

APPENDIX C
VMT EMISSIONS OFFSET DEMONSTRATION

VMT Emissions Offset Demonstration

A. INTRODUCTION

Within two years after the adoption of a national ambient air quality standard (standard), the Clean Air Act (CAA) requires states to submit enforceable transportation control strategies (TCSs) and transportation control measures (TCMs) to offset any growth in volatile organic compounds (VOC) emissions due to increases in vehicle miles traveled (VMT) and the number of vehicle trips from the base year to the attainment year of the state implementation plan (SIP). The Eastern Kern Air Pollution Control District has voluntarily reclassified the Eastern Kern ozone nonattainment area from serious to severe for the 75 parts per billion (ppb) and 70 ppb 8-hour ozone standards. Accordingly, the California Air Resources Board (CARB) analyzed the change in VOC emissions related to growth in VMT and whether additional TCSs and TCMs are needed for the Eastern Kern nonattainment area to meet the ozone standards for the severe classification, as required by Section 182(d)(1)(A) and in accordance with U.S. EPA's August 2012 guidance entitled "Implementing Clean Air Act Section 182(d)(1)(A): Transportation Control Measures and Transportation Control Strategies to Offset Growth in Emissions Due to Growth in Vehicle Miles Traveled" ("2012 guidance").¹

Table A-1 U.S. EPA GUIDANCE ON VMT OFFSET REQUIREMENT

In its 2012 guidance, U.S. EPA indicated that improvements in vehicle technology, motor vehicle fuels, and other transportation strategies could be used to offset emission increases from VMT. The guidance also set forth a methodology for demonstrating whether any increase in VOC emissions from VMT growth is adequately offset by existing TCSs and TCMs. If the projected attainment year emissions, assuming no new control measures and no VMT growth, are less than the projected actual attainment year emissions, including new control measures and VMT growth, then no additional TCMs or TCSs are required. The guidance recommends that the base year used in the VMT offset demonstration be the base year used in the attainment demonstration for the 75 ppb and 70 ppb 8-hour ozone standards.

Table A-2 TRANSPORTATION CONTROL STRATEGIES AND TRANSPORTATION CONTROL MEASURES

Generally, TCSs consist of strategies such as motor vehicle emission standards, inspection and maintenance programs, alternative fuel programs, and other technology-based measures. On the other hand, TCMs are strategies that reduce emissions or concentration of air pollutants by reducing the number of vehicle trips or VMT or improving traffic flow. The CAA §182(d)(1)(A) differentiates between TCSs and TCMs in more detail, both of which can be used as options to offset increased emissions from growth in VMT per the provisions of CAA §182(d)(1)(A) and U.S. EPA's 2012 guidance. Since 1990, when this requirement was established, California has adopted a substantial number of enforceable TCSs—more than enough to meet the requirement to offset increased emissions from VMT growth. Attachment A-1 provides a list of

¹ U.S. Environmental Protection Agency [EPA]: Office of Transportation and Air Quality. (2012, August). *Implementing Clean Air Act Section 182(d)(1)(A): Transportation Control Measures and Transportation Control Strategies to Offset Growth in Emissions Due to Growth in Vehicle Miles Traveled* (EPA-420-B-12-053). Retrieved from <http://www.epa.gov/otaq/stateresources/policy/general/420b12053.pdf>

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the State's mobile source TCSs that CARB has adopted since 1990 and for which the benefits are included in this analysis.

In contrast, TCMs are generally adopted at the regional scale as part of a regional transportation plan (RTP). For the Eastern Kern nonattainment area, the Kern Council of Governments (KCOG) is designated under federal law as a metropolitan planning organization (MPO) and under State law as a regional transportation planning agency and a council of governments and is therefore responsible for adopting TCMs. On August 16, 2018, KCOG adopted the 2019 federal state transportation improvement program (FSTIP), which contains their adopted TCMs.

Table A-3 METHODOLOGY

The following calculations are based on U.S. EPA's 2012 guidance. For the 75-ppb 8-hour ozone standard for the severe area, 2011 and 2026 are the base and attainment years, respectively. For the 70-ppb 8-hour ozone standard for the severe area, 2017 and 2032 are the base and attainment years, respectively.

This analysis uses California's motor vehicle emissions model, Emission FACTor (EMFAC).² On August 15, 2019, U.S. EPA approved EMFAC2017 for use in SIPs and to demonstrate transportation conformity.³ The EMFAC model estimates the emissions from two combustion processes – running exhaust and start exhaust – and from four evaporative processes – hot soak, running losses, diurnal, and resting losses. Emissions from running exhaust, start exhaust, hot soak, and running losses are a function of how much a vehicle is driven. Therefore, emissions from these processes are directly related to vehicle starts and VMT. These processes are included in calculating the emissions levels used in the VMT offset demonstration. Emissions from resting loss and diurnal loss processes are not related to VMT, trips, or vehicle starts and are not included in the analysis because these emissions occur whether or not vehicle travel occurs on a given day.

To calculate on-road emission inventories in the Eastern Kern ozone nonattainment area, EMFAC combines VMT and speed distributions from the 2019 FSTIP. The number of vehicle starts per day is based on household travel surveys, and vehicle population data are from the California Department of Motor Vehicles with corresponding emission rates from EMFAC to calculate emissions. The number of vehicle trips per day is based on data provided by KCOG's 2019 FSTIP amendment.

Table A-4 Analysis of Eastern Kern 75 ppb Standard

Following a two-step process with appropriate calculations, CARB staff compared target-year VOC emissions under three different VMT and emission control scenarios.

² More information on data sources can be found in the EMFAC technical support documentation at: <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-road-documentation>

³ 84 FR 41717 <https://www.federalregister.gov/d/2019-17476>

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Table A-5 Step 1. Provide the emissions levels for the 2011 base year.

Table 1 shows the Eastern Kern VOC emissions for the calendar year 2011 from the EMFAC2017 model.

Table 1: Eastern Kern Base Year (2011) VMT and Emissions

Description	VMT (miles/day)	VOC (tons/day)
2011 Vehicle-Miles Traveled and On-Road Emissions	3,082,742	1.8

Table A-6 Step 2. Calculate three emission levels in the 2026 attainment year.

- (1) Calculate emissions levels with the motor vehicle control program frozen at 2011 levels and with projected VMT in the attainment year. This would represent the emissions in the attainment year if TCSs and TCMs were not implemented after 2011.
- (2) Calculate emissions levels with the motor vehicle control program frozen at 2011 levels and assuming VMT does not increase from 2011 levels.
- (3) Calculate an emissions level that represents emissions of projected VMT in the attainment year with full implementation of all TCSs and TCMs since 2011.

Table A-7 Calculation 1. Calculate the emissions in the attainment year assuming growth in VMT and no new control measures since the base year.

To perform this calculation, CARB staff identified the on-road motor vehicle control programs adopted since 2011 and adjusted the EMFAC2017 output to reflect the VOC emission levels in 2026 without the benefits of the post-2011 control programs. As a result, the projected VOC emissions are 0.6 tons per day for 2026. In comparison, in the base year of 2011, VOC emissions were 1.8 tons per day.

Table A-8 Calculation 2. Calculate the emissions with no growth in VMT.

EMFAC2017 allows the user to input different VMT values. CARB ran EMFAC2017 for the calendar year 2026 with the 2011 VMT level of 3,082,742 miles per day without the benefits of the post-2011 control programs. The VOC emissions associated with the 2011 VMT level are 0.5 tons per day for 2026.

Table A-9 Calculation 3. Calculate emissions reductions with full implementation of TCSs and TCMs.

CARB calculated the VOC emission levels for 2026, assuming the benefits of the post-2011 motor vehicle control program and the projected VMT levels in 2026 are calculated using EMFAC2017. The projected VOC emissions levels are 0.5 tons per day for 2026.

VOC emissions for the calculations described above are provided in Tables 2 and 3.

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Table 2: Eastern Kern VOC Emissions Calculations for the 2026 Attainment Year (75-ppb Severe Plan)

Calculation Number	Description	VMT year	Vehicle Control Program year	VMT (miles/day)	VOC (tons/day)
1	Emissions with motor vehicle control program frozen at 2011 levels (VMT at 2026 projected levels)	2026	2011	3,887,618	0.6
2	Emissions with motor vehicle control program frozen at 2011 levels (VMT at 2011 levels)	2011	2011	3,082,742	0.5
3	Emissions with a full motor vehicle control program in place (VMT at 2026 projected levels)	2026	2026	3,887,618	0.5

As provided in the 2012 U.S. EPA guidance, to determine compliance with CAA §182(d)(1)(A), Calculation 3 emissions levels should be less than or equal to the Calculation 2 emissions levels:

VOC: $0.5 \approx 0.5$ tons per day for the 75-ppb Severe Plan

Since the estimated attainment year emissions are approximately equal to the VMT Offset ceiling (calculation 2), additional TCMs and TCSs will not be needed.

Table A-10 Analysis of Eastern Kern 70 ppb Standard

Following a two-step process with appropriate calculations, CARB staff compared target-year VOC emissions under three different VMT and emission control scenarios.

Table A-11 Step 1. Provide the emissions levels for the 2017 base year.

Table 1 shows the Eastern Kern VOC emissions for the calendar year 2017 from the EMFAC2017 model.

Table 3: Eastern Kern Base Year (2017) VMT and Emissions

Description	VMT (miles/day)	VOC (tons/day)
2017 Vehicle-Miles Traveled and On-Road Emissions	3,427,424	1.0

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Table A-12*Step 2. Calculate three emission levels in the 2032 attainment year.*

- (1) Calculate emissions levels with the motor vehicle control program frozen at 2017 levels and with projected VMT in the attainment year. This would represent the emissions in the attainment year if TCSs and TCMs were not implemented after 2017.
- (2) Calculate emissions levels with the motor vehicle control program frozen at 2017 levels and assuming VMT does not increase from 2017 levels.
- (3) Calculate an emissions level that represents emissions with full implementation of all TCSs and TCMs since 2017.

Table A-13*Calculation 1. Calculate the emissions in the attainment year assuming growth in VMT and no new control measures since the base year.*

To perform this calculation, CARB staff identified the on-road motor vehicle control programs adopted since 2017 and adjusted the EMFAC2017 output to reflect the VOC emission levels in 2032 without the benefits of the post-2017 control programs. As a result, the projected VOC emissions are 0.5 tons per day for 2032. In comparison, in the base year of 2017, VOC emissions were 1.0 tons per day.

Table A-14*Calculation 2. Calculate the emissions with no growth in VMT.*

EMFAC2017 allows the user to input different VMT values. CARB ran EMFAC2017 for the calendar year 2032 with the 2017 VMT level of 3,427,424 miles per day without the benefits of the post-2017 control programs. The VOC emissions associated with the 2017 VMT level are 0.4 tons per day for 2032.

Table A-15*Calculation 3. Calculate emissions reductions with full implementation of TCSs and TCMs.*

CARB calculated the VOC emission levels for 2037, assuming the benefits of the post-2017 motor vehicle control program and the projected VMT levels in 2032 are calculated using EMFAC2017. The projected VOC emissions levels are 0.4 tons per day for 2032.

VOC emissions for the sets of calculations described above are provided in Tables 2 and 3.

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Table 4: Eastern Kern VOC Emissions Calculations for the 2032 Attainment Year (70-ppb Severe Plan)

Calculation Number	Description	VMT year	Vehicle Control Program year	VMT (miles/day)	VOC (tons/day)
1	Emissions with motor vehicle control program frozen at 2017 levels (VMT at 2032 projected levels)	2032	2017	4,328,636	0.5
2	Emissions with motor vehicle control program frozen at 2017 levels (VMT at 2017 levels)	2017	2017	3,427,424	0.4
3	Emissions with a full motor vehicle control program in place (VMT at 2032 projected levels)	2032	2032	4,328,636	0.4

As provided in the 2012 U.S. EPA guidance, to determine compliance with CAA §182(d)(1)(A), Calculation 3 emissions levels should be less than or equal to the Calculation 2 emissions levels:

VOC: $0.4 \approx 0.4$ tons per day for the 70-ppb Severe Plan

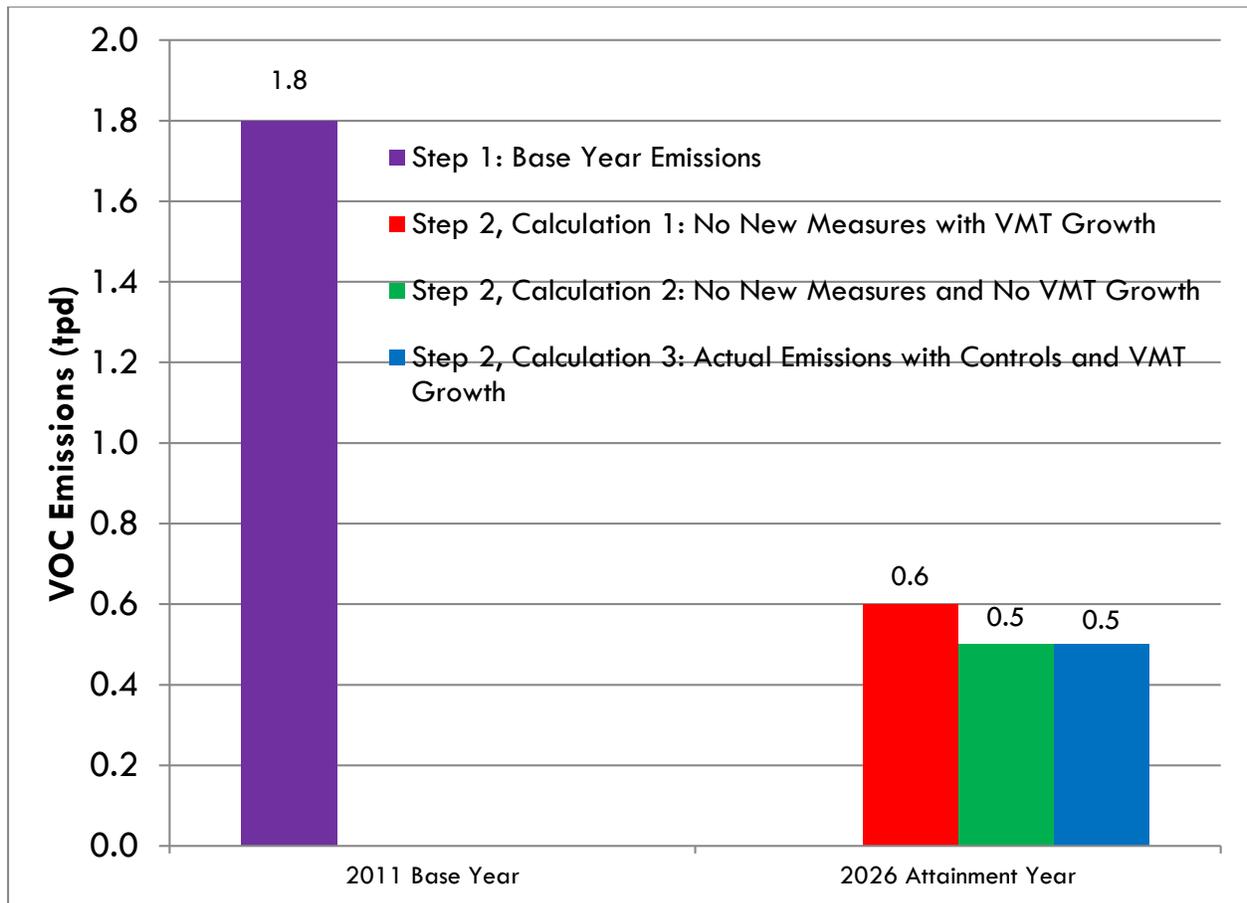
Since the estimated attainment year emissions are approximately equal to the VMT Offset ceiling (calculation 2), additional TCMs and TCSs will not be needed.

Table A-16 SUMMARY

To further illustrate the demonstration, Figures 1 and 2 graphically display the emissions benefits of the motor vehicle control programs in offsetting VOC emissions resulting from VMT increases in Eastern Kern County. For the 75 ppb 8-hour ozone Severe nonattainment standard (Figure 1), the left-most bar (in purple) shows the emissions in the base year, 2011. The three bars on the right show the emission levels in the attainment year 2026. The red bar on the right represents the emissions if there are no further motor vehicle controls after the base year (2011 level) and with projected VMT increases (2026 level). The green bar represents the emissions if VMT does not increase from the base-year (2011 levels) and there are no new TCSs or TCMs after the base year. Finally, the blue bar represents the emission levels with all the existing motor vehicle control programs in place with projected VMT increases.

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Figure 1 Eastern Kern VMT Offset Demonstration for the 75 ppb Standard*

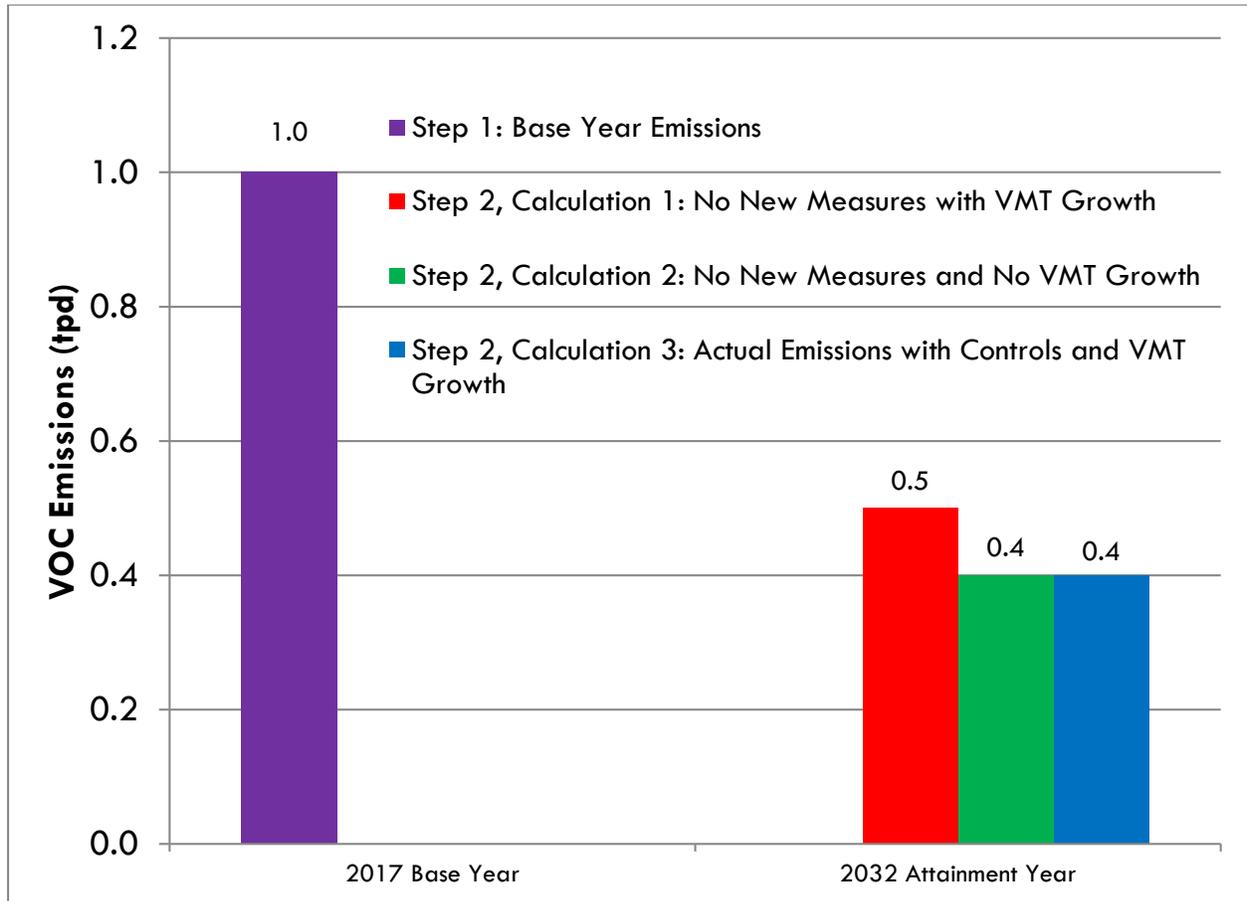


* Does not include resting or diurnal loss emissions

For the 70 ppb 8-hour ozone severe nonattainment standard (Figure 2), the left-most bar (in purple) shows the emissions in the base year. The three bars on the right show the emission levels in the attainment year 2032. The red bar on the right represents the emissions if there are no further motor vehicle controls after the base year (2017 level) and with projected VMT increases (2032 level). The green bar represents the emissions if VMT does not increase from the base-year (2017 levels) and there are no new TCSs or TCMs after the base year. Finally, the blue bar represents the emission levels with all the existing motor vehicle control programs in place with projected VMT increases.

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Figure 2 Eastern Kern VMT Offset Demonstration for the 70 ppb Standard*



* Does not include resting or diurnal loss emissions

Table A-17 CONCLUSION

The previous sections provide an analysis to demonstrate compliance with CAA §182(d)(1)(A). Based on the 2012 U.S. EPA guidance, since emissions with the existing control measures and VMT are less than or equal to emissions with no new measures and no VMT growth, and hence no additional TCSs and TCMs will be needed to offset the growth in emissions.

Attachment A-1

Table A-18 STATE OF CALIFORNIA MOTOR VEHICLE CONTROL PROGRAM (1990-PRESENT)

Table A-1 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	Hearing Date	Category
California Reformulated Gasoline (CalRFG), Phase I. T 13, CCR, 2251.5	9/27/1990	Fuels

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Table A-1 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	Hearing Date	Category
California Reformulated Gasoline, Phase II. T 13, CCR, 2250, 2255.1, 2252, 2260 - 2272, 2295	11/21/1991	Fuels
Wintertime Gasoline Program. T 13, CCR, 2258, 2298, 2251.5, 2296	11/21/1991	Fuels
Wintertime Oxygenate Program. T 13, CCR, 2258, 2251.5, 2263(b), 2267, 2298, 2259, 2283, 2293.5	9/9/1993	Fuels
Diesel Fuel Certification Test Methods. T 13, CCR, 1956.8(b), 1960.1(k), 2281(c), 2282(b), (c) and (g)	10/24/1996	Fuels
Diesel Fuel Test Methods. T 13, CCR, 1956.8(b), 1960.1(k), 2281(c), 2282(b), (c) and (g)	10/24/1996	Fuels
1997 Amendments to Onboard Diagnostics, Phase II, Technical Status. T 13, CCR, 1968.1, 2030, 2031	12/12/1996	On-Road
Low Emission Vehicles Standards (LEV 2) and Compliance Assurance Program (CAP 2000). T 13, CCR, 1961 & 1962 (both new); 1900, 1960.1, 1965, 1968.1, 1976, 1978, 2037, 2038, 2062, 2101, 2106, 2107, 2110, 2112, 2114, 2119, 2130, 2137-2140, 2143-2148	11/5/1998	On-Road
Exhaust Standards for (On-Road) Motorcycles. T 13, CCR, 1900, 1958, 1965	12/10/1998	On-Road
Light-and Medium Duty Low Emission Vehicle Alignment with Federal Standards. Exhaust Emission Standards for Heavy Duty Gas Engines. T 13, CCR, 1956.8 & 1961	12/7/2000	On-Road
Heavy Duty Diesel Engine Standards for 2007 and Later. T 13, CCR, 1956.8 and incorporated test procedures	10/25/2001	On-Road
Low Emission Vehicle Regulations. T 13, CCR, 1960.1, 1960.5, 1961, 1962 and incorporate test procedures and guidelines	11/15/2001	On-Road

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Table A-1 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	Hearing Date	Category
2003 Amendments to On-Board Diagnostic II Review Amendments. T 13, CCR, 1968.1, 1968.2, 1968.5	4/25/2002	On-Road
CaRFG Phase 3 Amendments. T 13, CCR, 2261, 2262, 2262.4, 2262.5, 2262.6, 2262.9, 2266.5, 2269, 2271, 2272, 2265, and 2296	7/25/2002	Fuels
Adoption of Minor Amendments to the Low-Emission Vehicle Regulations. T 13, CCR, 1961, 1965, 1978, and the incorporate test procedures	12/12/2002	On-Road
Incorporation of Federal Exhaust Emission Standards for 2008 and Later Model-Year Heavy Duty Gasoline Engines and the Adoption of Minor Amendments to the Low-Emission Vehicle Regulations. T 13, CCR, 1956.8 and documents incorporated by reference	12/12/2002	On-Road
CaRFG Phase 3 Amendments (specifications for De Minimis Levels of Oxygenates and MTBE Phase Out Issues). T 13, CCR, 2261, 2262.6, 2263, 2266.5, 2272, 2273, 2260, 2273.5	12/12/2002	Fuels
Specifications for Motor Vehicle Diesel Fuel. T 13 & T17, CCR, 1961, 2281, 2282, 2701, 2284, 2285, 93114, and incorporated test procedures	7/24/2003	Fuels
California Reformulated Gasoline, Phase 3. T 13, CCR, 2260, 2262, 2262.4, 2262.5, 2262.6, 2262.9, 2263, 2265 (and the incorporated "California Procedures"), and 2266.5	11/18/2004	Fuels
On-Board Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines (HD OBD). T 13, CCR, 1971.1	7/21/2005	On-Road

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Table A-1 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	Hearing Date	Category
Requirements to Reduce Idling Emissions from New and In-Use Trucks, Beginning in 2008. T 13, CCR, 1956.8, 2404, 2424, 2425, and 2485 and the incorporated document	10/20/2005	On-Road
Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yard. T 13, CCR, 2479	12/8/2005	On-road and Off-road
Evaporative and Exhaust Emission Test Procedures. T 13, CCR, 1961, 1976, 1978	6/22/2006	On-road
Heavy-Duty In-Use Compliance Regulation. T 13, CCR, 1956.1, 1956.8, and documents incorporated by reference	9/28/2006	On-Road
2007 Amendments to On-Board Diagnostic II. T 13, CCR, 1968.2, 1968.5, 2035, 2037 and 2038	9/28/2006	On-Road
Phase 3 Reformulated Gasoline (Ethanol Permeation) T 13, CCR, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2270, 2271, and 2273	6/14/2007	Fuels
2007 Amendments to Heavy-Duty In-Use Compliance Regulation. T 13, CCR, 1956.1, 1956.8, and documents incorporated by reference	12/6/2007	On-Road
Port Truck Modernization T 13, CCR, 2027	12/6/2007	On-Road
Cleaner In-Use Heavy-Duty Trucks (Truck and Bus Reg) T 13, CCR, 2025	12/11/2008	On-Road
2010 Amendments to On-Board Diagnostic II. T 13, CCR, 1968.2, 1968.5, 2035, 2037 and 2038	5/28/2009	On-Road
Plug-In Hybrid Electric Vehicle Test Procedure Amendments. T 13, CCR, 2032, 1900, 1962, 1962.1	5/28/2009	On-Road
2010 Amendments to On-Board Diagnostic System Requirements for Heavy-Duty Engines (HD OBD). T 13, CCR, 1971.1 and 1971.5	5/28/2009	On-Road
Truck and Bus Regulation 2010. T13, CCR, 2025	12/16/2010	On-Road

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Table A-1 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	Hearing Date	Category
2011 Amendments to Heavy-Duty In-Use Compliance Regulation. T 13, CCR, 1956.1, 1956.8, and documents incorporated by reference	6/23/2011	On-Road
Amendments to Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yard. T 13, CCR, 2479	9/22/2011	On-Road
Advanced Clean Cars T 13, CCR, 1900, 1956, 1960, 1961, 1962, 1965, 1968, 1976, 1978, 2037, 2038, 2062, 2112, 2139, 2140, 2145, 2147, 2235, 2300, 2302, 2303, 2304, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, and 2318	1/26/2012	On-Road
Zero Emission Vehicle Standards for 2009 through 2017 models. T 13, CCR, 1962.1, 1962.3	1/26/2012	On-Road
2012 Amendments to On-Board Diagnostic II. T 13, CCR, 1968.2, 1968.5, 2035, 2037 and 2038	1/26/2012	On-Road
Emergency Regulatory Amendments to the Tractor-Trailer Greenhouse Gas Regulation T 17, CCR, 95307	2/29/2012	On-Road
2013 Amendments to On-Board Diagnostics (OBD I and II) Regulations T 13, CCR, 1968.2, 1971.1	8/23/2012	On-Road
2013 Amendments to Heavy Duty On Board Diagnostic Requirements	8/23/2012	On-Road
Low Emission Vehicle III Greenhouse Gas and Zero Emission Vehicle Regulation Amendments for Federal Compliance Option T 13, CCR, 1900, 1956.8, 1960.1, 1961, 1961.2, 1961.3, 1962.1, 1962.2, 1976	11/15/2012	On-Road

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Table A-1 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	Hearing Date	Category
Heavy-Duty Greenhouse Gas Phase 1: On-Road Heavy Duty Greenhouse Gas Emissions Rule, Tractor-Trailer Rule, Commercial Motor Vehicle Idling Rule, Optional Emission Standards, Heavy-Duty Hybrid-Electric Vehicle Certification Procedure T 13, CCR, 1900, 1956.	12/12/2013	On-Road
Heavy-Duty Hybrid-Electric Vehicle Certification Procedure T 13, CCR, 1900, 1956.8, 2036, 2037, 2112, 2139, 2140, 2147, 2485, T 17, CCR, 95300, 95301, 95302, 95303, 95305, 95660, 95661, 95662, 95663, 95664	12/12/2013	On-Road
Amendments to Low Emission Vehicle III Criteria Pollutant Requirements for Light- and Medium-Duty Vehicles the Hybrid Electric Vehicle Test Procedures, and the Heavy-Duty Otto-Cycle and Heavy-Duty Diesel Test Procedures T 13, CCR, 1900, 1956.8, 1961.2, 1962.2, 1965, 1976, 1978	10/23/2014	On-Road
2014 Amendments to Zero Emission Vehicle Regulation T 13, CCR, 1962.1, 1962.2	10/23/2014/5/21/2015	On-Road