compliance flexibility, add two new vehicle categories for use in creating credits, increase credits for 300 mile FCVs, increase requirements for ZEVs and TZEVs, eliminate credit for PZEVs and AT PZEVs, expand applicability to smaller manufacturers, base ZEV credits on range, and make other minor changes in credit requirements	1/26/12
Amendments to Low Carbon Fuel Standard Regulation The amendments address several aspects of the regulation, including: reporting requirements, credit trading, regulated parties, opt-in and opt-out provisions, definitions, and other clarifying language.	12/16/11 10/10/12 EO
Amendments to Small Off-Road Engine and Tier 4 Off-Road Compression-Ignition Engine Regulations And Test Procedures; also "Recreational Marine" Spark-Ignition Marine Engine Amendments (Recreational Boats) adopted. Aligns California test procedures with U.S. EPA test procedures and requires off-road CI engine manufacturers to conduct in-use testing of their entire product lines to confirm compliance with previously established Not-To-Exceed emission thresholds.	12/16/2011 10/25/12 EO
Regulations and Certification Procedures for Engine Packages used in Light-Duty Specially Constructed Vehicles (Kit Cars) Ensures that certified engine packages, when placed into any Kit Car, would meet new vehicle emission standards, and be able to meet Smog Check requirements.	11/17/11 9/21/12 EO
Amendments to the California Reformulated Gasoline Regulations Corrects drafting errors in the predictive model, deletes outdated regulatory provisions, updates the notification requirements, and changes the restrictions on blending CARBOB with other liquids.	10/21/11 8/24/12 EO
Amendments to the In-Use Diesel Transport Refrigeration Units (TRU) ATCM Mechanisms to improve compliance rates and enforceability.	10/21/11 8/31/12 EO
Amendments to the Regulation for Cargo Handling Equipment (CHE) at Ports and Intermodal Rail Yards (Port Yard Trucks Regulation) Provides additional compliance flexibility, and maintains anticipated emissions reductions. As applicable to yard trucks and two-engine sweepers.	9/22/11 8/2/12 EO
Amendments to the Enhanced Vapor Recovery Regulation for Gasoline Dispensing Facilities New requirement for low permeation hoses at gasoline dispensing facilities.	9/22/11 7/26/12 EO
Amendments to Cleaner Main Ship Engines and Fuel for Ocean-Going Vessels Adjusts the offshore regulatory boundary. Aligns very low sulfur fuel implementation deadlines with new federal requirements.	6/23/11 9/13/12 EO
Particulate Matter Emissions Measurement Allowance For Heavy-Duty Diesel In-Use Compliance Regulation Emission measurement allowances provide for variability associated with the field testing required in the regulation.	6/23/11
Low Carbon Fuel Standard Carbon Intensity Lookup Table Amendments Adds new pathways for vegetation-based fuels	2/24/11
Amendments to Cleaner In-Use Heavy-Duty On-Road Diesel Trucks and LSI Fleets Regulations Amends five regulations to provide relief to fleets adversely affected by the economy, and take into account the fact that emissions are lower than previously predicted.	12/16/10 9/19/11 EO
Amendments to Cleaner In-Use Off-Road Diesel-Fueled Fleets Regulation Amendments provide relief to fleets adversely affected by the economy, and take into account the fact that emissions are lower than previously predicted.	12/16/10 10/28/11 EO
In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Rail Yard Facilities Amendments add flexibility to fleets' compliance schedules, mitigate the use of noncompliant trucks outside port and rail properties, and provide transition to the Truck and Bus regulation.	12/16/10 9/19/11 EO

Amendment of the ATCM for Diesel Transportation Refrigeration Units (TRU) Amendments expand the compliance options and clarify the operational life of various types of TRUs.	11/18/10 2/2/11 EO
Amendments to the ATCM for Stationary Compression Ignition Engines Approved amendments to closely align the emission limits for new emergency standby engines in the ATCM with the emission standards required by the federal Standards of Performance.	10/21/10 3/25/11 EO
Diesel Vehicle Periodic Smoke Inspection Program Adopted amendments to exempt medium duty diesel vehicles from smoke inspection requirements if complying with Smog Check requirements.	10/21/10 8/23/11 EO
Renewable Electricity Standard Regulation Approved a regulation that will require electricity providers to obtain at least 33% of their retail electricity sales from renewable energy resources by 2020.	9/23/10
Energy Efficiency at Industrial Facilities Adopted standards for the reporting of GHG emissions and the feasibility of emissions controls by the largest GHG-emitting stationary sources.	7/22/10 5/9/11 EO
Amendments to Commercial Harbor Craft Regulation Approved amendments to require the use of cleaner engines in diesel-fueled crew and supply, barge, and dredge vessels.	6/24/10 4/11/11 EO
Accelerated Introduction of Cleaner Line-Haul Locomotives Agreement with railroads sets prescribed reductions in diesel risk and target years through 2020 at four major railyards.	6/24/10
Sulfur Hexafluoride (SF6) Regulation Regulation to reduce emissions of sulfur hexafluoride (SF6), a high-GWP GHG, from high-voltage gas-insulated electrical switchgear.	2/25/10 12/15/10 EO
Amendments to the Statewide Portable Equipment Registration Regulation and Portable Engine ATCM Approved amendments that extend the deadline for removal of certain uncertified portable engines for one year.	1/28/10 8/27/10 EO 12/8/10 EO
Diesel Engine Retrofit Control Verification, Warranty, and Compliance Regulation Amendments Approved amendments to require per-installation compatibility assessment, performance data collection, and reporting of additional information, and enhance enforceability.	1/28/10 12/6/10 EO
Amendments to Limit Ozone Emissions from Indoor Air Cleaning Devices Adopted amendments to delay the labeling compliance deadlines by one to two years and to make minor changes in testing protocols.	12/9/09
Emission Warranty Information Reporting Regulation Amendments Repealed the 2007 regulation and readopted the 1988 regulation with amendments to implement adverse court decision.	11/19/09 9/27/10 EO
Amendments to Maximum Incremental Reactivity Tables Added many new compounds and modified reactivity values for many existing compounds in the tables to reflect new research data.	11/3/09 7/23/10 EO
Passenger Motor Vehicle Greenhouse Gas Limits Amendments Approved amendments granting credits to manufacturers for compliant vehicles sold in other states that have adopted California regulations.	9/24/09 2/22/10 EO
Amendments to In-Use Off-Road Diesel-Fueled Fleets Regulation Approved amendments to implement legislatively directed changes and provide additional incentives for early action.	7/23/09 12/2/09 EO 6/3/10 EO
Methane Emissions from Municipal Solid Waste Landfills Approved a regulation to require smaller and other uncontrolled landfills to install gas collection and control systems, and also requires existing and newly installed systems to operate optimally.	6/25/09 5/5/10 EO
Cool Car Standards Approved a regulation requiring the use of solar management window glass in vehicles up to 10,000 lb GVWR.	6/25/09
Enhanced Fleet Modernization (Car Scrap) Approved guidelines for a program to scrap up to 15,000 light duty vehicles statewide.	6/25/09 7/30/10 EO

Amendments to Heavy-Duty On-Board Diagnostics Regulations Approved amendments to the light and medium-duty vehicle and heavy duty engine OBD regulations.	5/28/2009 4/6/10 EO
Smog Check Improvements BAR adopted amendments to implement changes in state law and SIP commitments adopted by CARB between 1996 and 2007.	5/7/09 by BAR 6/9/09 EO
AB 118 Air Quality Improvement Program Guidelines The Air Quality Improvement Program provides for up to $50 million per year for seven years beginning in 2009-10 for vehicle and equipment projects that reduce criteria pollutants, air quality research, and advanced technology workforce training. The AQIP Guidelines describe minimum administrative, reporting, and oversight requirements for the program, and provide general criteria for how the program shall be implemented.	04/23/09 08/28/09 EO
Pesticide Element Reduce volatile organic compound (VOC) emissions from the application of agricultural field fumigants in the South Coast, Southeast Desert, Ventura County, San Joaquin Valley, and Sacramento Metro federal ozone nonattainment areas.	4/20/09 10/12/09 EO (2) 8/2/11 EO
Low Carbon Fuel Standard Approved new standards to lower the carbon content of fuels.	4/20/09 11/25/09 EO
Pesticide Element for San Joaquin Valley DPR Director approved pesticide ROG emission limit of 18.1 tpd and committed to implement restrictions on non-fumigant pesticide use by 2014 in the San Joaquin Valley.	4/7/09 DPR
Tire Pressure Inflation Regulation Approved a regulation requiring automotive service providers to perform tire pressure checks as part of every service.	3/26/09 2/4/10 EO
Sulfur Hexafluoride from Non-Utility and Non-Semiconductor Applications Approved a regulation to phase out use of Sulfur Hexafluoride over the next several years.	2/26/09 11/12/09 EO
Semiconductor Operations Approved a regulation to set standards to reduce fluorinated gas emissions from the semiconductor and related devices industry.	2/26/09 10/23/09 EO
Plug-In Hybrid Electric Vehicles Test Procedure Amendments Amends test procedures to address plug-in-hybrid electric vehicles.	1/23/09 12/2/09 EO
In-Use Off-Road Diesel-Fueled Fleets Amendments Makes administrative changes to recognize delays in the supply of retrofit control devices.	1/22/09
Aftermarket Critical Emission Parts on Highway Motorcycles Allows for the sale of certified critical emission parts by aftermarket manufacturers.	1/22/09 6/19/09 EO
Cleaner In-Use Heavy-Duty Diesel Trucks (Truck and Bus Regulation) Approved a regulation to reduce diesel particulate matter and oxides of nitrogen through fleet modernization and exhaust retrofits. Makes enforceability changes to public fleet, off-road equipment, and portable equipment regulations.	12/11/08 10/19/09 EO 10/23/09 EO
Large Spark-Ignition Engine Amendments Approved amendments to reduce evaporative, permeation, and exhaust emissions from large spark-ignition (LSI) engines equal to or below 1 liter in displacement.	11/1/08 3/12/09 EO
Small Off-Road Engine (SORE) Amendments Approved amendments to address the excessive accumulation of emission credits.	11/21/08 2/24/10 EO
Proposed AB 118 Air Quality Guidelines for the Air Quality Improvement Program and the Alternative and Renewable Fuel and Vehicle and Technology Program. The California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007 (AB 118) requires CARB to develop guidelines for both the Alternative and Renewable Fuel and Vehicle Technology Program and the Air Quality Improvement Program to ensure that both programs do not adversely impact air quality.	09/25/08 EO 05/20/09
Portable Outboard Marine Tanks and Components (part of Additional Evaporative Emission Standards) Approved a regulation that establishes permeation and emission standards for new portable outboard marine tanks and components.	9/25/08 7/20/09 EO

Cleaner Fuel in Ocean Going Vessels Approved a regulation that requires use of low sulfur fuel in ocean-going ship main engines, and auxiliary engines and boilers.	7/24/08 4/16/09 EO
Spark-Ignition Marine Engine and Boat Amendments Provides optional compliance path for > 500 hp sterndrive/inboard marine engines.	7/24/08 6/5/09 EO
Zero emission vehicles Updated California's ZEV requirements to provide greater flexibility with respect to fuels, technologies, and simplifying compliance pathways. Amendments give manufacturers increased flexibility to comply with ZEV requirements by giving credit to plug-in hybrid electric vehicles and establishing additional ZEV categories in recognition of new developments in fuel cell vehicles and battery electric vehicles.	3/27/08 12/17/08 EO
Amendments to the Verification Procedure, Warranty, and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines Adds verification requirements for control technologies that only reduce NOx emissions, new reduction classifications for NOx reducing technologies, new testing requirements, and conditional extensions for verified technologies.	1/24/08 12/4/08 EO
Gaseous Pollutant Measurement Allowances for In-Use Heavy-Duty Diesel Compliance Measurement accuracy margins are to be determined through an ongoing comprehensive testing program performed by an independent contractor. Amendments include these measurement accuracy margins into the regulation.	12/6/07 10/14/08 EO
Ocean-Going Vessels While at Berth (aka Ship Hoteling) - Auxiliary Engine Cold Ironing and Clean Technology Approved a regulation that reduces emissions from auxiliary engines on ocean-going ships while at-berth.	12/6/07 10/16/08 EO
In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Rail Yard Facilities Approved a regulation that establishes emission standards for in-use, heavy-duty diesel-fueled vehicles that transport cargo to and from California's ports and intermodal rail facilities.	12/6/07 10/12/08 EO
Commercial Harbor Craft Approved a regulation that establishes in-use and new engine emission limits for both auxiliary and propulsion diesel engines on ferries, excursion vessels, tugboats, and towboats.	11/15/07 9/2/08 EO
Suggested Control Measure for Architectural Coatings Amendments Approved amendments to reduce the recommended VOC content of 19 categories of architectural coatings.	10/26/07
Aftermarket Catalytic Converter Requirements Approved amendments that establish more stringent emission performance and durability requirements for used and new aftermarket catalytic converters offered for sale in California.	10/25/07 2/21/08 NOD
Limiting Ozone Emissions from Indoor Air Cleaning Devices Approved ozone emission limit of 0.050 ppm for portable indoor air cleaning devices in response to requirements of AB 2276 (2006).	9/27/07 8/7/08 EO
Pesticide Commitment for Ventura County in 1994 SIP Approved substitution of excess ROG emission reductions from state motor vehicle program for 1994 SIP reduction commitment from pesticide application in Ventura County.	9/27/07 11/30/07 EO
In-Use Off-Road Diesel Equipment Approved a regulation that requires off-road diesel fleet owners to modernize their fleets and install exhaust retrofits.	7/26/07 4/4/08 EO
Emission Control and Environmental Performance Label Regulations Approved amendments to add a Global Index Label and modify the formal of the Smog Index Label on new cars.	6/21/07 5/2/08 EO

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

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

2007-09 Model-year heavy duty urban bus engines and the fleet rule for transit agencies Adopted amendments to align urban bus emission limits with on-road heavy duty truck emission limits and allow for the purchase of non- complying buses under the condition that bus turnover increase to offset NOx increases.	10/20/05 10/27/05 7/28/06 EO
Portable fuel containers (part 2 of 2) Approved amendments to revise spout and automatic shutoff design.	9/15/05 7/28/06 EO
Portable Fuel Containers (part 1 of 2) Approved amendments to include kerosene containers in the definition of portable fuel containers.	9/15/05 11/9/05 NOD
2007-09 Model-year heavy duty urban bus engines and the fleet rule for transit agencies Adopted amendments to require all transit agencies in SCAQMD to purchase only alternate fuel versions of new buses.	9/15/05 Superceded by 10/20/05
Reid vapor pressure limit emergency rule Approved amendments to relax Reid vapor pressure limit to accelerate fuel production for Hurricane Katrina victims.	9/8/05 Operative for September and October 2005 only
Heavy-Duty Truck OBD Approved a regulation to require on-board diagnostic (OBD) systems for new gas and diesel trucks, similar to the systems on passenger cars.	7/21/05 12/28/05 EO
Definition of Large Confined Animal Facility Adopted a regulation to define the size of a large CAF for the purposes of air quality permitting and reduction of ROG emissions to the extent feasible.	6/23/05 4/13/06 EO
ATCM for stationary compression ignition engines Approved emergency amendments (3/17/05) and permanent amendments (5/26/05) to relax the diesel PM emission limits on new stationary diesel engines to current off-road engine standards to respond to the lack of availability of engines meeting the original ATCM standard.	3/17/05 5/26/05 7/29/05 EO
Transit Fleet Rule Approved amendments to add emission limits for non-urban bus transit agency vehicles, require lower bus and truck fleet-average NOx and PM emission limits, and clarify emission limits for CO, NMHC, and formaldehyde.	2/24/05 10/19/05 NOD
Thermal Spraying ATCM Approved a regulation to reduce emissions of hexavalent chromium and nickel from thermal spraying operations.	12/9/04 7/20/05 EO
Tier 4 Standards for Small Off-Road Diesel Engines (SORE) Approved new emission standards for off-road diesel engines to be phased in between 2008 and 2015.	12/9/04 10/21/05 EO
Emergency Regulatory Amendment Delaying the January 1, 2005 Implementation Date for the Diesel Fuel Lubricity Standard Adopted an emergency regulation delaying the lubricity standard compliance deadline by five months to respond to fuel pipeline contamination problems.	11/24/04 12/10/04 EO
Enhanced vapor recovery compliance extension Approved amendments to the EVR regulation to extend the compliance date for onboard refueling vapor recovery compatibility to the date of EVR compliance.	11/18/04 2/11/05 EO
CaRFG Phase 3 amendments Approved amendments correcting errors and streamlining requirements for compliance and enforcement of CaRFG Phase 3 regulations adopted in 1999.	11/18/04
Clean diesel fuel for harborcraft and intrastate locomotives Approved a regulation that required harborcraft and locomotives operating solely within California to use clean diesel fuel.	11/18/04 3/16/05 EO
Nonvehicular Source, Consumer Product, and Architectural Coating Fee Regulation Amendment Approved amendments to fee regulations to collect supplemental fees when authorized by the Legislature.	11/18/04
Greenhouse gas limits for motor vehicles Approved a regulation that sets the first ever greenhouse gas emission standards on light and medium duty vehicles starting with the 2009 model year.	9/24/04 8/4/05 EO

Gasoline vapor recovery system equipment defects list Approved the addition of defects to the VRED list for use by compliance inspectors.	8/24/04 6/22/05 EO
Unihose gasoline vapor recovery systems Approved an emergency regulation and an amendment to delay the compliance date for unihose installation to the date of dispenser replacement.	7/22/04 11/24/04 EO
General Idling Limits for Diesel Trucks Approved a regulation that limits idling of heavy-duty diesel trucks operating in California to five minutes, with exceptions for sleeper cabs.	7/22/04
Urban bus engines/fleet rule for transit agencies Approved amendments to allow for the purchase of hybrid diesel buses and revise the zero emission bus demonstration and purchase timelines.	6/24/04
Engine Manufacturer Diagnostics Approved a regulation that would require model year 2007 and later heavy duty truck engines to be equipped with engine diagnostic systems to detect malfunctions of the emission control system.	5/20/04
Chip Reflash Approved a voluntary program and a backstop regulation to reduce heavy duty truck NOx emissions through the installation of new software in the engine's electronic control module.	3/25/04 3/21/05 EO
Portable equipment registration program (PERP) Approved amendments to allow uncertified engines to be registered until December 31, 2005, to increase fees, and to modify administrative requirements.	2/26/04 1/7/05 EO 6/21/05 EO
Portable Diesel Engine ATCM Adopted a regulation to reduce diesel PM emissions from portable engines through a series of emission standards that increase in stringency through 2020.	2/26/04 1/4/05 EO
California motor vehicle service information rule Adopted amendments to allow for the purchase of heavy duty engine emission-related service information and diagnostic tools by independent service facilities and aftermarket parts manufacturers.	1/22/04 5/20/04
Transportation Refrigeration Unit ATCM Adopted a regulation to reduce diesel PM emissions from transport refrigeration units by establishing emission standards and facility reporting requirements to streamline inspections.	12/11/03 2/26/04 11/10/04 EO
Diesel engine verification procedures Approved amendments that reduced warranty coverage to the engine only, delayed the NOx reduction compliance date to 2007, added requirements for proof-of-concept testing for new technology, and harmonized durability requirements with those of U.S. EPA.	12/11/03 2/26/04 10/17/04
Chip Reflash Approved a voluntary program and a backstop regulation to reduce heavy duty truck NOx emissions through the installation of new software in the engine’s electronic control module.	12/11/03 3/27/04 3/21/05 EO
Revised tables of maximum incremental reactivity values Approved the addition of 102 more chemicals with associated maximum incremental reactivity values to existing regulation allowing these chemicals to be used in aerosol coating formulations.	12/3/03
Stationary Diesel Engines ATCM Adopted a regulation to reduce diesel PM emissions from stationary diesel engines through the use of clean fuel, lower emission standards, operational practices.	11/20/03 12/11/03 2/26/2004 9/27/04 EO
Solid waste collection vehicles Adopted a regulation to reduce toxic diesel particulate emissions from solid waste collection vehicles by over 80 percent by 2010. This measure is part of ARB's plan to reduce the risk from a wide range of diesel engines throughout California.	9/25/03 5/17/04 EO
Small off-road engines (SORE) Adopted more stringent emission standards for the engines used in lawn and garden and industrial equipment, such as string trimmers, leaf blowers, walk-behind lawn mowers, generators, and lawn tractors.	9/25/03 7/26/04 EO

Off-highway recreational vehicles Changes to riding season restrictions.	7/24/03
Clean diesel fuel Adopted a regulation to reduce sulfur levels and set a minimum lubricity standard in diesel fuel used in vehicles and off-road equipment in California, beginning in 2006.	7/24/03 5/28/04 EO
Ozone Transport Mitigation Amendments Adopted amendments to require upwind districts to (1) have the same no-net-increase permitting thresholds as downwind districts, and (2) Adopt "all feasible measures."	5/22/03 10/2/03 NOD
Zero emission vehicles Updated California's ZEV requirements to support the fuel cell car development and expand sales of advanced technology partial ZEVs (like gasoline-electric hybrids) in the near-term, while retaining a role for battery electric vehicles.	3/27/03 12/19/03 EO
Heavy duty gasoline truck standards Aligned its existing rules with new, lower federal emission standards for gasoline-powered heavy-duty vehicles starting in 2008.	12/12/02 9/23/03 EO
Low emission vehicles II Minor administrative changes.	12/12/02 9/24/03 EO
Gasoline vapor recovery systems test procedures Approved amendments to add advanced vapor recovery technology certification and testing standards.	12/12/02 7/1/03 EO 10/21/03 EO
CaRFG Phase 3 amendments Approved amendments to allow for small residual levels of MTBE in gasoline while MTBE is being phased out and replaced by ethanol.	12/12/02 3/20/03 EO
School bus Idling Adopted a measure requiring school bus drivers to turn off the bus or vehicle engine upon arriving at a school and restart it no more than 30 seconds before departure in order to limit children's exposure to toxic diesel particulate exhaust.	12/12/02 5/15/03 EO
California Interim Certification Procedures for 2004 and Subsequent Model Year Hybrid-Electric Vehicles in the Urban Transit Bus and Heavy-Duty Vehicle Classes Regulation Amendment Adopted amendments to allow diesel-path transit agencies to purchase alternate fuel buses with higher NOx limits, establish certification procedures for hybrid buses, and require lower fleet-average PM emission limits.	10/24/02 9/2/03 EO
CaRFG Phase 3 amendments Approved amendments delaying removal of MTBE from gasoline by one year to 12/31/03.	7/25/02 11/8/02 EO
Diesel retrofit verification procedures, warranty, and in-use compliance requirements Adopted regulations to specify test procedures, warranty, and in-use compliance of diesel engine PM retrofit control devices.	5/16/02 3/28/03 EO
On-board diagnostics for cars Adopted changes to the On-Board Diagnostic Systems (OBD II) regulation to improve the effectiveness of OBD II systems in detecting motor vehicle emission-related problems.	4/25/02 3/7/03 EO
Voluntary accelerated light duty vehicle retirement regulations Establishes standards for a voluntary accelerated retirement program.	2/21/02 11/18/02 EO
Residential burning Adopted a measure to reduce emissions of toxic air contaminants from outdoor residential waste burning by eliminating the use of burn barrels and the outdoor burning of residential waste materials other than natural vegetation.	2/21/02 12/18/02 EO
California motor vehicle service information rule Adopted regulations to require light- and medium-duty vehicle manufacturers to offer for sale emission-related service information and diagnostic tools to independent service facilities and aftermarket parts manufacturers.	12/13/01 7/31/02 EO
Vapor recovery regulation amendments Adopted amendments to expand the list of specified defects requiring equipment to be removed from service.	11/15/01 9/27/02 EO

Distributed generation guidelines and regulations Adopted regulations requiring the permitting by ARB of distributed generation sources that are exempt from air district permitting and approved guidelines for use by air districts in permitting non-exempt units.	11/15/01 7/23/02 EO
Low emission vehicle regulations (LEV II) Approved amendments to apply PM emission limits to all new gasoline vehicles, extend gasoline PZEV emission limits to all fuel types, and streamline the manufacturer certification process.	11/15/01 8/6/02 EO
Gasoline vapor recovery systems test methods and compliance procedures Adopted amendments to add test methods for new technology components, streamline test methods for liquid removal equipment, and***.	10/25/01 7/9/02 EO
Heavy-duty diesel trucks Adopted amendments to emissions standards to harmonize with EPA regulations for 2007 and subsequent model year new heavy-duty diesel engines.	10/25/01
Inboard and sterndrive marine engines Lower emission standards for 2003 and subsequent model year inboard and sterndrive gasoline-powered engines in recreational marine vessels.	7/26/01 6/6/02 EO
Asbestos from construction, grading, quarrying, and surface mining Adopted an Airborne Toxic Control Measure for construction, grading, quarrying, and surface mining operations requiring dust mitigation for construction and grading operations, road construction and maintenance activities, and quarries and surface mines to minimize emissions of asbestos-laden dust.	7/26/01 6/7/02 EO
Zero emission vehicle infrastructure and standardization of electric vehicle charging equipment Adopted amendments to the ZEV regulation to alter the method of quantifying production volumes at joint-owned facilities and to add specifications for standardized charging equipment.	6/28/01 5/10/02 EO
Pollutant transport designation Adopted amendments to add two transport couples to the list of air basins in which upwind areas are required to adopt permitting thresholds no less stringent than those adopted in downwind areas.	4/26/01
Zero emission vehicle regulation amendments Adopted amendments to reduce the numbers of ZEVs required in future years, add a PZEV category and grant partial ZEV credit, modify the ZEV range credit, allow hybrid-electric vehicles partial ZEV credit, grant ZEV credit to advanced technology vehicles, and grant partial ZEV credit for several other minor new programs.	1/25/01 12/7/01 EO 4/12/02 EO
Heavy duty diesel engines supplemental test procedures Approved amendments to extend "Not-To-Exceed" and EURO III supplemental test procedure requirements through 2007 when federal requirements will include these tests.	12/7/00
Light and medium duty low emission vehicle alignment with federal standards Approved amendments that require light and medium duty vehicles sold in California to meet the more restrictive of state or federal emission standards.	12/7/00 12/27/00 EO
Exhaust emission standards for heavy duty gas engines Adopted amendments that establish 2005 emission limits for heavy duty gas engines that are equivalent to federal limits.	12/7/00 12/27/00 EO
CaRFG Phase 3 amendments Approved amendments to regulate the replacement of MTBE in gasoline with ethanol.	11/16/00 4/25/01 EO
CaRFG Phase 3 test methods Approved amendments to gasoline test procedures to quantify the olefin content and gasoline distillation temperatures.	11/16/00 7/11/01 EO 8/28/01 EO
Diesel risk reduction plan Adopted plan to reduce toxic particulate from diesel engines through retrofits on existing engines, tighter standards for new engines, and cleaner diesel fuel.	9/28/00
Conditional rice straw burning regulations Adopted regulations to limit rice straw burning to fields with demonstrated disease rates reducing production by more than 5 percent.	9/28/00

Asbestos from unpaved roads Tightened an existing Air Toxic Control Measure to prohibit the use of rock containing more than 0.25% asbestos on unsurfaced roads.	7/20/00
Enhanced vapor recovery emergency regulation Adopted a four-year term for equipment certifications.	5/22/01 EO
Enhanced vapor recovery Adopted amendments to require the addition of components to reduce spills and leakage, adapt to onboard vapor recovery systems, and continuously monitor system operation and report equipment leaks immediately.	3/23/00 7/25/01 EO
Agricultural burning smoke management Adopted amendments to add marginal burn day designations, require day-specific burn authorizations by districts, and smoke management plans for larger prescribed burn projects.	3/23/00 1/22/01 EO
Urban transit buses Adopted a public transit bus fleet rule and emissions standards for new urban buses that mandates a lower fleet-average NOx emission limit, PM retrofits, lower sulfur fuel use, and purchase of specified percentages of zero emission buses in future years.	1/27/00 2/24/00 11/22/00 EO 5/29/01 EO
Small Off-Road (diesel) Equipment (SORE) Adopted amendments to conform with new federal requirements for lower and engine power-specific emission limits, and for the averaging, banking, and trading of emissions among SORE manufacturers.	1/28/00
CaRFG Phase 3 MTBE phase out Adopted regulations to enable refiners to produce gasoline without MTBE while preserving the emissions benefits of Phase 2 cleaner burning gasoline.	12/9/99 6/16/00 EO
Portable fuel cans Adopted a regulation requiring that new portable fuel containers, used to refuel lawn and garden equipment, motorcycles, and watercraft, be spill-proof beginning in 2001.	9/23/99 7/6/00 EO
Clean fuels at service stations Adopted amendments rescinding requirements applicable to SCAB in 1994-1995, modifying the formula for triggering requirements, and allowing the Executive Officer to make adjustments to the numbers of service stations required to provide clean fuels.	7/22/99
Gasoline vapor recovery Adopted amendments to certification and test methods.	6/24/99
Reformulated gasoline oxygenate Adopted amendments rescinding the requirement for wintertime oxygenate in gasoline sold in the Lake Tahoe Air Basin and requiring the statewide labeling of pumps dispensing gasoline containing MTBE.	6/24/99
Marine pleasurecraft Adopted regulations to control emissions from spark-ignition marine engines, specifically, outboard marine engines and personal watercraft.	12/11/98 2/17/00 EO 6/14/00 EO
Voluntary accelerated light duty vehicle retirement Adopted regulation setting standards for voluntary accelerated retirement program.	12/10/98 10/22/99 EO
Off-highway recreational vehicles and engines Approved amendments to allow non-complying vehicles to operate in certain seasons and in certain ORV-designated areas.	12/10/98 10/22/99 EO
On-road motorcycles Amended on-road motorcycle regulations, to lower the tailpipe emission standards for ROG and NOx.	12/10/98
Portable equipment registration program (PERP) Approved amendments to exclude non-dredging equipment operating in OCS areas and equipment emitting hazardous pollutants, include NSPS Part OOO rock crushers, require SCR emission limits and onshore emission offsets from dredging equipment operating in OCS areas, set catalyst emission limits for gasoline engines, and relieve certain retrofitted engines from periodic source testing.	12/10/98
Liquid petroleum gas motor fuel specifications Approved amendment rescinding 5% propene limit and extending 10% limit indefinitely.	12/11/98

Reformulated gasoline Approved amendments to rescind the RVP exemption for fuel with 10% ethanol and allow for oxygen contents up to 3.7% if the Predictive Model weighted emissions to not exceed original standards.	12/11/98
Low-emission vehicle program (LEV II) Adopted regulations adding exhaust emission standards for most sport utility vehicles, pick-up trucks and mini-vans, lowering tailpipe standards for cars, further reducing evaporative emission standards, and providing additional means for generating zero-emission vehicle credits.	11/5/98 9/17/99 EO
Off-road engine aftermarket parts Approved implementation of a new program to test and certify aftermarket parts in gasoline and diesel, light-duty through heavy duty, engines used in off-road vehicles and equipment.	11/19/98 10/1/99 EO 7/18/00 EO
Off-road spark ignition engines Adopted new emission standards for small and large spark ignition engines for off-road equipment, a new engine certification program, an in-use compliance testing program, and a three-year phase-in for large LSI.	10/22/98
Gasoline deposit control additives Adopted amendments to decertify pre-RFG additives, tighten the inlet valve deposit limits, add a combustion chamber deposit limit, and modify the test procedures to align with the characteristics of reformulated gasoline formulations.	9/24/98 4/5/99 EO
Stationary source test methods Adopted amendments to stationary source test methods to align better with federal methods.	8/27/98 7/2/99 EO
Locomotive MOA for South Coast Memorandum of agreement (MOA) signed by ARB, U.S. EPA and major railroads to concentrate cleaner locomotives in the South Coast by 2010 and fulfill 1994 ozone SIP commitment.	7/2/98
Gasoline vapor recovery Adopted amendments to certification and test methods to add methods for onboard refueling vapor recovery, airport refuelers, and underground tank interconnections, and make minor changes to existing methods.	5/21/98 8/27/98
Reformulated gasoline Approved amendments to rescind the wintertime oxygenate requirement, allow for sulfur content averaging, and make other minor technical amendments.	8/27/98
Ethylene oxide sterilizers Adopted amendments to the ATCM to streamline source testing requirements, add EtO limits in water effluent from control devices, and make other minor changes.	5/21/98
Chrome platers Adopted amendments to ATCM to harmonize with requirements of federal NESHAP standards for chrome plating and chromic acid anodizing facilities.	5/21/98
On-road heavy-duty vehicles Approved amendments to align on-road heavy duty vehicle engine emission standards with EPA's 2004 standards and align certification, testing, maintenance, and durability requirements with those of U.S. EPA.	4/23/98 2/26/99 EO
Small off-road engines (SORE) Approved amendments to grant a one-year delay in implementation, relaxation of emissions standards for non-handheld engines, emissions durability requirements, averaging/banking/trading, harmonization with the federal diesel engine regulation, and modifications to the production line testing requirements.	3/26/98
Heavy duty vehicle smoke inspection program Adopted amendments to require annual smoke testing, set opacity limits, and exempt new vehicles from testing for the first four years.	12/11/97 3/2/98 EO

Light-duty vehicle off-cycle emissions Adopted standards to control excess emissions from aggressive driving and air conditioner use in light duty vehicles and added two light duty vehicle test methods for certification of new vehicles under these standards.	7/24/97 3/19/98 EO
Enhanced evaporative emissions standards Adopted amendments extending the compliance date for ultra-small volume vehicle manufacturers by one year.	5/22/97
Emission reduction credit program Adopted standards for District establishment of ERC programs including certification, banking, use limitation, and reporting requirements.	5/22/97
Lead as a toxic air contaminant Adopted an amendment to designate inorganic lead as a toxic air contaminant.	4/24/97
Portable engine registration program (PERP) Adopted standards for (1) the permitting of portable engines by ARB and (2) District recognition and enforcement of permits.	3/27/97
Liquefied petroleum gas Adopted amendments to extend the compliance deadline from January 1, 1997, to January 1, 1999, for the 5% propene limit in liquefied petroleum gas used in motor vehicles.	3/27/97
Onboard diagnostics, phase II Adopted amendments to extend the phase-in of enhanced catalyst monitoring, modify misfire detection requirements, add PVC system and thermostat monitoring requirements, and require manufacturers to sell diagnostic tools and service information to repair shops.	12/12/96
Pollutant transport designation Adopted amendments to modify transport couples from the Broader Sacramento area and add couples to the newly formed Mojave Desert and Salton Sea Air Basins.	11/21/96
Diesel fuel certification test methods Approved amendments specifying the test methods used for quantifying the constituents of diesel fuel.	10/24/96 6/4/97 EO
Wintertime requirements for utility engines & off-highway vehicles Optional hydrocarbon and NOx standards for snow throwers and ice augers, raising CO standard for specialty vehicles under 25hp.	9/26/96
Large off-road diesel Statement of Principles National agreement between ARB, U.S. EPA, and engine manufacturers to reduce emissions from heavy-duty off-road diesel equipment four years earlier than expected in the 1994 SIP for ozone.	9/13/96
Regulatory improvement initiative Rescinded two regulations relating to fuel testing in response to Executive Order W-127-95.	5/30/96
Zero emission vehicles Adopted amendments to eliminate zero emission vehicle quotas between 1998 and 2002, and approved MOUs with seven automobile manufacturers to accelerate release of lower emission "49 state" vehicles.	3/28/96 7/24/96 EO
CaRFG variance requirements Approved amendments to add a per gallon fee on non-compliant gasoline covered by a variance and to made administrative changes in variance processing and extension.	1/25/96 2/5/96 EO 4/2/96 EO
Utility and lawn and garden equipment engines Adopted an amendment to relax the CO standard from 300 to 350 ppm for Class I and II utility engines.	1/25/96
National security exemption of military tactical vehicles Such vehicles would not be required to adhere to exhaust emission standards.	12/14/95
CaRFG regulation amendments Approved amendments to allow for downstream addition of oxygenates and expansion of compliance options for gasoline formulation.	12/14/95
Required additives in gasoline (deposit control additives) Terms, definitions, reporting requirements, and test procedures for compliance are to be clarified.	11/16/95

CaRFG test method amendments Approved amendments to designate new test methods for benzene, aromatic hydrocarbon, olefin, and sulfur content of gasoline.	10/26/95
Motor vehicle inspection and maintenance program Handled by BAR.	10/19/95 by BAR
Antiperspirants and deodorants, consumer products, and aerosol coating products Ethanol exemption for all products, modifications to aerosol special requirements, modifications for regulatory language consistency, modifications to VOC definition.	9/28/95
Low emission vehicle (LEV III) standards Reactivity adjustment factors, introduction of medium-duty ULEVs, window labels, and certification requirements and test procedures for LEVs.	9/28/95
Medium- and heavy-duty gasoline trucks Expedited introduction of ultra-low emission medium-duty vehicles and lower NOx emission standards for heavy-duty gasoline trucks to fulfill a 1994 ozone SIP commitment.	9/1/95
Retrofit emission standards: all vehicle classes to be included in the alternate durability test plan, kit manufacturers to be allowed two years to validate deterioration factors under the test plan, update retrofit procedures allowing manufacturers to disable specific OBDs if justified by law.	7/27/95
Gasoline vapor recovery systems Adopts revised certification and test procedures.	6/29/95
Onboard refueling vapor recovery standards 1998 and subsequent MY engine cars, LD trucks, and MD trucks less than 8500 GVWR.	6/29/1995 4/24/96 EO
Heavy duty vehicle exhaust emission standards for NOx Amendments to standards and test procedures for 1985 and subsequent MY HD engines, amendments to emission control labels, amendments to Useful Life definition and HD engines and in-use vehicle recalls.	6/29/95
Aerosol coatings regulation Adopted regulation to meet California Clean Air Act requirements and a 1994 ozone SIP commitment.	3/23/95
Periodic smoke inspection program Delays start of PSIP from 1995 to 1996.	12/8/94
Onboard diagnostics phase II Amendments to clarify regulation language, ensure maximum effectiveness, and address manufacturer concerns regarding implementation.	12/8/94
Alternative control plan (ACP) for consumer products A voluntary, market-based VOC emissions cap upon a grouping of consumer products, flexible by manufacturer that will minimize overall costs of emission reduction methods and programs.	9/22/94
Diesel fuel certification: new specifications for diesel engine certification fuel, amended oxygen specification for CNG certification fuel, and amended commercial motor vehicle liquefied petroleum gas regulations.	9/22/94
Utility and lawn and garden equipment (UGLE) engines Modification to emission test procedures, ECLs, defects warranty, quality-audit testing, and new engine compliance testing.	7/28/94
Evaporative emissions standards and test procedures Adopted evaporative emissions standards for medium-duty vehicles.	2/10/94
Off-road recreational vehicles Adopted emission control regulations for off-road motorcycles, all-terrain vehicles, go-karts, golf carts, and specialty vehicles.	1/1/94
Perchloroethylene from dry cleaners Adopted measure to control perchloroethylene emissions from dry cleaning operations.	10/1/93

Wintertime oxygenate program Amendments to the control time period for San Luis Obispo County, exemption for small retailers bordering Nevada, flexibility in gasoline delivery time, calibration of ethanol blending equipment, gasoline oxygen content test method.	9/9/93
Onboard diagnostic phase II	7/9/93
Urban transit buses Amended regulation to tighten state NOx and particulate matter (PM) standards for urban transit buses beyond federal standards beginning in 1996.	6/10/93
1-year implementation delay in emission standards for utility engines	4/8/93
Non-ferrous metal melting Adopted Air Toxic Control Measure for emissions of cadmium, arsenic, and nickel from non-ferrous metal melting operations.	1/1/93
Certifications requirements for low emission passenger cars, light-duty trucks & medium duty vehicles	1/14/93
Airborne toxic control measure for emissions of toxic metals from non-ferrous metal melting	12/10/92
Periodic self-inspection program Implemented state law establishing a periodic smoke self-inspection program for fleets operating heavy-duty diesel-powered vehicles.	12/10/92
Notice of general public interest for consumer products	11/30/92
Substitute fuel or clean fuel incorporated test procedures	11/12/92
New vehicle testing using CaRFG Phase 2 gasoline Approved amendments to require the use of CaRFG Phase 2 gasoline in the certification of exhaust emissions in new vehicle testing.	8/13/92
Standards and test procedures for alternative fuel retrofit systems	5/14/92
Alternative motor vehicle fuel certification fuel specification	3/12/92
Heavy-duty off-road diesel engines Adopted the first exhaust emission standards and test procedures for heavy-duty off-road diesel engines beginning in 1996.	1/9/92
Wintertime oxygen content of gasoline Adopted regulation requiring the addition of oxygenates to gasoline during winter to satisfy federal Clean Air Act mandates for CO nonattainment areas.	12/1/91
CaRFG Phase 2 Adopted CaRFG phase 2 specifications including lowering vapor pressure, reducing the sulfur, olefin, aromatic, and benzene content, and requiring the year-round addition of oxygenates to achieve reductions in ROG, NOx, CO, oxides of sulfur (SOx) and toxics.	11/1/91
Low emissions vehicles amendments revising reactivity adjust factor (RAF) provisions and adopting a RAF for M85 transitional low emission vehicles	11/14/91
Onboard diagnostic, phase II	11/12/91
Onboard diagnostics for light-duty trucks and light & medium-duty motor vehicles	9/12/91
Utility and lawn & garden equipment Adopted first off-road mobile source controls under the California Clean Air Act regulating utility, lawn and garden equipment.	12/1/90
Control for abrasive blasting	11/8/90
Roadside smoke inspections of heavy-duty vehicles Adopted regulations implementing state law requiring a roadside smoke inspection program for heavy-duty vehicles.	11/8/90
CaRFG Phase I Adopted CaRFG Phase I reformulated gasoline regulations to phase-out leaded gasoline, reduce vapor pressure, and require deposit control additives.	9/1/90

Low-emission vehicle (LEV) and clean fuels Adopted the landmark LEV/clean fuel regulations which called for the gradual introduction of cleaner cars in California. The regulations also provided a mechanism to ensure the availability of alternative fuels when a certain number of alternative fuel vehicles are sold.	9/1/90
Evaporative emissions from vehicles Modified test procedure to include high temperatures (up to 105 F) and ensure that evaporative emission control systems function properly on hot days.	8/9/90
Dioxins from medical waste incinerators Adopted Airborne Toxic Control Measure to reduce dioxin emissions from medical waste incinerators.	7/1/90
CA Clean Air Act guidance for permitting Approved California Clean Air Act permitting program guidance for new and modified stationary sources in nonattainment areas.	7/1/90
Medium duty vehicle emission standards Adopted three new categories of low emission MDVs, required minimum percentages of production, and established production credit and trading.	6/14/90
Medium-duty vehicles Amended test procedures for medium-duty vehicles to require whole-vehicle testing instead of engine testing. This modification allowed enforcement of medium-duty vehicle standards through testing and recall.	6/14/90
Ethylene oxide sterilizers Adopted Airborne Toxic Control Measure to reduce ethylene oxide emissions from sterilizers and aerators.	5/10/90
Asbestos in serpentine rock Adopted Airborne Toxic Control Measure for asbestos-containing serpentine rock in surfacing applications.	4/1/90
Certification procedure for aftermarket parts	2/8/90
Residential woodstoves Approved suggested control measure for the control of emissions from residential wood combustion.	11/1/89
On-Board Diagnostic Systems II Adopted regulations to implement the second phase of on-board diagnostic requirements which alert drivers of cars, light-trucks and medium-duty vehicles when the emission control system is not functioning properly.	9/1/89
Cars and light-duty trucks Adopted regulations to reduce ROG and CO emissions from cars and light trucks by 35 percent.	6/1/89
Reformulated Diesel Fuel Adopted regulations requiring the use of clean diesel fuel with lower sulfur and aromatic hydrocarbons beginning in 1993.	11/1/88
Vehicle Recall Adopted regulations implementing a recall program which requires auto manufacturers to recall and fix vehicles with inadequate emission control systems (Vehicles are identified through in-use testing conducted by the ARB).	9/1/88
Suggested control measure for oil sumps Approved a suggested control measure to reduce emissions from sumps used in oil production operations.	8/1/88
Suggested control measure for boilers Approved suggested control measure to reduce NOx emissions from industrial, institutional, and commercial boilers, steam generators and process heaters.	9/1/87
Benzene from service stations Adopted Airborne Toxic Control Measure to reduce benzene emissions from retail gasoline service stations (Also known as Phase II vapor recovery).	7/1/87
Agricultural burning guidelines Amended existing guidelines to add provisions addressing wildland vegetation management.	11/1/86

Heavy-duty vehicle certification Amended certification of heavy-duty diesel and gasoline-powered engines and vehicles to align with federal standards.	4/1/86
Cars and light-duty trucks Adopted regulations reducing NOx emissions from passenger cars and light-duty trucks by 40 percent.	4/1/86
Sulfur in diesel fuel Removed exemption for small volume diesel fuel refiners.	6/1/85
On-Board Diagnostics I Adopted regulations requiring the use of on-board diagnostic systems on gasoline-powered vehicles to alert the driver when the emission control system is not functioning properly.	4/1/85
Suggested control measure for wood coatings Approved a suggested control measure to reduce emissions from wood furniture and cabinet coating operations.	3/1/85
Suggested control measure for resin manufacturing Approved a suggested control measure to reduce ROG emissions from resin manufacturing.	1/1/85

D.7 TRANSPORTATION CONFORMITY

[S*ection D.7 provided by the California Air Resources Board*]

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

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

A SIP analyzes the region's total emissions inventory from all sources for purposes of demonstrating rate of progress (RFP), attainment, or maintenance. The portion of the total emissions inventory from on-road highway and transit vehicles in these analyses becomes the "motor vehicle emissions budget."[96] Motor vehicle emissions budgets are the mechanism for ensuring that transportation planning activities conform to the SIP. Budgets are set for each criteria pollutant or its precursors, for all RFP milestone years and attainment years. Subsequent transportation plans and programs produced by transportation planning agencies are required to conform to the SIP by demonstrating

[96] Federal Transportation Conformity Regulations are found in 40 CFR Part 51, subpart T – Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Title 23 U.S.C. of the Federal Transit Laws.

that the emissions from the proposed plan, program, or project do not exceed the budget levels established in the applicable SIP.

D.7.1 PM2.5 Requirements for Conformity

The United States Environmental Protection Agency (U.S. EPA) has promulgated separate rule makings addressing the PM2.5 emission categories and precursors that must be considered in PM2.5 transportation conformity determinations.

D.7.1.1 PM2.5 Motor Vehicle Emission Category Requirements

Guidance on the motor vehicle emission categories that must be considered in transportation conformity determinations is found in the July 1, 2004, Final Rule amending the Transportation Conformity Rule to implement criteria and procedures for the 8-hour ozone and PM2.5 standards (69 FR 40004):

> [A]ll regional emissions analyses in PM2.5 nonattainment and maintenance areas [must] consider directly emitted PM2.5 motor vehicle emissions from the tailpipe, brake wear, and tire wear…Sections IX. and X. [of the Final Rule] provide information on when re-entrained road dust and construction-related dust must also be included in PM2.5 conformity analyses…[T]he analysis for direct PM2.5 must include:
>
> - Tailpipe exhaust particles,
> - Brake and tire wear particles,
> - Re-entrained road dust, if before a SIP is submitted EPA or the state air agency has made a finding of significance or if the applicable or submitted SIP includes re-entrained road dust in the approved or adequate budget, and
> - Fugitive dust from transportation-related construction activities, if the SIP has identified construction emissions as a significant contributor to the PM2.5 problem. (69 FR 40331-40333)[97]

D.7.1.2 PM2.5 Motor Vehicle Emission Precursor Requirements

Following the July 1, 2004, Final Rule identifying the motor vehicle emission categories that must be considered in transportation conformity determinations, U.S. EPA issued the May 6, 2005, Final Rule (70 FR 24280) amending the Transportation Conformity Regulation to indicate the PM2.5 precursors that must be considered in regional transportation conformity determinations. In this Final Rule, U.S. EPA "identifies four transportation-related PM2.5 precursors—nitrogen oxides (NO_X), volatile organic compounds (VOCs), sulfur oxides (SO_X)[98], and ammonia (NH_3)—for consideration in the conformity process in PM2.5 nonattainment and maintenance areas." (70 FR 24282)[99] Of these PM2.5 precursors, the Final Rule indicates NO_X is required to be included in the regional transportation conformity determination unless it is found to be an insignificant contributor to the regional PM2.5 air quality problem per Section

[97] Codified in Sections 93.102(b)(1) and (3) and Section 93.122(f) of the Conformity Regulation.

[98] U.S. EPA revised the transportation conformity rule to revise PM2.5 precursors from SO_X to SO_2 for consistency with the broader PM2.5 implementation strategy. (73 FR 4435)

[99] Codified in Sections 93.102(b)(2)(iv) and (v) of the Conformity Regulation.

93.102(f) of the Conformity Regulation. (70 FR 24282)[100] Conversely, VOCs, SO_2, and NH_3 are not required unless any of these precursors are found to be significant contributors to the regional PM2.5 air quality problem. If it is determined through the SIP process that the on-road contribution of a precursor is a significant contributor the regional air quality problem, then an emissions budget must be prepared for that precursor in the SIP and MPOs are required to provide a conformity determination for each precursor for which there is an adequate or approved budget in the SIP. (70 FR 24287)

D.7.1.3 Factors for Determining Significance

As previously indicated, Sections 93.102(b)(2)(iv) and (v) of the Conformity Regulation require motor vehicle emissions budgets for PM2.5 precursors if they are deemed significant contributors to the regional air quality problem, while Section 93.102(b)(3) of the Conformity Regulation identifies re-entrained road dust from paved and unpaved roads as a PM2.5 emission category that must also have a motor vehicle emissions budget if deemed significant. Finally, Section 93.122(f) of the Conformity Regulation requires an emissions budget for fugitive dust PM2.5 emissions from highway and transit construction if they are deemed significant.

Within the context of transportation conformity, Section 93.109(f) of the Transportation Conformity Rule indicates that U.S. EPA considers a number of factors when making a finding that a SIP demonstrates that its motor vehicle pollutant or precursor emissions are insignificant contributors to regional air quality problems for a given air quality standard.[101] These factors used by U.S. EPA to make the finding of significance include "the percentage of motor vehicle emissions in the context of the total SIP inventory, the current state of air quality as determined by monitoring data for that NAAQS, the absence of SIP motor vehicle control measures, and historical trends and future projections of the growth of motor vehicle emissions." (Section 93.109(f))

It should be noted that while PM2.5 precursors must be included if they are found to be significant contributors to the regional PM2.5 air quality problem, SO_2 is deemed insignificant in all areas and conformity determinations are not required for this precursor. (70 FR 24283)

Based on guidance from the July 1, 2004, Final Rule, the significance finding for re-entrained road dust emissions will be based on a review of the following factors: "the contribution of road dust to current and future PM2.5 nonattainment, an area's current design value for the PM2.5 standard, whether control of road dust appears necessary to reach attainment, and whether increases in re-entrained dust emissions may interfere with attainment." (69 FR 40033) Such a review would include consideration of local air quality data, air quality modeling results, or emissions modeling results.

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[100] Codified in § 93.119(f)(9) and (10) of the Conformity Regulation.

[101] Pollutants and/or precursors from all sources may be found to be a significant contributor to the regional $PM_{2.5}$ air quality problem; however, the contribution of the motor vehicle emissions to these pollutants and/or precursors may be found insignificant based on the criteria indicated in Section 93.109(f) of the Transportation Conformity Regulation. Consequently, the pollutants and/or precursors found to be insignificant per Section 93.109(f) would not require regional transportation conformity determinations.

D.7.2 ASSESSMENT OF SIGNIFICANCE

This plan establishes motor vehicle emission budgets for primary emissions of PM2.5 from vehicle exhaust, tire and brake wear, and the precursor NOx. As discussed above, VOCs, SO_2, and ammonia are not required to be included in the regional transportation conformity determination unless found to be significant contributors to the regional PM2.5 air quality problem. Based on the criteria from Section 93.109(f), VOCs, SO_2, and ammonia are not found to be significant for the reasons discussed in the sections below, and therefore this plan does not establish motor vehicle emissions budgets for conformity purposes for these precursors. Please see Appendix B, Emissions Inventory, for a detailed description of the Valley's emissions inventory that was used to estimate the percentage of the Valley's total emissions inventory that are comprised from on-road mobile emissions.

VOC: On-road mobile emissions account for approximately ten percent of the Valley's total VOC emissions in the budget years. Air quality modeling for this plan indicates that control of VOC is generally ineffective in the control of PM2.5 and in some cases may actually result in increases in PM2.5 levels. (See Appendix G.) Therefore, on-road VOC emissions are considered insignificant and this plan does not establish VOC motor vehicle emissions budgets for conformity purposes.

SO_2: SO_2 is deemed insignificant in all areas and conformity determinations are not required for this precursor. (70 FR 24283) In addition, on-road mobile exhaust estimates are less than one ton per day Valley-wide in the budget years which equates to less than ten percent of the total SO_2 emissions inventory. SO_2 controls are focused on industrial sources, which contribute almost 80 percent of the total inventory. Therefore, on-road SO_2 emissions are considered insignificant and this plan does not establish SO_2 motor vehicle emissions budgets for conformity purposes.

Ammonia: The contribution of ammonia from on-road motor vehicles is approximately one percent of the total Valley-wide ammonia inventory. Consequently, ammonia emissions are not included in the motor vehicle emissions budgets for conformity purposes. Past research has demonstrated that ammonia is abundant throughout the Valley and does not act as a limiting precursor in the formation of PM2.5. Through performing sensitivity-based analysis and considering relevant contextualizing information such as emissions trends, studies, and available controls, the California Air Resources Board has determined that emissions of ammonia do not contribute significantly to PM2.5 levels that exceed the 1997, 2006, or 2012 NAAQS in the area. (See Appendix G.)

Paved Road Dust: Paved road dust PM2.5 emissions account for less than ten percent of the Valley's total direct PM2.5 emissions inventory in the budget years. While there are no additional paved road dust controls included in the attainment demonstration for this plan, paved road dust is controlled through the PM10 Plan and evaluated as part of PM10 conformity determinations. Analysis of average composition data from ambient air monitoring stations shows paved road dust contributes about two percent to the design values in the Valley. Therefore, paved road dust emissions are considered

insignificant and this plan does not establish paved road dust motor vehicle emissions budgets for conformity purposes.

Unpaved Road Dust: Total unpaved road dust is less than seven percent of the Valley's total direct PM2.5 emissions inventory in the budget years. Local roads are one of seven subcategories of unpaved road dust, and, as noted above, on-road dust makes a small contribution to design values in the Valley. While there are no additional unpaved road dust controls included in the plan, unpaved road dust is controlled via the PM10 Plan (including the prohibition of any new local unpaved roads), and unpaved road dust is evaluated as part of PM10 conformity determinations. Analysis of average composition data from ambient air monitoring stations shows unpaved road dust contributes less than two percent to the design values in the Valley. Therefore, unpaved road dust is considered insignificant and this plan does not establish emissions budgets for unpaved road dust for conformity purposes.

Construction Dust: Total construction and demolition dust is less than five percent of the Valley's total direct PM2.5 emissions inventory in the budget years. Because road construction is one of five subcategories of construction dust, its contribution to the total direct PM2.5 inventory would be even less than the total construction and demolition category. While there are no additional construction dust controls included in the plan, road construction dust is controlled extensively via the PM10 Plan and is evaluated as part of PM10 conformity determinations. Therefore, road construction dust is considered insignificant and this plan does not establish emissions budgets for road construction dust for conformity purposes.

D.7.3 CONFORMITY BUDGETS

Conformity budgets must be set for the attainment year for each PM2.5 NAAQS as well as each year for which reasonable further progress (RFP) is demonstrated. The attainment years are as follows:

- 1997 24-hour and annual standard: 2020
- 2006 24-hour standard: 2024
- 2012 annual standard: 2025

The RFP years for the various PM2.5 standards are as follows:

- 1997 24-hour and annual standard: 2017, 2020, and 2023
- 2006 24-hour standard: 2017, 2020, 2023, and 2026
- 2012 annual standard: 2019, 2022, 2025, and 2028

Note that the attainment year is also an RFP year for the 1997 and 2012 standards, while these years do not coincide for the 2006 standard.

Average daily emissions are used in the plan consistent with how the standard is measured. Consequently, conformity budgets were calculated in EMFAC2014 using annual average daily emissions for the 1997 and 2012 standards, while winter average daily emissions were used to calculate conformity budgets for the 2006 standard, for the analysis years listed above.

Section 93.124(e) of the Federal Conformity Regulation states that nonattainment areas with more than one MPO may establish motor vehicle emission budgets for each MPO in the non-attainment area. This plan establishes county-level emission budgets for each of the eight MPOs[102] in the Valley.

The transportation conformity budgets developed for this plan include recent travel activity projections provided by the Valley MPOs. This travel activity is consistent with the Final 2017 Federal Transportation Improvement Plan (2017 FTIP) for each of the eight Valley MPOs. Using this recent activity results in on-road emissions approximately one percent lower than the 2020, 2024, and 2025 attainment demonstration inventories for the 1997, 2006, and 2012 standards, respectively.

The budgets have been constructed to be consistent with the on-road emissions inventory using the following method:

1) Sum the emissions results for each county.
2) Calculate the budget by rounding each county's values to the nearest tenth ton (for both NOx and PM2.5) using conventional rounding.

This plan establishes sub-area county emission budgets for PM2.5 and NOx for the horizon years listed above as summarized in Tables 18, 19, and 20 below.

Table 18 San Joaquin Valley 1997 24-hour and Annual PM2.5 Motor Vehicle Emissions Budgets* (Annual average tons per day)

County	2017		2020		2023	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
Fresno	0.9	28.5	0.9	25.3	0.8	15.1
Kern (SJV)	0.8	28.0	0.8	23.3	0.7	13.3
Kings	0.2	5.8	0.2	4.8	0.2	2.8
Madera	0.2	5.3	0.2	4.2	0.2	2.5
Merced	0.3	10.7	0.3	8.9	0.3	5.3
San Joaquin	0.7	14.9	0.6	11.9	0.6	7.6
Stanislaus	0.4	11.9	0.4	9.6	0.4	6.1
Tulare	0.4	10.8	0.4	8.5	0.4	5.2
* Budgets based on the most recently amended 2017 FSTIP for each MPO as of January 2018. Budgets are rounded up to the nearest tenth of a ton.						

Table 19 San Joaquin Valley 2006 24-hour PM2.5 Motor Vehicle Emissions Budgets* (Winter average tons per day)

County	2017		2020		2023		2024		2026	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx

[102] The boundary of the Kern Council of Governments encompasses all of Kern County, while the portion of Kern County located within the PM2.5 non-attainment area only includes the portion located within the San Joaquin Valley Air Basin (SJVAB)/San Joaquin Valley Air Pollution Control District (SJVAPCD). Consequently, the motor vehicle emissions budgets for Kern County only include the non-attainment area located within the SJVAB/SJVAPCD.

Fresno	0.9	29.3	0.9	25.9	0.8	15.5	0.8	15.0	0.8	14.3
Kern (SJV)	0.8	28.7	0.8	23.8	0.7	13.6	0.7	13.4	0.8	12.8
Kings	0.2	5.9	0.2	4.9	0.2	2.9	0.2	2.8	0.2	2.7
Madera	0.2	5.5	0.2	4.4	0.2	2.6	0.2	2.5	0.2	2.3
Merced	0.3	11.0	0.3	9.1	0.3	5.5	0.3	5.3	0.3	4.9
San Joaquin	0.7	15.5	0.6	12.3	0.6	7.9	0.6	7.6	0.6	6.9
Stanislaus	0.4	12.3	0.4	9.8	0.4	6.2	0.4	6.0	0.4	5.6
Tulare	0.4	11.2	0.4	8.7	0.4	5.3	0.4	5.1	0.4	4.6
* Budgets based on the most recently amended 2017 FSTIP for each MPO as of January 2018. Budgets are rounded up to the nearest tenth of a ton.										

Table 20 San Joaquin Valley 2012 Annual PM2.5 Motor Vehicle Emissions Budgets* (Annual average tons per day

County	2019		2022		2025		2028	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
Fresno	0.9	27.6	0.9	21.2	0.8	14.3	0.9	13.5
Kern (SJV)	0.8	25.1	0.8	19.4	0.8	12.8	0.8	11.9
Kings	0.2	5.1	0.2	4.1	0.2	2.7	0.2	2.5
Madera	0.2	4.6	0.2	3.5	0.2	2.3	0.2	2.0
Merced	0.3	9.4	0.3	7.6	0.3	5.0	0.3	4.5
San Joaquin	0.6	12.7	0.6	10.0	0.6	6.9	0.6	6.3
Stanislaus	0.4	10.5	0.4	8.1	0.4	5.6	0.4	5.2
Tulare	0.4	9.3	0.4	6.9	0.4	4.7	0.4	4.2
* Budgets based on the most recently amended 2017 FSTIP for each MPO as of January 2018. Budgets are rounded up to the nearest tenth of a ton.								

D.7.4 EMISSIONS TRADING MECHANISM

Section 93.124(b) of the Federal Conformity Regulation allows for the SIP to establish emissions trading mechanisms between budgets for pollutants or precursors, or among budgets allocated to mobile and other sources. The 2008 PM2.5 Plan (as revised in 2011) included an emissions trading mechanism, approved by U.S. EPA effective January 9, 2012, to be used for analysis years after 2014.

Air quality modeling to support the SIP was used to determine the ratios for trading from the motor vehicle emissions budget for the PM2.5 precursor NOx to the motor vehicle emissions budget for primary PM2.5 in the San Joaquin Valley (SJV). To determine the NOx:PM2.5 trading ratios on both an annual and a 24-hour wintertime basis, two modeling sensitivity simulations were performed, reducing 30 percent of NO_x and PM2.5 emissions from on-road transportation in the SJV. The baseline model simulation was the 2024 attainment run. Consistent with past trading ratio determination in the San Joaquin Valley, only sources included in the transportation conformity process (i.e. on-road vehicles, paved road dust, unpaved road dust, and road construction dust) were evaluated in the emissions trading analysis.

Based on the 30 percent emission reduction sensitivity runs, reductions in both annual and 24-hour PM2.5 design values[103] (DVs) were calculated. Results for two sites in Bakersfield and two sites in Fresno are shown below since those two regions generally control the annual and 24-hour DVs in the SJV. Tables 21 and 22 show the change in DV per ton of emissions reduction at the four selected sites. For annual PM2.5 standards, annual emission totals are used, and for the 24-hour PM2.5 standards, wintertime emission totals are used. Dividing the change in DV per ton of PM2.5 emissions reduction by the change in DV per ton of NO_X emissions reduction yields the NOx:PM2.5 trading ratios, summarized in Table 23, which are the number of tons of NOx that achieve the same DV impact as one ton of direct PM2.5.

Table 21 Change in Annual DV per ton of PM2.5 or NOx Emissions Reduction from Transportation Related Sources in the SJV (µg/m3/ton emissions

Site	2024 annual DVs	ΔDV/ton of PM2.5 reduction	ΔDV/ton of NO_x reduction
Bakersfield-California Avenue	10.9	0.105	0.015
Bakersfield – Planz	11.9	0.118	0.017
Fresno – Garland	10.4	0.068	0.012
Fresno – Hamilton & Winery	10.0	0.068	0.012

[103] Consistent with past trading ratio determination in the San Joaquin Valley, the inter-pollutant trading ratios (relative to NOx) were calculated as the ratio in the reduction of annual PM2.5 DV at a particular location by reducing a ton of PM2.5 emissions as compared to a ton of NOx emission reductions.

Table 22 Change in 24-hour DV per ton of PM2.5 or NOx Emissions Reduction from Transportation Related Sources in the SJV (µg/m3/ton emissions)

Site	2024 24-hour DVs	ΔDV/ton of PM2.5 reduction	ΔDV/ton of NO_x reduction
Bakersfield-California Avenue	33.1	0.310	0.136
Bakersfield – Planz	29.8	0.215	0.102
Fresno – Garland	32.8	0.191	0.109
Fresno – Hamilton & Winery	35.1	0.187	0.117

Table 23 NOx:PM2.5 Trading Ratios (tons NOx per 1 ton direct PM2.5) for the Annual PM2.5 and 24-hour PM2.5 Standards

Site	Annual PM2.5 trading ratio *	24-hour PM2.5 trading ratio *
Bakersfield-California Avenue	7.0	2.3
Bakersfield – Planz	7.1	2.1
Fresno – Garland	6.0	1.8
Fresno – Hamilton & Winery	6.0	1.6
Average SIP Trading Ratio	**6.5**	**2.0**

* Due to rounding for display only in Tables 21 and 22, trading ratios shown here may differ from trading ratios calculated using the ΔDV/ton values shown in Tables 21 and 22.

Consistent with past trading ratio determination in the San Joaquin Valley, annual and 24-hour NOx:PM2.5 trading ratios across the four sites shown in Table 23 were averaged to obtain the trading ratios used in this SIP for the annual and 24-hour standards. Based on this analysis, this SIP allows trading from the motor vehicle emissions budget for NOx to the motor vehicle emissions budget for primary PM2.5 using a 6.5 to 1 ratio on an annual basis and a 2 to 1 ratio on a wintertime basis. These ratios indicate that PM2.5 reductions are approximately 6.5 times more effective at reducing annual PM2.5 DVs than are NO_x reductions, and that PM2.5 reductions are approximately twice as effective at reducing 24-hour PM2.5 DVs as NO_x reductions. It should be noted that the calculated trading ratios presented in Table 23 (e.g., a calculated ratio of 6.5 to 1 for the annual PM2.5 standard) are lower than the previous trading ratio estimates presented in the 2016 Moderate Area Plan for the 2012 PM2.5 Standard (e.g., a ratio of 8.8 to 1 for the annual PM2.5 standard[104]), as the trading ratios presented in Table 23 are based on model sensitivity simulations associated with 30 percent NOx and PM2.5 reductions, while the trading ratios from the 2016 Moderate Area Plan for the 2012 PM2.5 Standard are derived from carrying capacity isopleths.

The NOx emissions reductions available for trading are only those remaining after the NOx budget is met. For example, for a proposed plan that has a total of seven tons of NOx, and a NOx budget of ten tons, there are three tons of NOx available to meet the PM2.5 emissions budget. Each agency responsible for demonstrating transportation conformity shall clearly document the calculations used in the trading, along with any additional reductions of NOx or PM2.5 emissions in the conformity analysis.

[104] Table 3-10 from the 2016 Moderate Area Plan for the 2012 PM2.5 Standard.

D.7.5 Local Transportation Control Measures

Transportation Control Measures (TCMs) in CAA §108(f) are currently being implemented by the Valley MPOs as part of the adopted Congestion Mitigation and Air Quality (CMAQ) cost effectiveness policy and in the development of each Regional Transportation Plan (RTP). In addition, existing and new transportation legislation (MAP-21 and FAST Act) include enhanced emphasis on funding PM2.5 projects.

Valley MPOs continue to implement the adopted San Joaquin Valley CMAQ Policy, which was included in the District's *2007 Ozone Plan*, *2008 PM2.5 Plan, 2012 PM2.5 Plan, 2015 PM2.5 Plan, and 2016 Ozone Plan*. The CMAQ policy includes a standardized process for distributing 20 percent of the CMAQ funds to projects that meet a minimum cost effectiveness beginning in fiscal year 2011. This policy focuses on achieving the most cost effective emissions reductions, while maintaining flexibility to meet local needs. The minimum cost effectiveness standard was revisited in 2018 as part of the 2018 RTP and 2019 Federal Transportation Improvement Program (FTIP) development, consistent with the Valley CMAQ Policy. The Valley MPOs are implementing all reasonable transportation control measures at this time, and a listing of Adopted Transportation Control Measures may be found in Tables D-10 through D-17 in Appendix D of the 2016 Plan for the 2008 8-Hour Ozone Standard.

Each Valley MPO is required to update its RTP every four years. The RTP is a long-term regional transportation plan that provides a vision for transportation investments throughout the Valley. The 2018 RTPs were adopted by the Valley MPO Boards in the summer of 2018 and integrate land use and transportation planning to achieve, where feasible, regional greenhouse gas (GHG) targets set by ARB pursuant to Senate Bill 375 (SB 375).

To further illustrate the eight SJV MPOs commitment to the implementation of TCMs throughout the Valley, the RTPs contains a host of improvements to every component of the regional multimodal transportation system including:

- Active transportation (non-motorized transportation, such as biking and walking)
- Transportation demand management (TDM)
- Transportation system management (TSM)
- Transit
- Passenger rail
- Goods movement
- Aviation and airport ground access
- Highways
- Arterials
- Operations and maintenance

Included within these transportation system improvements are TCM projects that reduce vehicle use or change traffic flow or congestion conditions. TCMs include the following categories of transportation improvement projects and programs:

- Improved Transit
- High Occupancy Vehicle Lanes
- Traffic Flow Improvements
- Park and Ride Lots
- Ridesharing/Trip Reduction Programs
- Bicycle/Pedestrian Facilities

D.7.6 SB 375

The Sustainable Communities and Climate Protection Act of 2008 (Sustainable Communities, SB 375) enhances California's strategy to reduce GHG emissions through the coordination of transportation and land-use to reduce vehicle miles traveled per person through the development of a Sustainable Community Strategy. SB 375 identifies specific reduction goals for each of California's MPOs in 2020 and 2035 which the Sustainable Community Strategy must meet, if feasible. For the Valley, the current SB 375 target reductions are a 5% per capita GHG emissions reduction from 2005 by 2020 and a 10% per capita GHG emissions reduction from 2005 by 2035. Further, on March 2018, ARB has revised SB 375 targets for the Valley MPOs to make them more stringent as shown in Table 24 below. In order to meet these revised targets, the Valley MPOs will need to invest and implement additional TCM.

Table 24 Summary of San Joaquin Valley MPO SB 375 GHG Reduction Targets

MPO	2020 SB 375 Target	2035 SB 375 Target
Fresno	-6%	-13%
Kern	-9%	-15%
Kings	-5%	-13%
Madera	-10%	-16%
Merced	-10%	-14%
San Joaquin	-12%	-16%
Stanislaus	-12%	-16%
Tulare	-13%	-16%

The strategies contained in the RTP/SCS produce air quality co-benefits for the region far beyond simply reducing GHG emissions through reductions in VMT. The SCS integrates the transportation network and related strategies with an overall land use pattern that responds to projected growth, housing needs, changing demographics, and transportation demands. As a result, Sustainable Community Strategy development is anticipated to complement the *2018 PM2.5 Plan*.

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San Joaquin Valley 1997 Annual PM2.5 Motor Vehicle Emissions Budgets
2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards
(tons per annual average day)

Activity is the most recently amended 2017 FSTIP for each MPO as of January, 2018.

Motor Vehicle Emissions Budgets **2017**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.86	28.48	0.79	27.96	0.15	5.72	0.16	5.29	0.29	10.69	0.60	14.86	0.39	11.88	0.37	10.79	3.62	115.66
^																		
Total Budget	**0.86**	**28.48**	**0.79**	**27.96**	**0.15**	**5.72**	**0.16**	**5.29**	**0.29**	**10.69**	**0.60**	**14.86**	**0.39**	**11.88**	**0.37**	**10.79**	**3.70**	**115.70**
Budget*	**0.9**	**28.5**	**0.8**	**28.0**	**0.2**	**5.8**	**0.2**	**5.3**	**0.3**	**10.7**	**0.7**	**14.9**	**0.4**	**11.9**	**0.4**	**10.8**	**3.9**	**115.9**

Motor Vehicle Emissions Budgets **2020**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.84	25.21	0.73	23.25	0.14	4.75	0.15	4.18	0.26	8.87	0.58	11.86	0.36	9.51	0.33	8.41	3.39	96.03
^																		
Total Budget	**0.84**	**25.21**	**0.73**	**23.25**	**0.14**	**4.75**	**0.15**	**4.18**	**0.26**	**8.87**	**0.58**	**11.86**	**0.36**	**9.51**	**0.33**	**8.41**	**3.40**	**96.10**
Budget*	**0.9**	**25.3**	**0.8**	**23.3**	**0.2**	**4.8**	**0.2**	**4.2**	**0.3**	**8.9**	**0.6**	**11.9**	**0.4**	**9.6**	**0.4**	**8.5**	**3.8**	**96.5**

Motor Vehicle Emissions Budgets **2023**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.77	15.04	0.67	13.25	0.13	2.80	0.14	2.47	0.25	5.29	0.56	7.57	0.34	6.01	0.31	5.11	3.17	57.54
^																		
Total Budget	**0.77**	**15.04**	**0.67**	**13.25**	**0.13**	**2.80**	**0.14**	**2.47**	**0.25**	**5.29**	**0.56**	**7.57**	**0.34**	**6.01**	**0.31**	**5.11**	**3.20**	**57.60**
Budget*	**0.8**	**15.1**	**0.7**	**13.3**	**0.2**	**2.8**	**0.2**	**2.5**	**0.3**	**5.3**	**0.6**	**7.6**	**0.4**	**6.1**	**0.4**	**5.2**	**3.6**	**57.9**

* Budgets rounded up to the nearest tenth

^ Blank row indicates reductions from control measures *outside* of EMFAC. There are currently none in EMFAC2014.

San Joaquin Valley 2006 24-Hour PM2.5 Motor Vehicle Emissions Budgets
2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards
(tons per winter average day)

Activity is the most recently amended 2017 FSTIP for each MPO as of January, 2018.

Motor Vehicle Emissions Budgets **2017**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.86	29.23	0.80	28.66	0.15	5.88	0.17	5.46	0.29	10.99	0.60	15.43	0.39	12.25	0.37	11.15	3.62	119.05
^																		
Total Budget	**0.86**	**29.23**	**0.80**	**28.66**	**0.15**	**5.88**	**0.17**	**5.46**	**0.29**	**10.99**	**0.60**	**15.43**	**0.39**	**12.25**	**0.37**	**11.15**	**3.70**	**119.10**
Budget*	**0.9**	**29.3**	**0.8**	**28.7**	**0.2**	**5.9**	**0.2**	**5.5**	**0.3**	**11.0**	**0.7**	**15.5**	**0.4**	**12.3**	**0.4**	**11.2**	**3.9**	**119.4**

Motor Vehicle Emissions Budgets **2020**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.84	25.81	0.73	23.79	0.14	4.87	0.15	4.30	0.26	9.09	0.58	12.28	0.36	9.78	0.33	8.67	3.39	98.59
^																		
Total Budget	**0.84**	**25.81**	**0.73**	**23.79**	**0.14**	**4.87**	**0.15**	**4.30**	**0.26**	**9.09**	**0.58**	**12.28**	**0.36**	**9.78**	**0.33**	**8.67**	**3.40**	**98.60**
Budget*	**0.9**	**25.9**	**0.8**	**23.8**	**0.2**	**4.9**	**0.2**	**4.4**	**0.3**	**9.1**	**0.6**	**12.3**	**0.4**	**9.8**	**0.4**	**8.7**	**3.8**	**98.9**

Motor Vehicle Emissions Budgets **2023**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.77	15.42	0.67	13.58	0.13	2.87	0.14	2.55	0.25	5.43	0.56	7.85	0.34	6.19	0.31	5.27	3.17	59.17
^																		
Total Budget	**0.77**	**15.42**	**0.67**	**13.58**	**0.13**	**2.87**	**0.14**	**2.55**	**0.25**	**5.43**	**0.56**	**7.85**	**0.34**	**6.19**	**0.31**	**5.27**	**3.20**	**59.20**
Budget*	**0.8**	**15.5**	**0.7**	**13.6**	**0.2**	**2.9**	**0.2**	**2.6**	**0.3**	**5.5**	**0.6**	**7.9**	**0.4**	**6.2**	**0.4**	**5.3**	**3.6**	**59.5**

Motor Vehicle Emissions Budgets **2024**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.78	14.99	0.69	13.38	0.13	2.76	0.14	2.42	0.25	5.26	0.57	7.51	0.34	5.93	0.31	5.02	3.21	57.28
^																		
Total Budget	**0.78**	**14.99**	**0.69**	**13.38**	**0.13**	**2.76**	**0.14**	**2.42**	**0.25**	**5.26**	**0.57**	**7.51**	**0.34**	**5.93**	**0.31**	**5.02**	**3.30**	**57.30**
Budget*	**0.8**	**15.0**	**0.7**	**13.4**	**0.2**	**2.8**	**0.2**	**2.5**	**0.3**	**5.3**	**0.6**	**7.6**	**0.4**	**6.0**	**0.4**	**5.1**	**3.6**	**57.7**

Motor Vehicle Emissions Budgets **2026**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.79	14.28	0.71	12.71	0.13	2.63	0.14	2.22	0.25	4.85	0.58	6.86	0.35	5.53	0.31	4.58	3.26	53.64
^																		
Total Budget	**0.79**	**14.28**	**0.71**	**12.71**	**0.13**	**2.63**	**0.14**	**2.22**	**0.25**	**4.85**	**0.58**	**6.86**	**0.35**	**5.53**	**0.31**	**4.58**	**3.30**	**53.70**
Budget*	**0.8**	**14.3**	**0.8**	**12.8**	**0.2**	**2.7**	**0.2**	**2.3**	**0.3**	**4.9**	**0.6**	**6.9**	**0.4**	**5.6**	**0.4**	**4.6**	**3.7**	**54.1**

* Budgets rounded up to the nearest tenth
^ Blank row indicates reductions from control measures *outside* of EMFAC. There are currently none in EMFAC2014.

San Joaquin Valley 2012 Annual PM2.5 Motor Vehicle Emissions Budgets
2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards
(tons per annual average day)

Activity is the most recently amended 2017 FSTIP for each MPO as of January, 2018.

Motor Vehicle Emissions Budgets **2019**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.88	27.53	0.76	25.04	0.14	5.09	0.16	4.53	0.26	9.31	0.58	12.69	0.38	10.43	0.35	9.22	3.50	103.84
^																		
Total Budget	**0.88**	**27.53**	**0.76**	**25.04**	**0.14**	**5.09**	**0.16**	**4.53**	**0.26**	**9.31**	**0.58**	**12.69**	**0.38**	**10.43**	**0.35**	**9.22**	**3.60**	**103.90**
Budget*	**0.9**	**27.6**	**0.8**	**25.1**	**0.2**	**5.1**	**0.2**	**4.6**	**0.3**	**9.4**	**0.6**	**12.7**	**0.4**	**10.5**	**0.4**	**9.3**	**3.8**	**104.3**

Motor Vehicle Emissions Budgets **2022**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.80	21.17	0.71	19.36	0.13	4.02	0.15	3.43	0.26	7.52	0.57	9.93	0.35	8.03	0.32	6.89	3.29	80.35
^																		
Total Budget	**0.80**	**21.17**	**0.71**	**19.36**	**0.13**	**4.02**	**0.15**	**3.43**	**0.26**	**7.52**	**0.57**	**9.93**	**0.35**	**8.03**	**0.32**	**6.89**	**3.30**	**80.40**
Budget*	**0.9**	**21.2**	**0.8**	**19.4**	**0.2**	**4.1**	**0.2**	**3.5**	**0.3**	**7.6**	**0.6**	**10.0**	**0.4**	**8.1**	**0.4**	**6.9**	**3.8**	**80.8**

Motor Vehicle Emissions Budgets **2025**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.78	14.29	0.71	12.79	0.13	2.62	0.14	2.26	0.25	4.95	0.57	6.83	0.34	5.51	0.31	4.63	3.23	53.88
^																		
Total Budget	**0.78**	**14.29**	**0.71**	**12.79**	**0.13**	**2.62**	**0.14**	**2.26**	**0.25**	**4.95**	**0.57**	**6.83**	**0.34**	**5.51**	**0.31**	**4.63**	**3.30**	**53.90**
Budget*	**0.8**	**14.3**	**0.8**	**12.8**	**0.2**	**2.7**	**0.2**	**2.3**	**0.3**	**5.0**	**0.6**	**6.9**	**0.4**	**5.6**	**0.4**	**4.7**	**3.7**	**54.3**

Motor Vehicle Emissions Budgets **2028**

County	Fresno (SJV)		Kern (SJV)		Kings (SJV)		Madera (SJV)		Merced (SJV)		San Joaquin (SJV)		Stanislaus (SJV)		Tulare (SJV)		Total San Joaquin Valley Air Basin	
	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx	PM2.5	NOx
EMFAC2014 V1.0.7 exhaust, tire and brake wear	0.80	13.42	0.72	11.81	0.13	2.45	0.14	1.97	0.25	4.44	0.59	6.24	0.35	5.11	0.32	4.12	3.31	49.56
^																		
Total Budget	**0.80**	**13.42**	**0.72**	**11.81**	**0.13**	**2.45**	**0.14**	**1.97**	**0.25**	**4.44**	**0.59**	**6.24**	**0.35**	**5.11**	**0.32**	**4.12**	**3.40**	**49.60**
Budget*	**0.9**	**13.5**	**0.8**	**11.9**	**0.2**	**2.5**	**0.2**	**2.0**	**0.3**	**4.5**	**0.6**	**6.3**	**0.4**	**5.2**	**0.4**	**4.2**	**3.8**	**50.1**

* Budgets rounded up to the nearest tenth

^ Blank row indicates reductions from control measures *outside* of EMFAC. There are currently none in EMFAC2014.