

California Air Resources Board
**Public Hearing to Consider the Proposed
In-Use Locomotive Regulation**
Staff Report: Initial Statement of Reasons

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Executive Summary

Locomotives operate at railyards, traveling throughout the state of California on rail lines and in and around industrial facilities. Locomotives in California often operate in densely populated neighborhoods and the communities surrounding rail operations disproportionately bear the health burdens associated with emissions directly contributed by diesel locomotives. In spite of the wide commercial availability of cleaner locomotives that could cut average emissions by up to 80 percent, locomotive operators have continued to use locomotives that emit up to 25 times the cleanest available levels.

California Air Resources Board (CARB or Board) staff are proposing the In-Use Locomotive Regulation (title 13, California Code of Regulations, sections 2478 through 2478.16), hereafter referred to as the “Proposed Regulation.” This Initial Statement of Reasons presents staff’s proposal to achieve emission reductions from locomotives operating in California by encouraging the use of newer cleaner locomotives to reduce diesel particulate matter (DPM), oxides of nitrogen (NOx) and greenhouse gas (GHG) emissions. Driven by the Governor’s Executive Order (EO) N-79-20,¹ which set a goal for 100 percent ZE off-road vehicles and equipment by 2035, the Proposed Regulation begins the transition of diesel-powered locomotives to ZE technology and is a part of California’s holistic plan to meet the state’s multiple public health, air quality, and climate goals.

A. What are Locomotives?

Locomotives are self-propelled pieces of on-track equipment used to push or pull rail-mounted cars carrying freight or passengers. A typical locomotive is powered by a diesel generator, which powers electric traction motors, that drive the locomotive wheels. California locomotives power over 77,000,000 individual rides per year,² and haul 4.8 percent of all freight within the state.³

The Proposed Regulation includes requirements for the five types of locomotives listed below.

1. Freight line haul locomotives – Classified by the United States Environmental Protection Agency (U.S. EPA) and by CARB as locomotives over 2,300 horsepower (hp), these locomotives typically operate throughout the United States transporting freight to different states.
2. Switch locomotives or “switchers” – Classified by U.S. EPA and by CARB as locomotives 1,006 hp through 2,300 hp, these locomotives are most often used within localized areas and travel short distances.

¹ Executive Department, State of California, EO N-79-20, September 23, 2020. (weblink: <https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf>).

² Based on ridership reports for six California Passenger Operators that use self-propelled locomotives: Altamont Commuter Express (ACE), Amtrack Pacific Surfliner, Caltrain, Caltrans (which runs the Capitol Corridor and San Joaquin Corridor), Metrolink, and the North Coast Transit District (NCTD); average of the year 2018 and 2019 to capture pre-pandemic ridership. See ISOR Appendix B: Standardized Regulatory Impact Assessment.

³ National Freight Analysis Framework 5 Summary Statistics, November 2021, accessed July 7, 2022. (weblink: <https://faf.ornl.gov/faf5/SummaryTable.aspx>).

3. Industrial locomotives – Industrial locomotives are defined in the Proposed Regulation as locomotives operated by industrial operators; these are typically older locomotives that operate at an industrial facility.
4. Historic locomotives – Historic locomotives are defined in the Proposed Regulation as locomotives that are owned or operated by a historic railroad and that meet additional requirements described in the Proposed Regulation. For more information, see Appendix A: Proposed Regulation Order.
5. Passenger locomotives – Passenger locomotives are not differentiated by a U.S. EPA classification; however, they are typically over 2,300 hp. The Proposed Regulation identifies passenger locomotives separately because they are specialized for passenger service; they include specialized equipment needed for passenger comforts, such as an additional engine that provides electricity for lights, air conditioning and other operations while the main locomotive engine is off.

Locomotive operators, described below by type, typically use different locomotives depending on their needs:

Class I Locomotive Operators Use:

- Line haul locomotives to haul freight throughout the United States.
- Switchers to haul freight cars throughout a railyard or other freight facilities.

Class II and III Locomotive Operators Use:

- Switchers to haul freight over short distances between freight facilities or industrial facilities.
- Line haul locomotives to haul freight over short distances, although the use of line haul locomotives is not typical for Class II and Class III locomotive operators.

Industrial Locomotive Operators Use:

- Switchers to haul freight over short distances at industrial facilities.

Passenger Locomotive Operators Use:

- Passenger locomotives to transport passengers.
- Switchers to haul passenger railcars or locomotives throughout a railyard.

Historic Locomotive Operators Use:

- Locomotives of many types and sizes; key characteristics of historic locomotives are described in the Proposed Regulation.

B. Why do Locomotives Need to be Regulated in California?

Locomotives emit multiple air pollutants, such as DPM, particulate matter of 2.5 microns or less (PM_{2.5}), NO_x, and GHGs, including black carbon. Communities near railyards experience disproportionate burdens from exposure to air pollutants from locomotive activity. DPM is a known toxic air contaminant (TAC) and can cause lung cancer and other health problems. PM_{2.5} is associated with premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency room (ER) visits, respiratory symptoms, restricted activity days, and reduced lung function growth in children. As a precursor to smog, NO_x can cause or worsen numerous respiratory and other health ailments

and is also associated with premature death. GHGs, including black carbon, contribute to climate change.

The federal Clean Air Act (42 U.S.C. § 7401 et. seq.) requires areas that exceed the health-based national ambient air quality standards (NAAQS) to develop strategies to meet the NAAQS, which are standards that apply to specific pollutants, including PM and NO_x. Pollutants subject to NAAQS are sometimes referred to as criteria pollutants, because the NAAQS are set based on criteria which are characterizations of their effects on health or welfare. The California State Strategy for the State Implementation Plan (SIP) demonstrates how California will attain the standards by specified dates. The Draft 2022 State Strategy for the SIP (2022 State SIP Strategy) includes the critical emission reductions that would be achieved by the Proposed Regulation.⁴

California is making significant strides toward reducing PM_{2.5} and NO_x in other sectors, such as heavy-duty trucks. Since 2012, California has required heavy-duty trucks to reduce their emissions through the Statewide Truck and Bus Rule. Additionally, CARB adopted the Advanced Clean Trucks (ACT) Regulation⁵ and is developing the Advanced Clean Fleets (ACF) Regulation,⁶ which will move heavy-duty trucks toward zero emissions (ZE). Although these measures will bring substantial reductions in truck emissions, the reductions will not be enough for California to meet its State 2022 SIP Strategy⁷ goals, nor will they reduce the health effects caused from diesel emissions created by locomotives.

The Proposed Regulation is needed to reduce emissions from locomotives operating within California, which will help the state meet the Clean Air Act requirements for attaining the NAAQS by the required deadlines, reduce community exposure to toxic diesel emissions, reduce GHG and black carbon emissions, and support the state's climate change goals.

C. Which is a Cleaner Way to Haul Freight: Trucks or Locomotives?

In 2020, CARB published the Draft Truck versus Train Emissions Analysis. This analysis shows that as the California truck regulations are implemented through 2023, trucks will produce less PM_{2.5} and NO_x emissions than locomotives and will be the cleaner mode to transport freight. Further, beyond 2023, additional CARB regulations, such as the ACT and ACF Regulations, will continue to reduce truck emissions, eventually bringing them to ZE.

In describing which mode of freight transport is "cleanest," CARB has taken toxic and criteria pollutants into account, specifically PM_{2.5}, particulate matter (PM), NO_x, and greenhouse gases (GHG). A study on freight locomotives from the Berkeley National Laboratory⁸

⁴ CARB, Draft 2022 State Strategy for the State Implementation Plan, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

⁵ Cal. Code Regs., tit. 13, §§ 1963, 1963.1, 1963.2, 1963.3, 1963.4, 1963.5, 2012, and 2012.1; CARB, Advanced Clean Trucks Fact Sheet, August 20, 2021. (weblink: https://ww2.arb.ca.gov/sites/default/files/2021-08/200625factsheet_ADA.pdf).

⁶ CARB, Advanced Clean Fleets Fact Sheet, June 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-03/ACF%20Fact%20Sheet_ADA.pdf).

⁷ CARB, Draft 2022 State Strategy for the State Implementation Plan, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

⁸ Popovich, Natalie D., Deepak Rajagopal, Elif Tasar and Amol Phadke, Economic, environmental and grid-resilience benefits of converting diesel trains to battery-electric, Nature Energy, Vol 6, November 2021. (weblink: <https://www.nature.com/articles/s41560-021-00915-5>).

estimates “diesel locomotives emit 35 million tonnes of [carbon dioxide](CO₂) each year and produce air pollution that causes about 1,000 premature deaths annually, accounting for approximately US\$6.5 billion in health damage costs per year. Despite being more fuel efficient than trucks, these locomotives produce close to twice the air pollution damages compared with heavy-duty trucks per unit of fuel consumed because of the less stringent pollution controls on locomotives.”

To be fuel efficient and cost-effective, freight locomotive operators use long, heavy trains, sometimes up to three miles long, to transport freight across the U.S. While locomotives consume less fuel on average than some diesel freight trucks, they combust that fuel in engines that average federal Tier 1+ or Tier 2 emission standards, approximately 0.1-0.2 grams per brake horsepower-hour (g/b-hp-hr) of PM and 5.5 g/b-hp-hr of NO_x.⁹ See Tables 1 and 2 in Section E for a description of the federal locomotive emission Tiers. As of January 1, 2023, California heavy-duty diesel trucks will be required to run at 2010 engine model year emission rates of 0.01 g/bhp-hr of PM and 0.20 g/bhp-hr of NO_x.¹⁰

Although freight transport by locomotive often results in fewer GHG emissions than transport by truck on a per-ton basis,¹¹ ZE trucks will produce no tailpipe emissions, and heavy-duty trucks operating in California are projected to transition to ZE beginning in 2024 with the ACT and ACF Regulations. In addition, the carbon intensity of electricity and hydrogen are projected to decrease¹² and a full zero emissions truck fleet will emit less well-to-wheel GHGs than diesel trains starting around 2045.

D. What Air Pollution Burdens are Associated with Locomotives?

Locomotives operate throughout the state moving cargo to various railyards, industrial facilities, and seaports and moving passengers between passenger stations. Locomotives have electric engines that are most often powered by diesel fuel. Combustion of diesel fuel emits harmful air pollutants, including DPM, PM_{2.5}, NO_x, and GHGs.

In 1998, CARB identified DPM as a TAC¹³ based on published evidence of a relationship between diesel exhaust exposure and lung cancer and other adverse health effects. The majority of DPM is small enough to be inhaled into the lungs. DPM exposure leads to health effects, including premature death, hospitalizations, and emergency department visits for exacerbated chronic heart and lung disease, including asthma, increased respiratory symptoms, and decreased lung function in children; those most vulnerable to these health effects are children whose lungs are still developing and the elderly who often have chronic health problems.

⁹ Appendix G: CARB’s 2022 In-Use Locomotive Emission Inventory: Regulatory Proposal and Scenarios.

¹⁰ CARB, California Truck and Bus Regulation Fact Sheet, June 18, 2019. (weblink: <https://www.arb.ca.gov/msprog/onrdiesel/documents/fsregsum.pdf>).

¹¹ American Association of Railroads, Freight Rail & Preserving the Environment, May 2022. (weblink: <https://www.aar.org/wp-content/uploads/2020/06/AAR-Sustainability-Fact-Sheet.pdf>).

¹² CARB, Crude supply, carbon intensity, and in-state production, LCFS data dashboard and LCFS compliance scenario, accessed July 1, 2022. (weblink: <https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm>).

¹³ CARB, CARB Identified Toxic Air Contaminants, accessed July 1, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/carb-identified-toxic-air-contaminants#:~:text=CARB%20Identified%20Toxic%20Air%20Contaminants%20Background%20According%20to,a%20present%20or%20potential%20hazard%20to%20human%20health.%22>).

DPM has a significant impact on California's population. It is estimated that about 70 percent of the total known cancer risk related to air toxics in California is attributable to DPM. Based on 2012 estimates of statewide exposure, DPM is estimated to increase statewide cancer risk by 520 cancers per million residents exposed over a lifetime.¹⁴

PM2.5, or fine particulate matter, is defined as particles that are 2.5 microns or less in diameter. PM2.5 may be either directly emitted from sources (primary particles) or formed in the atmosphere through chemical reactions. For PM2.5, exposures have been associated with premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency room visits, respiratory symptoms, and restricted activity days. In addition, of all the common air pollutants, PM2.5 is associated with the greatest proportion of adverse health effects related to air pollution, both in the United States and world-wide, based on the World Health Organization's Global Burden of Disease Project.¹⁵

NOx includes nitrogen dioxide, a potent lung irritant, which can aggravate lung diseases such as asthma when inhaled. The non-cancer health impacts projected for the Proposed Regulation occur from the conversion of NOx into fine particles of ammonium nitrate (i.e., secondary PM2.5) through chemical processes in the atmosphere. PM2.5 formed in this manner is termed secondary PM2.5. Both directly emitted (primary) PM2.5 and secondary PM2.5 from mobile sources such as diesel-powered locomotives are associated with adverse health outcomes, such as cardiopulmonary mortality, hospitalizations for cardiovascular and respiratory illnesses, and ER visits for asthma. Additionally, NOx can react with other compounds to form ozone, which is the main component of smog. Ozone can cause irritation, damage lung tissue, and worsen asthma or chronic illnesses, including chronic obstructive pulmonary disease and reduced lung function. Reductions in PM2.5 and NOx emissions are associated with improvements in these adverse health outcomes.¹⁶

Health and Safety Code 38505 identifies seven GHGs that CARB is responsible to monitor and regulate to reduce emissions: CO₂, methane (CH₄), nitrous oxide (N₂O), sulfur hexafluoride (SF₆), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF₃). According to the report "Valuing Climate Damages" from the National Academies of Science, Engineering, and Medicine, "GHG emissions create changes in net agricultural productivity, energy use, human health, property damage from increased flood risk, as well as nonmarket damages, such as the services that natural ecosystems provide to society. Many of these damages from CO₂ emissions today will affect economic outcomes throughout the next several centuries."¹⁷

¹⁴ CARB, Overview: Diesel Exhaust & Health, accessed July 1, 2022. (weblink: <https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health>).

¹⁵ WHO, WHO Global Burden of Disease Project, 2013. (weblink: <https://www.thelancet.com/action/showPdf?pii=S0140-6736%2815%2900128-2>).

¹⁶ CARB, Nitrogen Dioxide and Health, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/resources/nitrogen-dioxide-and-health>).

¹⁷ National Academies of Sciences, Engineering, Medicine, Valuing Climate Damages: Updating Estimation of Carbon Dioxide, 2017. (weblink: <http://www.nap.edu/24651>).

E. Are There Already Regulations to Reduce Emissions from Locomotives in California?

Under the federal Clean Air Act, the U.S. EPA has established emissions standards for new locomotives. Freight line haul, switch, industrial, and passenger locomotives must adhere to one of two sets of emission standards based on engine size.

- Locomotives between 1,006 and 2,300 horsepower are defined as switchers.
- Locomotives with horsepower of greater than 2,300 are defined as line haul (includes freight and passenger locomotives).

U.S. EPA established the locomotive emission standards shown in Tables 1 and 2. There are a wide range of emission control requirements for diesel-powered locomotives, from no emission controls (uncontrolled) to the cleanest available (Tier 4).

Table 1: Existing Federal Locomotive Emission Standards for Line Haul Locomotives (> 2300 hp) Expressed in Grams per Brake Horsepower-Hour (g/bhp-hr)^{18,19}

Emissions Tier	Year of Original Manufacture	NO _x Standard (g/bhp-hr)	PM Standard (g/bhp-hr)	HC Standard (g/bhp-hr)	Carbon monoxide (CO) Standard (g/bhp-hr)
Tier 0	2000-2001 ²⁰	9.5	0.60	1.00	5.0
Tier 0+	1973-1992	8.0	0.22	1.00	5.0
Tier 1	2002-2004	7.4	0.45	0.55	2.2
Tier 1+	1993-2004	7.4	0.22	0.55	2.2
Tier 2	2005-2011	5.5	0.20	0.30	1.5
Tier 2+	2005-2011	5.5	0.10	0.30	1.5
Tier 3	2012-2014	5.5	0.10	0.30	1.5
Tier 4	2015 or later	1.3	0.03	0.14	1.5

¹⁸ U.S. EPA, 40 C.F.R. Part 1033 – Exhaust emission standards, Subpart B, p. 15-16, 2008. (weblink: <https://www.govinfo.gov/content/pkg/CFR-2020-title40-vol36/pdf/CFR-2020-title40-vol36-part1033.pdf>).

¹⁹ U.S. EPA, 40 C.F.R. Parts 85, 89 and 92 - Emission Standards for Locomotives and Locomotive Engines, April 16, 1998. (weblink: <https://www.govinfo.gov/content/pkg/FR-1998-04-16/pdf/98-7769.pdf>).

²⁰ 1973-1999 when remanufactured. U.S. EPA, 40 C.F.R. Part 92.8 Emission Standards - Emission Standards for Locomotives and Locomotive Engines, April 16, 1998. (weblink: <https://www.govinfo.gov/content/pkg/FR-1998-04-16/pdf/98-7769.pdf>).

Table 2: Existing Federal Locomotive Emission Standards Switchers (1006 hp – 2300 hp) Expressed in Grams per Brake Horsepower-Hour (g/bhp-hr)^{18,19}

Emissions Tier	Year of Original Manufacture	NO _x Standard (g/bhp-hr)	PM Standard (g/bhp-hr)	HC Standard (g/bhp-hr)	Carbon monoxide (CO) Standard (g/bhp-hr)
Tier 0	2000-2001 ²¹	14.0	0.72	2.10	8.0
Tier 0+	1973-2001	11.8	0.26	2.10	8.0
Tier 1	2002-2004	11.0	0.54	1.20	2.5
Tier 1+	2002-2004	11.0	0.26	1.20	2.5
Tier 2	2005-2011	8.1	0.24	0.60	2.4
Tier 2+	2005-2010	8.1	0.13	0.60	2.4
Tier 3	2011-2014	5.0	0.10	0.60	2.4
Tier 4	2015 or later	1.3	0.03	0.14	2.4

Federal Regulations also include a requirement to install a stop/start system which must shut off the main locomotive engine(s) after 30 minutes of idling (or less).²²

Despite federal locomotive regulations, operators continue to use older locomotives because there is no requirement to remove older, dirtier locomotives from service. Current federal requirements relate only to the emission level when newly manufacturing or remanufacturing locomotives.²³ Remanufacture, which is fully defined in Title 40 Code of Federal Regulations (C.F.R.) section 1033.901, includes an upgrade of a locomotive or a locomotive engine. Remanufacture may involve power assembly inspection or replacement, or other types of repair. After remanufacture, a locomotive will continue to operate at an emission level equivalent or nearly equivalent to the emission standard that applied to new locomotives at the time when the locomotive was originally manufactured.

²¹ 1973-1999 when remanufactured. U.S. EPA, 40 C.F.R. Part 92.8 Emission Standards - Emission Standards for Locomotives and Locomotive Engines, April 16, 1998. (weblink: <https://www.govinfo.gov/content/pkg/FR-1998-04-16/pdf/98-7769.pdf>).

²² U.S. EPA, 40 C.F.R. 1033.115(g) idle controls, 2008. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-B>).

²³ U.S. EPA, 40 C.F.R. Part 1033.1 Applicability – Exhaust emission standards, Subpart A, p. 14, 2008. (weblink: <https://www.govinfo.gov/content/pkg/CFR-2020-title40-vol36/pdf/CFR-2020-title40-vol36-part1033.pdf>).

F. Who Does the Proposed Regulation Apply To?

The Proposed Regulation would apply to the following locomotive types:

- Freight line haul and switch locomotives operated by Class I, Class II, and Class III locomotive operators and industrial operators.
- Passenger locomotives.
- Locomotives defined as “historic locomotives” under the Proposed Regulation.

The Proposed Regulation would not apply to:

- Locomotives with an engine having a total rated power of less than 1,006 horsepower.
- Locomotives used for certification of “hands-on experience” for mechanics and locomotive engineers.
- Equipment designed for operation both on roads and on rails.
- Military locomotives.

In addition, historic locomotive fleets that do not exceed 10,000 gallons of fuel use per year fleetwide could be exempt from the Spending Account and In-Use Operational Requirements (IUOR) provisions of the Proposed Regulation if they apply for an exemption and are approved by CARB. For more information on the full applicability of the Proposed Regulation, see Appendix A: Proposed Regulation Order.

G. What are the Requirements of the Proposed Regulation?

The Proposed Regulation has four main components: The Spending Account, the In-Use Operational Requirements (IUOR), idling requirements, and reporting/registering/recordkeeping requirements. Each of the four components are described below. Please note that there are other provisions that will be discussed later, such as the alternative compliance plan, administrative fee, historic railroad exemption, and small business extension. The Proposed Regulation may be found in Appendix A: Proposed Regulation Order.

1. Spending Account

For each locomotive operated in California, locomotive operators would be required to deposit funds into a spending account annually. The amount deposited in the account is calculated by using the locomotive’s annual usage in megawatt hours (MWh) and the locomotive’s emission factors. Emission factors reflect estimates of the health cost burden on Californians due to these locomotive emissions. Funds in the Spending Account may only be used for:

1. The purchase, lease, or rental of Tier 4 or cleaner locomotives, or for the remanufacture or repower to Tier 4 or cleaner locomotives until January 1, 2030.
2. The purchase, lease, or rental of ZE locomotives, ZE capable locomotive(s),²⁴ or ZE rail equipment, or to repower to ZE locomotive(s) or ZE capable locomotive(s). A ZE capable locomotive is one that is always operated in a ZE capacity in California and

²⁴ The ZE capable locomotive must only operate in a ZE configuration while operating in California.

does not emit any criteria pollutant, toxic pollutant, or greenhouse gas from any onboard source of power.

3. The purchase of ZE infrastructure intended to support ZE locomotives, ZE capable locomotives or ZE rail equipment.
4. Pilot projects or demonstrations of ZE locomotives or ZE rail equipment technologies.

a) ZE Credit in the Spending Account

Prior to January 1, 2030, use of any ZE locomotive, ZE capable locomotive, ZE rail equipment,²⁵ or wayside power (also known as “ground power” or “yard power”) in California would generate a credit that may be used to reduce Spending Account deposit obligations. Additionally, use of a ZE locomotive, ZE rail equipment, ZE capable locomotive, or wayside power in a disadvantaged community as defined by CalEnviroScreen,²⁶ would accrue double credit.

2. In-Use Operational Requirements

Starting January 1, 2030, only locomotives with original engine build dates 23 years old or less would be able to operate in California unless the locomotive is a ZE or ZE capable locomotive or the primary engine has not exceeded the specified MWh.

Additionally, on January 1, 2030, all switch, passenger, and industrial locomotives with an original engine build date of 2030 or newer would be required to operate in a ZE configuration when in California. Starting January 1, 2035, all line haul locomotives with an original engine build date of 2035 or newer would be required operate in a ZE configuration when in California.

The Proposed Regulation requires staff to publish an assessment of the progress made in ZE technologies for use with freight line haul, switch, industrial, and passenger locomotives, as well as the status of infrastructure improvements that may be needed to support ZE locomotives in 2027 and 2032. If staff finds that the compliance deadlines in the Proposed Regulation need to be adjusted forward or backward in time, the report will include recommendations to initiate staff’s development of potential formal regulatory amendments.

3. Idling Requirement

The Proposed Regulation specifies that locomotives cannot idle in California for more than 30 minutes before the engine must be shut down. Certain exemptions in the Proposed Regulation permit idling exceeding 30 minutes, consistent with those exemptions found in Title 40 C.F.R. Part 1033.

²⁵ Equipment capable of on-track operation that has a main function that is the same as a freight line haul, switch, industrial, or passenger locomotive.

²⁶ Office of Environmental Health Hazard Assessment (OEHHA) California Communities Environmental Health Screening Tool: CalEnviroScreen 4.0., October 2021, accessed July 7, 2022. (weblink: <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40>).

4. Recordkeeping and Reporting

The Proposed Regulation would require each locomotive operator to annually report locomotive operations by California air district. For example, the Proposed Regulation would require a locomotive emissions annual report providing the annual activity in MWh and the total engine hours operated for each locomotive on a per-air-district basis. As another example, the idling annual report must disclose the time, date, location, and duration of idling events that exceed 30 minutes and identify whether the locomotive is equipped with an automatic engine stop/start system.

H. How Does the Spending Account Work?

The Spending Account would require each locomotive operator in California to establish a trust account and fund the account annually starting on or before July 1, 2024. The Spending Account funding requirement is based on monetized premature mortalities caused from diesel emissions that locomotives create in California. To determine the Spending Account funding requirement for each locomotive, operators would use a formula provided in the funding requirement subsection of the regulatory language to calculate the estimated health costs of their locomotive activity over the previous year.

A locomotive operator would calculate their funding obligation based on the activity and the PM and NO_x emission factors of the locomotives they operated in the previous year, and deposit funds in their Spending Account. Operators would continue to deposit funds into their Spending Account each year based on the formula provided in the Proposed Regulation. Operators would only be permitted to use their Spending Account funds, along with any interest earned, to purchase, lease, rent, remanufacture, or repower to a locomotive with emission levels equivalent to or cleaner than Tier 4. Beginning in 2030, funds held in the Spending Account could only be used for ZE locomotives and ZE capable locomotives, ZE rail equipment, or infrastructure. Additionally, at any time, operators would also be permitted to use Spending Account funds for demonstrations or pilot projects of ZE locomotives, ZE rail equipment, and supporting infrastructure.

Once the newly purchased locomotive enters service, it may offset activity or even replace an older, dirtier locomotive in the same operator's control. In subsequent years, the locomotive operator's reported annual emissions would likely decrease due to the use of a cleaner locomotive, which would cause their Spending Account funding obligation to decrease.

By operating a ZE locomotive or by connecting to wayside power in California prior to 2030, operators may earn "credits" that could be used to offset their Spending Account funding obligations. ZE credit would be doubled for operating in a disadvantaged community as defined by California Communities Environmental Health Screening Tool (CalEnviroScreen).²⁷

I. Why Did CARB Choose 23 Years as the Age Limit for Locomotives?

The Proposed Regulation IUOR specifies that starting in 2030, only locomotives less than 23 years of age since their original engine build date would be permitted to operate in

²⁷ Office of Environmental Health Hazard Assessment, CalEnviroScreen 4.0, October 20, 2021, accessed July 7, 2022. (weblink: <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40>).

California. This provision is designed to address the emissions and health effects from continued use of locomotives operating with older, less effective emission control technologies. Under U.S. EPA's regulation, locomotives need only meet the emission standard that applied when they were originally manufactured. Because locomotives can be remanufactured indefinitely, locomotive operators have continued to use older, dirtier locomotives, some as old as 50 or 60 years. To address the health effects caused by diesel emissions, locomotives operating in California must transition to the cleanest available emission technologies as soon as possible.

The 23-year operational limit is intended to allow a minimum of two "useful life" time periods for a locomotive. A useful life is the period during which the locomotive engine is designed to properly function in terms of reliability and fuel consumption, without being remanufactured. It is also the period during which a locomotive is required to comply with all applicable federal emission standards. U.S. EPA defines minimum useful life as MWhs equal to the product of the rated horsepower multiplied by 7.50, and the minimum useful life in terms of years is 10 years. Allowing 23 years of operation would ensure that operators can use most locomotives for a time span equivalent to two useful lives.

J. Is there an Alternative to Compliance with the Spending Account or with the In-Use Operational Requirement?

Operators could be elect to pursue an Alternative Compliance Plan (ACP) rather than complying with the requirements of the Spending Account or the IUOR, or both. Their application must demonstrate that their ACP would achieve the equivalent or greater emission reductions as would have been achieved under the Spending Account or IUOR sections, as applicable, based on the assumptions listed in the Proposed Regulation. CARB may approve the ACP application if it satisfies the applicable requirements.

K. If There is Already a Federal Idling Rule, Why Does CARB Need to Include it in the Proposed Regulation?

The Proposed Regulation includes idling requirements to strengthen enforcement and limit unnecessary locomotive idling. CARB has received community complaints about excessive idling of locomotive engines. Although federal requirements limit excessive idling of locomotive engines, they do not provide adequate direction to CARB for enforce purposes. To minimize conflict, the idling requirements in the Proposed Regulation are closely aligned with current federal Idling restrictions.

L. What is the Purpose of Requesting a Report of Activity Data by Air District?

The Proposed Regulation requests an annual report of locomotive activity on a per-Air District basis. This would allow CARB to determine where harmful emissions are occurring, and to model the health effects of those exposures on the local communities. This would also allow CARB to respond to community requests for specific information about emissions in their areas.

1. What Health Benefits Would the Proposed Regulation Provide?

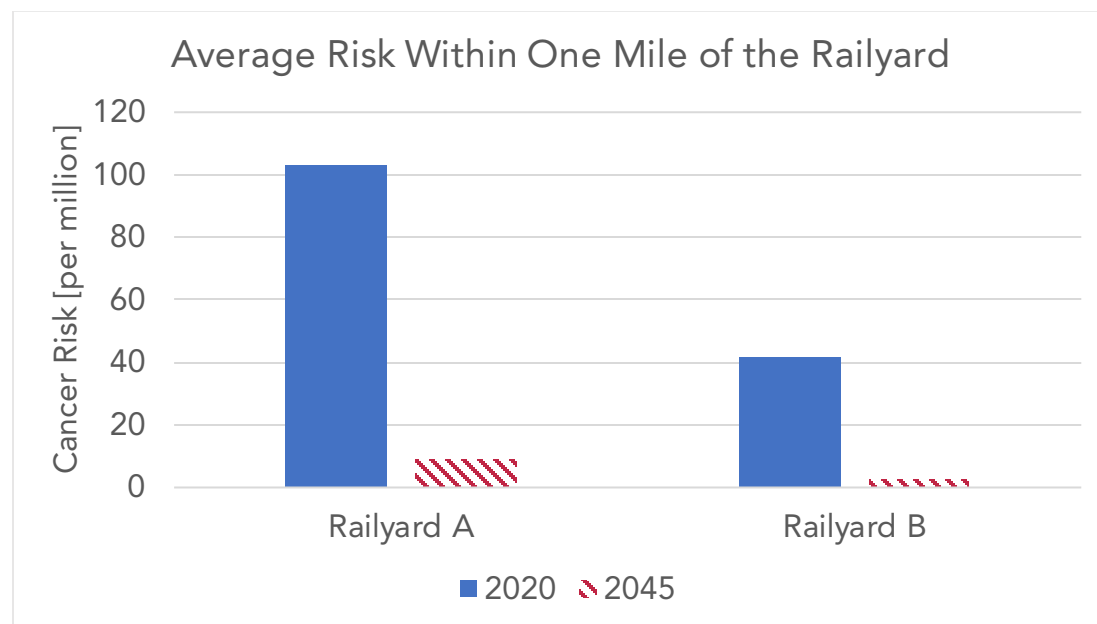
Exposure to pollution from diesel-powered locomotives has both potential cancer and non-cancer health impacts. Staff conducted a Health Risk Characterization (HRC) to evaluate the cancer risk reductions that would be gained if 100 percent of the locomotives operated at California railyards were Tier 4. Separately, staff estimated the non-cancer health impacts associated with the Proposed Regulation, such as cardiopulmonary mortality, hospitalizations for cardiovascular illness and respiratory illness, and emergency room visits for asthma associated with exposure to ambient levels of directly emitted PM2.5 and secondary PM2.5 formed in the atmosphere from locomotive NOx emissions. The results are summarized below. For more information on the health studies that support the Proposed Regulation, see the Initial Statement of Reasons (ISOR), Appendix H: Health Analyses.

2. Reduction in Potential Cancer Risk

The HRC evaluated the cancer risk associated with emissions from locomotives operating at two California railyards of different sizes to represent the range of results for railyards throughout California; one located in the southern part of the state, referred to as 'Railyard A,' and one located in the northern part of the state, referred to as 'Railyard B.' The HRC focuses on cancer risk from exposure to "primary" (directly emitted) diesel PM emissions experienced by people who live near railyards. Refer to the Appendix H: Health Analyses for additional modeling details.

For the HRC, cancer risk is presented as averages within a one-mile distance from the facility boundary. As shown in Figure 1, the HRC concludes that the Proposed Regulation would result in a 91 to 93 percent reduction in the average cancer risk in 2045 from both railyards when compared to the 2020 level (the baseline year). The projected reduction is consistent with the projected emission inventory in 2045. The HRC indicates an overall cancer risk benefit to both railyards with the implementation of the Proposed Regulation.

Figure 1: Cancer Risk Near Railyards Studied in the Health Risk Characterization



3. Reduction in Non-Cancer Health Impacts

Staff evaluated the statewide non-cancer health impacts associated with exposure to PM2.5 and NOx emissions from locomotives. PM2.5 may be directly emitted or created through secondary formation. Locomotive NOx emissions include nitrogen dioxide, a potent lung irritant, which can aggravate lung diseases such as asthma when inhaled.²⁸ However, the most serious quantifiable impacts of NOx emissions occur through its role in the formation of secondary PM2.5. Both directly emitted PM2.5 and secondary PM2.5 from locomotives are associated with adverse health outcomes, such as cardiopulmonary mortality, hospitalizations for cardiovascular illness and respiratory illness, and emergency room visits for asthma. Reductions in PM2.5 and NOx emissions are associated with reductions in these health outcomes.

Staff estimates that the total number of cases statewide that would be reduced (from 2023 to 2050) from implementation of the Proposed Regulation are as follows:

- 3,233 fewer premature deaths (2,529 to 3,951, 95 percent confidence interval (CI));
- 1,486 fewer emergency room visits (940 to 2,032, 95 percent CI);
- 597 fewer hospital admissions for respiratory illness (140 to 1,053, 95 percent CI);
- 500 fewer hospital admissions for cardiovascular illness (0 to 980, 95 percent CI).

In accordance with U.S. EPA practice,²⁹ statewide valuations of health benefits from the Proposed Regulation were calculated by multiplying the avoided non-cancer health outcomes above by the valuation per incident. The total statewide valuation due to avoided health outcomes (from 2024 to 2050) are summarized in Table 3. The total statewide health benefits for the Proposed Regulation are estimated to be \$32 billion.

Table 3: Statewide Valuation from Avoided Adverse Health Outcomes Between 2024 and 2050 as a Result of the Proposed Regulation (2020\$)

Outcome	Valuation*
Avoided Premature Deaths	\$31,895,938,673
Avoided Hospitalizations	\$59,477,776
Avoided Emergency Room Visits	\$1,239,324
Total	\$31,956,655,772

* Values have been rounded and are based on the 2019-year dollar.

²⁸ U.S. EPA, Integrated Science Assessment for Oxides of Nitrogen – Health Criteria, January 2016. (weblink: http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=526855).

²⁹ U.S. EPA, Mortality Risk Valuation – What does it mean to place a value on a life? Accessed July 7, 2022. (weblink: <https://www.epa.gov/environmental-economics/mortality-risk-valuation#means>).

M. What Air Quality and Climate Benefits Would the Proposed Regulation Provide?

The Proposed Regulation is expected to reduce PM_{2.5}, NO_x, and GHG emissions from locomotives beyond levels that would be achieved under business as usual. Staff estimates that from 2023 to 2050, the Proposed Regulation would reduce cumulative statewide emissions by approximately 7,455 tons of PM_{2.5}, 389,630 tons of NO_x, and 21.9 million metric tons of GHG. PM_{2.5}, NO_x, and GHG emission reductions would begin in 2025 when the first locomotives purchased using Spending Account funds would enter service. Substantial reductions would occur in 2030 since, beginning January 1, 2030, locomotives that are 23 years or older can only operate in California if one of the exceptions applies. Further, beginning January 1, 2030, switch, industrial and passenger locomotives with an original engine build date of 2030 or newer must be ZE locomotives or used exclusively in ZE configurations to operate in California. Additionally, in 2035, line haul locomotives with original engine build dates of 2035 or newer must be ZE locomotives or used exclusively in ZE configurations to operate in California.

N. How Will the Proposed Regulation Accelerate Emission Reductions in Disadvantaged Communities?

Disadvantaged communities (DAC) are communities suffering from high pollution burdens and vulnerability factors, such as exposure to PM_{2.5}, high ozone, drinking water contaminants, traffic impacts, high DPM, groundwater threats, poverty, asthma, cardiovascular disease, and other factors.

The Proposed Regulation includes provisions for ZE credit, in which locomotive operators using ZE locomotives, ZE rail equipment, or using wayside power in DACs prior to 2030 to apply to receive double credit to offset the funding obligation in their Spending Accounts. This credit would incentivize locomotive operators to concentrate their earliest ZE locomotive use within DACs.

O. What Other Benefits Would the Proposed Regulation Provide?

Transitioning older, dirtier locomotives to ZE or ZE capable under the Proposed Regulation would provide an opportunity to increase ZE technology in the off-road sector. As more locomotives use ZE technologies as a result of the Proposed Regulation, industry acceptance of advanced technologies will improve. The state of ZE locomotive technology would continue to progress from short range applications in switch, industrial, and passenger locomotives and expand into extended range applications such as line haul locomotives. Purchases of ZE or ZE capable locomotives would also benefit ZE locomotive manufacturers, as well as various businesses in the ZE locomotive supply chain, including those involved in battery and fuel cell technology throughout the state.

The Proposed Regulation would increase the installation of electric charging and hydrogen fueling infrastructure needed to support the use of ZE and ZE capable locomotives. Additional installations of electric charging and hydrogen fueling infrastructure would support the use of these technologies, as well as other advanced technology and equipment. Electric charging and hydrogen fueling infrastructure installations would provide

opportunities for design, engineering, construction, and project management firms to design new and expanded infrastructure statewide.

The increase in electric charging and hydrogen fueling infrastructure would also benefit suppliers, equipment installers, electricians, and hydrogen fuel providers. Infrastructure would be installed in California, and some infrastructure equipment may also be manufactured in California. The increased use of electric charging infrastructure would increase the amount of electricity supplied by utility providers and help the State's investor-owned utilities meet the goals of Senate Bill 350.³⁰ Senate Bill 350 requires the State's investor-owned utilities to develop programs to accelerate widespread transportation electrification with goals to reduce dependence on petroleum, increase the uptake of ZE vehicles and equipment, help meet air quality standards, and reduce GHGs.

Lastly, the Proposed Regulation may result in noise reduction benefits. Diesel-powered locomotives produce engine noise, which also results in adverse health impacts. This is of concern when locomotives operate in and near places where people live, work, and play. The Proposed Regulation would transition diesel-powered locomotives to ZE technology, which produces little to no noise.

P. What is the State of Current Zero Emission Locomotive Technology?

Under the Proposed Regulation, until 2030, locomotive operators could use Spending Account funds to purchase, lease, or rent Tier 4 or cleaner locomotives; to remanufacture or repower existing locomotives to a Tier 4 or cleaner emission level; to or begin investing, purchase, lease, or rent in ZE or ZE capable locomotives and ZE infrastructure; and to pilot or demonstrate ZE locomotives or ZE rail equipment technologies.

Tier 4 locomotives are commercially available for all locomotive types and can provide immediate emission reductions of 80 percent or more compared to a Tier 3 locomotive. Some original equipment manufacturers (OEM) are also working to create Tier 4 remanufacture kits or repower options³¹ for older locomotive models. To successfully reduce emissions from freight sources, locomotives will need to go beyond Tier 4 to ZE technologies. However, staff believes Tier 4 locomotives are a good option to replace older locomotives at the lowest cost while ZE technologies are continuing to be made more widely available.

After 2030, locomotive operators could no longer use their Spending Account funds to purchase Tier 4 locomotives. Other options would remain available, including converting their existing, older locomotives to ZE or ZE capable.

At all times, locomotive operators would have the option to acquire new ZE locomotives or convert their existing, older locomotives to ZE. Locomotive operators would be free to

³⁰ Senate Bill No. 350 (De León, Stats. 2015, ch. 547). (weblink: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB350).

³¹ Cummins, Cummins Rail Expands Clean Diesel Product Offerings with QST30 Tier 4 Locomotive Power Module. November 16, 2021, accessed July 7, 2022. (weblink: <https://www.cummins.com/news/releases/2021/11/16/cummins-rail-expands-clean-diesel-product-offering-qst30-tier-4-locomotive>).

choose the ZE option that makes the most sense for their individual operation. In addition, hybrid models may make it possible to operate with ZE when they are near communities, and convert to diesel-powered operation outside of California, making long-distance transport more feasible in the near term.

Of the technologies that would allow locomotive operators to comply with the regulation, some are widely available, and some are new and gradually becoming available. Tier 4 or cleaner technologies for diesel-powered locomotives are available now. ZE technologies are in different stages of commercial availability or pilot/demonstration. For example, it was announced in January 2022 that Union Pacific would be investing in 10 battery-electric EMD Joule switcher locomotives from Progress Rail. The locomotives will be tested at railyards in California and Nebraska and are expected to arrive onsite in late 2023, with complete delivery anticipated in early 2024.³² Based on the development timeline for new technology from research and design to commercial production, staff estimates that ZE switchers will be available for purchase in limited volume by 2025, ZE passenger locomotives by 2030, and ZE line haul locomotives by 2035. For more information about specific commercial models, as well as pilot and demonstration projects for models in development, see ISOR Appendix F: Locomotive Technology Feasibility Assessment.

Q. How Would CARB Staff Determine Progress is Being Made Towards ZE Technologies and Infrastructure?

To ensure ZE locomotive technology has advanced enough to meet the switcher, industrial, and passenger ZE operational requirement in 2030 and the line haul locomotive ZE operational requirement in 2035, staff would publish assessments in 2027 and 2032. The assessments would include an analysis of the progress made in ZE locomotive technologies. If staff determines compliance dates need to be adjusted, staff would initiate formal regulatory amendments.

R. How Much Would the Proposed Regulation Cost?

The direct costs of the Proposed Regulation to California locomotive operators are estimated to be approximately \$13.8 billion (valued in 2019\$) from 2023 to 2050. Direct costs reflect the incremental cost of the Proposed Regulation as compared to the Baseline. The direct costs include capital costs for locomotives, including new Tier 4 locomotives, end-of-life remanufactures/overhaul, ZE or ZE capable locomotives, and fueling tenders, supporting fueling infrastructure development and maintenance, and annual costs for locomotive maintenance; Levelized Cost of Energy³³ prices for diesel, hydrogen, and electricity; reporting and locomotive registration, Spending Account management, and CARB's annual administrative charge. The direct costs also include costs to state and local governments. The

³² Progress Rail, Caterpillar to Supply Locomotives to Union Pacific Railroad, Supporting Investment in World's Largest Battery-Electric Locomotive Fleet, January 28, 2022, accessed July 7, 2022. (weblink: <https://www.progressrail.com/en/Company/News/PressReleases/CaterpillartoSupplyLocomotivestoUnionPacificRailroadSupportingInvestmentinWorldsLargestBattery-ElectricLocomotiveFleet.html>).

³³ Fuel costs are based on financial analysis performed by California Energy Commission, U.S. Energy Information Administration, and California Air Resources Board. These costs incorporate the cost of production, infrastructure, and delivery of different fuel types to facilitate direct comparison to established fuels like diesel.

assumptions underlying the direct costs are detailed in ISOR Appendix B: Standardized Regulatory Impact Assessment (SRIA).

S. What if a Locomotive Operator Cannot Afford the Cost of Compliance?

The Proposed Regulation is structured to provide an opportunity for operators to take early action ahead of regulatory deadlines and would allow them to be eligible for grant funding that could substantially reduce or eliminate the costs of Tier 4 or cleaner locomotive purchases and infrastructure. CARB encourages interested stakeholders to act early and utilize funding while it is available. See Table 4 for more information on incentive funding.

Table 4: Funding Opportunities for Locomotives and Infrastructure

Program Name	Program Administrator	What the Program Targets	More Information
SB 350 - California Public Utilities Commission (CPUC)	Local utility programs	Infrastructure.	https://www.cpuc.ca.gov/sb350te/
Carl Moyer Memorial Air Quality Attainment Standards Program (Carl Moyer)	Local Air District	Cleaner-than-required by law engines, equipment, infrastructure, and other sources of air pollution.	https://ww2.arb.ca.gov/our-work/programs/carl-moyer-program-locomotives
Clean Diesel and Diesel Emissions Reduction Act Programs (DERA)	U.S. EPA	Protect human health, improve air quality, reduce diesel emissions. Funding for engine/motor, equipment.	https://www.epa.gov/dera
Clean Off-Road Voucher Incentive Project (CORE)	CARB	ZE off-road equipment in early stages of commercial development.	https://ww2.arb.ca.gov/our-work/programs/clean-off-road-equipment-voucher-incentive-project

Program Name	Program Administrator	What the Program Targets	More Information
Community Air Protection Incentives (CAP) Assembly Bill 617	Local Air District	Immediate air quality benefits to impacted communities: Funding for engine/motor, equipment, infrastructure.	https://ww2.arb.ca.gov/our-work/programs/community-air-protection-incentives
Low Carbon Fuel Standard (LCFS)	CARB	Low-carbon/renewable fuels.	https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard
Low Carbon Transportation Investments	CARB	Accelerate next-generation technology: vehicles, equipment, or emission controls.	https://ww2.arb.ca.gov/our-work/programs/low-carbon-transportation-investments-and-air-quality-improvement-program-0
Low Carbon Transit Operations Program	California State Transportation Agency (CalSTA)	Help transit agencies reduce GHG emissions, improve mobility, priority on disadvantaged communities. Funding for equipment, maintenance.	Low-Carbon Transit Operations Program — California Climate Investments
Goods Movement Emissions Reduction Program (Proposition 1B)	Select Local Air Districts	Early or extra emission reductions from freight transport. Funding for equipment, infrastructure.	https://ww2.arb.ca.gov/prop-1b-local-agency-contact-and-solicitation-information
Targeted Airshed Grants Program	U.S. EPA	Air pollution in areas with the highest levels of ozone and (PM2.5) ambient air concentrations. Funding for equipment, infrastructure.	https://www.epa.gov/air-quality-implementation-plans/targeted-airshed-grants-program

Program Name	Program Administrator	What the Program Targets	More Information
Transit Intercity Rail Capital Program	CalSTA	Capital improvements to modernize California’s intercity, commuter and urban rail systems; reduce GHG emissions, vehicle miles traveled, and congestion.	https://calsta.ca.gov/subject-areas/transit-intercity-rail-capital-prog
VW Mitigation Trust	CARB	Replacement of higher polluting engines including areas disproportionately impacted: freight corridors, ports, and railyards.	https://xappprod.aqmd.gov/vw/combustion.html

In addition, the Proposed Regulation includes small business hardship extensions for qualifying applicants. Approval of a Hardship Extension may grant the applicant any or all of three potential measures: up to a three-year extension in the time required to set aside funds into the Spending Account, a reduction in the amount of funds required to be set aside in the Spending Account for up to three years, or up to a three-year extension in the time allowed to operate a locomotive that does not comply with the In-Use Operational Requirements.

T. Will the Proposed Regulation Shift the Transportation of Freight from Trains to Trucks or Vice Versa?

Staff reviewed literature on freight diversion and mode shift (e.g., a shift from transport by train to transport by truck) and spoke with industry experts and did not find empirical research that focused on the impact of regulatory costs on freight diversion or mode shifts from rail to trucks. Staff researched and directly engaged industry stakeholders for their experience or data and found that the decision to divert freight from rail to truck is complex and unique to individual businesses.

Freight transport delivery companies rely on multiple factors and sophisticated proprietary models to guide decisions on when, where, and how to move freight. Transportation costs are only one of many factors determining the freight mode choice. Staff has determined that mode shift from train to truck as a direct result of impacts from the Proposed Regulation is unlikely. Appendix B: Standardized Regulatory Impact Analysis contains a more detailed discussion about the potential for mode shift under the Proposed Regulation. It is not the intent of the Proposed Regulation to prompt a mode shift.

CARB projects California freight will continue growing in the future. In order to reduce emissions, all modes of transport will need to move towards ZE, as outlined in the Governor’s

Executive Order N-79-20, to support California’s thriving economy and minimize community health risk. CARB does not favor one technology or mode of transport over another; however, CARB has made substantial progress toward reducing truck emissions and has mechanisms in place to move towards an even cleaner truck fleet. Conversely, the 2021 CARB locomotive emissions inventory projects Tier 4 locomotives, the cleanest Tier described by U.S. EPA, will account for only about 6 percent of freight line haul activity in California in 2021.

U. What was the Public Process for Developing the Proposed Regulation?

Staff has engaged in an extensive public process since development of the Proposed Regulation began in 2019. Staff held four public workshops and one railyard listening session to solicit stakeholder feedback and discuss regulatory concepts, methodology, and locomotive technologies and infrastructure, as well as the data used to develop the SRIA. All information regarding workshops and any associated materials were posted to the CARB locomotive website³⁴ and notice of these meetings was distributed through several public list serves that include over 40,000 recipients.

As of August 2022, staff has conducted more than 250 informal meetings, phone calls, and site visits with a broad group of stakeholders to discuss input and information for the Proposed Regulation. The informal meetings included members of impacted communities, environmental justice advocates, air districts, railroads, industrial operators, passenger agencies, trade associations, locomotive OEMs, and other interested parties. For more information on the public process, see Appendix I: List of Public Workshops, Meetings, Conference Calls, Video Conferences, and Site Visits Supporting the Public Process for Development of the Proposed Regulation.

³⁴ CARB, Reducing Rail Emissions in California Website, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/our-work/programs/reducing-rail-emissions-california/locomotives-and-railyards-meetings-workshops>).

I. Introduction and Background

The mission of the California Air Resources Board (CARB or Board) is to promote and protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants, while recognizing and considering the effects on the state’s economy. CARB strives to ensure that all individuals in California can live, work, and play in a healthful environment free from harmful exposure to air pollution. To help achieve this, CARB adopts regulations designed to reduce criteria pollutants, toxic air contaminants (TAC), and greenhouse gas (GHG) emissions.

Locomotives are utilized throughout the state to move cargo to various railyards, industrial facilities, and seaports and for moving passengers between passenger stations. Diesel-powered locomotives operating in California have an average age of Tier 1+ emission levels and emit harmful air pollutants, including diesel particulate matter (DPM), fine particulate matter (PM2.5), oxides of nitrogen (NOx), and GHGs. To support local operations at industrial facilities, seaports, and railyards, locomotive operators often use their oldest, dirtiest locomotives from the fleet to perform local jobs, resulting in the highest exposure to diesel emissions, which are classified as a TAC,³⁵ in and around railyards. The oldest locomotives in use in California today emit nearly 25 times the amount of harmful PM pollution of the cleanest commercially available locomotives.

Locomotives travel throughout California to seaports, railyards, and other locations that are often near sensitive receptors such as schools, hospitals, elder care facilities, and residential neighborhoods. Many of the communities near facilities where locomotives operate bear a disproportionate health burden due to their proximity to emissions from diesel-powered locomotives. As can be seen in Table 5, approximately 50 percent of all California railyards are in areas identified as disadvantaged communities per CalEnviroScreen designation.³⁶ Figure 2 shows the location railyards in California overlaid on the CalEnviroScreen map.

Table 5: Railyards in Disadvantaged Communities

Operator Type	Railyards in Disadvantaged Communities	Total Railyards ³⁷	Percent in Disadvantaged Communities
Class I	44	64	69 percent
Class III	16	30	53 percent
Military and Industrial	23	39	59 percent

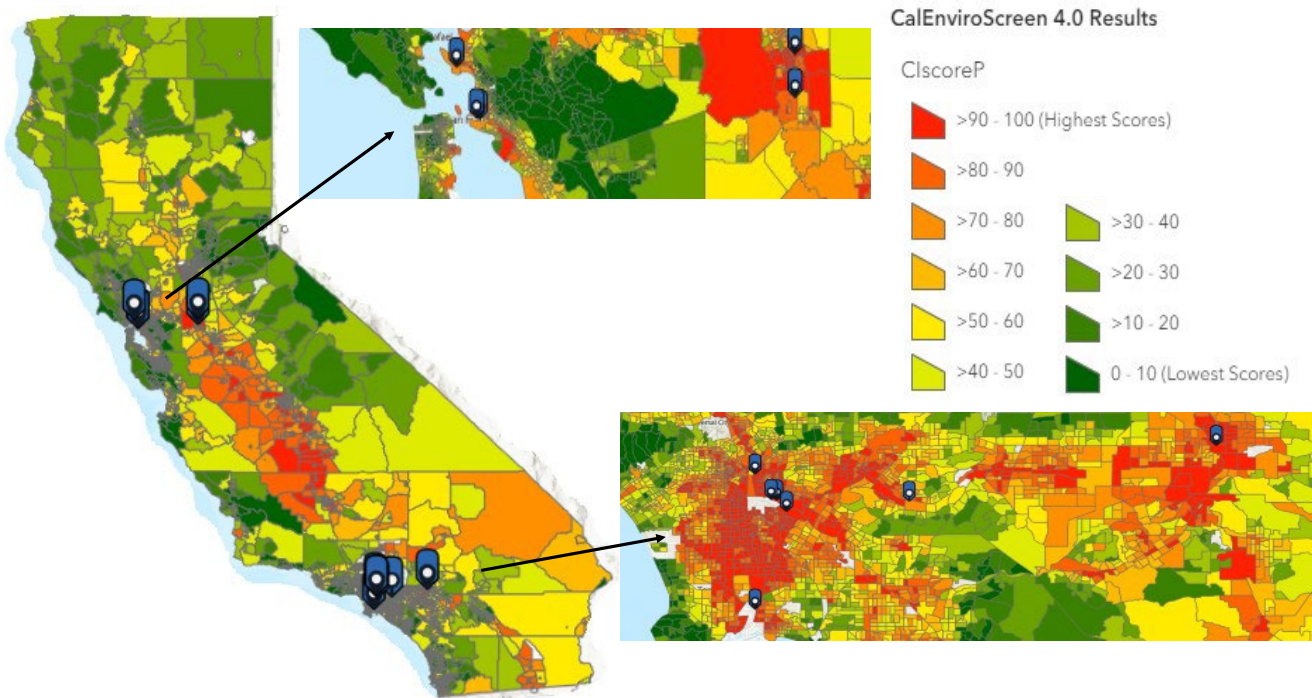
³⁵ CARB, Identified Toxic Air Contaminants, 2022, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/carb-identified-toxic-air-contaminants>).

³⁶ Office of Environmental Health Hazard Assessment, CalEnviroScreen 4.0, October 20, 2021. (weblink: <https://oehha.ca.gov/media/downloads/calenviroscreen/report/calenviroscreen40reportf2021.pdf>).

³⁷ Some railyards are not included in the counts and percentages due to an insufficient population in the census tract to be given a CalEnviroScreen 4.0 percentile.

Operator Type	Railyards in Disadvantaged Communities	Total Railyards ³⁷	Percent in Disadvantaged Communities
Passenger – Major Hubs	3	7	43 percent
Grand Total	86	140	61 percent

Figure 2: Disadvantaged Communities and Their Proximity to Large Railyards in California



This Initial Statement of Reasons (“ISOR” or “Staff Report”) describes how locomotive diesel emissions impact communities near rail operations and residents throughout the state, resulting in premature mortalities, increased cancer risk, hospitalizations, and emergency room visits and provides the basis for the In-Use Locomotives Operating in California (Proposed Regulation).

The Staff Report presents the Proposed Regulation and summarizes the information that staff used in developing the Proposed Regulation. The Staff Report is organized as follows:

- Chapter I provides an introduction and background information.
- Chapter II describes the problem this rulemaking is intended to address.
- Chapter III summarizes the specific purpose and rationale for each section of the Proposed Regulation.
- Chapter IV summarizes the benefits anticipated from the Proposed Regulation.
- Chapter V summarizes the air quality and climate benefits of the Proposed Regulation.
- Chapter VI presents the Environmental Analysis prepared to comply with the California Environmental Quality Act (CEQA).

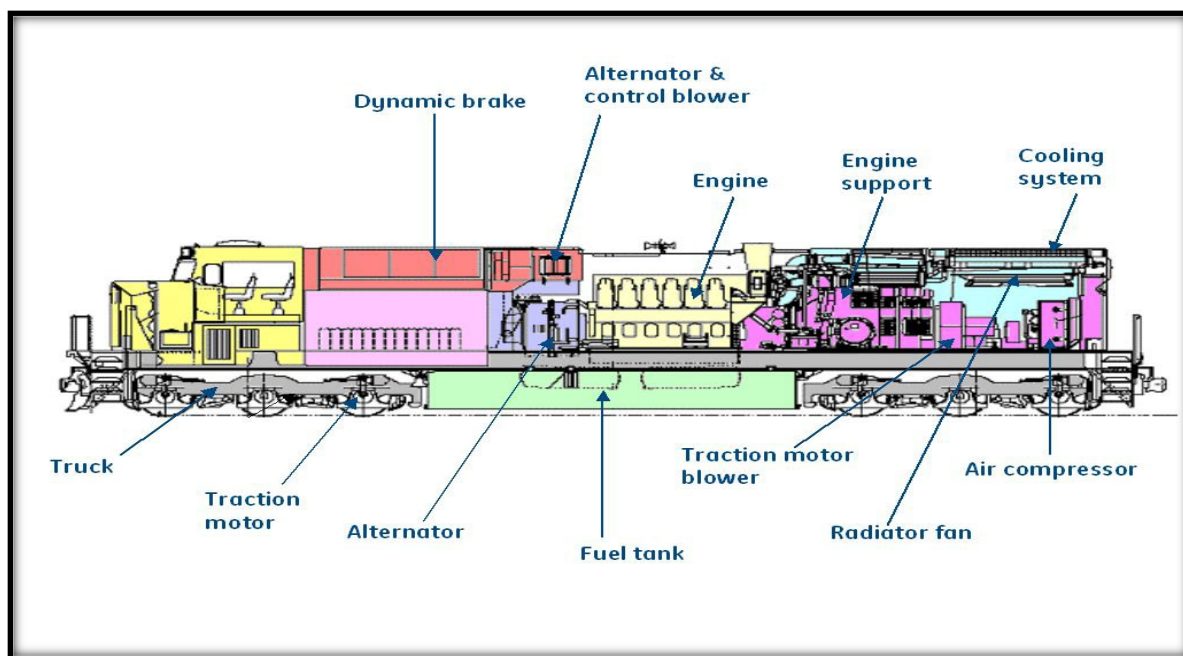
- Chapter VII describes how the proposal is consistent with CARB’s environmental justice policies.
- Chapter VIII summarizes the cost and economic impact analysis for the Proposed Regulation.
- Chapter IX summarizes the alternative proposals considered.
- Chapter X provides a justification for the adoption of regulations different from federal regulations.
- Chapter XI summarizes the public process for development of the Proposed Regulation.
- Chapter XII lists appendices.

A. Locomotives, Rail Operators, and California Rail Network

1. Freight and Passenger Locomotives

A locomotive is a self-propelled piece of on-track equipment used to push or pull rail-mounted cars carrying freight or passengers. A typical locomotive, as shown in Figure 3, derives its power from a diesel generator, which powers electric traction motors that drive the locomotive wheels. Because locomotives are powered by traction motors that are electric, emissions come from how the electricity is generated. Conventional diesel-electric locomotives use diesel engines to generate the electricity, and these combustion engines generate emissions that are of concern to CARB. California locomotives operate over 77,000,000 individual rides per year,³⁸ and haul 4.8 percent of all freight within the state.³⁹

Figure 3: Diagram of a Diesel-powered Locomotive



³⁸ Based on ridership reports for six California passenger operators that use self-propelled locomotives: Altamont Commuter Express (ACE), Amtrack Pacific Surfliner, Caltrain, Caltrans (which runs the Capitol Corridor and San Joaquin Corridor), Metrolink, and the North Coast Transit District (NCTD); average of the year 2018 and 2019 to capture pre-pandemic ridership. See Appendix B Standardized Regulatory Impact Assessment.

³⁹ National Freight Analysis Framework 5 Summary Statistics, Tonnage/Value for shipments Within, From, and To State by Trade Type and Mode, 1997-2050, accessed July 7, 2022. (weblink: <https://faf.ornl.gov/faf5/SummaryTable.aspx>).

2. Line Haul Locomotives

“Line haul” locomotives are primarily used for long-distance freight transport. By federal definition, line haul locomotives are powered by an engine with a maximum rated power (or a combination of engines having a total rated power) greater than 2,300 horsepower (hp).⁴⁰ Line haul locomotives carry freight throughout the North American rail system. A line haul locomotive is shown in Figure 4.

Figure 4: Freight Line Haul Locomotive



3. Switch Locomotives

Industry refers to locomotives that are typically used within the state (intrastate) for short distance and for work at railyards (in-yard) as “switch” locomotives. Switch locomotives or “switchers” are often the oldest locomotives because they are used in lower power settings than line haul locomotives and remain close to a base, which accommodates more frequent maintenance if needed. Generally, road switcher locomotives are operated by Class I and Class III railroads for both in-yard work and short distance hauls. In contrast, yard switch locomotives are primarily operated by industrial operators, although they can be used by any operators, within a localized area, moving locomotives or railcars throughout a railyard or industrial facility. CARB has separated road switch and yard switch to highlight differences in power demand. Road switch duties require the power of a typical switcher, while yard switch duties, because of their relatively smaller operating territory and smaller train lengths, may be able to move railcars with equipment that is smaller than a typical locomotive, such as a railcar mover. A switch locomotive is shown in Figure 5.

Figure 5: Freight Switch Locomotive



⁴⁰ U.S. EPA, Locomotives: Exhaust Emission Standards, March 2016. (weblink: <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100OA09.PDF?Dockey=P100OA09.PDF>).

4. Passenger Locomotives

Passenger locomotives are highly specialized and designed to pull passenger cars. They may travel over long (cross-country) or short (intrastate or local commuter) distances. One major difference between passenger locomotives and freight locomotives is that passenger locomotives generally have a main propulsion engine and onboard hotel power, sometimes referred to as head-end power. The head-end power can be sourced from the primary engine or by a separate diesel generator that provides electricity via cable for the lights, air conditioning, and other material comforts to connected passenger railcars. A passenger locomotive is shown in Figure 6.

Figure 6: Passenger Locomotive



B. Rail Operators

Locomotives are used by the railroad industry or “railroads.” For regulatory purposes, the federal Surface Transportation Board (STB) categorizes freight railroads by Class. Class I (major), Class II (regional), and Class III (shortline) freight railroad designation is based on annual operating revenue.⁴¹ Class I railroads use large fleets of locomotives to move freight throughout the country. Class II railroads typically move freight over smaller regions, such as between two or three states. Class III railroads often operate very small fleets, sometimes one or two locomotives, to move freight over local routes, such as from an industrial area to a local railyard.

In addition to Class I, II, and III railroads, there are also industrial and passenger railroads. Industrial operators are companies that use locomotives to move their products but don’t provide rail services to others, such as cement plants or oil refineries. Passenger railroads provide commuter transit services. Each railroad type (Class I, II, III, industrial, and passenger) has multiple operating companies referred to as “locomotive operators.” In 2021, California was served by the following operators:

- 2 Class I
- 1 Class II

⁴¹ Surface Transportation Board, Economic Data, June 2021, accessed July 15, 2022. (weblink: <https://prod.stb.gov/reports-data/economic-data/>).

- 25 Class III
- 42 Industrial
- 6 Passenger

1. Class I Freight Railroads

As of 2021, the Class I railroads that move freight in the state operate about 70 to 75 percent of their locomotive fleets, or about 11,000 locomotives, annually within California.⁴² Currently, Class I line haul locomotives represent about 90 percent of statewide locomotive activity and diesel emissions.⁴³ Class I Railroads also operate about 400 to 500 intrastate locomotives⁴⁴ that represent about an additional 4 percent of statewide locomotive activity and diesel emissions.⁴⁵

2. Class III Freight Railroads

As of 2021, California has about 28 Class III (shortline) railroads operating within the state. These freight rail operations are mostly intrastate, often belonging to larger freight rail companies that own several railroads throughout the country. Class III railroads typically feed a small number of railcars to the Class I railroads for transport across the North American freight rail network. Each year shortline railroads operate about 200 locomotives in California.

3. Industrial Operators

California industrial operators typically use smaller, older switchers and other lower horsepower locomotives. In 2020, 84 percent of the 70 locomotives used by California industrial operators were pre-Tier 0. Industrial locomotives typically operate within the boundaries of a granary, plant, or facility.

4. Passenger Railroads

As of 2021, California has five⁴⁶ passenger rail operators: Altamont Commuter Express (ACE), Amtrak (which runs the state funded Capitol Corridor, Pacific Surfliner, and San Joaquin intercity routes), Caltrain, Metrolink, and the North Coast Transit District (NCTD).

Passenger rail operators in California operate about 150 locomotives. Since 2015, passenger rail operators in California have replaced approximately 50 percent of their fleets with the cleanest available locomotives (Tier 4). The remaining fleet is a mix of mostly Pre-Tier 0 and

⁴² CARB, Enforceable Agreements data; 2021, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/rail-emission-reduction-agreements>).

⁴³ Emission Inventory Appendix G: CARB's 2022 In-Use Locomotive Emission Inventory: Regulatory Proposal and Scenarios.

⁴⁴ CARB, Technology Assessment: Freight Locomotives, 2016. (weblink: https://ww2.arb.ca.gov/sites/default/files/classic/msprog/tech/techreport/final_rail_tech_assessment_11282016.pdf).

⁴⁵ Emission Inventory Appendix G: CARB's 2022 In-Use Locomotive Emission Inventory: Regulatory Proposal and Scenarios.

⁴⁶ Sonoma-Marín Area Rail Transit (SMART) operates multiple-units (MU) that does not meet the definition of a locomotive, and is not counted here.

Tier 2 locomotives. The majority of Pre-Tier 0 locomotives in the California passenger rail fleets are planned to retire with the completion of the Caltrain Modernization Project.

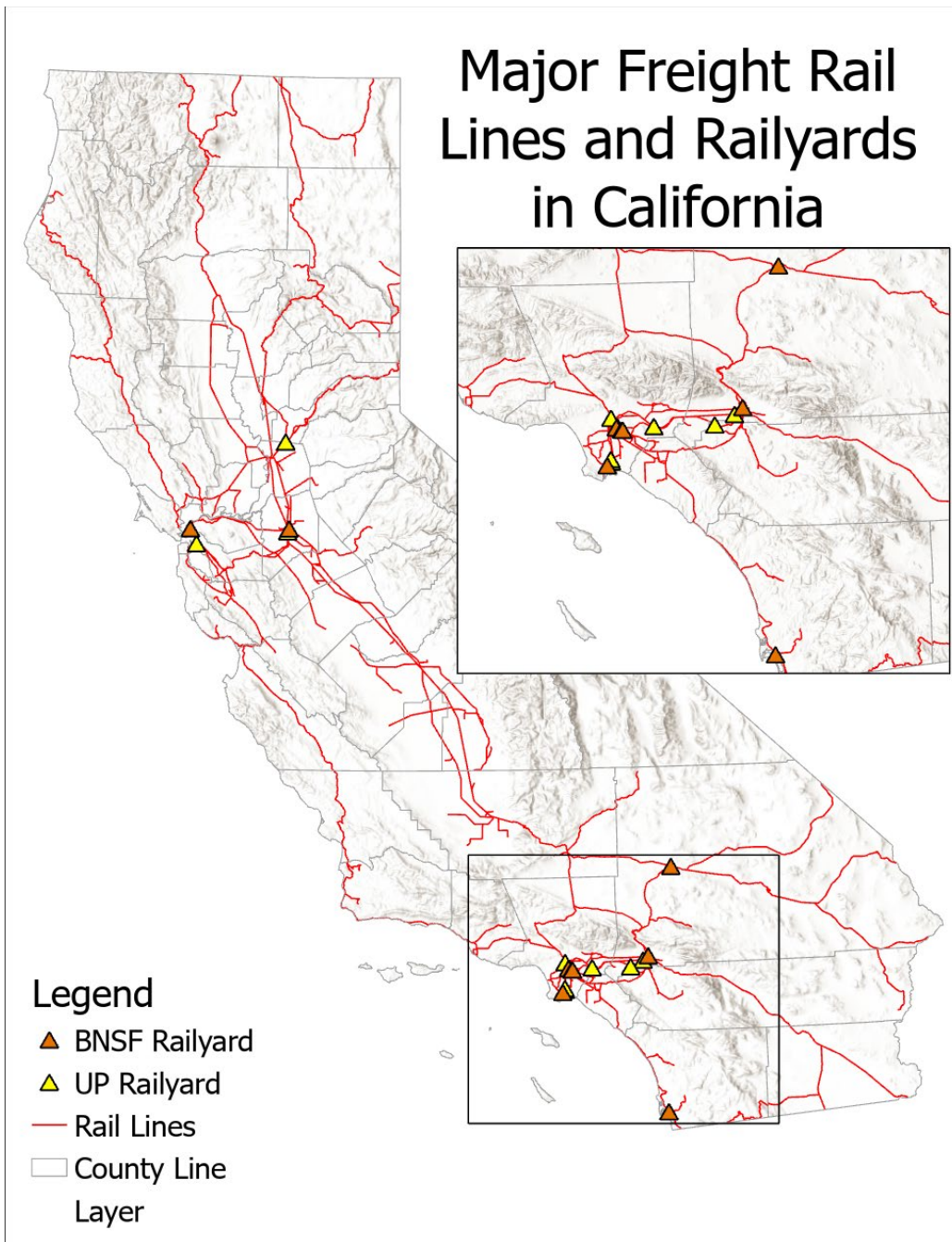
C. California Rail Network

More than 93 percent of switch locomotive and line haul locomotive activity in California is from freight railroads. Over 90 percent of California freight rail activity is performed by Class I railroads, which operate throughout the United States. Two railroads operating in California are identified as U.S. Class I freight railroads, Union Pacific Railroad (UP) and BNSF Railway Company (BNSF). The remaining freight railroads are non-Class I freight railroads (i.e., Class II or Class III railroads). Figure 7 shows the major rail lines in the state, as well as the major railyards.⁴⁷ In 2021, 51 percent of all California railyards were located within disadvantaged communities.⁴⁸

⁴⁷ The term “major railyard” or “major freight railyard” is used to describe railyards designated for study (“Designated Yards”), in the 2005 Statewide Railyard Agreement. (weblink: <https://ww2.arb.ca.gov/sites/default/files/2020-06/2005%20MOU%20Remediated%2003102020.pdf>).

⁴⁸ Office of Environmental Health Hazard Assessment, CalEnviroScreen 4.0, October 20, 2021. (weblink: <https://oehha.ca.gov/media/downloads/calenviroscreen/report/calenviroscreen40reportf2021.pdf>).

Figure 7: Major Freight Rail Lines and Railyards in California



D. Regulatory History

1. United States Environmental Protection Agency

Under the Clean Air Act (42 U.S.C. § 7401 et seq.), the United States Environmental Protection Agency (U.S. EPA) has established emissions standards for new locomotives. All locomotives, whether freight line haul, switcher, industrial, or passenger, must adhere to one of two sets of emission standards based on engine size.

- Locomotives between 1,006 and 2,300 horsepower are defined as switchers.
- Locomotives with horsepower of greater than 2,300 are defined as line haul locomotives; this includes both freight and passenger locomotives.

U.S. EPA approved the first set of locomotive emission regulations in 1998, specifying control levels for emissions (NO_x and PM_{2.5}) in engine Tiers 0-2. In 2008, U.S. EPA approved the second set of locomotive emission regulations, introducing “plus” designations when remanufacturing engines Tier 0, 1, and 2, and new standards for newly manufactured locomotives: Tier 3, and Tier 4. Tables 6 and 7 describe the existing federal emission standards for line haul and switch locomotives.

Table 6: Existing Federal Locomotive Emission Standards for Line Haul Locomotives (> 2300 hp) expressed in grams per brake horsepower-hour (g/bhp-hr)^{49, 50}

Emissions Tier	Year of Original Manufacture	NO _x Standard (g/bhp-hr)	PM Standard (g/bhp-hr)	HC Standard (g/bhp-hr)	Carbon monoxide (CO) Standard (g/bhp-hr)
Pre-Tier 0	1973-1999	13.5 ⁵¹	0.6 ⁵²	1.00	5.0
Tier 0	2000-2001 ⁵³	9.5	0.60	1.00	5.0
Tier 0+	1973-1992	8.0	0.22	1.00	5.0

⁴⁹U.S. EPA, 40 C.F.R. Part 1033.101, (a) Control of Emissions from Locomotives, Emission Standards and Related Requirements, Exhaust emission standards, accessed July 14, 2022. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-B/section-1033.101>).

⁵⁰U.S. EPA, Emission Factors for Locomotives (EPA-420-F-09-025), Office of Transportation and Air Quality, April 2009. (weblink: <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100500B.PDF?Dockey=P100500B.PDF>).

⁵¹ U.S. EPA, Locomotive Emissions Standards, Regulatory Support Document, p. 96 – Estimated NO_x Emission Rates, 1998, accessed July 15, 2022. (weblink: <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100F9QT.PDF?Dockey=P100F9QT.PDF>).

⁵² ARB staff assumed older pre-Tier 0 line haul and switch locomotives would be able to emit up to the Tier 0 PM emission standards, based on American Association of Railroads in-use emission testing (required to comply with U.S. EPA in-use emission testing requirements) for older switch locomotives with EMD 645 engines.

⁵³ 1973-1999 when remanufactured. U.S. EPA, 40 C.F.R. Part 92.8 Emission Standards - Emission Standards for Locomotives and Locomotive Engines, April 16, 1998. (weblink: <https://www.govinfo.gov/content/pkg/FR-1998-04-16/pdf/98-7769.pdf>).

Emissions Tier	Year of Original Manufacture	NO _x Standard (g/bhp-hr)	PM Standard (g/bhp-hr)	HC Standard (g/bhp-hr)	Carbon monoxide (CO) Standard (g/bhp-hr)
Tier 1	2002-2004	7.4	0.45	0.55	2.2
Tier 1+	1993-2004	7.4	0.22	0.55	2.2
Tier 2	2005-2011	5.5	0.20	0.30	1.5
Tier 2+	2005-2011	5.5	0.10	0.30	1.5
Tier 3	2012-2014	5.5	0.10	0.30	1.5
Tier 4	2015 or later	1.3	0.03	0.14	1.5

Table 7: Existing Federal Locomotive Emission Standards Switch Locomotives (1006 hp – 2300 hp) expressed in grams per brake horsepower-hour (g/bhp-hr)^{49, 50}

Emissions Tier	Year of Original Manufacture	NO _x Standard (g/bhp-hr)	PM Standard (g/bhp-hr)	HC Standard (g/bhp-hr)	Carbon monoxide (CO) Standard (g/bhp-hr)
Pre Tier 0	1973-1999	17.4 ⁵¹	0.72 ⁵²	2.10	8.0
Tier 0	2000-2001 ⁵⁴	14.0	0.72	2.10	8.0
Tier 0+	1973-2001	11.8	0.26	2.10	8.0
Tier 1	2002-2004	11.0	0.54	1.20	2.5
Tier 1+	2002-2004	11.0	0.26	1.20	2.5
Tier 2	2005-2011	8.1	0.24	0.60	2.4

⁵⁴ 1973-1999 when remanufactured. U.S. EPA, 40 C.F.R. Part 92.8 Emission Standards - Emission Standards for Locomotives and Locomotive Engines, April 16, 1998. (weblink: <https://www.govinfo.gov/content/pkg/FR-1998-04-16/pdf/98-7769.pdf>).

Emissions Tier	Year of Original Manufacture	NO _x Standard (g/bhp-hr)	PM Standard (g/bhp-hr)	HC Standard (g/bhp-hr)	Carbon monoxide (CO) Standard (g/bhp-hr)
Tier 2+	2005-2010	8.1	0.13	0.60	2.4
Tier 3	2011-2014	5.0	0.10	0.60	2.4
Tier 4	2015 or later	1.3	0.03	0.14	2.4

Manufacturers are required to ensure that their locomotives meet federal emissions standards throughout their useful life. There are a wide range of engine standards in diesel locomotives, from no emission controls (uncontrolled) to the current standard (Tier 4), with the higher numbered Tiers representing cleaner locomotives. The applicable federal emissions standards depend on the year that the locomotive was originally manufactured, and Tier 4 is the current standard applicable to new locomotives. U.S. EPA defines useful life as, “[t]he minimum useful life in terms of MW-hrs is equal to the product of the rated horsepower multiplied by 7.50. The minimum useful life in terms of years is ten years.”⁵⁵

At the end of its useful life, a locomotive is often remanufactured and placed back into operation. Older locomotives remanufactured to older standards emit far more than locomotives at the current cleanest standard: U.S. EPA Tier 4-certified locomotives. U.S. EPA has set emission standards for the remanufacture process, but these result in much smaller emission level improvements compared to buying a newly manufactured locomotive. U.S. EPA’s emission standards require remanufactured Tier 0, Tier 1, and Tier 2 locomotives to meet an improved “plus” emission standard denoted by “Tier 0+”, “Tier 1+”, or “Tier 2+.” As such, a Tier 0 locomotive could be repeatedly remanufactured following each useful life and need only achieve a Tier 0+ standard to continue to operate rather than being replaced with a Tier 4 or cleaner locomotive as would be required for new locomotives. This has resulted in older, lower tier locomotives representing the majority of locomotives operating in California, which results in high levels of emissions that harm communities despite the availability of cleaner technology.

Currently, there are no Tier 3+ or Tier 4+ emissions standards, and no remanufacture kits that improve the emissions of Tier 3 or Tier 4 locomotive engines beyond that of their original tier designation. In all cases, use of a Tier 4 locomotive results in much less emissions than lower tier locomotives regardless of whether those older, lower tier locomotives were remanufactured. (Outside of the remanufacture process, it is possible to improve locomotive emissions via fuel switching—either by switching the type of diesel fuel used or switching to powering the locomotive via battery and hydrogen fuel cell.)

For example, as shown in Tables 1 and 2, and Figures 8, 9, 10, and 11, the Tier 4 locomotive emission standards are over 90 percent cleaner for PM and NO_x than a Pre-Tier 0 locomotive

⁵⁵ U.S. EPA, 40 C.F.R. Part 1033; Subpart B—Emission Standards and Related Requirements; Section (g); p. 37200, June 30, 2008. (weblink: <https://www.govinfo.gov/content/pkg/FR-2008-06-30/pdf/R8-7999.pdf>).

and over 70 percent cleaner for PM and NOx than a remanufactured Tier 2+ standard. The largest locomotive operators in the state, UP and BNSF, operate at or below a Tier 2 emissions average.⁵⁸

Figure 8: Line Haul Locomotive PM Emission Standards by Tier

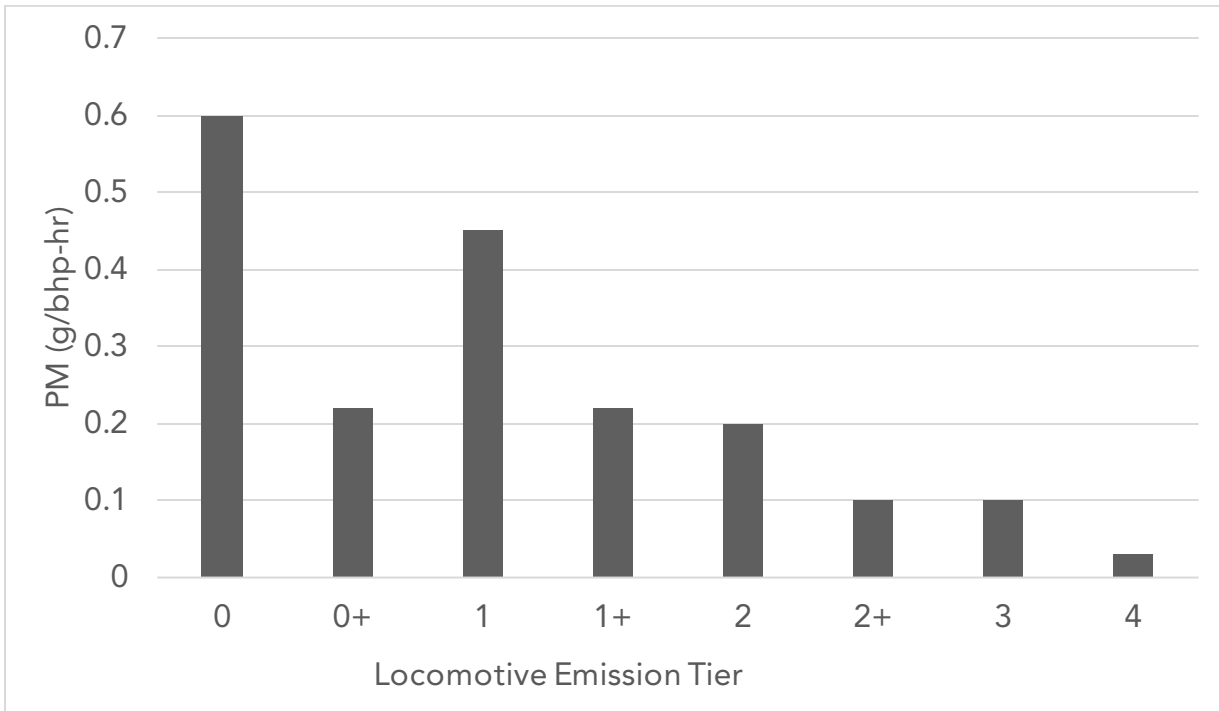


Figure 9: Line Haul Locomotive NOx Emission Standards by Tier

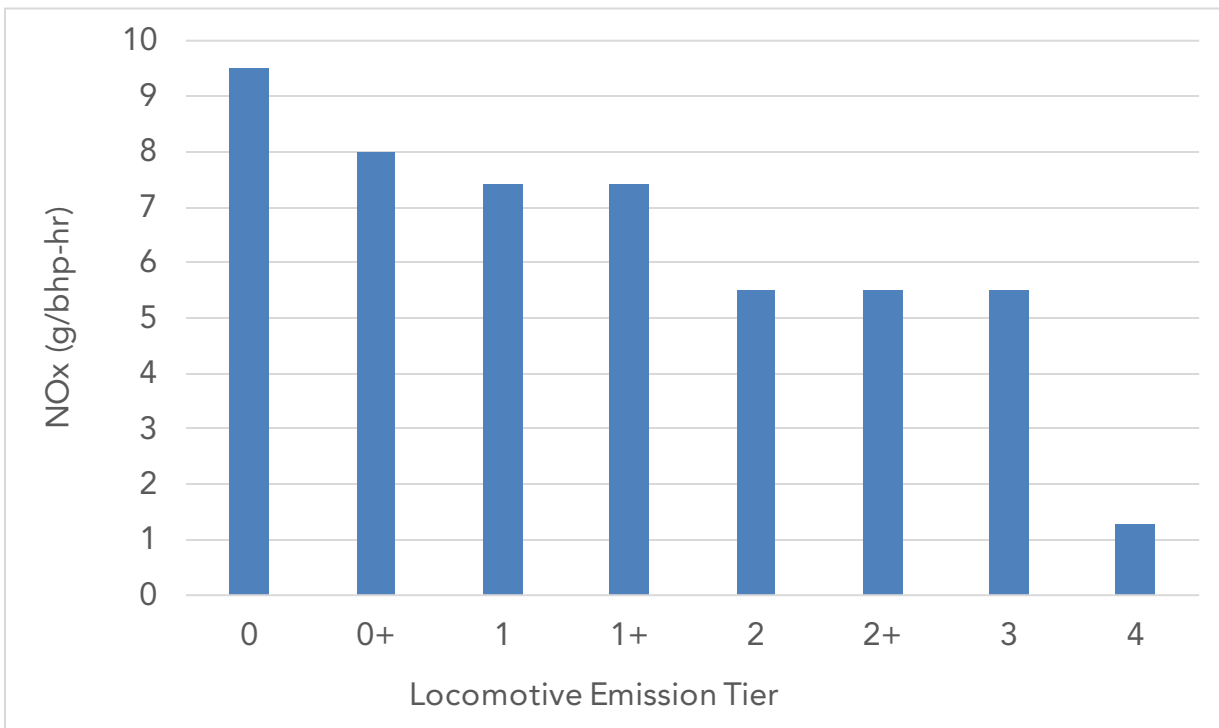


Figure 10: Switch Locomotive PM Emission Standards by Tier

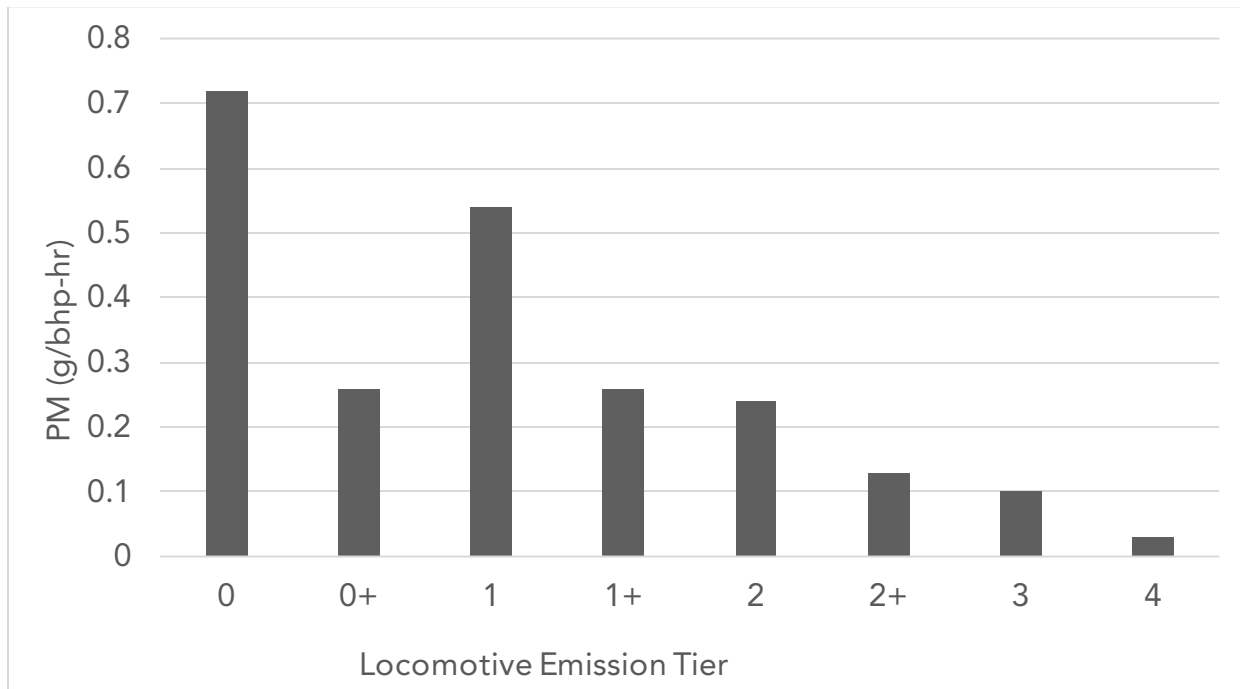
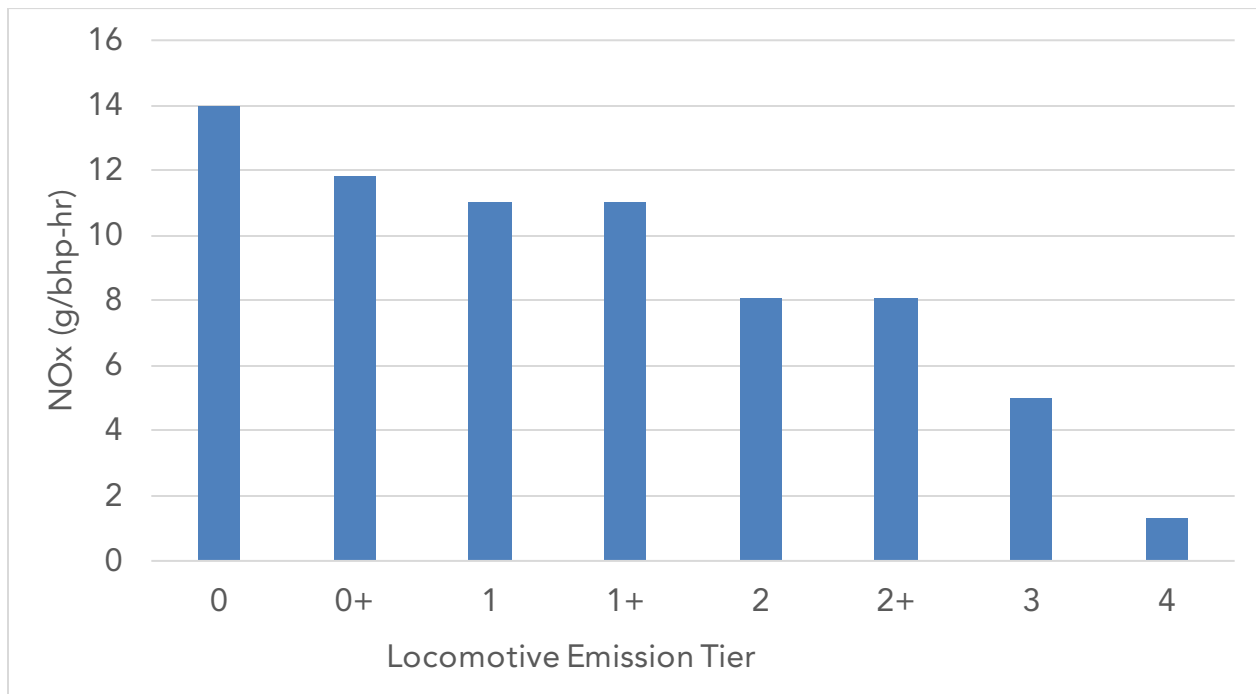


Figure 11: Switch Locomotive NOx Emissions Standards by Tier



2. California Air Resources Board

Per Section 5 of Chapter 1326 of the Statutes of 1987, as referenced in Health and Safety Code Section 43013(d), the Legislature directed CARB to conduct a study of locomotive emissions. At the first public meeting to announce delivery of that report, CARB staff summarized the study, which noted technology changes in locomotives, performed an inventory of locomotive emissions at the time, recommended operational changes such as

idle reduction, recommended the use of emission technology on locomotives, and finally, perhaps most notably, recommended an exploration of locomotives powered by electricity. Zero emission operation has therefore been a goal for locomotives operating in California since at least 1991.⁵⁶

At the second public discussion following the release of the study, the board discussed regulating locomotives, noting: “To date, railroads operating in the state and the locomotive manufacturers have not been required to comply with emissions-related regulations other than locally enforced opacity limits. As a result, engines have been optimized for performance and fuel economy, but not emissions. Locomotives emit significant quantities of oxides of nitrogen (NOx), sulfur oxides (SOx), and particulate (PM) in California.”⁵⁷

Since 1998, CARB has participated in two voluntary memoranda of understanding (MOU) with UP and BNSF. The 1998 Locomotive NOx Fleet Average Emissions Agreement in the South Coast Air Basin (Basin) required both Class I operators to reach a Tier 2 average NOx emission standard throughout the Basin by 2010. The Tier 2 fleet average was attained by both operators in 2010. From 2010 to 2021, UP and BNSF have remained at a Tier 2 average. The 1998 MOU will end in 2030.⁵⁸ As can be seen in Figure 12, UP and BNSF continue to rely on Tier 1 and Tier 2 locomotives for most of their operations; Figure 13 shows the minimal uptake of Tier 4, which was first introduced in 2015.

⁵⁶ CARB, Public Meeting to Consider Approval of the Final Report of the Locomotive Emission Advisory Committee Regarding the Feasibility and Cost-Effectiveness Of Controlling Emissions from Locomotives Operated in California, August 8, 1991; CARB, Locomotive Emission Study, January 1991. (weblink: <https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/reports/l343.pdf>).

⁵⁷ CARB, Notice of Public Meeting to Consider a Regulatory Plan for the Control of Locomotive Exhaust Emissions, August 8, 1991.

⁵⁸ CARB, Memorandum of Mutual Understanding and Agreements, South Coast Locomotive Fleet Average Emissions Program, July 2, 1998. (weblink: <https://ww2.arb.ca.gov/sites/default/files/2021-02/1998MOU.pdf>).

Figure 12: Locomotives MWhs (vertical bars) and NOx Emissions (line, unit in tpd) in the South Coast

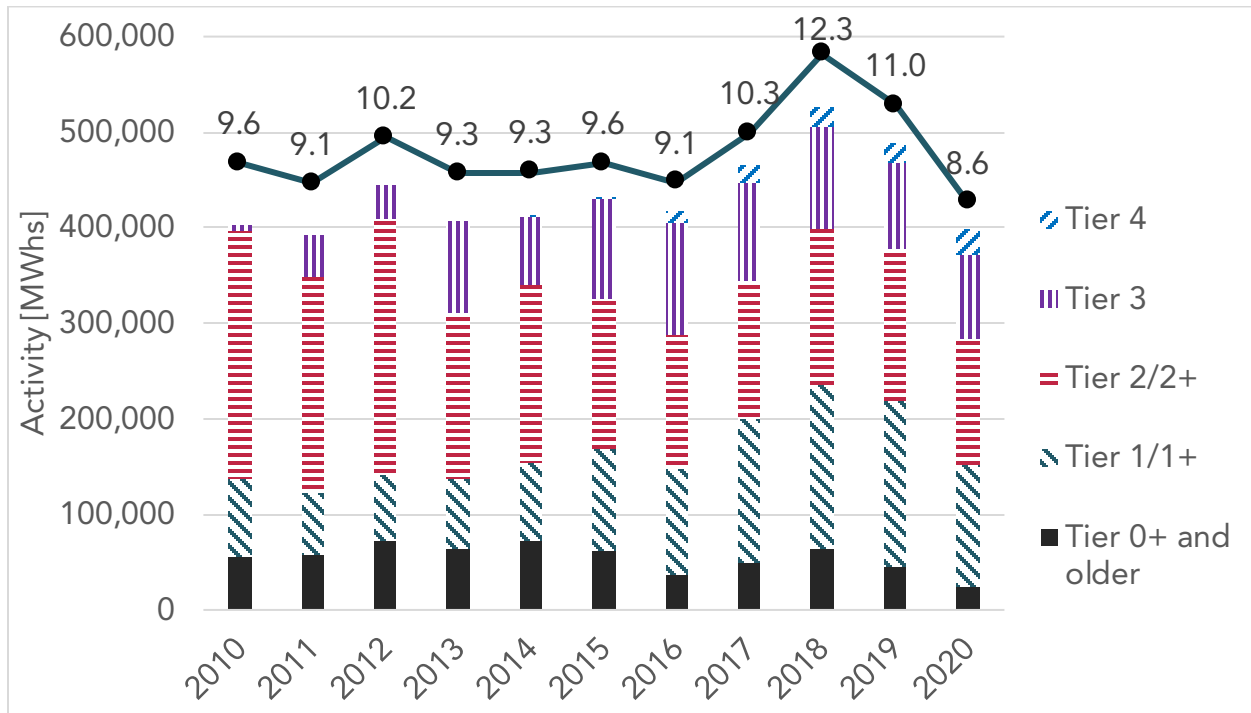
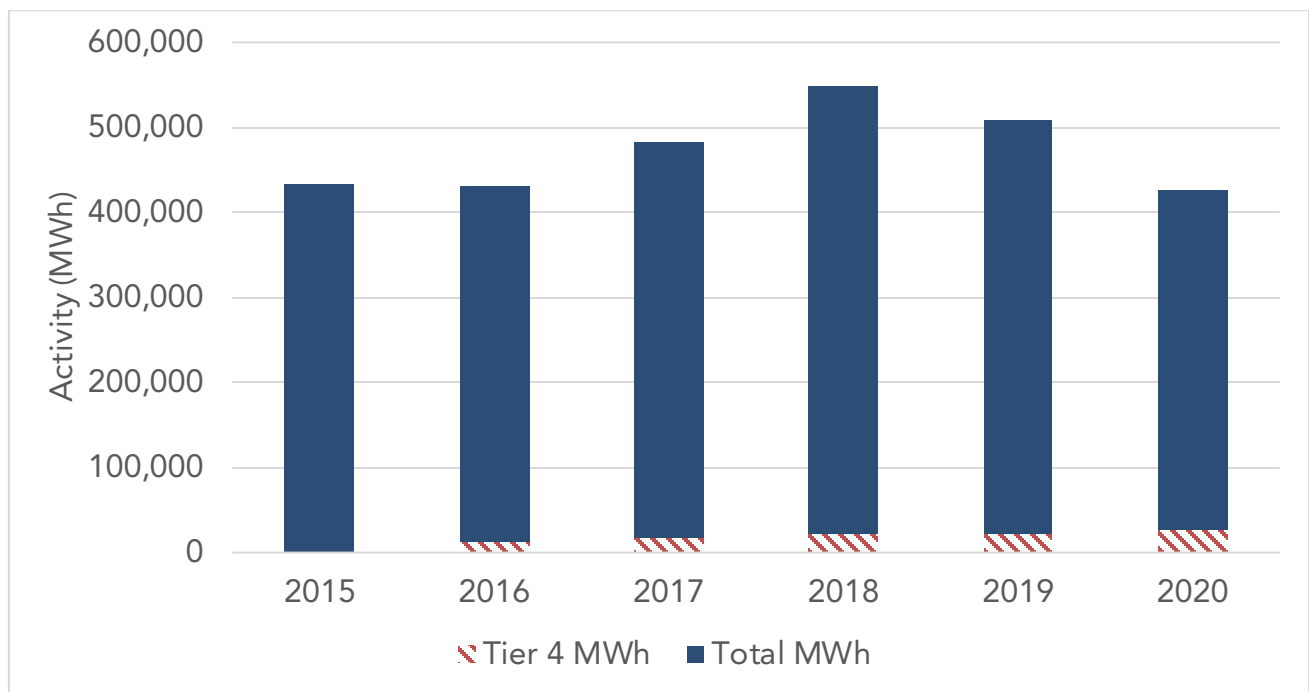


Figure 13: Class I Tier 4 Locomotive Activity Compared with Class I Total Activity in the South Coast Air Basin



The 2005 Statewide Railyard Agreement (2005 Agreement)⁵⁹ maximized the use of state and federal ultra-low sulfur diesel fuel in locomotives. From 2007 to 2014, low sulfur diesel fuel was phased in for locomotives. The 2005 MOU also established a statewide idle-reduction program which ensured operator training and the installation of idle-reduction devices on at least 99 percent of Class I locomotives compatible with the technology by 2008. In addition to the idling program, the 2005 Agreement required that UP and BNSF work with CARB to obtain Health Risk Assessments at 18 major railyards in California.⁶⁰

Although previous voluntary agreements and federal locomotive standards have reduced diesel emissions, by 2030 California locomotive emissions are projected to account for 16 percent of the state's total freight PM2.5 emissions and 14 percent of the NOx emissions.⁶¹ Additionally, while passenger operators have upgraded to Tier 4 locomotives more quickly than freight operators, passenger locomotives still emit criteria pollutants and toxic air contaminants near communities because their corridors (like those of freight locomotives) run through urban areas.

In 2017, CARB petitioned U.S. EPA to establish a Tier 5 standard for locomotives.⁶² The proposed standard would require lower emissions of PM and NOx, as well as enhanced zero emission (ZE) capability for occasional full ZE operation in sensitive areas; ZE operation would also reduce fuel consumption and greenhouse gas (GHG) emissions. As of August 2022, U.S. EPA has taken no action on this petition.

Further improvements are required and are critical to address the air quality, public health, and climate change impacts associated with locomotive operations. Without action to reduce or eliminate toxic diesel emissions from locomotives within California, it is almost certain that California will not meet the Clean Air Act requirements for attaining the National Ambient Air Quality Standards (NAAQS) by the required deadlines, communities will continue to be exposed to toxic diesel emissions, and black carbon will continue to be released into the atmosphere by locomotives. Additional information regarding requirements the Proposed Regulation will help to meet can be found in the CARB Draft 2022 Mobile Source Strategy.⁶³

E. Overview of the Proposed Regulation

The Proposed Regulation includes the following components: (1) Spending Account; (2) In-Use Operational Requirements; (3) alternative compliance plan; (4) idling limit; (5) registration, annual reporting, and recordkeeping; (6) administrative payment; (7) small business extension; (8) historic railroad exemption; (9) temporary operating waiver. The

⁵⁹ CARB, ARB/Railroad Statewide Agreement Particulate Emissions Reduction Program at California Rail Yards, June 2005. (weblink: <https://ww2.arb.ca.gov/sites/default/files/2020-06/2005%20MOU%20Remediated%203102020.pdf>).

⁶⁰ CARB, Railyard Health Risk Assessments, 2007-2008, accessed July 20, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/railyard-health-risk-assessments-and-mitigation-measures>).

⁶¹ CARB Draft 2022 Mobile Source Strategy, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

⁶² CARB, Locomotive Petition to U.S. EPA, April 13, 2017. (weblink: https://ww2.arb.ca.gov/sites/default/files/2020-07/final_locomotive_petition_and_cover_letter_4_3_17.pdf).

⁶³ CARB, Draft 2022 Mobile Source Strategy, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

Proposed Regulation would apply to all locomotives operating in the state of California except for:

- Locomotives with an engine that has a total rated power of less than 1,006 horsepower. This equipment does not meet the definition of “locomotive” in the Proposed Regulation or the federal regulations governing locomotives.
- Locomotives used for certification of “hands-on experience” for mechanics and locomotive engineers. CARB believes an educated workforce performing proper maintenance of locomotives minimizes unnecessary diesel emissions that may occur in circumstances of insufficient maintenance.
- Equipment designed for operation on both roads and on rails. Such equipment is designed with both steel wheels (for track-mounted operation) and rubber tires (for off-track operation). This equipment is not covered by the Proposed Regulation and is regulated under other CARB regulations.
- Military locomotives. CARB recognizes that it is necessary to exempt military locomotives from the Proposed Regulation as it may limit military operators’ ability to maintain surge capacity to respond to emergencies and security threats.

In addition, historic locomotives that do not exceed 10,000 gallons of fuel use per year fleetwide may seek an exemption from the Spending Account and In-Use Operational Requirements provisions of the Proposed Regulation. A small number of California historic locomotives are used solely for education, preservation, and historical experience, and use of historic locomotives in their original configuration is key to the educational, preservation, or historical experience.

1. Spending Account

As part of the Spending Account requirement, a locomotive operator would establish a trust account and fund the account annually. The amount each locomotive operator would be required to put into the Spending Account would be based on the monetized health cost to Californians from diesel emissions their locomotives create in California.

Starting on the effective date of the Proposed Regulation, locomotive operators would be required to begin tracking California locomotive activity in each air district. Annually locomotive operators would report the previous year’s activity, calculate diesel emissions from the year prior, and deposit funds into their “Spending Account”.

To determine the Spending Account funding obligation for each locomotive, operators would use a formula provided in the regulatory language to calculate the cost of the PM and NO_x associated with their locomotives’ cumulative diesel emissions, based on the number of MWh their locomotives operated in each California air district over the previous year.

By operating a ZE locomotive, ZE rail equipment, or by connecting to wayside power prior to 2030, operators may earn ZE credits that could be used to offset their Spending Account funding obligations. ZE credits would be doubled for operating a ZE locomotive, ZE rail equipment, or for connecting to wayside power in a disadvantaged community as defined by California Communities Environmental Health Screening Tool (CalEnviroScreen).⁶⁴ The credits

⁶⁴ Office of Environmental Health Hazard Assessment, CalEnviroScreen 4.0, October 20, 2021. (weblink: <https://oehha.ca.gov/media/downloads/calenviroscreen/report/calenviroscreen40reportf2021.pdf>).

could only be used to reduce Spending Account obligations; they would not have value and would not be tradeable.

Operators would only be permitted to use their Spending Account funds, along with any interest earned, in specified ways. Funds held in the Spending Account could be used for ZE locomotives, ZE capable locomotives, ZE rail equipment, or infrastructure. Prior to January 1, 2030, operators would also be able to use Spending Account funds to purchase, lease, rent, remanufacture, or repower to a locomotive with emission levels equivalent to or cleaner than the cleanest standard.

Additionally, at any time, operators would be permitted to use Spending Account funds for demonstrations or pilot projects of ZE locomotives, ZE rail equipment, ZE capable locomotives, and supporting infrastructure. During the technology demonstration phase, manufacturers are typically focused on producing single prototypes or small volume demonstration and testing projects. Pilot projects are generally larger scale deployments where issues around manufacturing design, user acceptance, and support can be assessed.

2. In-Use Operational Requirements

To reduce harmful emissions in California caused by older, heavily polluting locomotives, starting January 1, 2030, only locomotives with original engine build dates less than 23 years old would be able to operate in California unless they fall under one of the listed exceptions, which includes ZE locomotives and ZE capable locomotives.

Additionally, beginning January 1, 2030, switch, industrial, and passenger locomotives operating in California with original engine build dates of 2030 or later would need to be operated in a ZE configuration when in California. Further, beginning January 1, 2035, any freight line haul locomotives operating in California with engine build dates of 2035 or later would need to operate in a ZE configuration when in California. Two technology assessments would be published in 2027 and 2032 analyzing the progress in ZE locomotive technology and supporting infrastructure. These reports would include recommendations to initiate staff's development of potential formal regulatory amendments in the event that the assessment determines such amendments would be needed to adjust compliance deadlines.

3. Alternative Compliance Plan

Operators could be excluded from the requirements of the Spending Account, In-Use Operational Requirements, or both, if they apply for an Alternative Compliance Plan (ACP). An ACP would be required to achieve the same anticipated emission reductions as if an operator was in full compliance with the requirements of the Spending Account and In-Use Operational Requirements, applying the assumptions listed in the Proposed Regulation.

4. Idling Limit

The Proposed Regulation requires all locomotives equipped with an automatic engine shut down/start up (AESS) system to shut off no more than 30 minutes after the locomotive becomes stationary, unless it is for a specifically permitted reason, such as preventing engine damage or performing maintenance.

5. Registration, Reporting, and Recordkeeping

Locomotive operators would be required to register locomotives operating in California and report annually regarding activity of locomotives in the state. This would be used to provide CARB and impacted communities with an accurate representation of locomotive activity and the diesel emissions associated with the operation of locomotives throughout California. Locomotive operators would be required to track all applicable locomotive activity by air district in MWh, or in some cases fuel usage. The first report would be due July 1, 2024.

In addition, each of the other components of the Proposed Regulation—Spending Account, IUOR, and idling—have specific reporting and recordkeeping requirements. Records must be kept for three years and provide within 30 days upon request from CARB.

6. Administrative Payment

CARB would collect an annual payment of \$175 per diesel locomotive for the implementation costs of the Proposed Regulation. This payment would be due July 1 of each year with reporting documentation.

7. Small Business Hardship Extension

Staff developed a small business hardship extension for businesses that meet the criteria set forth in the Proposed Regulation and who wish to apply for temporary relief regarding the requirements in the Spending Account or IUOR sections, or both. To apply for the hardship extension, the business must submit to CARB financial documentation demonstrating that they are unable to comply with the requirements of the Spending Account, the IUOR or both, as applicable.

8. Historic Railroad Low-Use Exemption

A historic locomotive operator may seek an exemption from the spending account and in-use operational requirements if its fleet meets certain requirements identified in section 2478.12.

9. Temporary Operating Waiver

Locomotive Operator may submit a request to the Executive Officer to temporarily Operate the Locomotive in California. The request must be submitted to the Executive Officer at least seven (7) business days prior to the temporary Operation of the Locomotive within California. Certain information must be provided to show that the operation period is no longer than necessary to either remove the locomotive from California or for maintenance.

F. Public Outreach and Input

CARB staff have engaged in an extensive public process since development of the Proposed Regulation began in late 2019. Staff conducted meetings with members of impacted communities, environmental justice advocates, local air districts, industry stakeholders (including locomotive owners and operators, trade associations, locomotive original equipment manufacturers [OEM], and other interested parties). Meeting formats included

public workshops, work group meetings, community meetings, informal meetings, phone calls, and site visits.

1. Public Workshops and Meetings

Staff conducted four public workshops to solicit stakeholder feedback and discuss regulatory concepts, methodology, and data used to develop the emission inventory and conduct a health risk characterization, as well as compliance and enforcement mechanisms, and data for cost assessments. Staff notified stakeholders of all workshops with the issuance of a public notice at least two weeks prior to their occurrence. Staff posted the notices to the Locomotives and Railyards: Meetings & Workshops webpage⁶⁵ and distributed them through several public list serves that include over 40,000 recipients.⁶⁶ Each of these workshops was open to members of the public. Staff posted meeting materials, including agendas, slide presentations, preliminary cost information, and draft regulatory language on the CARB Locomotive Regulation website in advance of the workshops.

Staff held two public workshops in concert with the South Coast Air Quality Management District (SCAQMD) on November 20, 2019, in Los Angeles, California and on December 11, 2019, in San Bernardino, California. During these workshops, staff discussed concepts to reduce diesel emissions from locomotives, and solicited stakeholder feedback and suggestions on additional ideas. The December workshop was webcast to ensure all interested parties could access the information.

Staff conducted a two-day workshop held on October 29, 2020, and October 30, 2020, via Zoom. During this workshop, staff presented draft concepts for reporting locomotive activity, a locomotive emission reduction Spending Account, the In-Use Operational Requirement, and a locomotive engine idling limit. Staff solicited stakeholder input on the concepts and asked for alternatives. Staff also discussed emission inventory updates, new locomotive technology, and updates on locomotive operations and planning from California partner agencies, as well as data on health effects from exposure to emissions from diesel locomotive engines. The workshop included over 300 webcast participants on October 29, 2020, and over 200 participants on October 30, 2020. The workshop was webcast with the ability to submit questions online to ensure the opportunity for broader public participation.

Staff held a Railyard Listening Session with community stakeholders on March 4, 2021. During the listening session, staff and community members discussed their experiences living with locomotive impacts, such as noise and smoke. Staff explained what changes the

⁶⁵ CARB, Locomotives and Railyards: Meetings & Workshops webpage, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/our-work/programs/reducing-rail-emissions-california/Locomotives-and-railyards-meetings-workshops>).

⁶⁶ Number of subscribers for the following CARB lists as of April 30, 2021: AB32 Public Health Workgroup; Cargo Handling Equipment Regulatory Activities; Climate Change; Environmental Justice ChERRP, Commerce; Environmental Justice Stakeholders Group; Port and Rail Plan; Goods Movement Emission Reduction Program; Harbor Craft; Harbor Communities Monitoring; Tractor-Trailer GHG Regulation; Locomotive Emission Reduction Program; Environmental Justice ChERRP, Mira Loma; Truck and Bus Regulation; Port Truck; Railyard Emission Reduction Program; Reduction of GHG Emissions from Refrigerated Shipping Containers; Sustainable Freight Transport Initiative; Shore Power for Ocean Going Vessels; State Implementation Plan; Transport Refrigeration Units; Vessel Speed Reduction for Ocean Going Ships; West Oakland Risk Assessment; Environmental Justice ChERRP, Wilmington.

community members might see through the Proposed Regulation, as well as timing for the anticipated emission reductions. The listening session included over 200 webcast participants. The listening session was webcast with the ability to submit questions online to ensure the opportunity for broader public participation.

Staff held a final public workshop on March 30, 2021, via Zoom. During this workshop, staff walked through examples of the Spending Account as well as the Proposed Regulation language, and Preliminary Cost Document which were released prior to the workshop. Staff solicited stakeholder input on the concepts and asked for alternatives as well as feedback on the cost inputs for the Standardized Regulatory Impact Assessment (SRIA). The workshop included over 270 webcast participants. The workshop was webcast with the ability to submit questions online to ensure the opportunity for broader public participation.

2. Stakeholder Meetings and Site Visits

As of August 2022, CARB staff have conducted more than 250 informal meetings, phone calls, and site visits with a broad group of stakeholders. During these meetings, CARB staff discussed regulatory concepts, gathered input, and addressed questions and comments. Stakeholders included members of impacted communities, environmental justice advocates, local air districts, locomotive owners and operators, trade associations, and locomotive OEMs, as well as other interested parties.

G. Funding Opportunities

The Proposed Regulation is structured to provide an opportunity for operators who take action ahead of regulatory deadlines to be eligible for grant funding that could reduce or eliminate the costs of Tier 4 or cleaner locomotive purchases and infrastructure. The following section describes several funding sources for locomotives and infrastructure and identifies how incremental costs to operators of the Proposed Regulation could be offset. Each of these programs have different funding requirements, application timelines, and limited funding availability. Table 8 provides a brief overview of the funding sources, and the sections that follow describe the funding in more detail. CARB encourages interested stakeholders to act early and utilize funding while it is available.

Table 8: Funding Opportunities for Locomotives and Infrastructure

Program Name	Program Administrator	What the Program Targets	More Information
SB 350 - California Public Utilities Commission (CPUC)	Local utility programs	Infrastructure.	https://www.cpuc.ca.gov/sb350te/

Program Name	Program Administrator	What the Program Targets	More Information
Carl Moyer Memorial Air Quality Attainment Standards Program (Carl Moyer)	Local Air District	Cleaner-than-required by law engines, equipment, infrastructure, and other sources of air pollution.	https://ww2.arb.ca.gov/our-work/programs/carl-moyer-program-locomotives
Clean Diesel and Diesel Emissions Reduction Act Programs (DERA)	U.S. EPA	Protect human health, improve air quality, reduce diesel emissions. Funding for engine/motor, equipment.	https://www.epa.gov/dera
Clean Off-Road Voucher Incentive Project (CORE)	CARB	ZE off-road equipment in early stages of commercial development.	https://ww2.arb.ca.gov/our-work/programs/clean-off-road-equipment-voucher-incentive-project
Community Air Protection Incentives (CAP) Assembly Bill 617	Local Air District	Immediate air quality benefits to impacted communities: Funding for engine/motor, equipment, infrastructure.	https://ww2.arb.ca.gov/our-work/programs/community-air-protection-incentives
Low Carbon Fuel Standard (LCFS)	CARB	Low-carbon/renewable fuels.	https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard
Low Carbon Transportation Investments	CARB	Accelerate next-generation technology: vehicles, equipment, or emission controls.	https://ww2.arb.ca.gov/our-work/programs/low-carbon-transportation-investments-and-air-quality-improvement-program-0

Program Name	Program Administrator	What the Program Targets	More Information
Low Carbon Transit Operations Program	California State Transportation Agency (CalSTA)	Help transit agencies reduce GHG emissions, improve mobility, priority on disadvantaged communities. Funding for equipment, maintenance.	Low-Carbon Transit Operations Program — California Climate Investments
Goods Movement Emissions Reduction Program (Proposition 1B)	Select Local Air Districts	Early or extra emission reductions from freight transport. Funding for equipment, infrastructure.	https://ww2.arb.ca.gov/prop-1b-local-agency-contact-and-solicitation-information
Targeted Airshed Grants Program	U.S. EPA	Air pollution in areas with the highest levels of ozone and (PM2.5) ambient air concentrations. Funding for equipment, infrastructure.	https://www.epa.gov/air-quality-implementation-plans/targeted-airshed-grants-program
Transit Intercity Rail Capital Program	CalSTA	Capital improvements to modernize California’s intercity, commuter and urban rail systems; reduce GHG emissions, vehicle miles traveled, and congestion.	https://calsta.ca.gov/subject-areas/transit-intercity-rail-capital-prog
VW Mitigation Trust	CARB	Replacement of higher polluting engines including areas disproportionately impacted: freight corridors, ports, and railyards.	https://xappprod.aqmd.gov/vw/combustion.html

1. SB 350 – Clean Energy and Pollution Reduction Act of 2015

SB 350 provides opportunities for ZE locomotive infrastructure through the California Public Utilities Commission (CPUC).⁶⁷ Pacific Gas & Electric, Southern California Edison, and San Diego Gas & Electric, along with three small electrical corporations, filed applications on how they plan to develop electric infrastructure to enable the transportation electrification of light, medium, and heavy-duty vehicles in California, with an estimated total cost of approximately one billion dollars. The proposals focus on installing electric vehicle charging infrastructure and education programs to encourage the electrification of the transportation sector to reduce GHG emissions. ZE locomotive infrastructure may be eligible for funding.

2. Carl Moyer Memorial Air Quality Standards Attainment Program

The Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program) provides grant funding for cleaner-than-required engines, equipment, and other sources of air pollution. The Carl Moyer Program is implemented as a partnership between CARB and local air districts. Grants are available for Tier 4 combustion, ZE locomotives and ZE infrastructure. Because grants are based on emissions reduced in each year of the grant, longer grant lives typically correlate with higher grant amounts.

On the date a regulation is approved by the Board, project life requirements for any new grants are altered: the project life must be entirely prior to the regulatory requirement.

3. Diesel Emission Reduction Act National Grants

EPA annually offers a competitive funding opportunity for projects that achieve reductions in diesel emissions from mobile sources, including locomotives that operate 1,000 hours per year during the two years prior to upgrade.

4. Clean Off-Road Equipment (CORE)

The Clean Off-Road Equipment Voucher Incentive Project (CORE) is intended to accelerate deployment of advanced technology in the off-road sector by providing streamlined access to funding. CORE targets commercial-ready products that have not yet achieved a significant market foothold. By promoting the purchase of clean technology, the project is expected to reduce emissions, particularly in areas that are most impacted; help build confidence in ZE technology in support of CARB strategies and subsequent regulatory efforts where possible; and provide other sector-wide benefits, such as technology transferability, reductions in advanced technology component costs, and larger infrastructure investments.

5. Community Air Protection Incentives

To support the AB 617 effort, the California Legislature has appropriated incentive funding to support early actions to address localized air pollution in the most impacted communities. Funding for Community Air Protection (CAP) incentives are to be administered by air districts

⁶⁷ California Public Utilities Commission, SB 350 TE Programs, accessed August 4, 2022. (weblink: <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/transportation-electrification/transportation-electrification-activities-pursuant-to-senate-bill-350>).

in partnership with local communities. The legislature directed that air districts spend CAP funds on mobile source projects pursuant to the Carl Moyer Program and the Proposition 1B Goods Movement Emission Reduction Program. The scope of projects eligible for CAP incentives includes ZE locomotives and supporting fueling and charging infrastructure.

On the date a regulation is approved by the Board, project life requirements for any new grants are altered. The project life must be entirely prior to the regulatory requirement.

6. Low Carbon Fuel Standard

Low-Carbon Fuel Standard (LCFS) credits could be available for electricity use by operators once applicable fuel reporting entities have applied for and obtained a pathway carbon intensity based on approved ZE locomotive Energy Economy Ratios (EER).⁶⁸ To illustrate possible credit values, staff ran the LCFS Credit Calculator using a hypothetical scenario where the LCFS credit value is \$200, and battery-electric locomotives have an average Carbon Intensity of 53 grams of carbon dioxide equivalent emissions per megajoule of fuel energy and a EER of 2.1.⁶⁹ The results suggest that operators could receive nine to ten cents per kilowatt-hour (kWh) based on the short term (2023-2030).

7. Low Carbon Transportation Investments

Advanced Technology Demonstration and Pilot Projects help to accelerate the next generation of advanced technology vehicles, equipment, or emission controls which are not yet commercialized. Typically, local air districts, other public agencies, and California-based nonprofit organizations would be eligible to apply for these projects to demonstrate promising technologies to reduce emissions. Funding is expected in 2022 for Off Road Advanced Technology Demonstration and Pilot projects.

8. Low Carbon Transit Operations Program

The Low Carbon Transit Operations Program (LCTOP) provides operating and capital assistance for transit agencies to reduce GHG emissions and improve mobility, with a priority on serving disadvantaged communities. Approved projects will support new or expanded bus or rail services, expand intermodal transit facilities, and may include equipment acquisition, fueling, maintenance, and other costs to operate those services or facilities, with each project reducing GHG emissions. Five percent of the annual auction proceeds in the Greenhouse Gas Reduction Fund (GGRF) are continuously appropriated for LCTOP.

9. Proposition 1B

The \$1 billion Proposition 1B Goods Movement Emission Reduction Program is a partnership between CARB and local agencies, air districts, and seaports to quickly reduce air pollution emissions and health risk from freight movement along California's trade corridors. Local

⁶⁸ CARB, Low Carbon Fuel Standard (LCFS) Guidance 20-04, Requesting EER-Adjusted Carbon Intensity Using a Tier 2 Pathway Application, April 2020. (weblink: https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_20-04.pdf).

⁶⁹ CARB, The LCFS Credit Price Calculator Version 1.3. (weblink: <https://ww2.arb.ca.gov/sites/default/files/2022-03/creditvaluecalculator.xlsx>).

agencies apply to CARB for funding, then those agencies offer financial incentives to owners of equipment used in freight movement to upgrade to cleaner technologies. Projects funded under this program must achieve early or extra emission reductions not otherwise required by law or regulation; any grants executed after Board approval of the Proposed Regulation would be subject to grant life limitations. While funding has been allocated, additional solicitations may be released when existing projects are canceled.

10. Targeted Airshed Grants Program

The Targeted Airshed Grants program assists local, state, and tribal air pollution control agencies with developing plans and conducting projects to reduce air pollution in nonattainment areas that EPA determines are the top five most polluted areas relative to ozone, annual average fine particulate matter (PM_{2.5}), or 24-hour PM_{2.5} National Ambient Air Quality Standards. Congress authorized this program in 2010 and every year since 2015.

11. Transit and Intercity Rail Capital Program

The Transit and Intercity Rail Capital Program (TIRCP) receives ten percent of annual GGRF funds to provide grants to fund capital improvements that will modernize California's intercity, commuter, and urban rail systems, and bus and ferry transit systems, to significantly reduce GHG emissions, vehicle miles traveled, and congestion. Funding amounts are formula based and determined by the State Controller's Office.

12. VW Mitigation

The Volkswagen (VW) Environmental Mitigation Trust (Trust) provides about \$423 million for California to mitigate the excess nitrogen oxide (NO_x) emissions caused by VW's use of illegal emissions testing defeat devices in certain VW diesel vehicles. The Trust is a component of partial settlements with VW. The Trust provides funding opportunities for specified eligible actions that are focused mostly on "scrap and replace" projects for the heavy-duty sector, including freight switcher locomotives, on-road freight trucks, transit and shuttle buses, school buses, forklifts and port cargo handling equipment, and commercial marine vessels.

On the date a regulation is approved by the Board, project life requirements for any new grants are altered. The project life must be entirely prior to the regulatory requirement.

II. The Problem that the Proposal is Intended to Address

Locomotives operate at railyards, traveling throughout the state on rail lines and in and around industrial facilities. Locomotives in California often operate in densely populated neighborhoods. The communities surrounding rail operations disproportionately bear the health burdens associated with emissions directly contributed by diesel locomotives. The Proposed Regulation will achieve particulate matter (PM), oxides of nitrogen (NO_x) and greenhouse gas (GHG) emission reductions from locomotive engines and increase the use of cleaner technologies. This chapter provides a description of the problems the Proposed Regulation is intended to address.

The citizens of California suffer from exposure to the worst air quality in the nation. The 2021 American Lung Association's State of the Air report lists the 25 most polluted cities in the

country.⁷⁰ Ten California cities were on the top 25 most ozone⁷¹ polluted list and seven were on the top 25 PM2.5 pollution list—far more than any other state in the nation. Some of the most populated areas in California do not meet the health-based National Ambient Air Quality Standards (NAAQS).⁷² More than half (21 million out of nearly 40 million) of Californians live in areas that exceed the most stringent 70 ppb ozone standard. Further, a disproportionate number of California’s population live in areas that are deemed extreme nonattainment,⁷³ meaning they are most impacted by high ozone levels. Additionally, these Californians often live in low-income and disadvantaged communities that experience greater exposure to diesel exhaust and other toxic air pollutants compared to surrounding areas. Two areas of the State have the most critical air quality challenges: The South Coast and the San Joaquin Valley. These regions are the only two areas in the nation with an Extreme classification for the 70 ppb ozone standard.⁷⁴

Diesel locomotives have long emitted deadly toxic pollution, and these emissions are disproportionately concentrated in the most economically-disadvantaged communities in our state. Diesel engine emissions are classified as a Toxic Air Contaminant that has no threshold exposure level below which no significant adverse health effects are anticipated from exposure to the identified substance.⁷⁵

In spite of the wide commercial availability of cleaner locomotives that could cut average emissions by up to 80 percent, locomotive operators have continued to use locomotives that emit up to 25 times the cleanest available levels. Class I locomotive operators have remained at a Tier 2 average since 2010, and Class III and Industrial locomotive operators have upgraded their locomotives even less, operating at a Tier 0/0+ average.

NOx emissions from locomotives have not kept pace with NOx reductions in other freight transport sectors. Trucks in California have become much cleaner over the last decade and are moving towards ZE technology. NOx emissions from light-duty vehicles, heavy-duty trucks, and off-road equipment in the South Coast have declined by 75 percent since 2000, while emissions from locomotives have declined by half that amount over the same period.⁷⁶

⁷⁰ American Lung Association, 2021 State of the Air Report, 2021. (weblink: <https://www.lung.org/getmedia/17c6cb6c-8a38-42a7-a3b0-6744011da370/sota-2021.pdf>).

⁷¹ Ozone is formed in the atmosphere through chemical reactions between pollutants emitted from vehicles, factories and other industrial sources, fossil fuels, combustion, consumer products, evaporation of paints, and many other sources. Hydrocarbons and nitrogen oxide gases (NOx) react in the presence of sunlight to form ozone. CARB, Ozone and Health, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/resources/fact-sheets/ozone-effects#:~:text=The%20California%20Air%20Resources%20Board%20%28CARB%29%20is%20concerned,coughing%2C%20chest%20tightness%20and%20worsening%20of%20asthma%20symptoms>).

⁷² CARB, National Ambient Air Quality Standards, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/resources/national-ambient-air-quality-standards>).

⁷³ U.S. EPA, 83 Fed. Reg. 10377-10380, March 9, 2018. (weblink: <https://thefederalregister.org/83-FR/10376/2018-04810.pdf>).

⁷⁴ CARB, Draft 2022 State SIP Strategy, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

⁷⁵ CARB, Identified Toxic Air Contaminants, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/carb-identified-toxic-air-contaminants>).

⁷⁶ CARB, 2020 Mobile Source Strategy, pp.74, October 28, 2021 (weblink: https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf).

Locomotives are quickly becoming one of the top mobile-source polluters in the state, on a per-transport-container basis.⁷⁷ By 2030, locomotive emissions are projected to contribute 14 percent of the state's PM_{2.5} freight emissions and 16 percent of the state's NO_x freight emissions.⁷⁸ This is due in part to how much progress California has made through the regulation of other freight sources. For example, heavy-duty freight trucking fleets are subject to regulations that require upgrading to newer trucks with cleaner emissions technologies, while older, dirtier locomotives using outdated emissions technology continue to operate throughout the state.

To characterize the emission impacts of regulations for freight movement by trucks and freight movement by trains from 2020 until 2040, CARB analyzed current emissions and future projected emissions from moving cargo by both trucks and trains. CARB staff published the results in the Draft Truck versus Train Emissions Analysis. The analysis concludes that trucks will be the cleaner mode to move cargo by 2023.⁷⁷

A. Need to Reduce Exposure in Impacted Communities

Close proximity to rail operations threatens the health of communities in California due to increased exposure to harmful emissions. Diesel-powered locomotives emit a complex mixture of air pollutants, including diesel PM (DPM) and gases. The gaseous pollutants include volatile organic compounds (VOC) and NO_x, which can lead to the formation of ozone and the secondary formation of PM.⁷⁹

CARB listed DPM as a Toxic Air Contaminant (TAC) in 1998, due largely to its association with lung cancer.⁷⁹ DPM is composed primarily of PM_{2.5}, which is particulate matter measuring 2.5 microns or less.^{80,81} Due to its small size, inhaled PM_{2.5} can reach the lower respiratory tract and potentially pass into the bloodstream to affect other organs.^{80,82} In this way, PM_{2.5} air pollution contributes not only to increased cancer risk, but also to respiratory and cardiovascular diseases and even premature death; other adverse health outcomes from PM_{2.5} also include asthma, chronic heart disease, and heart attack.^{80,82, 83, 84}

As a gaseous pollutant from diesel-powered locomotives, NO_x can react with other compounds to form ozone, which is the main component of smog. Based on evidence from

⁷⁷ CARB Draft Truck vs. Train Emissions Analysis, September 2020, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/resources/fact-sheets/draft-truck-vs-train-emissions-analysis>).

⁷⁸ CARB Draft 2022 State SIP Strategy, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

⁷⁹ Cal. Code Regs., tit. 17, § 93000; CARB, Overview Diesel Exhaust & Health, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health>).

⁸⁰ CARB, Inhalable Particulate Matter and Health PM_{2.5} and PM₁₀, accessed July 15, 2022. (weblink: <https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health>).

⁸¹ U.S. EPA, Particulate Matter (PM) Basics Particulate Matter (PM) Pollution, accessed July 15, 2022. (weblink: <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>).

⁸² U.S. EPA, Health and Environmental Effects of Particulate Matter Pollution, accessed July 15, 2022. (weblink: <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>).

⁸³ World Health Organization, *Review of Evidence on Health Aspects of Air Pollution-REVIHAAP Project Technical Report*, 2013, accessed July 15, 2022. (weblink: https://www.ncbi.nlm.nih.gov/books/NBK361805/pdf/Bookshelf_NBK361805.pdf).

⁸⁴ U.S. EPA, Integrated Science Assessment for Particulate Matter, December 2019. (weblink: https://ordspub.epa.gov/ords/eims/eimscomm.getfile?p_download_id=539935).

scientific studies, the U.S. EPA has determined that short-term exposure to ozone is causally linked to adverse respiratory effects.⁸⁵ Ozone can cause irritation, damage lung tissue, and worsen asthma or chronic illnesses, including chronic obstructive pulmonary disease and reduced lung function.⁸⁶ And, similar to PM_{2.5}, other potential health effects from ozone exposure include impacts on the cardiovascular, nervous, and reproductive systems, and increased risk of mortality.⁸⁵

Many of the communities near rail operations throughout California are classified as disadvantaged by the California Environmental Protection Agency (CalEPA), using the California Communities Environmental Health Screening Tool (CalEnviroScreen), Version 4.0, developed by the Office of Environmental Health Hazard Assessment (OEHHA).⁸⁷ Economic disadvantage, environmental pollution, and increased health risks are closely tied; CalEnviroScreen shows that exposure to diesel particles in disadvantaged communities is, on average, twice the levels experienced in non-disadvantaged communities.⁸⁸ Emissions from locomotives are a significant contributor to the air pollution and associated health effects in many impacted communities.

B. Need to Attain National Ambient Air Quality Standards

For most areas in California, to attain the National Ambient Air Quality Standards (NAAQS) ozone standard, all potential reductions must be pursued.⁷⁴ The 2015 federal revisions⁸⁹ to air quality standards will require substantial emission reductions in California. Mobile sources such as trucks and locomotives, and the fossil fuels that power them, are the largest contributors to the formation of PM_{2.5}, NO_x, and ozone emissions in California.⁹⁰ The CARB 2020 Mobile Source Strategy (2020 MSS),⁹¹ which describes how the state will meet its air quality commitments, states that for California to meet air quality standards, it is imperative to reduce emissions from locomotives. The Proposed Regulation has been identified in the 2020 MSS as one of the important measures necessary for the state to attain its ambient air quality standards.⁹²

South Coast Air Basin and San Joaquin Valley Air Basin currently fail to meet ambient air quality standards for PM_{2.5} and ozone. In the South Coast Air Basin, excess NO_x emissions have led to the highest ozone levels in the nation. NO_x emission reductions are also key to PM_{2.5} emission reductions, as NO_x contributes to the formation of PM_{2.5} and ground level

⁸⁵ U.S. EPA, Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants, April 2020. (weblink: https://ordspub.epa.gov/ords/eims/eimscomm.getfile?p_download_id=540022).

⁸⁶ Gharibi H et. al. Ozone pollution and asthma emergency department visits in the Central Valley, CA, USA, June to September 2015, accessed July 15, 2022. (weblink: <https://pubmed.ncbi.nlm.nih.gov/30299181/>).

⁸⁷ Office of Environmental Health Hazard Assessment, CalEnviroScreen 4.0, Oct 20, 2021, accessed March 7, 2022. (weblink: <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40>).

⁸⁸ CARB, Air Quality Progress in California Communities, July 23, 2016. (weblink: <https://www.arb.ca.gov/board/books/2016/062316/16-6-2pres.pdf>).

⁸⁹ U.S. EPA, 80 Fed. Reg. 65292, October 26, 2015. (<https://thefederalregister.org/80-FR/65292/2015-26594.pdf>).

⁹⁰ CARB, Draft 2022 State SIP Strategy, p. 17, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

⁹¹ CARB, 2020 Mobile Source Strategy, October 28, 2021. (weblink: https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf).

⁹² CARB, 2020 Mobile Source Strategy, October 28, 2021. (weblink: https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf).

ozone. In the San Joaquin Valley, excess PM emissions are a substantial challenge to reaching attainment. In October 2015, U.S. EPA adopted a more stringent 70 ppb ozone standard with an attainment date of 2037. This ozone standard will likely result in additional areas being classified as nonattainment areas, as well as require even further emission reductions in California's existing nonattainment areas. The Proposed Regulation is a critical element in the state's plan to reach NAAQS attainment. For more information on the emission reductions projected under the Proposed Regulation, see Appendix G: CARB's 2022 In-Use Locomotive Emission Inventory: Regulatory Proposal and Scenarios.

Under the Clean Air Act, California is required to submit air quality management plans (AQMP) for areas that exceed the health-based national ambient air quality standards. The AQMPs discuss California's intention and pathway to attaining the standards by specific dates. As part of the 2016 AQMP, CARB included a State SIP Strategy (Strategy) which was approved by U.S. EPA that describes CARB's commitment to achieve the mobile source and consumer products reductions needed to meet federal air quality standards over the next 15 years.⁹³ Additionally, the California Legislature passed Senate Bill (SB) 44, which Governor Newsom signed into law on September 20, 2019.⁹⁴ SB 44 acknowledges the ongoing need to evaluate opportunities for mobile source emission reductions and required CARB to update the 2016 Strategy by January 1, 2021, and every five years thereafter.⁹⁵

C. Need to Reduce Greenhouse Gas and Black Carbon Emissions

Climate change is contributing to an increase in catastrophic problems throughout California, including violent wildfires, coastal erosion, disruption of water supply, threats to agriculture, spread of insect-borne diseases, and continuing health threats from air pollution. To combat these mounting issues, the state developed climate goals codified under Senate Bill 32 (SB 32).⁹⁶ SB 32 goals include a mid-term target of a 40 percent GHG emission reductions below 1990 levels by 2030 and longer-term targets for economy wide carbon neutrality in 2045. Additionally, Executive Order S-03-05 calls for an 80 percent GHG emission reduction below 1990 levels by 2050, a target that serves as a backstop to ensure these reductions are achieved in the transportation sector.⁹⁷

Black carbon, also known as soot, is created from the combustion of fuels such as coal, diesel, and biomass, as well as from various forms of non-fuel biomass. Black carbon is classified as a short-lived climate pollutant, a category which also includes methane (CH₄) and fluorinated gases (F-gases, including hydrofluorocarbons, or HFCs). Short-lived climate pollutants are powerful climate forcers that can have a strong and immediate impact on climate change. Short-lived climate pollutants are estimated to be responsible for about

⁹³ CARB, Revised Proposed 2016 State Strategy for the State Implementation Plan. March 7, 2017. (weblink: <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>).

⁹⁴ Senate Bill 44 (Skinner, Stats. 2019, ch. 297), Medium- and heavy-duty vehicles: comprehensive strategy, September 23, 2019. (weblink: http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200SB44).

⁹⁵ CARB, Revised Proposed 2016 State Strategy for the State Implementation Plan. March 7, 2017. (weblink: <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>).

⁹⁶ California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32 (Pavley, Stats. 2016, ch. 249), September 8, 2016. (weblink: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

⁹⁷ Executive Department State of California, Executive Order S-03-05, June 5, 2005.

40 percent of current net climate forcers. Black carbon contributes to climate change both directly by absorbing sunlight and indirectly by depositing on snow, which accelerates snowmelt.⁹⁸ In addition to its climate and health impacts, black carbon disrupts cloud formation, precipitation patterns, water storage in snowpack and glaciers, and agricultural productivity.⁹⁹

Senate Bill 605¹⁰⁰ required CARB to develop a plan to reduce emissions of short-lived climate pollutants,¹⁰¹ and Senate Bill 1383¹⁰² required the Board to approve and begin implementing the plan by January 1, 2018.¹⁰³ SB 1383 also sets targets for statewide reductions in short-lived climate pollutant emissions of 40 percent below 2013 levels by 2030 for methane and HFCs, and 50 percent below 2013 levels by 2030 for black carbon. As a result of these two senate bills, the final Short-Lived Climate Pollutant Reduction Strategy was published in March 2017.

Locomotives most often burn diesel to power their engines, which contributes to statewide black carbon and GHG emissions levels. The impacts of climate change on California have been documented by OEHHA in a 2018 report, Indicators of Climate Change in California,¹⁰⁴ which details the following changes:

- A recorded increase in annual average temperatures, as well as increases in daily minimum and maximum temperatures.
- An increase in the occurrence of extreme events, including wildfire and heat waves.
- A reduction in spring runoff volumes, as a result of declining snowpack.
- A decrease in winter chill hours, necessary for the production of high-value fruit and nut crops.
- Changes in the timing and location of species sightings.

The Proposed Regulation, if adopted, would achieve additional GHG reductions helping the state with its goals to reduce the impacts of climate change.

⁹⁸ U.S. EPA, Report to Congress on Black Carbon, March 2012, Section 2.6.2. (weblink: <https://19january2017snapshot.epa.gov/www3/airquality/blackcarbon/2012report/fullreport.pdf>).

⁹⁹ CARB, Short-Lived Climate Pollutant Reduction Strategy, March 2017. (weblink: https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf).

¹⁰⁰ Senate Bill 605 (Lara, Stats. 2014, ch. 523).

¹⁰¹ SB 605, Short-lived climate pollutants, September 21, 2014. (weblink: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201320140SB605).

¹⁰² Senate Bill 1383 (Lara, Stats. 2016, ch. 395).

¹⁰³ SB 1383, Short-lived climate pollutants: methane emissions: dairy and livestock: organic waste: landfills, September 19, 2016. (weblink: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383).

¹⁰⁴ Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Indicators of Climate Change in California, May 2018. (weblink: <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>).

D. Need to Address State Policy and Plans Directing CARB to Achieve Additional Diesel Emission Reductions

The Proposed Regulation is needed to address the State policies and plans summarized below directing CARB to achieve additional emission reductions, and to move towards ZE wherever possible.

1. Executive Order N-79-20

On September 23, 2020, Governor Newsom signed Executive Order (EO) N-79-20.¹⁰⁵ EO N-79-20 directed CARB, in coordination with other state agencies, U.S. EPA, and local air districts, to develop and propose technologically feasible and cost-effective strategies to achieve 100 percent ZE from off-road vehicles and equipment operations in the state by 2035. The Proposed Regulation supports the directive of the EO by transitioning locomotives to ZE technology and supports California's long-term economic resilience by working to eliminate emissions from a key transportation sector.

2. 2020 Mobile Source Strategy

On October 28, 2021, CARB released the 2020 Mobile Source Strategy.¹⁰⁶ The strategy document looks at existing and emerging technologies to reduce emissions from California's transportation sector, including cars, trucks, locomotives, ships, and other on-road and off-road sources. The strategies laid out in the 2020 Mobile Source Strategy illustrate the technology mixes needed for California to meet its various clean air goals, including community risk reduction, federal ambient air quality standards, and ambitious mid- and long-term climate change targets. The 2020 Mobile Source Strategy included the In-Use Locomotive Regulation as a concept that is needed to reduce emissions statewide and ultimately transition the industry to ZE in California.

3. 2016 and 2022 State Strategy for the State Implementation Plan

The federal Clean Air Act requires areas that exceed the health-based NAAQS to develop State Strategies for the State Implementation Plan (SIP): strategies that demonstrate how they will attain the standards by specified dates. The Draft 2022 State Strategy for the State Implementation Plan (State SIP Strategy) describes the In-Use Locomotive Regulation as a proposed measure to reduce emissions.¹⁰⁷ Similarly, the Board adopted the 2016 State SIP Strategy, a comprehensive strategy for CARB to reduce emissions from mobile sources to meet critical air quality and climate goals over the next 15 years, including a goal to increase the use of cleaner locomotive technologies.¹⁰⁸

¹⁰⁵ Executive Department State of California, Executive Order N-79-20, September 20, 2020. (weblink: <https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf>).

¹⁰⁶ CARB, 2020 Mobile Source Strategy, October 28, 2021. (weblink: https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf).

¹⁰⁷ CARB, Draft 2022 State Strategy for the State Implementation Plan, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

¹⁰⁸ CARB, Revised Proposed 2016 State Strategy for the State Implementation Plan, March 7, 2017. (weblink: <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>).

4. Assembly Bill 617

The State of California placed additional emphasis on protecting local communities from the harmful effects of air pollution through the passage of AB 617.¹⁰⁹ AB 617 is a significant piece of air quality legislation that highlights the need for further emission reductions in communities with high exposure burdens, such as communities near rail operations where exposure to diesel emissions is elevated. AB 617 requires CARB to pursue new community-focused and community-driven actions to reduce air pollution and improve public health in communities that experience disproportionate burdens from exposure to air pollutants.

In response to AB 617, CARB created the Community Air Protection Program (CAPP). CAPP strives to achieve emission reductions in disproportionately burdened communities as directed by AB 617. CAPP is part of a coordinated suite of strategies, including new regulations, new incentive grant funding, and new exposure reduction resources and tools, which aim to improve the air quality in these communities. The Proposed Regulation is a key regulatory measure included under the CAPP to assist in reducing air pollution in impacted communities.

5. California's 2017 Climate Change Scoping Plan

In 2006, Governor Schwarzenegger signed AB 32, the California Global Warming Solutions Act of 2006¹¹⁰ to address global climate change. AB 32 directed CARB to develop a scoping plan identifying integrated and cost-effective regional, national, and international GHG reduction programs. CARB adopted the AB 32 Scoping Plan in 2008 and subsequent updates in 2013 and 2017. California's 2017 Climate Change Scoping Plan¹¹¹ outlines the state's strategy to achieve the state's 2030 GHG targets and includes the development of more stringent locomotive requirements. The 2022 Climate Change Scoping Plan Update is currently in-progress and includes a measure to reduce locomotive emissions.¹¹²

6. Executive Order B-32-15 and Sustainable Freight Action Plan

In July 2015, Governor Brown issued EO B-32-15,¹¹³ which directed the secretaries of the California State Transportation Agency, CalEPA, and California Natural Resources Agency to lead other relevant state departments in developing an integrated action plan by July 2016 that "establishes clear targets to improve freight efficiency, transition to ZE technologies,

¹⁰⁹ California Health and Safety Code § 40920.6, 42400, 42402, 39607.1, 40920.8, 42411, 42705.5, and 44391.2, Division 26, Assembly Bill No. 617 (Garcia, Stats. 2017, ch. 136), Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants, July 26, 2017. (weblink: https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB617).

¹¹⁰ Assembly Bill 32 (Núñez, Stats. 2006, ch. 488), the California Global Warming Solutions Act of 2006. (weblink: http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf).

¹¹¹ CARB, California's 2017 Climate Change Scoping Plan, November 2017. (weblink: https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf).

¹¹² CARB, AB32 Climate Change Scoping Plan Update Meetings & Workshops webpage, accessed July 18, 2022. (weblink: <https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/scoping-plan-meetings-workshops>).

¹¹³ State of California, Executive Order B-32-15, July 17, 2015, accessed July 18, 2022. (weblink: <https://www.ca.gov/archive/gov39/2015/07/17/news19046/index.html>).

and increase competitiveness of California's freight system." In response to the directive, the California State Transportation Agency, CalEPA, California Natural Resources Agency, CARB, California Department of Transportation, California Energy Commission (CEC), and the Governor's Office of Business and Economic Development developed the California Sustainable Freight Action Plan.¹¹⁴ The plan establishes clear targets to improve freight efficiency, transition to ZE technologies (deployment of over 100,000 freight vehicles and equipment capable of ZE operation and maximization of near-ZE freight vehicles and equipment powered by renewable energy by 2030), and increase competitiveness of California's freight system. The 2016 California Sustainable Freight Action Plan includes a measure to reduce emissions from locomotives as a state agency action to advance the objectives of the EO and the Sustainable Freight Action Plan.

7. Sustainable Freight Pathways to Zero and Near-Zero Discussion Document

In April 2015, CARB released the Sustainable Freight Pathways to Zero and Near-Zero Discussion Document (Discussion Document)¹¹⁵ in response to Board Resolution 14-2,¹¹⁶ which directed CARB to identify and prioritize actions to move California toward a sustainable freight transport system. The Discussion Document set out California's vision of a clean freight system and included immediate and potential near-term CARB actions to be developed for future Board consideration. The near-term CARB measures identified in the Discussion Document included the development of a regulation to achieve additional emission reductions from diesel-powered locomotives.

8. Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles

California's Air Toxics Program, established under California law by Assembly Bill 1807,¹¹⁷ and set forth in Health and Safety Code sections 39650 through 39675, mandates the identification and control of air toxics in California. In 1998, CARB identified diesel PM (DPM) as a toxic air contaminant, and in September 2000, adopted the Diesel Risk Reduction Plan. The Diesel Risk Reduction Plan¹¹⁸ was the first formal product of the risk management phase and serves as the assessment of needs under the AB 1807 process. Locomotives are included as a source that needs to reduce diesel PM.

¹¹⁴ CARB, California Sustainable Freight Action Plan, July 2016. (weblink: https://ww2.arb.ca.gov/sites/default/files/2019-10/CSFAP_FINAL_07272016.pdf).

¹¹⁵ CARB, Sustainable Freight Pathways to Zero and Near-Zero Discussion Document, April 2015. (weblink: <https://ww2.arb.ca.gov/sites/default/files/2020-09/Sustainable%20Freight%20Pathways%20to%20Zero%20and%20Near-Zero%20Emissions%20Discussion%20Document.pdf>).

¹¹⁶ CARB, Sustainable Freight Strategy Update Resolution 14-2, January 23, 2014. (weblink: <https://ww2.arb.ca.gov/sites/default/files/barcu/board/res/2014/res14-2.pdf>).

¹¹⁷ Assembly Bill 1807 (Stats. 1983, ch. 1047).

¹¹⁸ CARB, Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles, October 2000. (weblink: <https://ww2.arb.ca.gov/sites/default/files/classic/diesel/documents/rpfinal.pdf>).

The Proposed Regulation aligns with the goals of the Diesel Risk Reduction Plan and complies with the requirements of Health and Safety Code sections 39666 and 39669.5 to reduce emissions of DPM and prevent an endangerment to public health.

9. Health and Safety Code Requirement to Reduce Emissions Through the Best Available Control Technology or a More Effective Control Method.

Health and Safety Code 39666 (c) requires, for toxic air contaminants for which the state board has not specified a safe exposure level, that an Airborne Toxics Control Measure (ATCM) must be made to reduce emissions to the lowest level achievable through the following pathways:

- 1) "through application of best available control technology;" or
- 2) "a more effective control method."

Within the Proposed Regulation, CARB intends to widen the application of the best available control technology as of the date of proposed promulgation, Tier 4. Tier 4 locomotive technology was first described by U.S. EPA in 2008¹¹⁹ and has been commercially available since 2015.

Per Health and Safety Code 39666 (c), CARB is also pursuing the use of "a more effective control method" as it becomes available: widening of the use of ZE locomotive technology. Options for ZE locomotives and ZE-capable locomotives are entering the market. The Proposed Regulation includes provisions to foster the widest feasible use of ZE locomotives and ZE-capable locomotives, provided CARB's technological assessment demonstrates sufficient commercial availability by the dates specified in the Proposed Regulation language. For more information on availability of ZE locomotive technologies and projected timelines for commercialization of these technologies, see Appendix F: Locomotive Technology Feasibility Assessment.

The Proposed Regulation meets the requirements of Health and Safety Code section 39666 to reduce emissions of DPM from locomotives operating in California and to prevent the endangerment to public health posed by DPM.

E. Need to Address Lack of Cleaner Technology Usage

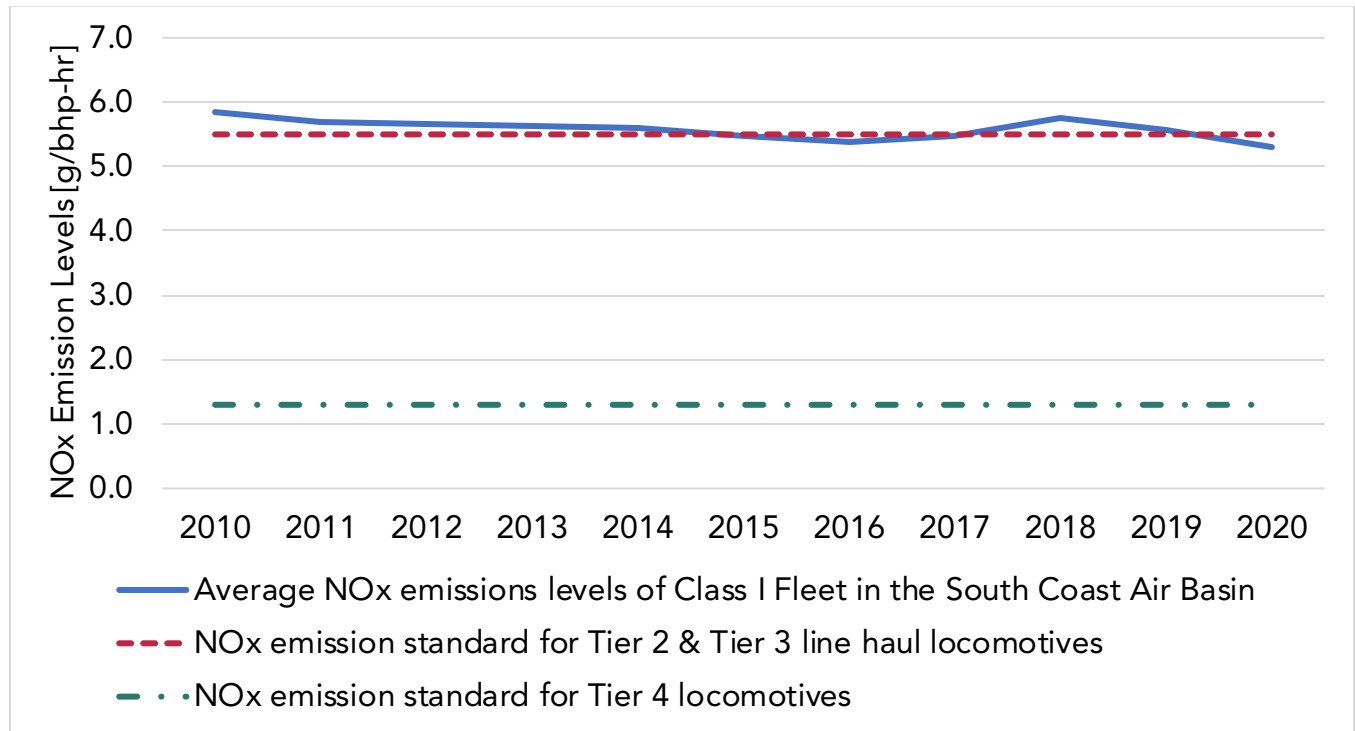
The Proposed Regulation is needed to accelerate the locomotive industry's use of cleaner technologies to move freight throughout California. Under the existing locomotive engine standards set by U.S. EPA, original equipment manufacturers (OEM) must ensure that freshly manufactured locomotives meet the current standard. However, there is currently no requirement for locomotives in-use to operate with any specific standard. Because of this,

¹¹⁹ U.S. EPA, 40 C.F.R. Part 1033.10, Exhaust Emissions Standards, June 2008. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033>).

diesel locomotives in operation in California fall under a wide range of engine standards, from no emission controls (uncontrolled) to the cleanest available.¹²⁰

To address locomotive emissions in California’s South Coast Air Basin, in 1998, CARB entered into a Memorandum of Understanding (MOU)¹²¹ with the two Class I locomotive operators in the state: Union Pacific (UP) and BNSF Railway Company (BNSF). As shown in Figure 14, data from this MOU reveals that, although Tier 4 engines have been available since 2015, Class I locomotive operators in California have continued to operate a fleet with average NOx emissions of Tier 2 since 2010.

Figure 14: 1998 MOU Data 2010-2020 Annual Locomotive Fleet Average NOx Emission Levels in the South Coast Air Basin^{122, 123}



There has been a lack of momentum in moving freight locomotives towards cleaner technologies by the industry compared to other source categories. Heavy duty trucks,¹²⁴

¹²⁰ U.S. EPA, Technical Highlights, Emission Factors for Locomotives (EPA-420-F-09-025), Office of Transportation and Air Quality, April 2009. (weblink: <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100500B.PDF?Dockey=P100500B.PDF>).

¹²¹ CARB, Memorandum of Mutual Understandings and Agreements, South Coast Locomotive Fleet Average Emissions Program, July 2, 1998. (weblink: <https://ww2.arb.ca.gov/sites/default/files/2021-02/1998MOU.pdf>).

¹²² U.S. EPA, Technical Highlights, Emission Factors for Locomotives (EPA-420-F-09-025), Office of Transportation and Air Quality, April 2009. (weblink: <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100500B.PDF?Dockey=P100500B.PDF>).

¹²³ Chart shows actual NOx emission levels, final reported levels were calculated per the methodology provided in the 1998 MOU, using credits that do not reflect actual emissions in the year reported.

¹²⁴ CARB, Advanced Clean Trucks, Regulatory Documents, Initial Statement of Reasons, October 22, 2019. (weblink: <https://ww2.arb.ca.gov/rulemaking/2019/advancedcleantrucks>).

drayage trucks,¹²⁵ transport refrigerators,¹²⁶ and cargo handling equipment¹²⁷ have already moved toward cleaner emissions and are now moving toward ZE wherever feasible.

In 2017, CARB petitioned U.S. EPA to establish a Tier 5 standard for locomotives.¹²⁸ The proposed standard would require lower emissions of PM and NOx, as well as enhanced ZE capability for occasional full ZE operation in sensitive areas. As of August 2022, U.S. EPA has taken no action on this petition. Even if U.S. EPA were to act, CARB anticipates that a Tier 5 standard alone would not fully address the underlying problem this Proposed Regulation seeks to address—the continued use of locomotives with emission technology several generations past the current cleanest available standard.

In sum, the Proposed Regulation is needed to transition from older, dirtier locomotives that exacerbate pollution in California communities to cleaner technology that will help communities come into attainment with the NAAQS.

F. Need to Enforce Excess Idling

Although the federal locomotive idling rules found in Title 40 C.F.R. section 1033.115(g) limit excess idling throughout the U.S., U.S. EPA enforces the federal rule and CARB does not control U.S. EPA's actions. CARB has received complaints and comments from its communities and air districts about pollution from excessive idling.¹²⁹

As part of its mission to promote and protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants, CARB has a duty to respond to community complaints about air pollution. It is necessary to include idling limits in the Proposed Regulation so that CARB has the authority to investigate cases where excessive idling is suspected and to enforce the requirements when excessive idling is discovered.

G. Need to Foster Zero Emission Technology

Zero emission technology deployments are needed in the locomotive market to meet the state's emission reduction goals.

While the Proposed Regulation does not impose requirements on OEMs, it will indirectly impact locomotive OEMs by encouraging development of cleaner technologies. In the past, major locomotive OEMs have been slow to develop cleaner locomotive technologies. In CARB staff outreach meetings, locomotive OEMs expressed concern over slow sales of Tier 4 locomotives, and the potential implications for further technology development, including ZE

¹²⁵ CARB, Advanced Clean Fleets Fact Sheet, June 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-03/ACF%20Fact%20Sheet_ADA.pdf).

¹²⁶ CARB, Final Regulation Order, Amendments to the ATCM for In-Use Diesel-Fueled Transport Refrigeration Units, (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate, 2021. (weblink: <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2021/tru2021/fro.pdf>).

¹²⁷ CARB, Cargo Handling Equipment Regulation to Transition to Zero-Emissions, accessed July 18, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/cargo-handling-equipment-regulation-transition-zero-emissions>).

¹²⁸ CARB, Locomotive Petition to U.S. EPA, April 13, 2017. (weblink: https://ww2.arb.ca.gov/sites/default/files/2020-07/final_locomotive_petition_and_cover_letter_4_3_17.pdf).

¹²⁹ CARB log: Community Complaints About Locomotives June 24, 2020.

development. More recently, through ZE locomotive demonstrations that framed benefits in terms of fuel cost savings, interest in ZE locomotive technology is growing.

Today, many locomotive OEMs have announced plans to launch commercially available ZE locomotives in the next few years. Additionally, some locomotive operators, such as UP, have shown interest in the ZE locomotive space and placed some small orders.¹³⁰ Several railroad and passenger rail agencies have developed and released plans describing pathways to ZE locomotives or are actively working to electrify their locomotive fleets. Metrolink released their Climate Action Plan in March 2021, which outlines a pathway to aggressively phase out fossil fuel powered equipment and reduce their impact on the environment. The plan describes steps Metrolink is taking to help reach the goal of having a locomotive fleet of 100 percent zero emissions by 2028.¹³¹ Caltrans released the Caltrans Zero Emission Vehicle Action Plan 2.0 in March 2021; the plan includes transitioning to a 100 percent ZE intercity fleet by 2035.¹³²

The Proposed Regulation would encourage locomotive OEMs to invest in the development and production of ZE locomotives and associated infrastructure and technology and to bring retrofitting and hybridization technologies to market.

H. Need to Understand Locomotive Emissions Statewide

Through the 1998 MOU, CARB receives direct reports of freight locomotive emissions in the South Coast Air Basin each year from the Class I railroads. This is the only locomotive emissions information specific to a California region that is directly reported to CARB. The remaining data is collected intermittently through interviews or other outreach. For more information on the locomotive data used in the Proposed Regulation, see Appendix G: CARB's 2022 In-Use Locomotive Emission Inventory: Regulatory Proposal and Scenarios.

The state is divided into 35 distinct air districts, each with its own topography and set of pollution sources, and each with disadvantaged communities. To better understand how locomotive emissions are tied to regional health outcomes, and to assess the effectiveness of policies to reduce pollution, CARB needs comprehensive locomotive emissions data on a location-specific basis. To increase the understanding of where and when locomotive emissions are occurring, the Proposed Regulation includes reporting requirements that would help quantify locomotive emissions annually by air district.

¹³⁰ UP, Union Pacific Railroad to Assemble World's Largest Carrier-Owned Battery-Electric Locomotive Fleet, News Releases, January 28, 2022, accessed July 18, 2022. (weblink: <https://www.up.com/media/releases/battery-electric-locomotive-nr-220128.htm>).

¹³¹ Metrolink, Climate Action Plan – The Link to a Zero Emissions Future, March 26, 2021. (weblink: <https://metrolinktrains.com/globalassets/about/agency/sustainability/climate-action-plan.pdf>).

¹³² Caltrans Zero-Emission Vehicle Action Plan 2.0, March 1, 2021. (weblink: https://static.business.ca.gov/wp-content/uploads/2021/03/Caltrans_ZEV-Action-Plan_Web_v2.pdf).

III. The Specific Purpose and Rationale of Each Adoption, Amendment, or Repeal

A. Section 2478. In-Use Locomotive Regulation.

Purpose

The purpose of this section is to implement a new regulation for locomotives operating in California.

Rationale

Diesel-powered locomotives that operate in California create harmful emissions. By 2025, locomotives operating in California are projected to emit over 630 tons per year of particulate matter of size 2.5 microns or less (PM_{2.5}), over 30,000 tons per year of oxides of nitrogen (NO_x), and over 2.5 million metric tons (MMT) per year of greenhouse gas (GHGs).¹³³ At projected population and freight growth rates, these emissions will cause approximately 6,300 premature deaths from cardiopulmonary illness, approximately 2,000 hospitalizations for cardiovascular or respiratory illness, and approximately 2,900 asthma-related emergency room visits from 2024 to 2050. Exposure to PM_{2.5} from diesel-powered locomotive engines also significantly elevates cancer risk.¹³⁴ To address these threats to human health and the environment, it is necessary to reduce locomotive emissions. For more information on diesel emissions from diesel-powered locomotives, see Chapter V: Air Quality and Emissions, and for more information on health effects, see Appendix H: Health Analyses.

Reducing the use of older, dirtier locomotives in California would bring substantial diesel emission reductions, resulting in health and environmental benefits. Although new Tier 4 locomotives are widely commercially available and emit significantly less than the average diesel-powered locomotive in operation today, it is common for operators to use locomotives that do not meet Tier 4 standards and are 30 years or older, meaning that they are pre-Tier 0. Pre-Tier 0 locomotives, sometimes called uncontrolled locomotives, are locomotives not regulated by any emission standards. Locomotives originally built before 1973 are generally pre-Tier 0 locomotives, and they are not required to meet any emission standards. Locomotives originally built from 1973 through 2001 are only required to meet Tier 0 standards when remanufactured, but it is common for Class III and industrial locomotives originally built through 2001 to continue to operate as pre-Tier 0 locomotives. For example, about 10 percent of the locomotives operated by passenger locomotive operators are pre-Tier 0 locomotives, 66 percent of the locomotives operated by Class III locomotive operators are pre-Tier 0, and 83 percent of locomotives operated by industrial locomotive operators are pre-Tier 0.

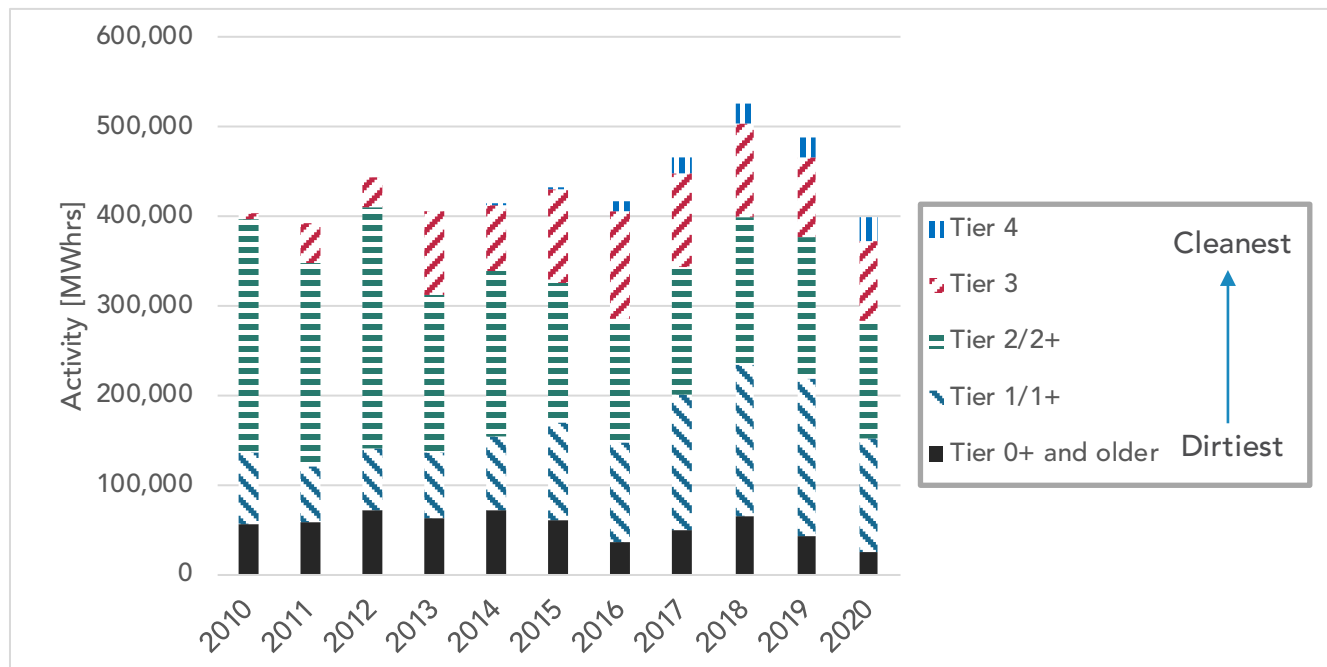
Class I locomotive operators, whose locomotives create 95 percent of the PM_{2.5} locomotive emissions, have also shown minimal uptake of newer, cleaner locomotives in their operations. As part of an agreement with the two Class I railroads operating in California, Union Pacific (UP) and BNSF Railway Company (BNSF), CARB receives locomotive usage data for the South

¹³³ Chapter V: Air Quality, Baseline year 2025.

¹³⁴ Appendix H: Health Analyses.

Coast Air Basin. Figure 15 shows locomotive usage data in the South Coast Air Basin of California.¹³⁵ At the bottom of each bar are Tier 0 and Tier 1 locomotives. These are the oldest and dirtiest locomotives, and, as can be clearly seen, their use is not generally decreasing. In fact, from 2018 through 2019, the use of Tier 0, Tier 0+ Tier 1, and Tier 1+ locomotives increased. Figure 15 also shows the very slow uptake of Tier 4 locomotives, the dark portion at the top of bars beginning in 2014. Although diesel emissions from Tier 4 locomotives are over 75 percent less than average emissions from Tier 1+/Tier 2 locomotives,¹³⁶ From 2016 to 2021, UP and BNSF have purchased Tier 4 locomotives at a rate of less than 1 percent per year as compared to their total fleets.¹³⁷

Figure 15: Locomotive Activity by Emission Tier in the South Coast Air Basin



After newly purchased locomotives have operated for several years, their parts become worn. To bring the locomotive back to fully operating condition, locomotives are often remanufactured. Remanufacture is described in title 40 of the C.F.R., section 1033.901 as “(i) To replace, or inspect and qualify, each and every power assembly of a locomotive or locomotive engine, whether during a single maintenance event or cumulatively within a five-year period. (ii) To upgrade a locomotive or locomotive engine. (iii) To convert a locomotive or locomotive engine to enable it to operate using a fuel other than it was originally manufactured to use. (iv) To install a remanufactured engine or a freshly manufactured engine into a previously used locomotive. (v) To repair a locomotive engine that does not contain power assemblies to a condition that is equivalent to or better than its original condition with respect to reliability and fuel consumption.” After remanufacture a

¹³⁵ CARB, Memorandum of Mutual Understanding and Agreements, South Coast Locomotive Fleet Average Emissions Program. (weblink: <https://ww2.arb.ca.gov/sites/default/files/2021-02/1998MOU.pdf>).

¹³⁶ U.S. EPA, Technical Highlights, Emission Factors for Locomotives, April 2009. (weblink: <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100500B.PDF?Dockey=P100500B.PDF>).

¹³⁷ Surface Transportation Board, UP and BNSF Annual Report Financial Data, Schedule 710, 2016-2021. (<https://www.stb.gov/reports-data/economic-data/annual-report-financial-data/>).

locomotive may continue to operate at an emission level equivalent or nearly equivalent to the emission standard that applied to new locomotives at the time when the locomotive was originally manufactured. Thus, heavily-polluting locomotives that are 30-, 40-, or 50 or more-years old are operating in California. It costs approximately 1 to 15 percent of the cost of a new locomotive to remanufacture a locomotive to its as-built standard.¹³⁸ As a result, California locomotive operators have continued to remanufacture older, dirtier locomotives rather than purchase new, cleaner locomotives.

The average locomotive operated in California are Tier 2,¹³⁹ which is the emission control technology that was required in 2005 and was first described as technically feasible in 1998. A Tier 2 locomotive creates over 12 times the amount of particulate matter (PM) emissions and four times the amount of NO_x emissions of a Tier 4 locomotive.¹⁴⁰ For additional information on locomotive emissions in the state, see Chapter V.

The Proposed Regulation would be implemented statewide and would mitigate regional pollution and long-standing environmental justice concerns for communities near railyards. For more information on the problems the Proposed Regulation intends to address, see Chapter II.

B. Section 2478.1. Applicability.

Purpose

The purpose of this section is to establish the applicability of the Proposed Regulation. This section specifies that, unless exempt, the Proposed Regulation would apply to any person that operates a locomotive in the state of California.

Additionally, this section specifies a locomotive operator could delegate one or more requirements of the Proposed Regulations to the locomotive owner. If the locomotive operator were to delegate the requirements to the locomotive owner, the delegated requirements would apply to the locomotive owner and be enforceable against the locomotive owner in addition to the locomotive operator.

This section also lists which locomotives would be specifically included in the requirements of the Proposed Regulation.

Rationale

This section is necessary to define who is subject to the Proposed Regulation. Some members of the regulated community may have business structures where the locomotive operator and the locomotive owner are separate entities. This section allows locomotive operators to choose to delegate responsibility for compliance with the Proposed Regulation

¹³⁸ CARB, Preliminary Cost Document for the In-Use Locomotive Regulation, March 16, 2021. (weblink: https://ww2.arb.ca.gov/sites/default/files/2021-03/3.16.21%20Locomotive%20Reg%20-%20Preliminary%20Cost%20Document_Final.pdf).

¹³⁹ CARB Rail Emission Reduction Agreement, Fleet Activity Data for the South Coast Air Basin, accessed July 18, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/rail-emission-reduction-agreements>).

¹⁴⁰ U.S. EPA, Technical Highlights, Emission Factors for Locomotives, April 2009. (weblink: <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100500B.PDF?Dockey=P100500B.PDF>).

to locomotive owners. To delegate responsibility for compliance, owners and operators would need to execute a legally binding agreement setting forth the delegation. A legal agreement is needed to clearly show which entity bears responsibility for compliance with the Proposed Regulation. Legally binding agreements setting forth the delegation reduce the possibility of confusion regarding who is the responsible party.

Additionally, as the Proposed Regulation would apply to all locomotive operators, it is important to also specify which locomotives would be subject to the Proposed Regulation.

C. Section 2478.2. Exemptions.

Purpose

This section describes the locomotives that are exempt from the Proposed Regulation. The exemptions include the following: locomotives propelled by locomotive engines with a total rated power of less than 1,006 horsepower (hp); locomotives owned by an accredited college, technical institute, or university used for “hands-on experience” certification; equipment designed for operation both on roads and on rails; and military locomotives.

Rationale

This section is needed to define which locomotives would be exempt from the Proposed Regulation.

The exemption of locomotive engines with a total rated power of less than 1,006 hp is necessary for consistency with the Code of Federal Regulations,¹⁴¹ which excludes from the definition of “locomotive” vehicles propelled by engines with total rated horsepower of less than 1,006 hp.¹⁴² Equipment that is designed for operation both on rails and on roads is regulated in the In-Use Off-Road Diesel-Fueled Fleets regulation¹⁴³ and is not considered to be a locomotive.

The exemption of locomotives owned by an accredited college, technical institute, or university used for “hands-on experience” certification is necessary to allow for training of specialized professionals. To be properly trained, it is necessary for locomotive mechanics and locomotive engineers to have completed their certification of “hands-on experience” with all locomotive types that they may need to repair or operate. An educated workforce of mechanics and engineers able to perform the proper maintenance and operation of all locomotive types would ensure optimal locomotive performance and minimize unnecessary emissions that may occur in circumstances of insufficient maintenance. Also, it is likely training events would create minimal emissions due to the small number of locomotives that would be needed to provide this training.

¹⁴¹ U.S. EPA, 40 C.F.R. § 1033.901 (up to date as of 7-14-2022). (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-J/section-1033.901>).

¹⁴² U.S. EPA, 40 C.F.R. § 1039.1 and 40 C.F.R. § 1039.5. (weblink: <https://www.govinfo.gov/content/pkg/CFR-2021-title40-vol36/pdf/CFR-2021-title40-vol36-part1039.pdf>).

¹⁴³ Cal. Code Regs., tit. 13, § 2449 et seq.; CARB, Final Regulation Order, In-Use Off-Road Diesel-Fueled Fleets, 2000. (weblink: <https://ww2.arb.ca.gov/sites/default/files/classic/msprog/ordiesel/documents/finalregorder-dec2011.pdf>).

The exemption of military locomotives is necessary so that the military can respond to emergencies and security threats. Further, military locomotives are a relatively minor source of emissions in California due to their small population and infrequent use. Staff documented only 13 military locomotives that operate within California. These military locomotives have fuel consumption averaging around 1,000 gallons per year. This is about 5 to 10 percent of the fuel consumption compared to an average Class III or industrial locomotive in California.

The exemption for equipment designed for operation both on roads and on rails is necessary because that equipment is not considered a locomotive under the Code of Federal Regulations,¹⁴⁴ and will be regulated in the In-Use Off-Road Diesel-Fueled Fleets Regulation.¹⁴⁵

D. Section 2478.3. Definitions.

Purpose

The purpose of this section is to set forth definitions for terms used in the Proposed Regulation.

Rationale

This section is necessary for CARB to define terms with meanings specific to the regulatory text.

1. "Automatic Engine Stop/Start (AESS)"

Purpose

This provision defines "automatic engine stop/start (AESS)" as the automatic engine shut down/start up system that controls the engine by stopping or starting it without operator action, described in Code of Federal Regulations, title 40, section 1033.115.

Rationale

This provision is necessary to define the term "AESS," which is used in the Idling Requirements section, the Reporting and Recordkeeping Requirements section, and the Historic Railroad Low-Use Exemption section of the Proposed Regulation. This definition is consistent with the description provided in the Code of Federal Regulations.¹⁴⁶

¹⁴⁴ U.S. EPA, 40 C.F.R. § 1033.901 (up to date as of 7-14-2022). (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-J/section-1033.901>).

¹⁴⁵ CARB, Final Regulation Order, In-Use Off-Road Diesel-Fueled Fleets, 2000. (weblink: <https://ww2.arb.ca.gov/sites/default/files/classic/msprog/ordiesel/documents/finalregorder-dec2011.pdf>).

¹⁴⁶ U.S. EPA, 40 C.F.R. § 1033.115, accessed July 14, 2022. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-B/section-1033.115#p-1033.115>).

2. "Calendar Year"

Purpose

This provision defines "calendar year" as the period beginning on January 1 through December 31 of a single year.

Rationale

This provision is necessary to define the term "Calendar Year," which is used throughout the Proposed Regulation. Numerous requirements of the Proposed Regulation are based on a calendar year and as such, it is necessary to define what constitutes a "Calendar Year" so that the regulated community has clarity regarding the meaning of that term.

3. "California Air District"

Purpose

This provision defines "California air district" as one of the local air pollution control districts or air quality management districts established under Health and Safety Code sections 40000 et seq.

Rationale

This provision is necessary to define the term "California air district," which is used in the Reporting and Recordkeeping Requirements section. The Proposed Regulation requires locomotive activity to be tracked and reported to CARB at a California air district level. Therefore, it is necessary to define what is considered to be a California air district.

4. "California Air Resources Board (CARB)"

Purpose

The purpose of this provision is to define "California Air Resources Board" or "CARB" as the agency of the State of California established and empowered to regulate sources of air contaminant emissions.

Rationale

This definition is necessary to define the term "CARB," which is used throughout the Proposed Regulation. This definition identifies CARB as the agency responsible for regulating sources of air contaminant emissions and defines the acronym "CARB" as a shorthand.

5. "Class I, Class II, or Class III Railroad"

Purpose

The purpose of this provision is to define "Class I Railroad," "Class II Railroad," and "Class III Railroad" as it is defined by the Surface Transportation Board in Title 49, Code of Federal Regulations, section 1201 Railroad Companies, 1-1 Classification of carriers, pp. 7-8, which was accessed July 27, 2022. The class is based on the carrier's annual operating revenues.

Rationale

This definition is necessary to establish what constitutes a Class I, Class II or Class III railroad so readers understand the classifications for the types of railroads in the Proposed Regulation and to align with the federal definition. These terms are generally understood by the regulated community.

6. “Cleaner Locomotive”

Purpose

The purpose of this provision is to define “Cleaner Locomotive” as any locomotive that is equal to or lower than the emission levels for the current U.S. EPA tier for all U.S. EPA certified emission levels and is lower for at least one measured emission level.

Rationale

Several places in the Proposed Regulation describe a Tier 4 or “cleaner locomotive.” This definition is required to establish what constitutes a cleaner locomotive for the Proposed Regulation.

7. “Disadvantaged Community (DAC)”

Purpose

The purpose of this provision is to define “disadvantaged community (DAC)” as an area which suffers from a combination of economic, health, and environmental burdens. These burdens include poverty, high unemployment, air and water pollution, and presence of hazardous wastes, as well as high incidence of asthma and heart disease. DACs are designated by the California Environmental Protection Agency for the purposes of SB 535, and their boundaries are identified in CalEnviroScreen,¹⁴⁷ an analytical tool developed by the Office of Environmental Health Hazard Assessment.

Rationale

This provision is necessary to define the term “DAC,” which is used in the Spending Account section. The Proposed Regulation allows locomotive operators to reduce their Spending Account deposit requirement through the use of zero emission (ZE) credits. The ZE credits would be generated from the use of ZE locomotives, ZE rail equipment, or wayside power before 2030. If the ZE locomotive or ZE rail equipment are operated in an area designated as a DAC or if the wayside power connection is made in an area designated as a DAC, the ZE credits would be multiplied by two. Therefore, it is necessary to clearly define DACs as determined using CalEnviroScreen.

¹⁴⁷ California Disadvantaged Communities identified by CalEnviroScreen, accessed on July 18, 2022. (weblink: <https://oehha.ca.gov/calenviroscreen/sb535>).

8. “Enforceable Emission Reductions”

Purpose

This provision defines “enforceable emission reductions” as emission reductions for which CARB has authority to hold a particular party or parties liable and to take enforcement action if the emission reductions claimed are not achieved.

Rationale

This provision is necessary to define the term “enforceable emission reductions,” which is used in the Alternative Compliance Plan (ACP) section in the Proposed Regulation. The ACP allows locomotive operators to submit a proposed plan which would follow an alternative path to reduce emissions equivalent to the levels that would have been achieved by the Spending Account or the IUOR section, or both. The ACP application would be required to demonstrate that the ACP would achieve real, quantifiable, verifiable, and enforceable emission reductions from the locomotive operations covered by the ACP. Therefore, it is important the reader understands what enforceable emission reductions are for purposes of the Proposed Regulation.

9. “Engine Tier”

Purpose

This provision defines “engine tier” as the locomotive engine emission level as defined by U.S. EPA in Code of Federal Regulations, title 40, section 1033.101.

Rationale

This provision is necessary to define the term “engine tier,” which is used in the Registration Requirements section. The Proposed Regulation requires locomotive operators to report the engine tier when registering a locomotive that operates or may operate in California. Thus, a definition of “engine tier” is necessary. These tiers have been established by the Code of Federal Regulations, and is necessary to align with the federal standard. Also, the meaning of this term is commonly understood by industry.

10. “Executive Officer”

Purpose

This provision defines “Executive Officer” as the Executive Officer of CARB or their designee.

Rationale

This provision is necessary to define the term “Executive Officer,” since numerous provisions in the Proposed Regulation refer to CARB’s Executive Officer. For example, requests for a Temporary Locomotive Operating Waiver and applications for ACPs are required to be submitted to the Executive Officer, who then approves the request or application if the applicable requirements are met. It is necessary to specify who the Executive Officer is to clarify to the regulated community who is being referred to in the provisions that specify the Executive Officer. Further, it is necessary to define the term “Executive Officer” to include the Executive Officer’s designee such that the regulated community understands that the

Executive Officer may designate another individual to perform the role(s) required by the Executive Officer in the Proposed Regulation.

11. "Fair Market Value"

Purpose

This provision defines "fair market value" as the amount of money that property would sell for if offered for sale in the open market where the buyer and the seller have access to the same information.

Rationale

This provision is necessary to define the term "fair market value" since it is used in the ACP section. For an ACP, calculation of the quantity of reductions that would have been achieved based on the requirements in the Spending Account section requires the assumption that locomotives that would have been purchased by Spending Account funds would have been purchased at fair market value. "Fair market value" is a term of art used by professional appraisers to describe a value that can be corroborated by values exchanged in sales transactions; given conditions where the buyer and seller have equal access to the same information, an appraiser assumes that the price paid is determined only by fair market value.

12. "Freight Line Haul Locomotive"

Purpose

This provision defines "freight line haul locomotive" as a locomotive that does not meet the definition of switch, industrial, historic, passenger, or military locomotive.

Rationale

This provision is necessary to define the term "freight line haul locomotive," which is used in the definitions, Spending Account, In-Use Operational Requirements, and ACP sections. This definition is necessary because the Proposed Regulation classifies six categories of locomotives: freight line haul, switch, industrial, passenger, historic, and military locomotives. It is important to specifically define locomotive types because the Proposed Regulation has distinct requirements that would apply to different types of locomotives. For example, the Spending Account section assigns specific emission factors to be used for freight line haul locomotives if a locomotive operator does not have emission factor information and assigns a specific fuel usage conversion factor to freight line haul locomotives. As another example, the IUOR section sets forth the specific requirements applicable for freight line haul locomotive engines operating in California.

By defining freight line haul, industrial, passenger, historic, and military locomotives separately, the Proposed Regulation can set requirements for these locomotive operators appropriately and remove ambiguity between the U.S. EPA definition of "line haul" locomotive and "freight line haul locomotive" as defined in the Proposed Regulation. U.S. EPA 40 CFR § 1033.901 defines "line haul locomotive" and "switch locomotive." "Switch locomotive" is defined as "a locomotive that is powered by an engine with a maximum rated power ... of 2,300 hp or less." "Line haul locomotive" is defined as "a locomotive that does

not meet the definition of switch locomotive.” Note that this federal definition includes both freight and passenger locomotives, as well as any industrial locomotive over 2,300 hp.

By creating only two categories of locomotives, and by basing the categorization only on engine size, U.S. EPA groups locomotives with different operational characteristics into either the “switch” or “line haul” type. For example, a Class I locomotive that runs interstate routes, an industrial locomotive over 2,301 hp working in a cement factory, and a passenger locomotive running commuter routes are all included in the U.S. EPA definition of a line haul locomotive. While U.S. EPA’s definition of “line haul,” includes passenger and industrial locomotives if they are 2,301 hp or greater, CARB acknowledges that these locomotives operate differently than typical freight line haul locomotives.

Additionally, CARB assesses that different ZE technologies may be suitable for freight line haul locomotives, industrial locomotives, and passenger locomotives.

13. “Five-Year Verification Period”

Purpose

This provision defines “five-year verification period” as the span of time an ACP may be implemented. The five-year verification period commences on the start date stated in the Executive Order approving the ACP and ends five years later unless an earlier end date is specified in the Executive Order.

Rationale

This provision is necessary to define the term “five-year verification period,” which is used in the ACP section. ACPs are only valid for a “five-year verification period,” and this definition provides clarity to the regulated community regarding the specific timeframe it represents. It is necessary to specify that the start date of the five-year verification period is the start date designated in the Executive Order approving the ACP to provide clarity as to when this period would begin. It is also necessary to provide that the ACP would end five-years later unless an earlier end date is specified in the Executive Order to provide clarity as to the end of this period. The five-year cap is necessary to ensure that the ACP can only continue for a maximum of five years following the start date, after which it would expire unless an earlier date is included in the Executive Order. Following expiration of an ACP, an operator would have to submit a new application for an ACP if they would like to continue to use an ACP.

14. “Greenhouse Gas (GHG)”

Purpose

This provision defines “greenhouse gas (GHG)” as carbon dioxide, methane, nitrogen trifluoride, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, perfluorocarbons, and other fluorinated GHGs.

Rationale

This provision is necessary to define the term “GHGs,” which is used in the ACP section. Locomotive operators that elect to implement an ACP must reduce GHG emissions in California by the amount specified in the Proposed Regulation. As such, it is necessary to

define what constitutes GHGs for the purposes of the Proposed Regulation in order to provide clarity to the regulated community regarding what constitutes a GHG.

15. "Head End Power"

Purpose

This provision defines "head end power" as power used for passenger cabin comforts such as heating and cooling.

Rationale

This provision is necessary to define the term "head end power," which is used in the Idling Requirements section of the Proposed Regulation. This definition is necessary because the Idling Requirements section requires locomotives equipped to connect to wayside power to turn off on-board engines, including separate engines providing head end power, and use wayside power if idling for longer than 30 minutes and if wayside power is available. Thus, this definition is necessary to provide clarity to the regulated community regarding the meaning of the term "head end power."

16. "Historic Locomotive"

Purpose

This provision defines "historic locomotive" as a locomotive that is owned or operated by a historic railroad. A historic locomotive does not haul freight, is used solely for education, preservation, or historical experience and the use of the locomotive in its original configuration is key to education, preservation, or historical experience.

Rationale

This provision is necessary to define the term "historic locomotive," which is used in the Administrative Payment section and the Historic Railroad Low-Use Exemption section in the Proposed Regulation. This definition is necessary to provide clarity to the regulated community as to what is considered a historic locomotive. It is necessary to specify that a historic locomotive does not haul freight so that the historic railroad low-use exemption cannot be improperly expanded to include locomotives that haul freight. Similarly, it is necessary to specify that historic locomotives are used solely education, preservation, or historical experience, because the Historic Railroad Low-Use Exemption is only intended to apply to these types of locomotives. Further, it is necessary to specify that the use of the locomotive in its original configuration is key to the educational, preservation, or historical experience to align with the intent of the Historic Railroad Low-Use Exemption, which carves a narrow exemption for cases where use of the locomotive in its original configuration is key to the preservation of these experiences.

17. "Historic Railroad Fleet"

Purpose

This provision defines "historic railroad fleet" as all applicable historic locomotives used by a historic railroad operating under a historic railroad low-use exemption throughout the reporting period.

Rationale

This provision is necessary to define the term "historic railroad fleet," which is used in the Historic Railroad Low-Use Exemption section. The Historic Railroad Low-Use Exemption section allows historic railroad fleets to seek an exemption from some requirements of the Proposed Regulation. This definition is necessary to provide clarity to the regulated community as to what comprises a "historic railroad fleet."

18. "Historic Railroad "

Purpose

This provision defines "historic railroad" as any entity that has the primary purpose of exhibiting or operating one or more historic locomotives.

Rationale

This provision is necessary to define the term "historic railroad," which is used in the Historic Railroad Low-Use Exemption section. By specifying the type of entity that constitutes a historic railroad for the purposes of the Proposed Regulation, this definition provides direction to the regulated community as to what entities are eligible to seek a historic railroad low-use exemption.

19. "Idling"

Purpose

This provision defines "idling" as the period in which the locomotive engine is running while the locomotive is stationary. It exempts from the definition of "idling" a locomotive operating in a ZE configuration.

Rationale

This provision is necessary to define the term "idling," which is used in the Idling Requirements section and in the Idling Annual Report subsection of the Reporting and Recordkeeping Requirements section. The Proposed Regulation seeks to reduce emissions from locomotives idling. Some locomotives may be in an engine setting that is considered "idle," meaning the engine is turned on but the throttle is not engaged, and the engine will not propel the locomotive; however, the locomotive is moving, for example rolling down a slope, or being towed by another locomotive, and under supervision by an operator. This definition specifies that the locomotive must be stationary to be considered to be "idling" for the purposes of the Proposed Regulation.

The second sentence exempts locomotives operating in a ZE configuration from the definition of “idling” such that the idling requirements would not apply to locomotives while they are operating in ZE configuration. This is necessary because the idling provisions aim to reduce emissions that occur when diesel locomotives idle. Locomotives operating in ZE configuration do not generate emissions from idling and thus need not comply with the idling requirements.

20. “Industrial Locomotive”

Purpose

This provision defines “industrial locomotive” as a locomotive operated by an industrial operator.

Rationale

This provision is necessary to define the term “industrial locomotive,” which is used in the definitions, Spending Account, In-Use Operational Requirements, and ACP sections. This definition is necessary because the Proposed Regulation classifies six categories of locomotives, such as freight line haul, switch, industrial, passenger, historic, and military locomotives. It is important to specifically define the different types of locomotives because the Proposed Regulation has distinct requirements that apply to freight line haul, industrial, passenger, and switch locomotives. For example, the IUOR section sets forth the specific requirements applicable for industrial locomotives operating in California.

By defining freight line haul locomotives, industrial locomotives, and passenger locomotives separately, the Proposed Regulation can set requirements for these locomotive operators appropriately and remove ambiguity between the U.S. EPA definition of “line haul locomotive” and “freight line haul locomotive” as defined in the Proposed Regulation. U.S. EPA defines “line haul locomotive” and “switch locomotive” in title 40 of the Code of Federal Regulations, section 1033.901. “Switch locomotive” is defined as “a locomotive that is powered by an engine with a maximum rated power ... of 2,300 hp or less.” (40 CFR § 1033.901). “Line haul locomotive” is defined as “a locomotive that does not meet the definition of switch locomotive.” Note that this federal definition includes both freight and passenger locomotives, as well as any industrial locomotive over 2,300 hp.

By creating only two categories of locomotives, and by basing the categorization only on engine size, U.S. EPA groups locomotives with different operational characteristics into either the “switch” or “line haul” type. For example, a Class I locomotive that runs interstate routes, an industrial locomotive over 2,301 hp working in a cement factory, and a passenger locomotive running commuter routes are all included in the U.S. EPA definition of a line haul locomotive. While U.S. EPA’s definition of “line haul” includes passenger and industrial locomotives if they are 2,301 hp or greater, CARB uses separate definitions to acknowledge that these locomotives operate differently than typical freight line haul locomotives.

Additionally, CARB assesses that different ZE technologies may be suitable for freight line haul locomotives, industrial locomotives, and passenger locomotives.

21. "Industrial Operator"

Purpose

This provision defines "industrial operator" as a locomotive operator that operates locomotives to move their company products but doesn't provide rail services to other companies or to passengers.

Rationale

This provision is necessary to define the term "industrial operator," which is used in the definition of "industrial locomotive." Industrial operators operate locomotives differently from railroads that provide rail service as their main business using freight line haul and passenger locomotives. Industrial duties often require short hauls, most similar to the way switchers operate. Therefore, it is necessary to define "industrial operator" so that the definition of "industrial locomotives" can be clearly distinguished from the other types of locomotives of the Proposed Regulation.

This provision defines "locomotive" as a self-propelled piece of on-track equipment designed for moving or propelling cars that are designed to carry freight, passengers, or other equipment, but which itself is not designed or intended to carry freight, persons (other than those operating the locomotive), or other equipment.

22. "Locomotive"

Rationale

This provision defines "locomotive" as a self-propelled piece of on-track equipment designed for moving or propelling cars that are designed to carry freight, passengers, or other equipment, but which itself is not designed or intended to carry freight, persons (other than those operating the locomotive), or other equipment.

Purpose

This provision is necessary to define the term "locomotive," which is used extensively throughout the Proposed Regulation. It is necessary to specifically define locomotives such that they are distinguished from other types of track-mounted equipment because they adhere to specific engine size requirements and U.S. EPA emissions requirements. This definition aligns with the U.S. EPA's definition of locomotive found in title 40 CFR section 1033.901.

23. "Locomotive Engine"

Purpose

This provision defines "locomotive engine" as an engine that propels or provides power to propel a locomotive. For locomotives propelled by two or more engines, the total rated power is the sum of the rated power of each engine.

Rationale

This provision is necessary to define the term “locomotive engine,” which is used in the definition of numerous terms in the Definitions section (including “engine tier” and “idling”) as well as in the In-Use Operational Requirements, ACP, Historic Railroad Low-Use Exemption, and Idling Requirements sections. Locomotives may have multiple engines. Some locomotive engines may not be used for propulsion, such as small engines used to provide auxiliary power to heat and cool the engineer’s compartment. Therefore, it is necessary to identify the engine or engines covered by the applicable sections of the Proposed Regulation.

The second sentence of the definition is necessary because, in some cases, locomotives may also have multiple propulsion engines. It is important the regulated community knows that the total rated power, which is the maximum brake horsepower output of the locomotive, is what is used to categorize the locomotive for the purposes of the Proposed Regulation. The total rated power is the sum of the rated power of each engine because multiple engines work as a single system with the common purpose of providing propulsion for the locomotive.

24. “Locomotive Operator (Operator)”

Purpose

This provision defines “locomotive operator (operator)” as the person that is responsible for operating locomotive(s) in California. A locomotive operator includes a locomotive owner, lessee, or rentee if they are responsible for operating locomotive(s) in California.

Rationale

This provision is necessary to define the term “locomotive operator,” also referred to by the shorthand “operator,” which is used extensively throughout the Proposed Regulation. The Proposed Regulation applies to all locomotive operators that operate locomotives in California. In cases where the locomotive owner and the locomotive operator may be different, this definition is necessary to distinguish the regulated party. The second sentence is necessary to clarify that a locomotive owner, lessee, or rentee falls under the definition of a locomotive operator if they are responsible for operating locomotive(s) in California.

25. “Locomotive Owner”

Purpose

This provision defines “locomotive owner” as the person that is identified as the owner of the locomotive by the records to demonstrate ownership for that locomotive. These records include: bill of sale, title of ownership, or record of Surface Transportation Board filing of security agreement.

Rationale

This provision is necessary to define the term “locomotive owner,” which is used in the Applicability and the Definitions sections. The Applicability section includes a provision that allows a locomotive operator to delegate one or more of the requirements of the Proposed

Regulation to the locomotive owner through execution of a legally binding agreement between the operator and the owner. The second sentence of this definition provides acceptable forms of records that demonstrate ownership of a locomotive, which is necessary to provide clarity as to the type of records referred to in the preceding sentence.

26. "Military Locomotive"

Purpose

This provision defines a "military locomotive" as a locomotive owned by the United States government and used by a branch of the military.

Rationale

This provision is necessary to define the term "military locomotive," which is used in the Exemptions section. Military locomotives are exempt from the Proposed Regulation. It is necessary to define what CARB considers to be military locomotives to clearly delineate the military locomotives exemption.

27. "Operate"

Purpose

This provision defines "operate" as start, cause to function or otherwise control, fuel, or keep in operation.

Rationale

This provision is necessary to define the term "operate," which is used extensively throughout the Proposed Regulation. For example, the Applicability section provides that the Proposed Regulation applies to any locomotive operator that operates a locomotive in California. This definition clarifies what the term "operate" means so that the regulated community understands the various requirements applicable to operations of locomotives in California.

28. "Original Engine Build Date"

Purpose

This provision defines "original engine build date" as the date of final assembly of the locomotive engine, prior to any remanufacture of the locomotive engine.

Rationale

This provision is necessary to define the term "original engine build date," which is used in the Definitions, In-Use Operational Requirements, ACP, Registration Requirements, and Recordkeeping and Reporting Requirements sections. The Proposed Regulation uses the original engine build date to determine several requirements. For example, the IUOR section's requirements depend on the original engine build date of the locomotive's primary engine. It is important to define what CARB considers as the original build date to avoid confusion on locomotive engine build dates and to clarify that remanufacture does not impact the original engine build date.

29. "Oxides of Nitrogen (NOx)"

Purpose

This provision defines "oxides of nitrogen (NOx)" as compounds of nitric oxide, nitrogen dioxide, and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes and are major contributors to smog formation and acid deposition.

Rationale

This definition is necessary because the term "NOx" is used in the Spending Account, ACP, and the Registration Requirements sections. NOx is one of the pollutants the Proposed Regulation is targeting for emission reductions from in-use locomotives. For example, the NOx emission factor is one of the terms used to calculate the funding requirement in the Spending Account section. As such, it is necessary to define what NOx means in order to provide clarity as to these provisions.

30. "Particulate Matter (PM)"

Purpose

This provision defines "particulate matter (PM)" as any airborne finely divided material, except uncombined water, which exists as a liquid or solid at standard conditions (e.g., dust, smoke, mist, fumes, or smog).

Rationale

This provision is necessary to define the term "PM," which is used in the Spending Account, ACP, and Registration Requirements sections. PM is one of the pollutants the Proposed Regulation is targeting for reductions from in-use locomotives. For example, the PM emission factor is one of the terms used to calculate the funding requirement in the Spending Account section. As such, it is necessary to define what PM means in order to provide clarity as to these provisions.

31. "Passenger Locomotive"

Purpose

This provision defines "passenger locomotive" as a locomotive designed and constructed for the primary purpose of propelling passenger trains and providing power to the passenger cars of the train for such functions as heating, lighting, and air conditioning as set forth in title 40, C.F.R. section 1033.901.

Rationale

This provision is necessary to define the term "passenger locomotive," which is used in the Definitions, Spending Account, In-Use Operational Requirements, and ACP sections. This definition is necessary because the Proposed Regulation classifies six categories of locomotives: freight line haul, switch, industrial, passenger, historic, and military locomotives. It is important to specifically define the different types of locomotives because the Proposed Regulation has distinct requirements that apply to freight line haul, industrial, passenger, and

switch locomotives. For example, the IUOR section sets forth the specific requirements applicable for passenger locomotives operating in California.

By defining freight line haul locomotives, industrial locomotives, and passenger locomotives separately, the Proposed Regulation can set requirements for these locomotive operators differently and remove any potential ambiguity between the U.S. EPA definition of "line haul" locomotive and "passenger locomotive" as defined in the Proposed Regulation. U.S. EPA defines "line haul locomotive" and "switch locomotive" in title 40 C.F.R., section 1033.901. "Switch locomotive" is defined as "a locomotive that is powered by an engine with a maximum rated power ... of 2,300 hp or less" (40 C.F.R. § 1033.901). "Line haul locomotive" is defined as "a locomotive that does not meet the definition of switch locomotive." Note that this federal definition includes both freight and passenger locomotives, as well as any industrial locomotive over 2,300 hp.

By creating only two categories of locomotives, and by basing the categorization only on engine size, U.S. EPA groups locomotives with different operational characteristics into either the "switch" or "line haul" type. For example, a Class I locomotive that runs interstate routes, an industrial locomotive over 2,301 hp working in a cement factory, and a passenger locomotive running commuter routes are all included in the U.S. EPA definition of a line haul locomotive. While U.S. EPA's definition of "line haul" includes passenger and industrial locomotives if they are 2,301 hp or greater, CARB uses separate definitions to acknowledge that these locomotives operate differently than typical freight line haul locomotives.

Additionally, CARB assesses that different ZE technologies may be suitable for freight line haul locomotives, industrial locomotives, and passenger locomotives.

32. "Person"

Purpose

This provision defines "person" as having the meaning set forth in Health and Safety Code section 39047.

Rationale

This provision is necessary to define the term "person," which is used in the definition for "locomotive operator" and "locomotive owner." Both of these defined terms are critical to the applicability of the Proposed Regulation; therefore, it is necessary to define "person" so that its meaning in the definitions of other terms is clear to the regulated community.

33. "Primary Engine"

Purpose

This provision defines "primary engine" as the locomotive engine that propels the locomotive. If the locomotive is propelled by more than one locomotive engine, for any provisions of the Proposed Regulation which use the primary engine's age, the primary engine's age shall be based on the Original Engine Build Date of the oldest locomotive engine.

Rationale

This provision is necessary to define the term “primary engine,” which is used in the In-Use Operational Requirements and ACP sections. The IUOR section’s requirements depend on the age of the locomotive’s primary engine. In the case where a locomotive has more than one engine, it is important that the regulated community understand the oldest engine would be used to determine the locomotive’s original engine build date. Therefore, it is necessary to define what the primary engine is so that the regulated community is clear on the requirements set forth in the Proposed Regulation.

34. “Quantifiable Emission Reduction”

Purpose

This provision defines “quantifiable emission reduction” as reductions in emissions accurately measured and calculated, in a reliable and replicable manner, relative to a projected baseline.

Rationale

This provision is necessary to define the term “quantifiable emission reduction,” which is used in the ACP section. If a locomotive operator elects to use an ACP instead of complying with the Spending Account and the IUOR sections, they must show that the ACP they propose as an alternative will achieve the necessary reductions of emissions from the locomotive operations and that the quantification occurs in a way that meets CARB standards. Therefore, it is important the regulated community understands what quantifiable emission reductions are. Further, it is necessary to ensure that the reductions to be achieved by an ACP are quantifiable and can be accurately measured and calculated in a reliable and replicable manner.

35. “Railcar”

Purpose

This provision defines “railcar” as a rail-mounted container also known as a “car” designed to carry freight or passengers.

Rationale

This provision is necessary to define the term “railcar,” which is used in the Definitions section. The term “railcar” is used in the definition of “train.” Therefore, a definition of “railcar” is required to understand the definition of “train,” which are locomotives pulling railcars or non-operational locomotives.

36. “Real Emission Reduction”

Purpose

This provision defines “real emission reduction” as reductions in emissions resulting from a demonstrable action or set of actions, quantified using the applicable Carl Moyer Program

Guidelines quantification methodology, or another methodology specified in the Executive Order approving an Alternative Compliance Plan.

Rationale

This provision is necessary to define the term “real emission reduction,” which is used in the ACP section. If a locomotive operator elects to use an ACP instead of complying with the Spending Account and the IUOR sections, they must show that the ACP they propose as an alternative will achieve the necessary amount of real reductions of emissions from the locomotive operations. Therefore, it is important the regulated community understands what is considered to be real emission reductions such that there is clarity as to the requirements if they elect to apply for an ACP. It is necessary that the reductions to be achieved by an ACP be the result of demonstrable action(s) to ensure that the reductions achieved will be real. Further, it is necessary to clarify that the default methodology to be used to quantify these reductions would be the applicable Carl Moyer Program Guidelines quantification methodology. Due to the variety of potential ACPs that may be utilized, the Carl Moyer Program Guidelines quantification methodology may not work in all cases. Therefore, CARB needs to maintain some flexibility to specify an alternative quantification methodology in the Executive Order approving the ACP.

37. “Remanufacture”

Purpose

This provision defines the term “remanufacture” as meaning one of the following (1)(i) to replace, or inspect and qualify, each and every power assembly of a locomotive or locomotive engine, whether during a single maintenance event or cumulatively within a five-year period; (ii) to upgrade a locomotive or locomotive engine; (iii) to convert a locomotive or locomotive engine to enable it to operate using a fuel other than it was originally manufactured to use; (iv) to install a remanufactured engine or a freshly manufactured engine into a previously used locomotive; to repair a locomotive engine that does not contain power assemblies to a condition that is equivalent to or better than its original condition with respect to reliability and fuel consumption; (2) remanufacture also means the act of remanufacturing.¹⁴⁸

Rationale

This provision is necessary to define the term “remanufacture,” which is used in the Spending Account, In-Use Operational Requirements, and Registration Requirements sections. For example, the Spending Account section provides that one of the permitted uses of funds held in the Spending Account is for the remanufacture of locomotive(s) to Tier 4 or cleaner emission levels. As another example, in the IUOR section, the original engine build date may depend on the date that the primary engine was remanufactured. It is necessary to define the term “remanufacture” to provide clarity as to the use of the term in these sections.

¹⁴⁸ U.S. EPA, 40 C.F.R. § 1033.901, accessed July 14, 2022. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-J/section-1033.901>).

Staff used the same definition set forth in C.F.R., title 40, section 1033.901 for consistency with the federal regulation.

38. "Repower"

Purpose

This provision defines "repower" as having the meaning set forth in the title 40, C.F.R. section 1033.901.

Rationale

This provision is necessary to define the term "repower," which is used in the Spending Account and the IUOR sections. For example, the Spending Account section provides that one of the permitted uses of funds held in the Spending Account is for the repower to Tier 4 or cleaner locomotive(s). As another example, in the IUOR Section, the original engine build date may depend on the date that the primary engine was repowered. A locomotive repowered to meet Tier 4 emissions standards under EPA regulation prior to 2030 would have its original build date based on the date of repowering. It is necessary to define the term "repower" to provide clarity regarding the use of the term in these sections. Staff defined it based on the definition in title 40, C.F.R. section 1033.901 for consistency with the federal regulation.

39. "Responsible Official"

Purpose

This provision defines "responsible official" as an individual with the authority to certify that the locomotive complies with the requirements of the Proposed Regulation. The operator of each locomotive may only have one responsible official at any given time.

Rationale

This provision is necessary to define the term "responsible official," which is used in the Definitions, Spending Account, Registration Requirements, Historic Railroad Low-Use Exemption, and Submittals to CARB sections. The Proposed Regulation requires the Spending Account to be held in the name of a responsible official. The responsible official is also required to certify reporting data as correct. As such, it is necessary to describe and define who is considered a responsible official.

40. "Spending Account"

Purpose

This provision defines "Spending Account" as a trust fund where all funds, including any interest earned on those funds, remain in the possession and control of the locomotive operator; funds are to be solely dedicated to compliance with the Spending Account requirements. No other funding sources shall be comingled in this account.

Rationale

This provision is necessary to define the term “Spending Account,” which is used in the Definitions, Spending Account, ACP, Reporting and Recordkeeping, and Small Business Hardship Extension sections. This definition is necessary to clarify the meaning of the term “Spending Account” so that the regulated community would understand the requirements set forth in the Spending Account and related sections. The Spending Account section requires locomotive operators to establish a spending account. Locomotive operators who operate locomotives in California must deposit funds into the account and may only use the funds for one of the permitted purposes. The last sentence of the definition is necessary to ensure that the funds deposited in the Spending Account pursuant to the Spending Account section remain separated from other funds.

41. “Spending Account Owner”

Purpose

This provision defines “Spending Account owner” as an individual with the authority to access and control data and funds in the Spending Account.

Rationale

This provision is necessary to define the term “Spending Account owner,” which is used in the Spending Account section. The Spending Account section provides that CARB and any CARB designee, such as the California Department of Finance, may audit a Spending Account at any time. In the event of an audit, the Spending Account owner must give CARB and any CARB designee access to all documents and information required to conduct an audit upon request. As such, it is necessary to define the person who is required to provide CARB and CARB’s designee access to these records and information in order to clarify the requirements of the Proposed Regulation.

42. “Switch Locomotive” or “Switcher”

Purpose

This provision defines “switch locomotive” or “switcher” as a locomotive that is powered by an engine with a maximum rated power (or a combination of engines having a total rated power) of 2,300 hp or less and that does not meet the definition of industrial or passenger locomotive.

Rationale

This provision is necessary to define the term “switch locomotive” or “switcher,” which is used in the Definitions, Spending Account, In-Use Operational Requirements, and ACP sections. It is important to specifically define the different types of locomotives because the Proposed Regulation has distinct requirements that apply to switchers as opposed to the requirements that apply to freight line haul, industrial, and passenger locomotives. For example, the Spending Account section identifies specific emission factors to apply to switchers if a locomotive operator does not have emission factor information and assigns a specific fuel usage conversion factor to switchers.

U.S. EPA defines two types of locomotives in title 40 C.F.R., part 1033, line haul and switch locomotives. In 40 C.F.R. part 1033, a switch locomotive is defined as “a locomotive that is powered by an engine with a maximum rated power of 2,300 hp or less,” and line haul locomotive is defined as “a locomotive that does not meet the definition of switch locomotive.” 40 C.F.R. part 1033 also notes that line haul locomotive includes both freight and passenger locomotives.

While some locomotives operating at industrial facilities and some passenger locomotives are switch locomotives under the U.S. EPA definition, CARB acknowledges that these two subgroups of switch locomotives operate differently than typical switch locomotives. Additionally, CARB assesses that different ZE technologies may be suitable for switch locomotives, industrial locomotives, and passenger locomotives. By defining switch locomotive to exclude industrial locomotive and passenger locomotive, the Proposed Regulation can set different requirements for these operators. As such, it is necessary to define switch locomotive for the purposes of the Proposed Regulation.

43. “Train”

Purpose

This provision defines “train” as a combination of locomotive(s) pulling freight or passenger railcars, or non-operational locomotives.

Rationale

This provision is necessary to define the term “train,” which is used in the Definitions section. Specifically, “passenger locomotive” is defined as a locomotive designed and constructed for the primary purpose of propelling passenger trains and providing power to the passenger cars of the train. It is necessary to define “train” to provide clarity to the regulated community because “train” is sometimes used to describe anything rail-mounted, which is different than the definition of “train” in the Proposed Regulation. As such, it is necessary to state that for the purposes of this Proposed Regulation, the word “train” has only the specified meaning.

44. “United States Environmental Protection Agency (U.S. EPA) Locomotive Engine Certification Data (U.S. EPA Locomotive ECD)”

Purpose

This provision defines “United States Environmental Protection Agency (U.S. EPA) locomotive engine certification data (U.S. EPA locomotive ECD)” as the duty cycle weighted emission test results after deterioration factor and all other applicable adjustments have been applied, used by the U.S. EPA to certify the locomotive.

Rationale

This provision is necessary to define the term “U.S. EPA locomotive ECD,” which is used in the Spending Account and Registration Requirements sections. The Spending Account section requires locomotive emission factors to be used for calculating the Spending Account deposit amount. The locomotive emission factors are found in the U.S. EPA locomotive ECD.

Therefore, it is necessary to specify and define the source of the emission level data so that the regulated community has clarity as to the inputs into the Spending Account equation.

45. “Verifiable Emission Reductions”

Purpose

This provision defines “verifiable emission reductions” as claims of emission reductions that are accurately, truthfully documented, and transparent such that one is able to objectively review and reproduce such claims.

Rationale

This provision is necessary to define the term “verifiable emission reductions,” which is used in the ACP section. If a locomotive operator elects to use an ACP instead of complying with the Spending Account or the IUOR sections, they must show that the reductions in the ACP they propose would be verifiable in a way that meets CARB standards. Therefore, it is important the regulated community understands the CARB definition of verifiable emission reductions such that there is clarity as to the requirements if they elect to apply for an ACP.

46. “Wayside Power”

Purpose

This provision defines “wayside power” as an electric utility supplied power system designed to provide power from the electric utility to a locomotive, while the locomotive is stationary.

Rationale

This provision is necessary to define the term “wayside power,” which is used in the Spending Account, Idling, and Reporting and Recordkeeping sections. The Spending Account section allows operators to reduce the required Spending Account deposit through credits earned for ZE operation or the use of wayside power. Additionally, the Idling Requirements section provides that locomotives equipped to connect to wayside power must turn off on-board engines and use wayside power if idling for longer than 30 minutes and if wayside power is available. As such, it is necessary to define wayside power so that the regulated community has clarity regarding these sections. This definition of wayside power is consistent with the commonly understood meaning of the term.

47. “Zero Emission (ZE) Capable Locomotive”

Purpose

This provision defines “zero emission (ZE) capable locomotive” as a locomotive that can be switched to a ZE configuration. To qualify as a ZE capable locomotive, the operator shall demonstrate that, when operating in California, the locomotive does not emit any criteria pollutant, toxic pollutant, or GHG from any onboard source of power at any power setting. For purposes of this definition, “onboard source of power” includes any propulsion power that is connected to and moves with the locomotive when it is in motion. To qualify as a ZE capable locomotive, the operator shall accurately track whether and where the locomotive is operating in ZE configuration in California and shall report that tracking data to CARB

annually. A ZE capable locomotive that has been operated outside of ZE configuration within California at any point during a calendar year, shall not qualify as a ZE capable locomotive and shall be treated as an emitting locomotive based on the U.S. EPA Tier of its engine for that calendar year.

“Propulsion power” distinguishes sources of propulsion from other sources of power such as “head end power” (which powers the heating and cooling of a passenger cabin). The inclusion of the phrase “that is connected to and moves with the locomotive while it is in motion” ensures that ZE locomotives that are drawing power from emitting sources such as a generator or another locomotive do not qualify as ZE locomotives if that source is connected to and moves with the ZE locomotive. For example, because multiple locomotives can be used to power a single train, it is possible for a locomotive to draw power from another locomotive. If a ZE locomotive is drawing power from a diesel locomotive that moves with it, it would generate emissions and would not qualify as a ZE locomotive. However, a ZE locomotive could draw power from an overhead catenary line, which does not move with the locomotive, and still be considered a ZE locomotive.

Rationale

This provision is necessary to define the term “ZE capable locomotive,” which is used in the Spending Account, In-Use Operational Requirements, ACP, Idling Requirements, Registration Requirements, and Administrative Payments sections. For example, the Spending Account section allows for the use of Spending Account funds to purchase, lease, or rent ZE capable Locomotives. It is necessary to define this term to provide clarity to the regulated community that ZE capable locomotives may operate with no emissions, but that they also are capable of creating emissions, depending on whether they are switched to ZE configuration.

This definition is necessary to explain that, to qualify as a ZE capable locomotive, the locomotive must not emit any criteria pollutant, toxic pollutant, or greenhouse gas from any onboard source of power at any setting when operating in California. This ensures that the emissions reductions desired by the Proposed Regulation will be achieved. The sentence defining “onboard source of power” is necessary to clarify that the use of that term within this definition means any propulsion power that is connected to and moves with the locomotive when it is in motion. The inclusion of the term “propulsion power” distinguishes sources of propulsion from other sources of power such as “head end power” (which powers the heating and cooling of a passenger cabin). The inclusion of the phrase “that is connected to and moves with the locomotive while it is in motion” ensures that ZE capable locomotives that are drawing power from emitting sources such as a generator or another locomotive do not qualify as ZE capable locomotives if that source is connected to and moves with the ZE capable locomotive. For example, because multiple locomotives can be used to power a single train, it is possible for a locomotive to draw power from another locomotive. If a ZE capable locomotive is drawing power from a diesel locomotive that moves with it during operation in California, it would generate emissions and would not qualify as a ZE capable locomotive. However, a ZE capable locomotive could draw power from an overhead catenary line, which does not move with the locomotive, and still be considered a ZE capable locomotive.

The requirement that the operator accurately track whether and where the locomotive operated in ZE configuration in California and report that data to CARB annually is necessary so CARB can verify if a locomotive qualifies as a ZE capable locomotive based on this

definition. Finally, this definition clarifies that a ZE capable locomotive that is operated outside of ZE configuration in California shall be treated as an emitting locomotive for purposes of the Proposed Regulation. This is necessary because operating a ZE capable locomotive outside of ZE configuration in California defeats the emission reduction purposes of the Proposed Regulation.

48. "Zero Emission (ZE) Configuration"

Purpose

This provision defines "zero emission (ZE) configuration" as a locomotive that operates in a ZE capacity in California, which includes a ZE capable locomotive or a ZE locomotive.

Rationale

This provision is necessary to define the term "ZE configuration," which is used in the IUOR section. This definition is necessary to provide clarity that operating a locomotive in ZE configuration means that the locomotive operates in a ZE capacity while in California. The second part of the sentence is necessary to provide clarity that ZE configuration can include a ZE capable locomotive or a ZE locomotive. It is necessary that the ZE configuration definition include the definition of ZE locomotives, which are always operated in a ZE capacity. Further, it is necessary that the ZE configuration definition include the definition of ZE capable locomotives so that locomotives that are operated only in ZE configuration while in California are included. Note that the requirements for qualification for a ZE capable locomotive are incorporated into this definition such that a locomotive operated outside of a ZE configuration within California at any point during a calendar year does not qualify as being operated in ZE configuration for that calendar year.

49. "Zero Emission (ZE) Infrastructure"

Purpose

This provision defines "zero emission (ZE) infrastructure" as infrastructure that provides the appropriate fuel type or power to support the operation of a ZE locomotive or ZE equipment. ZE infrastructure cannot use a local (on-site or near-site) combustion engine or combustion generator for main power or for backup power.

Rationale

This provision is necessary to define the term "ZE infrastructure," which is used in the Spending Account section. The Proposed Regulation authorizes the use of Spending Account funds to purchase ZE infrastructure intended to support ZE locomotives and to increase the use of other ZE equipment. It is necessary to clarify the meaning of this term so that the regulated community understands what type of infrastructure is permitted to be purchased using Spending Account funds. The second sentence is necessary because it clarifies that ZE infrastructure cannot use a combustion engine or combustion generator for main power or backup power, which would create additional emissions and contravene the purpose of the provision, to reduce emissions.

50. "Zero Emission (ZE) Locomotive"

Purpose

This provision defines "zero emission (ZE) locomotive" as a locomotive that never emits any criteria, toxic, or GHG pollutant from any onboard source of power at any power setting. For purposes of this definition, "onboard source of power" includes any propulsion power that is connected to and moves with the locomotive when it is in motion.

Rationale

This provision is necessary to define the term "ZE locomotive," which is used in the Spending Account, In-Use Operational Requirements, ACP, Idling Requirements, Registration Requirements, Reporting and Recordkeeping, and Administrative Payment sections. It is necessary to clarify the meaning of this term so that the regulated community understands what constitutes a ZE locomotive. For example, some types of locomotives are called ZE locomotives outside of the Proposed Regulation even though they use onboard power systems that use combustion engines. It is possible for some combustion engine technologies to achieve 0.00 g/bhp-hr for NO_x and 0.000 g/bhp-hr for PM after rounding. However, even if the rounded result shows zero, PM and NO_x emission rates may not truly be ZE. It is important to establish that these forms of power are not considered ZE in the Proposed Regulation. The last sentence of this definition is necessary to clarify the meaning of "onboard source of power" for purposes of this definition. The inclusion of the term "propulsion power" distinguishes sources of propulsion from other sources of power such as "head end power" (which powers the heating and cooling of a passenger cabin). The inclusion of the phrase "that is connected to and moves with the locomotive while it is in motion" ensures that ZE locomotives that are drawing power from emitting sources such as a generator or another locomotive do not qualify as ZE locomotives if that source is connected to and moves with the ZE locomotive. For example, because multiple locomotives can be used to power a single train, it is possible for a locomotive to draw power from another locomotive. If a ZE locomotive is drawing power from a diesel locomotive that moves with it, it would generate emissions and would not qualify as a ZE locomotive. However, a ZE locomotive could draw power from an overhead catenary line, which does not move with the locomotive, and still be considered a ZE locomotive.

51. "Zero Emission (ZE) Rail Equipment"

Purpose

This provision defines "zero emission (ZE) rail equipment" as equipment capable of on-track operation whose main function is the same as a freight line haul, switch, industrial, or passenger locomotive, but does not meet the definition of locomotive and that never emits any criteria, toxic pollutant, or GHG from any onboard source of power at any power setting.

Rationale

This provision is necessary to define the term "ZE rail equipment," which is used in the Spending Account, ACP, and Reporting and Recordkeeping sections. The Proposed Regulation authorizes the use of Spending Account funds to purchase ZE rail equipment. It is necessary to clarify the meaning of this term so that the regulated community understands

what type of rail equipment is permitted to be purchased using Spending Account funds. ZE rail equipment is not locomotives, but may be capable of replacing a locomotive depending on the duties required. For example, ZE rail equipment may be below 1,006 hp, or it may have both rubber tires for on-road use and wheels for track-mounted use, or it may be track-mounted with an onboard source of power that also carries passengers, or it may be track-mounted that draws power from an overhead catenary. None of these examples meet the definition of locomotive under the Proposed Regulation. This definition also clarifies the meaning of “onboard source of power” for purposes of the Proposed Regulation. The inclusion of the term “propulsion power” distinguishes sources of propulsion from other sources of power such as “head end power” (which powers the heating and cooling of a passenger cabin). The inclusion of the phrase “that is connected to and moves with the locomotive while it is in motion” ensures that ZE rail equipment that are drawing power from emitting sources such as a generator or a locomotive do not qualify as ZE rail equipment if that source is connected to and moves with the ZE rail equipment. For example, because a locomotive can be used to power a ZE rail equipment, it is possible for ZE rail equipment to draw power from another locomotive. If ZE rail equipment is drawing power from a diesel locomotive that moves with it, it would generate emissions and would not qualify as ZE rail equipment. However, a ZE rail equipment could draw power from an overhead catenary line, which does not move with the ZE rail equipment, and still be considered ZE rail equipment.

E. Section 2478.4. Spending Account.

Purpose

The purpose of the Spending Account section is to require locomotive operators to set aside funds for the uptake of cleaner locomotives, infrastructure, or other freight equipment. The Spending Account section of the Proposed Regulation would require locomotive operators to annually set aside money into a trust fund based on the emissions from their operations in California during the prior year. Operators would calculate the Spending Account funding requirement for each of their locomotives that operated in California annually based on the emissions discharged by the locomotives in the state.

The Spending Account funding requirement is based on the monetized premature deaths caused by their emissions; for more information on this study and on the health effects from exposure to diesel emissions, see Appendix H: Health Analyses. The funds held in the Spending Account could only be used to purchase, lease, or rent Tier 4 or cleaner locomotives (until 2030); or to purchase, lease, or rent ZE locomotives, ZE capable locomotives, or ZE rail equipment; or to fund ZE infrastructure or fund ZE pilot projects or demonstrations.

Rationale

This section is necessary to reduce emissions from locomotives operating within California, which pollute the air and impact the health of California residents. Because the Spending Account funds could only be used for cleaner locomotive technology, this section would improve the air quality of California and the health of its residents by upgrading the locomotive technology used throughout the state and reducing emissions from the use of older, high emission locomotives.

This section is necessary because older, high emission locomotives continue to be pervasively operated throughout the state despite the availability of cleaner technology, resulting in premature mortalities and other health impacts. Uptake of cleaner locomotives is less than one percent per year, and the average locomotive operated in the state has emission technology that is old and less effective than the technologies currently available.¹⁴⁹ Locomotive operators could only use funds set aside in the Spending Account for Tier 4 and cleaner locomotives and infrastructure, which would decrease future emissions by encouraging the transition to cleaner technology.

Staff based the cost of annual locomotive emissions in California on the cost of premature mortalities. Premature mortalities were assigned a monetary cost using federally derived values.¹⁵⁰

The Spending Account is structured to provide flexibility to locomotive operators in complying with the regulation while encouraging a transition to cleaner locomotive operations to protect the health of California residents. Locomotive operators would choose how to use their Spending Account funds by electing to spend the money on any of the permitted investments described in the Proposed Regulation. The timing of spending would not be dictated by CARB, and operators would be free to spend funds when they prefer.

1. Subsection 2478.4(a). Spending Account.

Purpose

Subsection 2478.4(a) sets forth the requirement for non-exempt locomotive operators to establish a Spending Account in the responsible officer's name. This subsection also would require that the Spending Account be set up by July 1, 2024. Additionally, as an alternative to the Spending Account, locomotive operators may elect to use an Alternative Compliance Plan (ACP) following the requirements set forth in the ACP section of the Proposed Regulation.

Rationale

Subsection (a) is necessary to set forth the requirement that locomotive operators establish a Spending Account in the responsible official's name by July 1, 2024. It is necessary to specify that the Spending Account must be set up by July 1, 2024 so it will be established by the first Spending Account deposit date of July 1, 2024. The account would need to be held in the responsible official's name so that CARB or the California Department of Finance could identify the person that would provide access to information in the event of audit or other oversight. Additionally, it is necessary to explain that the locomotive operator can elect to using an ACP as an alternative to compliance with the Spending Account.

¹⁴⁹ CARB Rail Emission Reduction Agreement, Fleet Activity Data for the South Coast Air Basin, accessed July 18, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/rail-emission-reduction-agreements>).

¹⁵⁰ National Center for Environmental Economics et al., Appendix B: Mortality Risk Valuation Estimates, Guidelines for Preparing Economic Analyses (EPA 240-R-10-001), December, 2010. (weblink: <https://www.epa.gov/sites/production/files/2017-09/documents/ee-0568-22.pdf>).

2. Subsection 2478.4(b). Spending Account.

Purpose

Subsection (b) sets forth the annual deposit obligation, which would require locomotive operators that have operated locomotives in California during the previous year to deposit funds into their Spending Account on or before July 1, 2024, and annually every subsequent July 1.

Rationale

Subsection (b) is necessary because it establishes that locomotive operators would need to annually deposit funds in the Spending Account and provides the deadline for locomotive operators to deposit the funds. Staff selected the initial deposit date of July 1, 2024, to provide sufficient time for locomotive operators to review the 2023 data that would be used to determine the amount of funds that must be deposited in their Spending Account. From discussions with stakeholders, and from previous work done on locomotive activity reporting with the 1998 MOU,¹⁵¹ staff determined affected parties would need between four and six months following the calendar year to collect and organize the data, submit the report to CARB, and deposit the funds in their Spending Account. The annual reporting deadline of July 1 was determined to be ample time for locomotive operators to gather information from the prior calendar year, deposit the funds, and submit reports to CARB.

3. Subsection 2478.4(c). Spending Account.

Purpose

Subsection (c) sets forth the calculation that would be used to determine the annual total Spending Account funding requirement. An operator would determine the total annual Spending Account funding requirement by calculating the funding requirement for each locomotive and subtracting any ZE credits. Subsections (1) and (2) then point the reader to the provisions in the Proposed Regulation that define the per locomotive funding requirement and per locomotive ZE credit.

Rationale

Subsection (c) is necessary for the regulated community to determine how to calculate their total annual Spending Account funding requirement. This subsection explains that the total funding requirement is the funding requirement per locomotive minus any ZE credits the locomotive operator elects to use (if there are applicable credits to use). Subsections (1) and (2) are necessary to point to the provisions in the Proposed Regulation that define these terms.

¹⁵¹ Memorandum of Mutual Understanding and Agreements: South Coast Locomotive Fleet Average Emissions Program, July 18, 1998. (weblink: <https://ww2.arb.ca.gov/sites/default/files/2021-02/1998MOU.pdf>).

4. Subsection 2478.4(d). Spending Account.

Purpose

Subsection 2478.4(d) sets forth the permissible uses for Spending Account funds. Subsection (d)(1) provides that, until January 1, 2030, Spending Account funds would be allowed to be used for the purchase, lease, or rental of Tier 4 or cleaner locomotives or for the remanufacture or repower to Tier 4 or cleaner locomotives. Subsection (d)(2) provides that, at any time, Spending Account funds may be used for the purchase, lease, or rental of ZE locomotives, ZE capable locomotives, or ZE rail equipment, or to repower to ZE locomotives or ZE capable locomotives. Subsection (3) provides that, at any time, Spending Account funds may be used to purchase ZE infrastructure to support ZE locomotives, ZE capable locomotives, and ZE rail equipment. Subsection (4) provides that Spending Account funds may be used to pilot or demonstrate ZE locomotives or ZE rail equipment.

Rationale

Subsection (d) is necessary because it specifies what expenditures would be allowed when using the Spending Account funds. Subsection (d)(1) is necessary to specify that Spending Account funds may be used toward purchase, lease, rental, remanufacture, or repower to Tier 4 or cleaner locomotives until 2030. Tier 4 is currently the lowest emitting certified U.S. EPA Tier for locomotives. They are commercially available in large numbers and are able to replace older locomotives currently in use. Tier 4 locomotives are over 75 percent cleaner than Tier 2 locomotives¹⁵² (the average Tier of locomotives used by Class I railroads in California). Although Tier 4 locomotives have been commercially available since 2015, locomotive operators have been slow upgrading their older locomotives. There are very few Tier 4 locomotives currently being operated in California. Allowing the purchase of Tier 4 locomotives using Spending Account funds from 2024 to 2030 would bring critical near-term reductions of diesel emissions in California.

Although they are significantly cleaner than older technology, Tier 4 locomotives are powered by diesel fuel and generate harmful pollution. Therefore, it is important that operators continue progress toward using technologies that are cleaner than Tier 4. Beginning in 2030, Tier 4 locomotives would no longer be permitted to be purchased with Spending Account funds. Through staff research on the progress of ZE locomotive technology, CARB determined 2030 to be a feasible date for incorporation of ZE locomotive technologies into fleets operating in California.¹⁵³ ZE switch and passenger locomotive technologies are being tested, are already in limited operation, or are at the prototype stage. More details on the technical feasibility of ZE locomotives can be found in Appendix F: Locomotive Technology Feasibility Assessment.

Since the permissible purchases under subsection (1) expire on January 1, 2030, subsections (d)(2)–(4) are necessary to set forth what the funds could be used for at any time (including after January 1, 2030). Specifically, at any time, Spending Account funds could be used for the purchase, lease, or rental of ZE locomotives, ZE rail equipment, and infrastructure, to repower locomotives to ZE locomotives, or to pilot or demonstrate ZE locomotive and rail

¹⁵² U.S. EPA, Technical Highlights, Emission Factors for Locomotives, 2009. (weblink: <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100500B.PDF?Dockey=P100500B.PDF>).

¹⁵³ Appendix F: Locomotive Technology Feasibility Assessment.

equipment technologies. Subsection (2) is necessary to allow spending on ZE locomotives, ZE capable locomotives, and ZE rail equipment. Subsection (3) is necessary to allow spending on the infrastructure needed to support ZE locomotives, ZE capable locomotives, and ZE rail equipment. Infrastructure would include items such as charging stations, hydrogen fueling stations, etcetera. Subsection (4) is necessary to allow spending to pilot or demonstrate ZE locomotives and ZE rail equipment technologies, which would foster new and emerging technologies.

The interim incorporation of Tier 4 locomotives and the deployment of ZE locomotives are both essential for California to meet its SIP goals,¹⁵⁴ and to meet the goals of EO N-79-20,¹⁵⁵ which directs California to achieve 100 percent ZE from off-road vehicles and equipment in the state by 2035 where feasible. To further the progress toward these goals while allowing flexibility in the use of new technologies, Spending Account funds could be used to purchase, lease, rent, or repower ZE locomotives, ZE capable locomotives, or ZE rail equipment, fund the infrastructure needed to support ZE equipment, or to fund ZE pilots and demonstrations.

5. Subsection 2478.4(e). Spending Account.

Purpose

The purpose of subsection 2478.4(e) is to set forth the annual funding requirement, which is one of the two terms used to calculate the annual Spending Account deposits. Subsection (1) specifies the timeframe for the measurement of the funding requirement in 2023, which would be calculated from the effective date of the Proposed Regulation through to the end of 2023. For all subsequent years, the funding requirement would be calculated starting on January 1 and run through December 31 of that year.

Subsection (2) sets forth the equation used to calculate the Spending Account “funding requirement” term. Subsections (2)(A)–(F) define the values used to calculate the funding requirement, including tables where these values are provided. The funding requirement is calculated based on the weighted factor, the PM emissions factor (EF), the NOx EF, the annual factor, and the usage of the locomotive, as seen in Figure 16.

Figure 16: Spending Account Calculation

$$\text{Funding Requirement } [\$] = \{(\text{Weighted Factor}) \times (\text{PM EF [g/bhp-hr]}) + (\text{NOx EF [g/bhp-hr]})\} \times (\text{Annual Factor}) \times (\text{Usage [MWhs]})$$

Rationale

Section 2478.4(e) is necessary to provide clarity as to the funding requirement term, which is the first of the two values used to calculate the annual Spending Account deposit obligation.

¹⁵⁴ CARB, Draft 2022 State Strategy for the State Implementation Plan, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

¹⁵⁵ Executive Department State of California, Executive Order N-79-20 - State of California Executive Order signed by Governor Gavin Newsom, September 23, 2020. (weblink: <https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf>).

Subsection(e)(1) is necessary to clarify the timeframe for the measurement of the annual deposit obligation in 2023. Subsection (1) provides that, for 2023, the annual deposit obligation would be measured from the effective date of the Proposed Regulation through December 31, 2023. This timeframe clarifies the dates that the annual deposit obligation calculation would cover for the first year it is effective. The second sentence is necessary to clarify that the funding requirement would be calculated starting on January 1st of all subsequent years and would run through December 31 of that year. The amount of funds calculated would then need to be deposited on July 1 of the following year pursuant to section 2478.4(b).

Subsection (2) is necessary to set forth the calculation used to determine the funding requirement. The Spending Account calculation ties emissions from locomotives with the amount of cardiopulmonary mortality incidents those emissions would result in. The variables used in this formula, which are listed in subsections (2)(A)–(F), reflect the effect of the PM and NOx emissions from diesel-powered locomotives on the health of California residents. To estimate the health outcomes from PM2.5 emitted directly from locomotives and from PM2.5 formed from precursor NOx by chemical processes in the atmosphere, CARB uses the Incident Per Ton (IPT) methodology. CARB’s IPT methodology¹⁵⁶ is based on the methodology developed by U.S. EPA. The basis of the IPT methodology is that changes in emissions are approximately proportional to changes in health outcomes. The Spending Account formula calculates a locomotive’s emissions and the associated health costs to society using emission factors (EF) and the MWhs of usage of the locomotive. Exposure to PM and NOx emissions are known to cause death from heart and/or lung illness, also known as cardiopulmonary mortality incidents. Preventing each cardiopulmonary mortality incident by way of reducing emissions can be monetized. In accordance with U.S. EPA practice, staff monetized health outcomes by multiplying incidence by a standard value derived from economic studies.¹⁵⁷ For example, each cardiopulmonary mortality incident reduced is valued to have approximately \$9.9 million dollars in cost savings. For more information on health valuations see Appendix H: Health Analyses.

Subsection (A) is necessary to establish the use of the “weighted factor” in the Spending Account calculation and to point to the Table where the applicable values can be found. The weighted factor is required for the Spending Account calculation because PM and NOx have different health outcomes per ton of emissions. The weighted factor is the relative health outcome of PM compared to NOx. The weighted factor is applied only to the PM emission factor (EF), because the Spending Account equation is set up such that the “annual factor” includes any factors that need to be multiplied to the NOx EF. The methodology is designed so that there is no explicit multiplier to the NOx EF. Only the PM EF is multiplied by the weighted factor, which adjusts the relative effect of PM in comparison to NOx.

It is necessary to provide the weighted factor for different years because, under the Proposed Regulation, the population distribution in each air basin is projected to change

¹⁵⁶ CARB, Estimating the Health Benefits of Reductions in Emissions of PM2.5 or its Precursors: Short Description, accessed July 18, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/estimating-health-benefits-reductions-emissions-pm25-or-its-precursors-short>).

¹⁵⁷ National Center for Environmental Economics et al., Appendix B: Mortality Risk Valuation Estimates, Guidelines for Preparing Economic Analyses (EPA 240-R-10-001), December, 2010. (weblink: <https://www.epa.gov/sites/production/files/2017-09/documents/ee-0568-22.pdf>).

annually. PM and NO_x have different health effects depending on the population distribution of a region and on the region's topography. Different air basins have different population density, and NO_x and PM affect them differently. A change in population distribution would result in a difference in the relative health effects of PM and NO_x, and therefore, the weighted factor changes based on the year. For more information on how the weighted factor was developed see Appendix E: Development Process for the Spending Account Equation and Inputs.

Subsections (B) and (C) are necessary to specify the value that would be used for the PM and NO_x emissions factors. PM and NO_x emission factors are necessary because the Spending Account funding requirement is based on the total PM and NO_x emissions from all locomotives, and emission factors and usage are necessary to calculate the total emissions from locomotives. The PM and NO_x emission factors that would be required for the Spending Account calculation are provided in the U.S. EPA Locomotive Engine Certification Data (ECD) for NO_x and PM. The U.S. EPA Locomotive Engine Certification Data lists emission levels of locomotives of each engine family. Engine family is a group of locomotives that are expected to have similar emission characteristics throughout the useful life. Original equipment manufacturers (OEM) submit testing data for each locomotive engine family to U.S. EPA. The test results are collected in a nationwide database and posted online. The database includes the emission certification levels for each locomotive. Staff chose to base the PM and NO_x EFs on the U.S. EPA Locomotive Certification Database because it is the most comprehensive locomotive emissions database available.

Subsection (D) is necessary to provide default values for the PM and NO_x emission factors in cases where the U.S. EPA Locomotive ECD does not provide the PM or NO_x emission factor for a locomotive and the emission factors are not otherwise known to the operator. The emission factors are typically found in the U.S. EPA Locomotive Engine Certification database and are typically listed on the engine label. Occasionally, a locomotive does not have emission factors listed in the U.S. EPA Locomotive Engine Certification database or on the engine label. This may happen when a locomotive is old, for example, with pre-Tier 0 locomotives. Engine emission data may also be excluded from the U.S. EPA Locomotive Engine Certification database when emission data from a previous model was used for the certification, known as "carryover emission data." In cases where carryover emission data was used for certification, the locomotive operator can use the certification levels from the model referenced in the certification. When the PM and NO_x emission factors are not listed in the U.S. EPA Locomotive Engine Certification database, and the locomotive operator does not wish to research the emission data or no emission data is available due to the locomotive being pre-Tier 0, locomotive operators must use emission factors based on the emission factors listed in subsection (e)(2)(D)(1) or (2), as applicable. The values listed in subsection (e)(2)(D)(1) and (2) reflect the PM and NO_x emissions factors of pre-Tier 0 locomotives. Using pre-Tier 0 emission factors as a default ensures locomotive operators are accounting for all emissions released from their locomotive activity in California.

Subsection (E) is necessary for the regulated community to determine the "annual factor" needed for the funding requirement calculation. To calculate the Spending Account funding requirement, the weighted factor is multiplied by the PM EF, and the resulting value is added to the NO_x EF. Then, that value is multiplied by the annual factor and the usage. The annual factors applicable to each year are listed in Table 1.

The annual factor incorporates two components: the number of mortality incidents in California per ton of NO_x, and the cost per mortality incident in the specific year of the emissions, accounting for inflation. The methodology multiplies the annual factor (the estimated number of mortality incidents in California per g/bhp-hr of NO_x) by the usage, and multiplies this by the sum of the NO_x EF and the PM EF multiplied by the weighted factor. From this, the total number of mortality incidents from NO_x and PM emissions created by diesel-powered locomotives in California is calculated. Multiplying the cost per mortality incident to the number of mortality incidents results in the health cost of that specific locomotive's operation in a given year. Similar to the weighted factor, the value of the annual factor changes depending on the year. Since the number of mortality incidents per ton of NO_x changes with population growth, and the cost per mortality incident increases with inflation, the annual factor increases over time. As a result, the funding required per MWh increases year over year. For more information on how the annual factor was developed see Appendix E: Development Process for the Spending Account Equation and Inputs.

Subsection (F) is necessary to define the term "usage," which is used in the last part of the funding requirement equation. The usage is the total MWh each locomotive was operated in California during the year. Locomotive operators are required to track California locomotive usage by MWh. Although rare, some locomotives may not have a MWh meter to monitor activity. In those cases, locomotive operators must install a MWh meter, or if the locomotive operates 100 percent within the state, their usage may be calculated using the formula set forth in subsection (F). This formula multiplies the annual fuel usage in gallons by a conversion factor in MWh per gallon. The applicable factors for converting fuel use to the MWh equivalent are listed in Table 2. To facilitate more accurate calculations for varying locomotive sizes, staff differentiated large and small line haul locomotives, using a rated horsepower of 4,000 horsepower (hp) as a boundary between large and small line haul locomotives. Because industrial locomotives are generally operated as switchers, staff assumed all industrial locomotives have the same conversion factor as switchers for purposes of the conversion factor.

6. Subsection 2478.4(f). Spending Account.

Purpose

The purpose of subsection 2478.4(f) is to inform locomotive operators how to calculate the ZE credit, which is the second of the two terms used to calculate the annual Spending Account funding requirement. It specifies that, from the effective date of the regulation to January 1, 2030, operation of ZE locomotives, ZE rail equipment, or wayside power in California could result in credits that reduce that locomotive operator's annual Spending Account total funding requirement.

Subsection (1) clarifies that ZE locomotives, ZE rail equipment, or wayside power would only result in ZE credits if the usage is either prior to January 1, 2030, or in excess of any legal mandate requiring its use. The following sentence then clarifies that a legal mandate may include any federal, state, or local rule or regulation, settlement agreement, or mitigation requirement.

Subsection (2) provides that ZE credits would be reported to CARB starting in July 1, 2024, and refers to section 2478.10(d)(6), which identifies the specific information that would need to be reported and includes the due date for the annual report.

Subsection (3) sets forth the equation used to calculate the “ZE Credit” as shown in Figure 17. Subsection (3)(A) and (B) define the values used to calculate the ZE credit.

Figure 17: ZE Credit Calculation

$$\text{ZE Credit } [\$] = \{0.16 \times (\text{Weighted Factor}) + 6.5\} \\ \times (\text{Annual Factor}) \times (\text{Usage [MWhs]})$$

Subsection (4) provides that non-ZE locomotives connected to wayside power could claim ZE credit by reporting the MWhs provided to the locomotive through the connection.

Subsection (5) provides that the ZE credit could be multiplied by two for the usage of a ZE locomotive or ZE rail equipment in a DAC or for wayside power connections made in a DAC.

Subsection (6) explains that, if a locomotive operator has a negative funding requirement due to the ZE credits, the negative balance may be banked and applied to any subsequent calendar year prior to the expiration of the ZE credit.

Subsection (7) provides that all ZE credits expire on January 1, 2030, if not used by that date.

Subsection (8) clarifies that ZE credits do not constitute property or a property right, have no monetary value, and are not tradeable.

Rationale

Subsection (f) is necessary to provide an incentive for the early adoption of ZE locomotives, ZE rail equipment, and the use of wayside power in California, which would reduce emissions. The Spending Account funding requirement could be reduced by using a ZE credit. Locomotive operators can earn ZE credits by using ZE locomotives, ZE rail equipment, or connecting to and using wayside power prior to 2030. The ZE credit is calculated using usage in MWhs.

Subsection (f)(1) is necessary to ensure that locomotive operators do not earn ZE credits by using ZE locomotives, ZE rail equipment, or wayside power that they are legally mandated to use. If any federal, state, or local rule or regulation or a settlement agreement or mitigation requirement mandates the use of ZE locomotives, ZE rail equipment, or wayside power in California, the locomotive operator cannot count these uses towards their ZE credit.

Subsection (f)(2) is necessary to provide clarity to the regulated community regarding the reporting requirements by explaining that ZE credits must be reported to CARB as set forth in subsection 2478.10(d)(6) starting July 1, 2024.

Subsection (f)(3) is necessary because it sets forth the formula to be used in calculating the ZE credit. This calculation is based on the weighted factor, the annual factor, and the usage. Staff set the ZE credit such that the per MWh credit could offset half of the funding required if an operator used the same MWh with a pre-Tier 0 locomotive. Values 0.16 and 6.5 are half of NOx and PM emission factors of pre-Tier 0 locomotives¹⁵², and calculating the ZE credit with these values would result in ZE credit equal to half of the funding required if an operator used the same MWh with a pre-Tier 0 locomotive. Subsections (f)(3)(A) and (B) are necessary to define the variables used to calculate the ZE credit.

Subsection (f)(4) is necessary to clarify to the regulated community how they can claim ZE credits by connecting a non-ZE locomotive to wayside power, which requires that they report the MWhs provided to the locomotive through the connection.

Subsection (f)(5) is necessary to provide an additional incentive for the operation of ZE locomotives and ZE rail equipment and the use of wayside power in DACs¹⁵⁸. This subsection doubles the ZE credit that can be earned by such uses in order to accelerate the earliest possible use of ZE technology in the most heavily burdened communities. The per MWh ZE credit increases year over year to incorporate inflation, the increased number of avoided exposures due to population growth, and the expansion of freight transport by rail. Since all ZE credits expire on January 1, 2030, pursuant to subsection (f)(7), the doubling of ZE credits due to operation of ZEs or use of wayside power in a DAC is only permitted prior to December 31, 2029.

Subsection (f)(6) is necessary to provide clarity to the regulated community for cases where the annual calculation produces a negative funding requirement due to ZE credits. It allows for the negative balance due to the ZE credit to be banked and applied to any subsequent calendar year until the expiration of the ZE credit.

Subsection (f)(7) is necessary to set forth the expiration of all ZE credits on January 1, 2030, if they are not used by that date. ZE credits are set to expire in 2030 because they represent an additional incentive to locomotive operators to make early investments in ZE technology. Staff estimates that by 2030, ZE technology will be commercially available and the ZE credit would no longer be necessary to encourage these early investments.

Subsection (f)(8) is necessary to clarify that ZE credits do not constitute property or a property right and have no monetary value, and they are not tradeable. This is necessary because ZE credits are earned by a specific locomotive operator and can only be used to reduce the funds that operator is required to deposit in its Spending Account.

7. Subsection 2478.4(g). Spending Account.

Purpose

The purpose of subsection 2478.4(g) is to specify that the Spending Account may be audited by CARB, the Department of Finance, or any other CARB designee at any time. Subsection (g) also provides that the Spending Account owner must give CARB and any CARB designee access to documents and information required to conduct an audit of the Spending Account upon CARB request.

Rationale

Subsection (g) is necessary to clarify to the regulated community that CARB, the Department of Finance, and any CARB designee may audit a Spending Account at any time. The Spending Account funds are intended to mitigate emissions created from the use of diesel-powered locomotives in California. The Spending Account funds are in the control of the Spending Account owner, and CARB must be permitted access to documents and

¹⁵⁸ OEHHA, California Disadvantaged Communities identified by CalEnviroScreen, accessed on July 18, 2022. (weblink: <https://oehha.ca.gov/calenviroscreen/sb535>).

information required to conduct an audit to ensure that locomotive operators remain in compliance with the Spending Account requirements. CARB must be able to audit the Spending Account to ensure that the required funds are being deposited and that the funds are only spent on permitted purposes.

F. Section 2478.5. In-Use Operational Requirements.

Purpose

The IUOR section is necessary to reduce harmful emissions in California caused by older, heavily polluting locomotives. The In-Use Operational Requirements would prevent older, dirtier locomotives from continuing to operate indefinitely in California despite the availability of alternative, cleaner technologies. Starting January 1, 2030, only locomotives with original engine build dates less than 23 years old would be permitted to operate in California.

Additionally, this section provides that, beginning January 1, 2030, switch, industrial, and passenger locomotives with original engine build dates of 2030 or newer would need to always operate in a ZE configuration—in California. Further, this section provides that, beginning January 1, 2035, any freight line haul locomotives operating in California with original engine build dates of 2035 or newer would need to operate in a ZE configuration. This section also provides for two technology assessments to be published in 2027 and 2035 analyzing the progress in ZE locomotive technology and supporting infrastructure. These reports would include recommendations to initiate staff's development of potential formal regulatory amendments in the event that the assessment determines such amendments would be needed to adjust compliance deadlines.

Rationale

Section 2478.5 is necessary to reduce harmful emissions from older, heavily polluting locomotives continuing to operate in California despite the availability of cleaner technology. CARB data shows that locomotive operators have relied on older, higher polluting locomotives to conduct the bulk of their operations in California and have been slow in transitioning to locomotives with lower emissions. The emissions from older, higher-polluting locomotives are of particular concern in and around railyards and freight facilities because these areas are disproportionately impacted by diesel emissions. The Health Risk Characterization and Mortality & Illness studies in Appendix H describe the elevated health risk experienced by residents who are exposed to the emissions from diesel-powered locomotives.¹⁴⁷ Because of the health and environmental impacts of diesel emissions, it is the intent of this section to address the unnecessarily high emissions created by operators that continue to use older, higher-emitting diesel-powered locomotives in California.

To verify that ZE locomotive technology has advanced enough to support the operation of ZE switch, industrial, and passenger locomotives in 2030 and the operation of ZE line haul locomotives in 2035, staff would publish technology assessments in 2027 and 2032. The assessments would include an analysis of the progress made in ZE locomotive technologies. If staff were to determine compliance dates need to be adjusted, staff would initiate formal amendments accordingly.

1. Subsection 2478.5(a). In-Use Operational Requirements.

Purpose

The purpose of subsection 2478.5(a) is to establish that, beginning January 1, 2030, only locomotives with original engine build dates less than 23 years old could continue to operate in California. This subsection also clarifies that the age of the engine would be based on the primary engine's original engine build date.

Subsection (a)(1) provides that a locomotive that was remanufactured or repowered to a Tier 4 or cleaner locomotive prior to 2030 would have an original engine build date that is based on the first year that the primary engine was so remanufactured or repowered.

Subsection (a)(2) sets forth the qualifications a locomotive must meet to continue to operate in California with an original engine build date older than 23 years. Specifically, a locomotive may continue to operate in California beyond the age specified in subsection (a) if either (A) the locomotive has not reached the federal useful life in terms of MWh, meaning that the locomotive's primary engine MWh has not exceeded a total of (rated hp) x 20.25 MWh of operation since its original engine build date or (B) the locomotive is always operated in a ZE configuration while in California.

Rationale

Subsection (a) is necessary to prevent older, higher-polluting locomotives from continuing to operate in California despite the availability of cleaner locomotive emission technologies. The 23-year limit on operation in the state is intended to allow a minimum of two "useful life" time periods for a locomotive. A useful life is the period during which the locomotive engine is designed to properly function in terms of reliability and fuel consumption, without being remanufactured. It is also the period during which a locomotive is required to comply with all applicable emission standards. U.S. EPA defines minimum useful life as MWhs equal to the product of the rated horsepower multiplied by 7.50; the minimum useful life in terms of years is approximately 10 years. Most locomotives are certified to 10 years or (rated hp) x (7.5) MWhs of useful life. Of 1,686 locomotive engine families listed in the U.S. EPA Locomotive Engine Certification Data (for model years 2007 to present), only one engine family is certified for longer than a 10-year useful life. The total of 23 years represents two useful lives in terms of MWhs or years plus an additional 35 percent, added by staff to allow flexibility for circumstances such as shortages in parts, maintenance downtime, and delays associated with delivery of replacement locomotives. Allowing 23 years of operation before any In-Use Operational Requirements apply would ensure that operators can continue to operate most locomotives in California for a timespan equivalent to two useful lives.

Subsection (a)(1) is necessary to clarify that the original engine build date for locomotives that are remanufactured or repowered to Tier 4 or cleaner prior to 2030 would be based on the first year that the primary engine was remanufactured or repowered to a Tier 4 or cleaner locomotive. Upon remanufacture to Tier 4 or cleaner locomotive, the age of the locomotive would be based on the date that the locomotive was remanufactured to Tier 4 or cleaner and not the original engine build date. Remanufacturing a locomotive to Tier 4 or cleaner may not change a locomotive's original engine manufacture date, but the emission reductions would be equivalent to that of a new Tier 4 or cleaner locomotive. This would give operators an option to remanufacture Tier 3 and dirtier locomotives to Tier 4 or cleaner, which may be a more cost-effective pathway for some operators to transition fleets to cleaner locomotives.

Subsection (a)(2) is necessary to provide circumstances when a locomotive may continue to operate in California beyond the age specified in subsection (a). Subsection (a)(2)(A) allows a locomotive operator to operate the locomotive in California even if it has exceeded the 23 years of age, provided it has not exceeded a total of (rated hp) x (20.25). Subsection (A) is necessary to ensure operators may use locomotives for approximately two useful lives as defined by U.S. EPA.

Subsection (a)(2)(B) is necessary to allow for the continued operation of locomotives that are always operated in a ZE configuration while in California despite the age of those locomotives. This means that operators can continue to operate in California regardless of subsection (a) if they are either ZE locomotives or ZE capable locomotives that are only operated in California in a ZE configuration. This is necessary because ZE locomotives and ZE capable locomotives operating in ZE configuration would not emit any criteria pollutant, toxic pollutant, or GHG from any onboard source of power. As such, their adoption and use is encouraged by the Proposed Regulation regardless of the age of these locomotives.

2. Subsection 2478.5(b)–(c). In-Use Operational Requirements.

Purpose

The purpose of subsection (b) is to set forth the requirement that, beginning in 2030, all switch, industrial, and passenger locomotives operating in California with an original engine build date of 2030 or newer would be required to operate in a ZE configuration—i.e., qualify as either a ZE locomotive or ZE capable locomotive. Subsection (b)(1) provides that, by December 1, 2027, staff would publish an assessment of the progress made in ZE technologies for use with freight line haul, switch, industrial, and passenger locomotives, as well as the status of infrastructure improvements that may be needed to support ZE locomotives. If staff finds that the assessment demonstrates the need for adjustments to the compliance deadlines, the reports would include recommendations for staff to initiate potential formal regulatory amendments.

The purpose of subsection (c) is to set forth the requirement that, beginning in 2035, all freight line haul locomotives with an original engine build date of 2035 or newer would be required to operate in a ZE configuration when in California. Subsection (c)(1) provides that, by December 1, 2032, staff would conduct and publish an assessment of the progress made in ZE technologies for use with freight line haul, switch, industrial, and passenger locomotives, as well as the status of infrastructure improvements that may be needed to support ZE locomotives. If the assessment demonstrates the need for adjustments to the compliance deadlines, the reports would include recommendations for staff to initiate potential formal regulatory amendments.

Rationale

Subsections (b) and (c) are necessary because, without specific ZE targets, California communities will continue to be exposed to harmful PM and NO_x emissions from locomotive operations. Currently, there is no endpoint for the dangerous and deadly emissions that come from diesel-powered locomotives, and Californians will continue to be affected. For more information on the emissions from locomotives and the reductions in the Proposed Regulation, see Section V.

In addition, drastic reductions of emissions from the entire California freight industry, such as reductions from transitioning trucks to ZE and from requiring in-use locomotives to be ZE, are necessary for California to achieve attainment with the NAAQS by the required deadlines. The SIP demonstrates how California will attain the NAAQS by specified dates. The Draft 2022 State Strategy for the SIP (2022 State SIP Strategy) includes the critical emission reductions that would be achieved by the Proposed Regulation.¹⁵⁹ Although the SIP measures other than the Proposed Regulation will bring substantial reductions in emissions, the reductions will not be enough for California to meet its State 2022 SIP Strategy¹⁶⁰ goals, nor will they reduce the health effects caused from diesel emissions created by locomotives. The Proposed Regulation is needed to reduce emissions from locomotives operating within California, which will help the state meet the Clean Air Act requirements for attaining the NAAQS by the required deadlines, and to reduce community exposure, particularly in Disadvantaged Communities, which already suffer disproportionality from exposure to toxic diesel emissions.

In September 2020, Governor Newsom issued EO N-79-20, which directed CARB, in coordination with other state agencies, U.S. EPA, and local air districts, to transition to 100 percent ZE from off-road vehicles and equipment in the state where feasible by 2035. The Proposed Regulation supports the directive of the EO by requiring locomotive operators to operate some categories of locomotives in CA in a ZE configuration beginning in 2030.

Setting the in-use ZE operational requirement of 2030 for switch, industrial, and passenger locomotives, and 2035 for freight line haul locomotives, sets clear policy goals and would allow time for the development and buildout of ZE infrastructure. Based on the current demonstration projects and development timelines of previous technologies, staff estimated that ZE switch, industrial, and passenger locomotives will be commercially available by 2030, and ZE freight line haul locomotives will be commercially available by 2035. Staff has described the technical feasibility of ZE locomotives in Appendix F: Locomotive Technology Feasibility Assessment.

Subsections (b)(1) and (c)(1) are necessary to set forth the requirement that CARB publish two technical assessments by December 1, 2027 and December 1, 2032 evaluating the progress made in ZE technologies and infrastructure. This would ensure that the compliance deadlines are in line with the availability of technology and supporting infrastructure. If staff were to determine that the compliance deadlines need to be adjusted based on the information in the technological assessment, the report(s) would include recommendations to initiate staff's development of formal regulatory amendments. These dates were selected because they are each approximately three years prior to the first year that subsections (b) and (c) would apply, which provides sufficient time for CARB to amend the Proposed Regulation if the assessment demonstrates a need for an amendment.

¹⁵⁹ CARB, Draft 2022 State Strategy for the State Implementation Plan, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

¹⁶⁰ CARB, Draft 2022 State Strategy for the State Implementation Plan, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

G. Section 2478.6. Temporary Locomotive Operating Waiver.

Purpose

The purpose of the Temporary Locomotive Operating Waiver section is to provide an avenue for locomotive operators to submit a request to CARB to temporarily operate a locomotive in California after the locomotive is prohibited from operating in California pursuant to section 2478.5. This section establishes the qualifications and submittal guidelines for the Temporary Locomotive Operating Waiver.

Rationale

After a locomotive is prohibited from use in California due to the In-Use Operating Requirements, it may become necessary to operate the locomotive in California temporarily, to remove it from California or to perform maintenance. If CARB approves a Temporary Locomotive Operating Waiver request, the locomotive may temporarily operate in California.

1. Subsection 2478.6(a). Temporary Locomotive Operating Waiver.

Purpose

The purpose of subsection 2478.6(a) is to provide a pathway for locomotive operators to temporarily operate locomotives in California after such operation would otherwise be prohibited pursuant to section 2478.5. Specifically, it provides that a locomotive operator may submit a request to the Executive Officer at least seven business days prior to the planned operation of the locomotive in California. The Executive Officer must grant the request if it satisfies the requirements set forth in subsections (1)–(4). Subsections (1) and (2) require that the request contain all of the information set forth in subsection (c) and be submitted as required in the Submittals to CARB section. Subsection (3) provides that the request demonstrates to the satisfaction of the Executive Officer that the period of operation specified in the request is no longer than necessary to perform the specified task. Subsection (4) provides that the request demonstrates to the satisfaction of the Executive Officer that the purpose of the temporary operation is to either remove a locomotive from California or for maintenance.

Rationale

Subsection (a) is necessary to provide an avenue for locomotive operators to operate their locomotive in California after such operation would otherwise be prohibited by section 2478.5 in certain limited circumstances. A locomotive operator would apply for the Temporary Locomotive Operating Waiver at least seven business days prior to the planned operation of the locomotive in California. Staff selected this timeframe because seven business days will allow staff the necessary time to review requests and for the Executive Officer to issue the approval.

Subsection (a)(1) and (2) are necessary because the Executive Officer would not need to approve a request that does not contain all of the required information or is not submitted as required in the Submittals to CARB section.

Subsection (a)(3) is necessary because the period of temporary operation requested in the waiver should be no longer than necessary to perform the specified task. For example, a

waiver that would be granted for longer than necessary may allow time for the locomotive to operate in service, while the intent of the waiver is to allow only the time necessary to fulfill the approved task.

Subsection (a)(4) is necessary to set forth the permissible purposes of the temporary operation, which is either (A) to remove a locomotive from California or (B) for maintenance. Subsection (A) is necessary to provide an avenue for the temporary operation of the locomotive in California for the purpose of moving a locomotive from California to another state or country. Subsection (B) is necessary to provide an avenue for the temporary operation of the locomotive in California for the purpose of maintenance. For example, relocation to a maintenance facility may allow an operator to upgrade the locomotive to an emission level that would be permitted to operate in the state.

2. Subsection 2478.6(b). Temporary Locomotive Operating Waiver.

Purpose

The purpose of subsection 2478.6(b) is to provide an avenue for locomotive operators to request to operate a locomotive after such operation would otherwise be prohibited by section 2478.5, if the operator would not meet the requirements of section 2478.5 due to emergency events beyond the reasonable control of an operator, including fires, floods, earthquakes, embargoes, epidemics, quarantines, war, acts of terrorism, riots, strikes, or lockouts. These requests for temporary operation must be made prior to or during operation. The Executive Officer may approve the request if it satisfies the requirements set forth in subsections (1)–(3). Subsections (1) and (2) require that the request contain all of the information set forth in subsection (c) and be submitted as required in the Submittals to CARB section. Subsection (3) provides that the request demonstrates to the satisfaction of the Executive Officer that temporary operation of the locomotive is necessary during that period.

Rationale

Subsection 2478.6(b) is necessary to allow for temporary operation of locomotives that otherwise would be prohibited from operation in California in circumstances where such operation would be necessary due to events that are beyond the control of an operator (fire, floods, earthquakes, etc.). Emergency events are abrupt, and rapid response is often required. Therefore, staff would allow locomotive operators to submit a request for temporary operation due to such events prior to or during the locomotive's temporary operation. This would provide flexibility to locomotive operators faced with emergency circumstances, since the nature of these events and the necessary response are often unpredictable.

The Executive Officer may approve a properly submitted, complete request if it demonstrated to the Executive Officer's satisfaction that the temporary operation of the locomotive was necessary during that period. This discretion would be necessary to prevent locomotive operators from taking advantage of the waiver process by seeking waivers in circumstances that were not emergencies beyond their reasonable control. The Executive Officer would need discretion regarding whether the locomotive operator's explanation of why temporary operation was necessary during that period constituted a satisfactory demonstration of need.

3. Subsection 2478.6(c). Temporary Locomotive Operating Waiver.

Purpose

The purpose of subsection 2478.6(c) is to set forth the information that would be required in the request for a Temporary Locomotive Operating Waiver. Operators would be required to submit the locomotive operator/company name, the locomotive ID number, the reason for the Temporary Locomotive Operating Waiver, the specified period of operation, an explanation of why temporary operation of the locomotive is necessary during that period, the location(s) of operation, an attestation that the information provided is true, accurate and complete, and an attestation that the Locomotive Operator shall resume meeting the requirements specified in the IUOR section immediately following the temporary period of operation.

Rationale

Subsection 2478.6(c) is necessary to provide clarity to the regulated community regarding the information that would be required in a request for a Temporary Locomotive Operating Waiver. This information would be required for staff to understand the details and scope of the request as well as the reasoning behind it. Further, locomotive operators would be required to submit a signed attestation stating that all the information provided was true, accurate, and complete and an attestation that they would resume meeting the requirements of the IUOR section immediately following the requested temporary period of operation. This would be necessary to ensure that locomotive operators have submitted true, accurate, and complete information and that they resume compliance with the IUOR section of the Proposed Regulation once the temporary operation conducted pursuant to an approved request was complete.

4. Subsection 2478.6(d) and (e). Temporary Locomotive Operating Waiver.

Purpose

The purpose of subsection 2478.6(d) is to require that, within 3 calendar days of the date when a request that does not include all the information required in subsection (c) is submitted, the Executive Officer must issue a notice of deficiency that identifies the missing information.

The purpose of subsection 2478.6(e) is to require that, within 3 calendar days of the date when a complete request is submitted as required by the Submittals to CARB section, the Executive Officer would issue an approval or disapproval of the request.

Rationale

Subsection 2478.6(d) is necessary to set forth the process for CARB issuing a notice of deficiency in the event that a request for a Temporary Locomotive Operating Waiver does not include all of the information required by subsection (c). This notice will identify the missing information so that the operator can resubmit a complete request if they would like to continue to pursue the waiver. A resubmitted waiver would have to comply with all of the applicable requirements set forth in subsections (a), (b), and (c).

Subsection 2478.6(e) is necessary to set forth the process for CARB issuing a determination regarding a request for a Temporary Locomotive Operating Waiver. Three days was selected to provide locomotive operators time to schedule the travel of a locomotive that would operate under a Temporary Locomotive Operating Waiver for requests submitted pursuant to subsection (a) and to provide a rapid response in the event of an emergency event for requests submitted pursuant to subsection (b).

H. Section 2478.7. Alternative Compliance Plan.

Purpose

The purpose of the ACP section is to provide flexibility to locomotive operators to comply with the Proposed Regulation. Locomotive operators that wish to follow alternatives to either the Spending Account or the In-Use Operating Requirements, or both, may apply for an ACP. The emission reductions achieved by the ACP would need to be the same or greater than if the operator followed the requirements of the Spending Account or In-Use Operational Requirements, or both (as applicable), taking into account the assumptions listed in the Proposed Regulation.

Rationale

The ACP section is necessary to provide an alternative avenue for locomotive operators to comply with the Proposed Regulation instead of complying with the Spending Account or the IUOR section, or both. As long as the locomotive operator could achieve equivalent or greater emission reductions as would have been achieved purchasing locomotives using Spending Account funds or as would have been achieved ceasing to operate older, dirtier locomotives in California pursuant to the In-Use Operational Requirements, they may be approved for the ACP (if they meet all of the applicable requirements and applying the assumptions listed in the ACP section).

1. Subsection 2478.7(a). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(a) is to set forth the pathway for locomotive operators who wish to use an ACP instead of following the requirements set forth in either the Spending Account or the IUOR sections, or both. Subsection 2478.7(a) establishes that the timeframe within which locomotive operators may apply for an ACP is from the effective date of the Proposed Regulation through 2053.

Rationale

Subsection 2478.7(a) is necessary to provide flexibility for locomotive operators who elect to follow an alternative pathway to generate the emission reductions equal to or greater than what would have been achieved through compliance with the Spending Account or the IUOR section of the Proposed Regulation, or both. Locomotive operators could apply for an ACP from the effective date of the Proposed Regulation until 2053. The end date was selected because, under the requirements of the Spending Account and IUOR sections, staff determined all locomotives operating in California would be ZE by 2053, and there would no longer be a need for the ACP.

2. Subsection 2478.7(b). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(b) is to specify the amount of emission reductions required to be achieved by the ACP to be approved for use as an alternative to the requirements of either the Spending Account or the IUOR sections, or both. Specifically, an ACP must reduce emissions of PM, NO_x, and GHGs in California in equal or greater amounts to what would have been achieved during the five-year verification period using the Spending Account or the In-Use Operational Requirements, or both, as applicable, taking into account the listed assumptions.

The purpose of subsection (b)(1) is to set forth the methodology for calculating the amount of reductions that would need to be achieved in order to use the ACP as an alternative to the Spending Account section. If the locomotive operator elected to use the ACP as a replacement to the Spending Account requirements, the operator would need to demonstrate that the ACP would achieve emission reductions equal to or greater than the reductions that would have been achieved under the Spending Account section. To determine the amount of emission reductions required to be achieved by the ACP in order to replace the Spending Account requirement, the locomotive operator would determine the amount of emission reductions that would have been achieved through compliance with the Spending Accounts section. To determine the reductions necessary, the operator would calculate the funding obligation that would have been required under the Spending Account section. The operator would then take into account the assumptions set forth in subsection (b)(1)(A)–(C). Specifically, they would need to assume that all Spending Account funds they would have been required to set aside would have been used to purchase Tier 4 or cleaner locomotives as required in the Spending Account section. The locomotive operator would also need to assume that they introduced the Tier 4 or cleaner locomotives purchased with these funds into use in California within one year of the accumulation of sufficient funds to purchase a Tier 4 or cleaner locomotive. Finally, the locomotive operator must assume that Tier 4 locomotives would operate for 23 years prior to being removed from California service. This will allow them to determine the amount of reductions that must be achieved by the ACP in order to serve as an alternative to the Spending Account requirements.

The purpose of subsection (b)(2) is to set forth the methodology for calculating the amount of reductions that would need to be achieved in order to use the ACP as an alternative to the IUOR section. If the locomotive operator elected to use the ACP as a replacement to the IUOR section, the operator would need to demonstrate that the ACP would achieve emission reductions equal to or greater than the reductions that would have been achieved under the IUOR section. To determine the amount of emission reductions necessary, the operator would determine the amount of emission reductions that would have been achieved if the applicable locomotive(s) were removed from operation in California as required by the IUOR section. To do so, they would need to take into account the assumptions set forth in subsection (b)(2)(A)–(C). Specifically, they would have to assume that, beginning in 2030, the locomotives with a primary engine build date that is 23 years or older would no longer be operated in the state as specified in section 2478.5(a). Further, they must assume that, beginning in 2030, any switch, industrial, or passenger locomotive operating in California with an original engine build date of 2030 or newer would always operate in a zero emission configuration in California as specified in section 2478.5(b). Finally, they would need to assume that, beginning in 2035, any freight line haul locomotive engine operating in

California with an original engine build date of 2035 or newer would always operate in a zero emission configuration in California as specified in section 2478.5(c). This would allow them to determine the amount of reductions that would need to be achieved by the ACP during the five-year verification period in order to serve as an alternative to the In-Use Operational Requirements.

The purpose of subsection (b)(3) is to provide that, if the locomotive operator elected to use the ACP as a replacement to both the Spending Account and the IUOR section, the operator would be required to demonstrate the ACP would achieve emission reductions equal to or greater than the reductions that would have been achieved under both the Spending Account and the IUOR section, applying all the applicable assumptions listed above.

Rationale

Subsection 2478.7(b) is necessary to specify the amount of reductions that would be required to be achieved in order for a locomotive operator to use an ACP as an alternative to the Spending Account requirements, the In-Use Operational Requirements, or both. It is necessary to reduce emissions of PM and NO_x so that California can achieve attainment with the PM and NO_x NAAQS. Further, it is necessary to reduce GHG emissions from the locomotive sector for California to attain its climate change goals. As such, it is critical that the ACP achieve equivalent reductions of PM, NO_x, and GHG emissions as the reductions that would have been achieved during the five-year verification period from the applicable section(s) that the ACP is used as an alternative to, taking into account the listed assumptions.

The assumptions set forth in subsections (b)(1), (b)(2), and (b)(3) were incorporated into the ACP section to ensure that the emission reductions achieved by the ACP would be equal to or greater than the emission reductions that would have been achieved by compliance with the Spending Account or IUOR sections. They are the same compliance assumptions that staff used when preparing the emission inventory for the Proposed Regulation.

The assumptions set forth in subsections (b)(1)(A)–(C) are necessary to guide the locomotive operator's calculation of the emission reductions that would be achieved through compliance with the Spending Account section. For ACPs used to replace the requirements set forth in the Spending Account section, the first assumption would be that all Spending Account funds would have been used to purchase Tier 4 or cleaner locomotives at fair market price. Staff included the fair market price requirement to prevent inflated price assumptions from reducing potential emission reduction estimates. For example, if a locomotive operator would be required to deposit ten-million-dollars into the Spending Account based on operations in California, they should be able to purchase at least two Tier 4 locomotives at a fair market price (assuming a \$5 million dollar price per Tier 4 locomotive), meaning they can replace activity from two older, dirtier locomotives with those funds. If they assume an inflated price, they may conclude that they can only replace one locomotive, thus reducing their projected emission reductions and reducing their obligation to achieve reductions under the ACP. Additionally, the ACP must assume that a Tier 4 or cleaner locomotive that would have been purchased with Spending Account funds would begin operating in California within one year of accumulation of sufficient funds to purchase that locomotive. This assumption provides time for operators to order and receive locomotives before they would have begun to achieve emission reductions by introducing them into operation as a replacement to older, dirtier locomotives. Finally, the ACP must assume that Tier 4

locomotives would operate for 23 years prior to being removed from California service. An ACP must demonstrate total emissions throughout the full five-year verification period; the assumption that a Tier 4 locomotive will operate 23 years in California will allow the operator to make the necessary calculations of total emissions from all locomotives they operate.

The assumptions set forth in subsections (b)(2)(A)–(C) are necessary to guide the locomotive operator’s calculation of the emission reductions that would be achieved through compliance with the IUOR section. For ACPs used to replace the requirements set forth in the IUOR section, the ACP would need to assume that, beginning January 1, 2030, all locomotives with a primary engine whose original engine build date of 23 years old or older would be removed from California operations. In addition, they must assume that, beginning January 1, 2030, any switch, industrial, or passenger locomotive operating in California with an original engine build date of 2030 or newer would always be operated in a ZE configuration in California. Also, they must assume that, beginning January 1, 2035, any freight line haul locomotive operating in California with an original engine build date of 2035 or newer would have been a ZE locomotive or ZE capable locomotive. These assumptions in the ACP mirror those found in the IUOR section and were included in this subsection to set forth the specific requirements that need to be followed for an ACP that is used to replace compliance with the IUOR section.

Subsection (b)(3) is necessary to clarify that, for operators who elect to use an ACP to replace the requirements in both the Spending Account and IUOR sections must incorporate all of the assumptions set forth in subsections (b)(1) and (b)(2) when calculating the reductions that must be achieved by the ACP.

3. Subsection 2478.7(c). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(c) is to ensure that the reductions achieved by ACPs would occur in and around California railyard facilities or within three miles of railyard facilities or railroad tracks where locomotives operate in California.

Rationale

Subsection 2478.7(c) is necessary to ensure that reductions of emissions of PM and NO_x resulting from the implementation of an ACP benefit the communities that, due to their proximity to railyards and train tracks, are most impacted by the pollution emitted from locomotives. These communities often suffer disproportionately high levels of air pollution and the resulting health impacts due to the operation of locomotives in proximity to homes, schools, and places of work. Since the emission reductions that would have been achieved by compliance with the Spending Account or the IUOR section would have benefited these communities by decreasing emissions at railyards and other places where locomotives operate, staff added this provision to ensure these communities reap the benefits from the ACPs used to replace these requirements.

4. Subsection 2478.7(d). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(d) is to set forth the timeframe for submission of an application for an ACP. An ACP application would need to be submitted at least six months prior to the requested start date for the ACP following the requirements found in the Submittals to CARB section.

The purpose of subsections (d)(1)–(8) is to set forth the information that would need to be submitted along with an ACP application. Specifically, the application would need to include the following: (1) locomotive operator name or company name; (2) whether the ACP is meant to apply to the Spending Account section, the IUOR section, or both; (3) a detailed demonstration of the methods used to reduce emissions of PM, NO_x, and GHGs in California in amounts equivalent to or greater than the reductions that would have been achieved through compliance with the Spending Account and IUOR sections throughout the five-year verification period; (4) a detailed explanation of the information and calculations used to demonstrate that the reductions the ACP would achieve are real, quantifiable, verifiable, and enforceable in the amounts required by subsection (b); (5) a detailed explanation of the information and calculations used to take into account the applicable assumptions; (6) a detailed description of the emission calculation methodologies and proposed recordkeeping, annual reporting, and monitoring requirements that the applicant plans to follow to demonstrate that the reductions satisfy the requirements; (7) a statement explaining whether the ACP is intended to span five-years or a lesser timeframe; and (8) a signed attestation that the contents of the application are true, accurate, and complete as required in the Submittals to CARB section.

Rationale

Subsection 2478.7(d) is necessary because it sets forth the requirements and the timing for submittal of an ACP application. The ACP application would need to be submitted at least six months prior to the requested start date of the ACP to provide sufficient time for CARB to evaluate the application, and if accepted, for the locomotive operator to plan for and make the arrangements necessary to implement the ACP by the start date. The reference to the Submittals to CARB section was included to provide clarity to the regulated community regarding where in the Proposed Regulation they can find the specific requirements for submittal.

Subsections (d)(1)–(8) are necessary to enumerate the specific information that must be provided in an ACP application. The documentation requested would be needed for staff to determine if the ACP would reduce emissions to the level required and to validate the methodologies for calculating ACP emission projections.

Subsection (1) is necessary so that the application is tied to the locomotive operator and company submitting it.

Subsection (2) is necessary to specify whether the locomotive operator intends to use the ACP to replace the requirements in the Spending Account section, the IUOR section, or both. This is important because the ACP provides locomotive operators the flexibility to choose whether they wish to use the ACP as an alternative to the Spending Account section, IUOR section, or both. The emission reduction and other applicable requirements would be

different for an ACP used as an alternative to the Spending Account section as compared to an ACP used as an alternative to the IUOR section.

Subsection (3) is necessary so that staff can evaluate whether an ACP application demonstrates that the ACP will achieve emission reductions equal to or greater than the amount that would have been achieved by compliance with the section(s) that it is intended to replace throughout the lifetime of the ACP.

Subsection (4) is necessary for staff to evaluate the information and calculations used to demonstrate that the reductions would be real, quantifiable, verifiable, and enforceable in the amount required by subsection (b).

Subsection (5) is necessary for staff to verify that the calculations used for calculating the ACP requirements properly take into account the applicable assumptions set forth in subsection (b).

Subsection (6) is necessary to ensure that the ACP application includes recordkeeping, annual reporting, and emission monitoring sufficient to demonstrate that the emission reductions satisfy the regulatory requirements throughout the lifetime of the ACP. The operator would need to include information such as the methodologies used to calculate their projected emission reductions that would have been achieved under the section(s) to be replaced as well as the amount of reductions that will be achieved by the ACP. It is important that the emission reductions are actually achieved, and proper monitoring, reporting, and recordkeeping needs to be in place so staff can confirm compliance with the requirements of the ACP.

Subsection (7) is necessary so that locomotive operators can specify that they would like the ACP to apply to a full five-year period or, for those who did not intend for their ACP to span a full five years, the application may indicate a shorter timeframe. Some ACPs may be more short term than the full five-year period, and the application must specify whether that is the case. If the ACP will not span five years, the Executive Order approving the ACP would specify an alternative, lesser timeframe, which is consistent with the definition of the five-year verification period.

Subsection (8) is necessary to ensure that the information submitted in the ACP application is true, accurate, and complete and to provide that the attestation required is set forth in the Submittals to CARB section.

5. Subsection 2478.7(e). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(e) is to set forth the procedures for if an ACP is deficient because it is incomplete or inaccurate. CARB would notify the applicant of the deficiencies of the ACP within 45 calendar days of the submission of the application. The applicant would then have 30 calendar days to correct any deficiency and resubmit the application to CARB (unless the Executive Officer provides additional time or the ACP application would be denied). If CARB does not receive the updated application within 30 calendar days of the notice or within the alternative timeframe specified in writing by the Executive Officer, the application will be denied.

Rationale

Subsection 2478.7(e) is necessary to establish the process and timeline for circumstances where an application is incomplete or inaccurate. Staff selected 45 days from the submission of the application as the timeframe for issuance of a notice of deficiency because staff considers 45 calendar days adequate time to review an ACP for deficiencies and report to the Executive Officer if there are problems with the ACP. Allowing the applicant 30 calendar days to respond with requested information or corrections balances providing enough time for applicants to correct the deficiency while avoiding unnecessary delay to the ACP approval process. It is necessary to clearly state that deficient applications which are not corrected within 30 calendar days of the notice of deficiency or within an alternative timeframe provided by the Executive Officer would be denied so that it is clear what would happen if the applicant fails to resubmit an application within that timeframe. The 30 day timeframe was chosen as it strikes the right balance between providing the regulated entity time to correct while balancing the need for the Executive Officer to make a timely decision.

6. Subsection 2478.7(f). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(f) is to set forth the requirements that would need to be met for CARB to issue an approval of the ACP application.

Subsection (1) predicates approval on whether the application complies with the requirement that it reduces emissions in amounts equal to or greater than the reductions that would have been achieved by the section(s) the ACP intends to replace and whether these reductions occur in proximity to California locomotive operations.

Subsection (2) predicates approval on whether the application was submitted at least six months prior to the requested start date of the ACP, was submitted following the requirements set forth in the Submittals to CARB section, and contains all of the information required to be included in the ACP application.

Subsection (3) predicates approval on whether the ACP application provides sufficient information to accurately project emission reductions throughout the five-year verification period and to demonstrate that the reductions will be real, quantifiable, verifiable, and enforceable. This includes emission reductions that would have been achieved if the locomotive operator complied with the section(s) the ACP intends to replace (taking into account the assumptions required to be applied) as well as the emission reductions that would be achieved by the ACP. It also requires a detailed explanation of the information and calculations used to demonstrate these reductions.

Subsection (4) predicates approval on whether the ACP application provides sufficient information to verify that the applicable assumptions were properly applied, including a detailed explanation of the information and calculations used in applying the assumptions to determine the amount of emission reductions that must be achieved by the ACP.

Subsection (5) predicates approval on whether the ACP achieves reductions of PM, NO_x, and GHG emissions equivalent to or greater than the level that would have been achieved by compliance with the Spending Account section or the IUOR, or both. Additionally, in order for an application to be approved, it must demonstrate that these reductions will be real,

quantifiable, verifiable, and enforceable, and it must include a detailed explanation of the information and calculations used to demonstrate that the reductions to be achieved by the ACP will satisfy the requirements of subsection (b).

Subsection (6) predicates approval on whether the ACP application includes a signed attestation that the contents of the application are true, accurate, and complete.

Rationale

Subsection 2478.7(f) is necessary to establish the requirements for CARB to approve of an ACP application and to inform locomotive operators what standards would be applied in CARB's review of an ACP application.

Subsection (1) is necessary to establish that ACP applications would only be approved if they comply with the emission reduction requirements in subsection (b), and the requirement that the reductions be achieved at or within three miles of railyard facilities or railroad tracks where locomotives operate in California in subsection (c).

Subsection (2) is necessary to establish that ACP applications would only be approved if they are submitted at least six months prior to the requested start date, followed the requirements in the Submittals to CARB section, and contained all the information required to be included in the ACP application.

Subsection (3) is necessary because, for CARB to issue an approval, the ACP application must include sufficient information to accurately project the emission reductions that would have been achieved by compliance with the section(s) being replaced by the ACP. For CARB to verify the emission reductions cited in the ACP application, the application must include a detailed explanation of the information and calculations used to determine the amount of emission reductions that must be achieved by the ACP throughout the five-year verification period.

Subsection (4) is necessary because the ACP application must provide sufficient information for staff to verify that the assumptions were properly applied. Staff would need to review the information and calculations that were used in applying these assumptions in order to verify that the assumptions were properly taken into account in determining the amount of reductions that need to be achieved by the ACP.

Subsection (5) is necessary because for CARB to issue an approval, the ACP application would need to demonstrate that it would achieve reductions of PM, NO_x, and GHGs equal to or greater than the level that would have been achieved due to compliance with the section(s) it is intended to replace. Further, the application would need to demonstrate that the reductions are real, quantifiable, verifiable, and enforceable. Staff would need to review the information and calculations used to demonstrate that the required reductions would be achieved throughout the five-year verification period.

Subsection (6) is necessary to clarify to locomotive operators that CARB would not approve an ACP application that did not include an attestation as to the veracity and completeness of the application.

7. Subsection 2478.7(g). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(g) is to set forth the process and timeline for CARB's approval or disapproval of an ACP application. Specifically, the Executive Officer would issue an approval or disapproval via an Executive Order within 45 calendar days of the date when a complete application is submitted to CARB.

Subsection (1) sets forth that an ACP approval could not serve as a substitute for any other approvals that may be required by the federal, state, or local government. Further, approval would be contingent on the ACP's compliance with all applicable laws, ordinances, and regulations, including obtaining any permits or approvals necessary to undertake the activities constituting the ACP, and complying with all environmental review requirements associated with such activities.

Subsection (2) informs locomotive operators that, if their ACP is approved, they would be exempt from the regulatory obligations required by the Spending Account section or the IUOR section, or both, beginning on the start date for the ACP provided in the Executive Order and until the expiration or revocation of the ACP. It also provides that the Executive Order would indicate whether the ACP exempts the operator from the requirements in the Spending Account or IUOR section, or both.

Rationale

Subsection 2478.7(g) is necessary to establish the timeframe CARB would need to approve or deny a complete ACP application unless a notice of deficiency is issued. This provision is also essential to advise the ACP applicant that staff would have 45 calendar days from the time a complete ACP plan was submitted for the Executive Officer to notify an applicant in writing of the approval or disapproval of the ACP. Staff considers 45 calendar days an adequate amount of time to review the ACP, then draft and route for signature an Executive Order approving the ACP application.

Subsection (1) is necessary to ensure that the approval cannot serve as a substitute for other approvals that may be required by federal, state, or local government and to establish that approval would be contingent on the ACP's compliance with all applicable laws, ordinances, regulations, and standards, including permits or approvals and environmental reviews necessary to implement the ACP.

Subsection (2) is necessary to establish the timeframe for the exemption from the requirements of the Spending Account or the IUOR sections, or both. This exemption would begin on the start date for the ACP that is listed in the Executive Order approving the ACP and continues until the ACP expires at the end of the five-year verification period identified in the Executive Order or is revoked.

8. Subsection 2478.7(h). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(h) is to establish the timeline for the expiration of an ACP, set forth the process for the revocation of an approved ACP, and to clarify that revoked or

expired ACPs could not be used for compliance with the Proposed Regulation as of the date of the expiration or revocation.

Subsection (1) provides that an approved ACP would only be valid for the five-year verification period, as specified in the Executive Order, and the ACP would expire after the five-year verification period.

Subsection (2) provides that an approved ACP could be revoked at any time by the Executive Officer for any of the reasons listed in subsections (2)(A)–(C). Subsection (2)(A) allows for revocation if the locomotive operator fails to meet the requirements of the ACP section, including but not limited to submittal of a complete, accurate, and timely annual report. Subsection (2)(B) allows for revocation if the locomotive operator fails to meet the requirements set forth in the ACP itself, including but not limited to the reductions that must be achieved by the ACP. Subsection (2)(C) allows for revocation if the ACP is not in compliance with any applicable laws or if the operator did not obtain the permits or approvals necessary to undertake the activities constituting the ACP or has not complied with all environmental review requirements associated with the ACP.

Subsection (3) establishes that if any of the circumstances listed in section 2478.7 subsections (h)(2)(A) through (h)(2)(C) occur, the operator would notify CARB following the requirements in the Submittals section within 15 calendar days of the date when the operator discovers or reasonably should have discovered that one of these circumstances has occurred.

Subsection (4) indicates that, CARB will provide notice of revocation, including the date of the official revocation, to the applicant in writing at least 30 calendar days prior to the official revocation.

Rationale

Subsection 2478.7(h) is necessary to establish the process and timeline for expiration and revocation of an ACP and to clarify that a revoked or expired ACP could not be used for compliance with the Proposed Regulation.

Subsection (1) is necessary to provide the timeframe for the expiration of an ACP, which is valid for the five-year verification period. Based on the definition of the “five-year verification period,” the Executive Order could indicate that the ACP spans a full five-year term or could set forth a shorter timeframe.

Subsection (2) is necessary to set forth the grounds for a revocation of an ACP and to establish that the ACP may be revoked at any time by the Executive Officer for any of the listed reasons. Subsection (2)(A) is necessary because, if the locomotive operator failed to meet the requirements of the ACP section, including submission of a complete, accurate, and timely annual report, the ACP could be revoked. This is important to ensure that the requirements of the ACP section are met for the locomotive operator to reap the benefits of using an ACP as an alternative to the Spending Account or IUOR sections, or both. Subsection (2)(B) is necessary to ensure that the locomotive operator meets the requirements of the ACP, including the reductions required to be achieved by the ACP. If the operator does not comply with the requirements set forth in the ACP, the ACP could be revoked. This is important to ensure that the reductions required by the ACP section are achieved for the locomotive operator to reap the benefits of using an ACP as an alternative to the Spending Account or IUOR sections, or both. Subsection (2)(C) is necessary to ensure that the ACP complies with any applicable laws, ordinances, or regulations and that the operator obtains

all permits and approvals necessary to undertake the ACP and complies with all environmental review requirements associated with the ACP. If they do not, the ACP could be revoked.

Subsection (3) is necessary to inform the regulated community that they will need to provide documentation if the ACP no longer meets in the requirements of the approved ACP. CARB is requiring notification of changes to ensure changes do not result in increased emissions and to establish if the ACP will need to be revoked.

Subsection (4) is necessary to establish the timeline for CARB to provide the notice of revocation and to specify that it will be in writing. CARB selected 30 days to provide sufficient time for the locomotive operator to prepare to comply with the Spending Account or IUOR sections, or both (as applicable).

9. Subsection 2478.7(i). Alternative Compliance Plan.

Purpose

The purpose of section 2478.7(i) is to set forth a pathway for an applicant to reapply for an ACP such that they can continue to use an ACP for another five-year verification period following the expiration of the previous five-year verification period without any gaps in time between these periods. To do so, the applicant must apply at least six months before the expiration of the ACP. It also specifies that requirements set forth in section 2478.7 apply to reapplications.

Rationale

Subsection 2478.7(i) is necessary to allow ACPs to continue to be used without any gap in time between when an ACP expires and the start date of a new ACP. This is necessary to provide applicants with the option of avoiding having to comply with the requirements of the provisions the ACP replaces for a gap period between the expiration of the previous five-year verification period and the start date of a new five-year verification period. It is necessary to require ACT reapplication and would take approximately six months to process. It is necessary to specify that the requirements of section 2478.7 apply to reapplications so that it is clear that the reapplications are subject to the same requirements as applications. For example, a reapplication of an ACP must include all of the information required to be included in an application as established by subsection (d) and is approved based on the criteria set forth in subsection (f).

10. Subsection 2478.7(j). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(j) is to require locomotive operators using an approved ACP to submit an annual report for each year throughout the five-year verification period. It also sets forth the deadline for submittal of the report on July 1 of each year and provides that the report be submitted following the requirements in the Reporting and Recordkeeping section in the Proposed Regulation.

Rationale

Subsection 2478.7(j) is necessary to establish the annual reporting for locomotive operators using an ACP. This report would be necessary for CARB to verify that the locomotive operator was implementing the ACP as required throughout the five-year verification period. The submittal deadline of July 1 is the same deadline specified in section 2478.10; it was chosen to give locomotive operators time to compile their records and calculate their reductions before reporting. The reports must be submitted as required by the Recordkeeping and Reporting section, which contains general requirements applicable to recordkeeping and reporting as well as a section that provides the information required to be included in the Annual ACP Report.

11. Subsection 2478.7(k). Alternative Compliance Plan.

Purpose

The purpose of subsection 2478.7(k) is to establish that if any section, subsection, paragraph, subparagraph, sentence, clause, phrase, or portion of the Proposed Regulation is, for any reason, held invalid, unconstitutional, or unenforceable by any court of competent jurisdiction (referred to here as the "invalidated requirement or application"), an ACP would no longer be required to achieve the emission reductions tied to the invalidated requirement or application. For ACPs in effect, if and when an applicable requirement or application was invalidated, the locomotive operator would no longer be responsible for any portion of the ACP which was solely devoted to achieving emission reductions that would have been required by the invalidated requirement or application.

Rationale

Subsection 2478.7(k) is necessary to instruct ACP applicants as to the status of their ACP if any relevant portion of the Proposed Regulation is invalidated by a court. If the invalidation is not related to the ACP section itself or the provisions the ACP intends to replace (the Spending Account section, IUOR section, or both), the ACP requirements would remain in place. However, if requirements to achieve emission reductions under the Spending Account or IUOR sections or applications of those requirements are invalidated, the locomotive operator would not be responsible for compliance with any portion(s) of the ACP intended to replace the invalidated requirements.

For example, if the ACP serves as an alternative to the Spending Account section and if the entire Spending Account section were invalidated, the locomotive operator would no longer have to comply with the requirements of the ACP. If the ACP serves as an alternative to both the Spending Account and the IUOR section, and only the Spending Account section is invalidated, the locomotive operator would no longer need to achieve the emission reductions in the ACP that serve as an alternative to the reductions that would have been achieved by compliance with the Spending Account but would still be responsible for achieving the emission reductions that would have been achieved by compliance with the IUOR section. If the ACP serves as an alternative to the IUOR section and some portion of the emission reductions required to be achieved under that section are invalidated but the entire section is not invalidated, the locomotive operator would not be responsible for achieving the reductions that would have been required by the invalidated portion but would

still be responsible for achieving the reductions that would have been required by any remaining provisions.

I. Subsection 2478.8. Idling Requirements

Purpose

The purpose of section 2478.8 is to provide CARB inspectors with authority and direction to enforce idling requirements first promulgated by U.S. EPA by creating a state regulation that mirrors these requirements. The overarching purpose, therefore, is to reduce emission that result from excess locomotive idling.

Rationale

Subsection 2478.8 aligns state operational requirements with existing federal locomotive idling rules applicable to manufacturers and remanufacturers found in title 40 C.F.R. section 1033.115(g). Currently, CARB does not have regulations in place to facilitate enforcement of locomotive idling. The Proposed Regulation would provide CARB the means to investigate cases where excess idling in California is suspected and to enforce the requirements when unnecessary idling is discovered. Locomotives often idle in areas that are heavily impacted by diesel emissions such as railyards and freight facilities. The Health Risk Characterization and Mortality & Illness studies in Appendix H: Health Analyses describes the elevated health risk experienced by residents who live and work nearby locomotive operations. Limiting idling wherever operationally feasible is critical to reducing emissions for these communities. Although most locomotives are equipped with AESS, communities have expressed concerns about extended idling, and have asked CARB to investigate such events. See the Purpose and Rationale section for the definition of “idling” above for additional context.

1. Subsection 2478.8(a). Idling Requirements.

Purpose

The purpose of subsections 2478.8(a)(1)–(4) is to reduce emissions that occur because of excess idling of locomotives. Specifically, it establishes that a locomotive operator shall ensure an AESS equipped locomotive engine is shut off no more than 30 minutes after the locomotive becomes stationary. Subsections (1)–(4) set forth the only reasons that a locomotive could exceed 30 minutes of idling: (1) to prevent engine damage such as to prevent the engine coolant from freezing; (2) to maintain air pressure for brakes or starter system, or to recharge the locomotive battery; (3) to perform necessary maintenance, including necessary passenger rail car/passenger compartment environmental conditioning; and (4) to otherwise comply with federal or state regulations. The exceptions listed in subsections (1)–(4) are intended to align closely with the idling exceptions found in 40 C.F.R. 1033.115(g).¹⁶¹

¹⁶¹ U.S. EPA, 40 C.F.R. § 1033.115, accessed July 14, 2022. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-B/section-1033.115#p-1033.115>).

Rationale

Subsection 2478.8(a) aligns state operational requirements and the listed idling exception with existing federal locomotive idling rules applicable to manufacturers and remanufacturers found in 40 C.F.R. section 1033.115(g) to the extent feasible. An AESS is designed to automatically shut down the engine during idling to save fuel and reduce emissions. This requirement is complementary to the federal requirement to equip locomotives with AESS devices, which limit idling to no longer than 30 minutes.¹⁶²

2. Subsection 2478.8(b). Idling Requirements.

Purpose

The purpose of subsection 2478.8(b) is to establish that no person could remove, tamper with, or disable a properly functioning AESS unless for maintenance. This requirement is complementary to the federal requirement that forbids tampering with or disabling AESS devices.¹⁶³

Rationale

Subsection 2478.8(b) is necessary to establish that removing, tampering with, or disabling a properly functioning AESS would be a violation of the Proposed Regulation unless for maintenance. Staff is concerned that railroads could bypass the AESS to circumvent the idling requirements. This requirement mirrors the federal requirement that forbids tampering with or disabling AESS devices.¹⁶⁴ Staff recognizes that there may be a need to remove or disable a properly functioning AESS to perform maintenance and has excepted maintenance from this provision.

3. Subsection 2478.8(c). Idling Requirements.

Purpose

The purpose of subsection 2478.8(c) is to establish that a locomotive operator with an AESS equipped locomotive is responsible for ensuring the AESS is functional at all times during the Locomotive's Operation. As explained in the Definitions section, AESS means the automatic engine shut down/start up system that controls the engine by stopping it or starting it.

The purpose of subsection (c)(1) is to require the operator to replace or repair a malfunctioning or broken AESS no later than 30 days after discovering the initial malfunction or break.

The purpose of subsection (c)(2) is to set forth the requirement that for the time when an AESS is inoperative, the locomotive would need to be manually shut off no more than

¹⁶² U.S. EPA, 40 CFR § 1033.115, accessed July 14, 2022. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-B/section-1033.115#p-1033.115>).

¹⁶³ U.S. EPA, 40 CFR § 1068.101(b), accessed July 18, 2022. (weblink: [https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1068/subpart-B/section-1068.101#p-1068.101\(b\)\(1\)](https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1068/subpart-B/section-1068.101#p-1068.101(b)(1))).

¹⁶⁴ U.S. EPA, 40 CFR §1068.101(b), accessed July 18, 2022. (weblink: [https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1068/subpart-B/section-1068.101#p-1068.101\(b\)\(1\)](https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1068/subpart-B/section-1068.101#p-1068.101(b)(1))).

30 minutes after it becomes stationary unless the locomotive is operating under one of the listed exceptions in subsections (a)(1)–(4).

Rationale

Subsection 2478.8(c) is necessary to ensure that locomotive operators have an AESS that is functional at all times during the locomotive’s operation. Because the AESS is designed to automatically shut down the engine during idling to save fuel and reduce emissions, having a properly functioning AESS will reduce emissions.

Subsection 2478.8(c)(1) is necessary to ensure repair or replacement of a malfunctioning or broken AESS would be conducted in a timely manner. A locomotive with a malfunctioning AESS may idle for longer than it otherwise would, creating harmful emissions. Therefore, it is necessary to ensure that a malfunctioning AESS would be repaired as soon as possible. Staff determined 30 calendar days following discovery of the issue provides sufficient time for the operator to acquire AESS replacements parts and to conduct the repair.

Subsection 2478.8(c)(2) is needed to establish the requirements for when an AESS is inoperative, which includes but is not limited to when it is in need of repair or replacement. Although AESS is the preferred method for limiting idling in locomotives, excess idling can be reduced or eliminated by manually shutting off the locomotive engine while it is stationary. Therefore, staff chose to instruct operators that they would need to manually shut off engines if idling longer than 30 minutes unless one of the exemptions listed in subsections (a)(1)–(4) applies.

4. Subsection 2478.8(d). Idling Requirements.

Purpose

The purpose of subsection 2478.8(d) is to require locomotives equipped to connect to wayside power to turn off all engines, including separate engines providing head end power, and use wayside power if idling for longer than 30 minutes and if wayside power is available.

Rationale

Subsection 2478.8(d) is necessary because many newer passenger locomotives are equipped with the ability to connect to wayside power, so that they may continue to power necessary passenger compartment functions while the locomotive is stationary. To reduce the emission impacts from extended idling times, the Proposed Regulation would require the use of wayside power in properly equipped locomotives if wayside power is available. Staff has consulted with passenger locomotive operators and found that many already use wayside power in maintenance yards. Connecting to wayside power is a simple plug-in process that takes approximately 10 to 20 minutes to complete.¹⁶⁵

¹⁶⁵ Metrolink, CARB/Metrolink Technical Working Group Presentation February 17, 2022.

5. Subsection 2478.8(e). Idling Requirements.

Purpose

The purpose of subsection 2478.8(e) is to require locomotive operators to annually report all the information described in the Idling Annual Report section of the Proposed Regulation for each locomotive they operated in California during the previous year. This report would need to be submitted to CARB no later than July 1 of the year following the calendar year for which the information is reported.

Rationale

Subsection 2478.8(e) is necessary to ensure that CARB receives the information it needs to ensure compliance with the Idling Requirements section on an annual basis. Further, it is necessary to establish the deadline for submittals of the annual idling report to CARB. It provides clarity by citing to the applicable provision in the Reporting and Recordkeeping Requirements section that sets forth the specific information required to be submitted in the Annual Idling Report. This requirement is complementary to federal regulations, which requires states to inventory emissions sources and report this information to the U.S. EPA.¹⁶⁶ Subsection 2478.8(e) is necessary to ensure accurate inventory and reporting of emissions from locomotive idling and to provide the information needed for CARB to investigate excessive idling and undergo enforcement action.

J. Section 2478.9. Registration Requirements

Purpose

The purpose of section 2478.9 is to provide a means for CARB to track locomotives that operate in California subject to the Proposed Regulation. Staff will use this registration information to monitor compliance with the Proposed Regulation and to conduct enforcement in the event of a violation of the Proposed Regulation.

Rationale

CARB intends to establish a database of the locomotive operators and locomotives that operate in California and would be subject to the Proposed Regulation in order to monitor compliance, conduct enforcement actions, and to model emissions. Locomotive Operators are in the best position to know this information regarding each locomotive. Therefore, CARB is requiring Locomotive Operators to report and keep up-to-date this information on locomotives operating within the State.

1. Subsection 2478.9(a). Registration Requirements.

Purpose

The purpose of subsection 2478.9(a) is to set forth the requirement for every locomotive operator to register all locomotives operating in the state by submitting the listed

¹⁶⁶ U.S. EPA, 40 C.F.R. part 51, accessed July 18, 2022. (weblink: <https://www.ecfr.gov/current/title-40/chapter-1/subchapter-C/part-51>).

information following the requirements set forth in the Submittals to CARB section by July 1, 2024.

Subsection (a)(1)(A)–(F) lists the information each locomotive operator must submit: (A) locomotive operator or company name; (B) company or operator headquarters; (C) tax identification number; (D) responsible official title and name; (E) responsible official phone number; and (F) the responsible official’s email address.

Subsection 2478.9(a)(2)(A)–(P) sets forth the information locomotive operators must submit for each locomotive: (A) locomotive road number; (B) locomotive serial number; (C) locomotive model number; (D) engine tier; (E) engine family; (F) engine manufacturer name; (G) engine serial number; (H) original engine build date; (I) engine power rating in horsepower; (J) latest remanufacture date; (K) date acquired; (L) U.S. EPA locomotive ECD values for PM and NO_x (if applicable); (M) whether it is a ZE locomotive or a ZE capable locomotive; (N) whether the locomotive is operating under a small business hardship extension, (O) the total MWh of operation since the locomotive’s original engine build date, as of December 31 of the Calendar Year prior to the registration date; and (P) photographic documentation that verifies the items in (2)(A)–(I).

Rationale

Subsection 2478.9(a) is necessary provide CARB with the information needed to establish a database of the locomotive operators and locomotives that operate in California and would be subject to the Proposed Regulation. Staff will use this registration information to monitor compliance with the Proposed Regulation and to conduct enforcement in the event of a violation of the Proposed Regulation.

Subsection 2478.9(a)(1) is necessary to set forth the information that locomotive operators would be required to submit and to establish that the initial deadline for registration is July 1, 2024. Staff chose July 1, 2024, because all other reporting requirements would be due on that date, so the registration could be submitted along with any other applicable reports. The information for the locomotive operator and responsible official would be necessary for CARB to identify the operator connected to the registration and contact the individual with authority to certify that the locomotive complies with the requirements of the Proposed Regulation. Information requested by CARB in subsections 2478.9(a)(1)(A), (B), (D), (E), and (F) would be necessary for CARB to use for identification and contact purposes. Under subsection 2478.9(a)(1)(C), staff would require the tax identification number to differentiate businesses that may operate together under larger business groups or corporations; several of the Class III railroads operating in the state are owned by separate entities.

Subsection 2478.9(a)(2)(A)–(P) would be necessary to identify each locomotive operating in California and the characteristics relevant to CARB’s analysis and to provide information needed for CARB to model emissions. The locomotive road number (A) and serial number (B) would be necessary to establish the unique identity of each locomotive being registered. The locomotive model number (C) would be necessary to substantiate the locomotive build year. The locomotive engine Tier (D) and engine family number (E) would be needed to identify the emission levels of the locomotive. It is necessary to collect separate information on the locomotive engine (D)–(I) because a locomotive may not be powered by the engine of original manufacture. Locomotives are sometimes repowered with new engines, therefore the engine Tier (D), engine family name (E), engine manufacturer name (F), engine serial number (G), engine build date (H), and engine power rating (I) would be necessary to

characterize the engine and its emissions. Specifically, the original engine build date (H) would be necessary to validate the reported emission levels since emission certifications are specified according to the year of manufacture. Because the IUOR section specifies that engines of a certain age may no longer operate within the state after the applicable dates, a report of the original engine build date would be also essential to determine whether the locomotive would be allowed to operate in the state.

The engine horsepower rating (I) would be required by CARB as it is a component of the calculation of total emissions from a locomotive. The latest remanufacture date (J) would be essential to validate the emission level reported after manufacture, since remanufacture kit emission levels are specified according to the year of kit manufacture. CARB would require that operators report the date acquired (K) to corroborate any report of transfers of ownership or purchase dates for the locomotives purchased with Spending Account funds. CARB requests the U.S. EPA locomotive ECD values for PM and NO_x, if applicable (L) because the emission levels would be necessary to calculate the total annual emissions of each individual locomotive. CARB would require locomotive operators to report whether the locomotive is a ZE locomotive or a ZE capable locomotive (M) in order to determine emissions (or lack thereof). CARB would require the locomotive operator indicate whether the locomotive is operating under a small business hardship extension registration under subsection (N) so that CARB can identify registered locomotives for which this extension is being used and connect them to the relevant information regarding the extension. CARB would require the total MWh of operation since the locomotive original engine build date (O) as of December 31 of the prior calendar year because this information is necessary to quantify emissions to calculate the Spending Account funding obligation. Additionally, the total MWh would be required to be used in consideration of a request for extension of the In-Use Operational Requirements. Under subsection (P), CARB would require that locomotive operators submit photographic documentation to verify the items in (2)(A)-(I): locomotive road number, locomotive serial number, locomotive model number, engine tier, engine family, engine manufacturer name, engine serial number, original engine build date, and engine power rating to corroborate reported registration information. Information requested to be photographed can be found in various locations on a locomotive. For example, a locomotive road number is found on the outside of a locomotive and engine information may be found on engine labels.

2. Subsection 2478.9(b). Registration Requirements.

Purpose

The purpose of subsection 2478.9(b) is to establish that, if registration information for any locomotive changes, then the locomotive operator would be required to submit updated information to CARB within 30 calendar days of the change.

Rationale

Subsection 2478.9(b) is required to ensure accurate and current registration information is submitted to CARB by locomotive operators. CARB staff would use registration data to establish a database for all locomotives operating in California, including the relevant age and emissions data for each. Thus, having accurate up-to-date information is required for enforcement and implementation of the Proposed Regulation. Additionally, this subsection is also necessary to ensure that CARB would have the current contact information for the

locomotive operator and the responsible official. Staff selected 30 days to provide sufficient time for the locomotive operator to collect and submit the updated information while ensuring that CARB receives this information in a timely manner and can maintain a database that is up to date.

3. Subsection 2478.9(c). Registration Requirements.

Purpose

The purpose of subsection 2478.9(c) is to require any locomotive that is added to a locomotive operator's California operations after July 1, 2024, to register within 30 calendar days of the locomotive first operating in California.

Rationale

Subsection 2478.9(c) is necessary to ensure that locomotives introduced into operation in California after July 1, 2024 are registered in a timely fashion. To monitor compliance with the Proposed Regulation, CARB needs locomotive registration information. Requiring a locomotive to be registered within 30 calendar days of the first day of operation in California balances allowing for adequate time for locomotive operators to gather the necessary information and submit their registration while ensuring CARB receives this information in a timely manner. This timeframe will minimize a potential disruption in CARB's evaluation of compliance and any necessary enforcement action.

K. Section 2478.10. Reporting and Recordkeeping Requirements.

Purpose

The purpose of the Reporting and Recordkeeping Requirements section is to set forth the requirement to include an attestation statement along with each report submitted, general recordkeeping requirements, and the requirements for the Locomotive Emissions Annual Report, the Spending Account Annual Report, the Annual ACP Report, the Idling Annual Report, the ZE Credit Annual Report, and the Historical Railroad Low-Use Exemption Annual Report.

Rationale

Section 2478.10 is necessary so that the specific reporting and recordkeeping requirements for the Proposed Regulation are presented in one section. A locomotive operator need only submit the reports that are required to be submitted pursuant to the applicable provisions of the Proposed Regulation. For example, if the operator is not utilizing an ACP, they need not submit an Annual ACP Report.

1. Subsection 2478.10(a). Reporting and Recordkeeping Requirements.

Purpose

The purpose of section 2478.10(a) is to set forth the requirement that each submitted annual report would follow the requirements in the Submittals to CARB section of the Proposed Regulation. This would include the requirement to submit an attestation statement as well as the other requirements in that section.

Rationale

Subsection 2478.10(a) is needed to ensure that locomotive operators submit the reports as required by the Submittals to CARB section. It is necessary that the reports be submitted in English and include an attestation that the submitted information is true, accurate, and complete. It is essential that this information be accurate and complete so that the purposes of the Proposed Regulation are achieved. For more analysis, see the Purpose and Rationale section covering the Submittals to CARB section.

2. Subsection 2478.10(b). General Recordkeeping Requirements.

Purpose

Subsection 2478.10(b)(1)-(3) is necessary to establish that locomotive operators would need to (1) maintain all reporting records for three years after the report date (unless another timeframe is provided in the Proposed Regulation); (2) make reporting records available to CARB or a designee within 30 days of request; and (3) maintain records for any locomotive(s) that are removed from operations in California for three years after it has been removed.

Rationale

Subsection 2478.10(b) is necessary to establish the general requirements that would apply to the records that would need to be kept pursuant to section 2478.10.

Subsection (b)(1) is necessary to ensure that the records would be maintained for three years. Staff selected this timeframe so that CARB's oversight and audits may evaluate the previous three years of records. This will ensure access to records that will be necessary for CARB to monitor compliance and enforce the Proposed Regulation. The three-year retention schedule is consistent with recordkeeping retention requirements in various CARB regulations.

Subsection (b)(2) is necessary to require that the locomotive operator make records available to CARB within 30 days of CARB's request. This would allow CARB to verify reported information and to evaluate compliance with the requirements of the Proposed Regulation. Additionally, these records may be needed to undertake an enforcement action. The 30-day timeframe was selected to provide sufficient time for locomotive operators to collect and submit the requested records and to ensure that the records are provided to CARB in a manner that will not cause unnecessary delay.

Subsection (b)(3) is necessary to require that locomotive operators maintain records for any locomotives that are removed from operations in California for three years after it is removed from California operations to ensure operators have proper documentation for potential enforcement actions.

3. Subsection 2478.10(c), Locomotive Emissions Annual Report.

Purpose

The purpose of subsection 2478.10(c) is to set forth the information each locomotive operator would be required report annually to CARB beginning July 1, 2024, and every subsequent July 1, for each locomotive that operated in California the year prior.

Subsection (1) sets forth the information that needs to be included in the Locomotive Emissions Annual Report for each locomotive operated in California during the prior calendar year: (A) the locomotive operator's name; (B) the locomotive identifier (road number and serial number); (C) total MWh operated, or, if applicable, total fuel used in each California air district. Subsection (C)(1) establishes that if the MWh meter was replaced or reset for maintenance purposes, the reading of the old MWh meter and the total from the new MWh meter would need to be added together to determine the current MWh for that year. The reading of the old MWh meter, the date it was replaced, the reading of the new MWh meter, and the current MWh must be recorded and included in the report. Subsection (D) would require the total engine hours operated in each California air district during the Calendar Year. Subsection (E) would require all locomotives subject to section 2478.5(a)(2)(A) to prove the engine meets the requirements for extended use under the IUOR section, by submitting the total MWh of operation since the locomotive's original engine build date.

Subsection (2) establishes that locomotive operators are not required to include ZE locomotives in their Locomotive Emissions Annual Report. However, ZE locomotives may still need to be included in other applicable reports, such as the ZE Credit portion of the Spending Account Annual Report or the Annual ACP Report.

Rationale

Subsection 2478.10(c) is necessary for CARB to quantify emissions from locomotives in California in order to track progress towards achieving the planned emission reductions called for in the SIP and to ensure attainment to the federally-required NAAQS.¹⁶⁷ For CARB to quantify emissions from locomotive activity statewide, CARB would need to identify each individual locomotive and review the report on locomotive usage and emission levels on an annual basis. This subsection states that the first annual reports would be submitted by July 1, 2024, then annually each July 1 after. Staff chose a reporting date of July 1 based on processing times for established programs and consultation with industry members. Staff chose to provide six months after the end of a calendar year for locomotive operators to collect the required data, sort it, convert it to the appropriate format, and submit it to CARB. This is consistent with the deadline of the other reports required in the Proposed Regulation.

Subsection (1)(A) is needed to identify the operator of each locomotive being reported to connect an operator with the locomotives they are reporting.

Subsection (1)(B) is necessary to identify each locomotive. Unique locomotive identifiers are a locomotive's road number and serial number.

Subsection (1)(C) is necessary because many requirements in the Proposed Regulation are based on quantifying emissions resulting from the use of diesel-powered locomotives. Therefore, CARB would need a report of the quantity and location of the MWh operated by each locomotive in California. It would be necessary for CARB to keep track of the MWh operated in each California air district because of the need to understand where toxic emissions are occurring. Each of California's 35 air districts have different population counts, which means varying numbers of exposed and impacted people. It is important to quantify populations exposed to understand the scale of impact from diesel-powered locomotive

¹⁶⁷ U.S. EPA, National Ambient Air Quality Standards Table, accessed July 18, 2022. (weblink: <https://www.epa.gov/criteria-air-pollutants/naaqs-table>).

emissions, and to understand a population's proximity to those emissions. Scientific literature has demonstrated the broad impacts of exposure to pollution, specifically living and working near locomotive activity. For more information on the health impacts of locomotive emissions, see Appendix H: Health Analyses.

Most locomotives in operation in California are equipped with MWh meters pursuant to U.S. EPA requirement.¹⁶⁸ MWh meters have historically provided the comprehensive fleet data required for Class I operators to comply with the 1998 Locomotive NOx Fleet Average Emissions Agreement in the South Coast Air Basin.¹⁶⁹ Collecting locomotive MWh information would allow CARB and locomotive operators to understand their obligations under the Proposed Regulation. In cases where a locomotive did not have a MWh meter, operators would use a conversion factor to derive MWh using gallons of fuel consumed by the locomotive, as explained in the Spending Account section.

Subsection (1)(C)1. is necessary to ensure locomotive operators accurately tracked and reported locomotive activity. Subsection (1)(C)1. explains the information that would need to be recorded and reported in the event that a MWh meter needed to be replaced or reset for maintenance purposes.

Subsection (1)(D) is necessary because the total engine hours of each locomotive annually would be used to compare and corroborate the level of MWh usage reported from the MWh meter reading.

Subsection (1)(E) is necessary for locomotives that fall under section 2478.5(a)(2)(A), which would allow a locomotive to continue to operate in California beyond the age limit that otherwise applies. This information would be necessary for CARB to determine if a locomotive older than 23 years of age could continue to operate in California because it had not exceeded a total of (rated hp) x (20.25) MWh of operation since its original engine build date, as specified in section 2478.5(a)(2)(A).

Subsection (2) is necessary to establish that ZE locomotives need not be included in the Locomotive Emissions Annual Report. ZE locomotive inclusion in the Locomotive Emissions Annual Report is optional because there are no emissions associated with ZE locomotives.

4. Subsection 2478.10(d). Spending Account Annual Report.

Purpose

The purpose of subsection 2478.10(d) is to set forth the requirement that locomotive operators annually report information necessary to demonstrate compliance with the Spending Account. Operators subject to the requirements in the Spending Account section would need to submit reporting annually, no later than July 1 of each calendar year. The Spending Account annual report would require: (1) the Locomotive Operator/company name; (2) The calculated Spending Account funding requirement for the previous calendar year; (3) the total amount deposited in the Spending Account to meet funding requirement

¹⁶⁸ U.S. EPA, 40 C.F.R. § 1033.115, accessed July 14, 2022. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-B/section-1033.115#p-1033.115>).

¹⁶⁹ CARB, Rail Emission Reduction Agreements, accessed July 18, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/rail-emission-reduction-agreements>).

for the previous calendar year; (4) a list of all purchases made with Spending Account funds, including an item description, location, and amount of Spending Account funds used for the purchase of each item; (5) the Spending Account balance on December 31 of the previous calendar year.

The purpose of subsection (6) is to set forth the requirement for reporting information related to the ZE credit for operators who elect to use ZE credits to offset their funding requirement applicable to the previous calendar year. Operators of ZE locomotives, ZE rail equipment and locomotives that connect to wayside power could claim ZE credits as set forth in the Spending Account section by submitting a ZE credit annual report no later than July 1 of each calendar year. This subsection only applies prior to 2030 because the ZE credit provisions in the Spending Account section only apply to operation that occurs prior to January 1, 2030.

Subsection (6) sets forth the reporting requirements applicable to operators who wish to claim ZE credits for the previous calendar year for operation of ZE locomotives, ZE rail equipment, and operators of locomotives that connect to wayside power that elect to use ZE credits to decrease their funding obligation for the Spending Account must report the listed information.

Subsection (6)(A) requires the following information for each ZE locomotive and ZE rail equipment during the prior calendar year: 1. locomotive road number (or external identifier for ZE rail equipment); 2. Serial number of the locomotive or ZE rail equipment; 3. The total MWhs that locomotive or ZE rail equipment operated in each California air district; and 4. If the locomotive wishes to receive double credit for operation in a DAC, the report must include the total MWh operated within the boundaries of a DAC and identify the DAC(s) in which this operation occurred.

Subsection (6)(B) requires the report to include the following for each wayside power connection in California during the previous year: 1. the time, date, location, and duration of the connection to wayside power for each locomotive that was connected to wayside power in California; 2. the total MWhs provided to each locomotive by wayside power in California; and 3. for operators who wish to obtain double credit pursuant to the ZE credit section, total MWh of wayside power provided to each locomotive within the boundaries of a DAC and identification of the DAC(s) in which this occurred, for the previous calendar year.

Rationale

Subsection 2478.10(d) is necessary so staff could verify the calculations performed pursuant to the Spending Account section and determine whether there are violations of the Spending Account section that should be the subject of investigation and enforcement action.

Subsection (1) is necessary so that the report can be tied to the locomotive operator.

Subsection (2) is necessary to disclose the funding requirement calculated for the previous calendar year. Subsection (3) is necessary to ensure the Spending Account was funded with the correct amount to meet the funding requirement applicable to the previous calendar year.

Subsection (4) is necessary so staff can verify whether any purchases made using the Spending Account funds was made in compliance with the list of permissible expenditures in section 2478.4(d). Subsection (5) is necessary for staff to keep track of the balance in the Spending Account at the end of each calendar year. Therefore, the total annual Spending Account funding requirement, the balance, and the purchases made using these funds must be reported to allow oversight, audits, and enforcement.

Subsection 2478.10(d)(6) is necessary to ensure that CARB receives the information required to verify that ZE credits claimed are in compliance with the ZE credits subsection of the Proposed Regulation.

Subsections A(1) and A(2) are necessary for CARB to verify that the credits are being created by a ZE locomotive or ZE rail equipment that satisfies the requirements of the Proposed Regulation. To do so, CARB would require operators to report the ZE locomotive road number or external verifier and serial number. To verify the correct credit amount, CARB would require locomotive operators to submit annual ZE locomotive and ZE rail equipment MWh usage, including specification of which California air district this operation occurred in. CARB would require this information to be provided for each California air district so that staff could analyze reductions achieved in each district to ensure compliance with the SIP. If operators wish to receive double ZE credit for operation in areas defined as DACs, the operators would need to report the MWh used in each area designated as a DAC and identify the DAC in which this operation occurred.

Subsection (B) is necessary for CARB to verify that the credits being created by connecting locomotives to wayside power in California satisfy the requirements of the Proposed Regulation. To verify credits for wayside power use, CARB would require the time, date, location, and duration of the connection to wayside power. Staff also would also need to review the total MWh provided to each locomotive when the locomotive was plugged into wayside power. If operators wish to receive double ZE credit for plugging into wayside power in areas defined as DACs, the operators would need to report the total MWh provided to each locomotive by wayside power within the boundaries of a DAC and identify the DAC in which this occurred.

5. Subsection 2478.10(e). Annual ACP Reports.

Purpose

The purpose of subsection 2478.10(e) is to set forth the requirements for the Annual ACP Report. Locomotive operators using an approved ACP would need to submit an Annual ACP Report by July 1 of each year throughout the five-year verification period. The report must include: (1) the locomotive operator/company name; (2) a detailed explanation of the progress of the ACP for the prior calendar year; (3) a detailed accounting of the reductions achieved pursuant to the ACP for the prior calendar year, including all relevant calculations and values; (4) a detailed explanation as to how the reductions achieved by the ACP in the prior calendar year were real, quantifiable, verifiable, and enforceable; (5) the location(s) of the emission reductions that were achieved by the ACP in the prior calendar year; (6) a detailed accounting of the emission reductions that would have been achieved pursuant to the Spending Account section, IUOR section, or both (as applicable) for the prior calendar year; (7) and any other information that is necessary for the evaluation of whether the locomotive operator complied with the requirements of the ACP (this information would be required to be provided in the terms and conditions contained in the Executive Order approving the ACP).

Subsection (6)(A) specifies the information required to be reported for ACPs used as an alternative to the Spending Account section: 1. The amount of Spending Account funds that would have been required to be deposited in the prior calendar year; 2. The type of locomotives (Tier 4 or ZE) that these funds would have been used to purchase pursuant to

the Spending Account requirements; 3. The fair market value of the locomotives that would have been purchased (which is the value used to calculate the emission reductions that would have been achieved by these purchases); 4. Detailed calculations of the emission reductions that would have been achieved through these purchases; and 5. Documentation and calculations demonstrating compliance with the required assumptions described in subsection (b)(1) of the ACP section.

Subsection (6)(B) specifies the information required for ACPs used as an alternative to the IUOR section. Subsection (6)(B)1. requires that, for annual ACP reports covering the 2030 calendar year and later years, a description of all locomotives with a primary engine whose original engine build date is 23 years and older that would otherwise be prohibited from operating in the state pursuant to section 2478.5(a) and the amount of excess emissions those locomotives released by continuing to operate in California during the applicable calendar year instead of being replaced with Tier 4 locomotives or cleaner would need to be reported. Subsection (6)(B)2. requires that, for annual ACP reports covering the 2030 calendar year and any later years, a detailed description of all switch, industrial, or passenger locomotives operating in California with an original engine build date of 2030 or newer that would otherwise be prohibited from operating in the state pursuant to section 2478.5(b) and the amount of excess emissions that locomotive would have released if they continued to operate in California during the applicable calendar year instead of being replaced with ZE locomotives must be provided. Subsection (6)(B)3. requires that, for annual ACP reports covering the 2035 calendar year and later years, a detailed description of all freight line haul locomotive engines operating in California with an original engine build date of 2035 or newer that would otherwise be prohibited from operating in the state pursuant to section 2478.5(c) and the amount of excess emissions that would have released if they continued to operate in California during the applicable calendar year instead of being replaced with ZE locomotives must be provided.

For ACPs that serve as an alternative to both the Spending Account and IUOR sections, the ACP annual report must include the information listed in both subsections (6)(A) and (B).

Subsection (7) requires the report to include any other information that is necessary for the evaluation of whether the Locomotive Operator has complied with the requirements of the ACP section and the requirements of the ACP itself. Any additional information that would be required to be reported would be specified in the Executive Order specifying the ACP.

Rationale

Subsection 2478.10(e) is necessary to collect information needed to verify the ACP complies with the requirements set forth in the ACP section of the Proposed Regulation.

Subsection (1) is needed to correspond the ACP locomotive operator or company submitting the report with the approved ACP on file.

Subsection (2) is necessary to explain the progress of the ACP over the prior calendar year so that CARB could analyze whether the ACP has achieved the reductions necessary to comply with the ACP section.

Subsection (3) is necessary for staff to substantiate the reported emission reductions achieved by the ACP annually. Staff would need to review the calculations and values to ensure that the reductions achieved satisfy the requirements of the ACP section.

Subsection (4) is necessary for staff to confirm the emission reductions were real, quantifiable, verifiable, and enforceable, which determines whether the locomotive operator is implementing the ACP in compliance with the applicable requirements.

Subsection (5) is necessary to verify emission reductions were achieved at or within three miles of California railyard facilities or railroad tracks where locomotives operate in California as required by subsection (c) of the ACP section.

Subsection (6) is necessary to verify the accuracy of the calculations used to determine the emission reductions required to be achieved by the ACP.

Subsection (6)(A) is needed to verify the accuracy of the values and calculations used to determine the emission reductions required to be achieved by ACPs that serve as an alternative to the Spending Account section. Staff would require detailed information regarding the amount of funds that would have been required pursuant to the Spending Account section, the type of locomotives those funds would have been used to purchase, the fair market value of those locomotives, detailed calculations of the emission reductions that would have been achieved by purchasing Tier 4 or ZE locomotives using these funds, and documentation and calculations demonstrating that the assumptions required to be applied by subsection 2478.7(b)(1) were applied correctly, as applicable.

Subsection (6)(B) is needed to verify the accuracy of the values and calculations used to determine the emission reductions required to be achieved by ACPs that serve as an alternative to the IUOR section. Staff would require detailed descriptions of locomotives that would have been prohibited from operation in California pursuant to the applicable IUOR section and the amount of emissions those locomotives released as they continued to operate in California during the applicable calendar year instead of being replaced with cleaner locomotives.

Subsection (7) is necessary to require the report to include any other information that CARB would need to evaluate whether the locomotive operator had complied with the requirements set forth in the ACP section or set forth in the ACP itself. Individual ACPs could include a diverse range of actions that require specific information to be submitted to CARB for staff to be able to verify compliance, and staff cannot foresee all of the various types of information this could include. In order to provide certainty to the regulated community regarding these requirements, the Executive Order approving the ACP would list any additional information required to be included in the Annual ACP Report. The operator would have to submit such information as required by the Executive Order.

6. Subsection 2478.10(f). Idling Annual Report.

Purpose

The purpose of subsection 2478.10(f) is to set forth the requirement to report idling information annually by July 1 for the previous calendar year. Locomotive operators would be required to report for each locomotive that was not a ZE locomotive operated in California the following information: (1) whether the locomotive was AESS equipped; (2) the time, date, location, and duration of each instance when a locomotive idled for longer than 30 minutes in California; and (3) the reason for idling longer than 30 minutes in each such instance.

Rationale

Subsection 2478.10(f) is necessary so that CARB can verify compliance with the idling limits and investigate and enforce against violations of these requirements. As discussed in the Idling Requirements section of the Proposed Regulation, U.S. EPA regulations require all new locomotives to be equipped with AESS systems that must shut off the main locomotive engine(s) after 30 minutes of idling (or less).¹⁷⁰ The Idling Requirements section of the Proposed Regulation also requires AESS equipped locomotives limit idling to 30 minutes unless one of the exceptions applies.

To monitor compliance with the idling provisions, it would be necessary for locomotive operators to report specific idling information. In order to determine whether the idling requirements apply, staff would need to know whether the locomotive is equipped with an AESS. In addition to checking for compliance with the idling requirements of the Proposed Regulation, in order to evaluate the impact of idling on communities located near rail operations, staff would need to know the time, date, location, and duration of any instance when idling exceeds 30 minutes. To determine whether idling that exceeds 30 minutes falls under one of the listed idling exceptions, CARB would need to know the reason for each instance when a locomotive idled for longer than 30 minutes in California.

7. Subsection 2478.10(g). Historic Railroad Low-Use Exemption Annual Report.

Purpose

The purpose of subsection 2478.10(g) is to set forth the requirement that operators of historic railroads who claim the historic railroad low-use exemption must submit a Historic Railroad Low-Use Exemption Annual Report by July 1 of each calendar year. The report must contain the following information: (1) an attestation that all historic locomotives used by a historic railroad operating under a Historic Railroad Low-Use Exemption throughout the reporting period satisfy the definition of a historic locomotive; and (2) the gallons of fuel used by the operator's entire historic railroad fleet during the previous calendar year.

Rationale

Subsection 2478.10(g) is necessary so that CARB would have the information required to verify that a historic railroad's use of the Historic Railroad Low-Use Exemption is in compliance with the Proposed Regulation. CARB needs this information to verify that the historic railroad qualifies for the exemption. To do so, CARB would need to verify that all historic locomotives operated under the exemption during the prior year meet the definition of a historic locomotive. Also, CARB would need to verify that the operator's entire historic railroad fleet did not use a cumulative total of over 10,000 gallons of fuel during the prior year.

¹⁷⁰ U.S. EPA, 40 CFR 1033.115, accessed July 14, 2022. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-B/section-1033.115#p-1033.115>).

L. Section 2478.11. Administrative Payment.

Purpose

The purpose of section 2478.11 is to set forth the requirement that locomotive operators would pay a \$175 administrative payment per each diesel-powered locomotive or ZE capable locomotive that they operated in California during the previous calendar year. This payment would be due to CARB with the Locomotive Emissions Annual Reporting on July 1 of each year, starting in 2024. Historic locomotives, ZE locomotives, and ZE rail equipment would not be subject to this requirement. Subsection (1) specifies the payment process details and how applicable parties would be required to submit payments. Additionally, subsection (b) establishes that if any part of the administrative payment is, for any reason, held invalid, unconstitutional, or unenforceable by any court of competent jurisdiction as to any party, the Executive Officer would continue to assess and collect payments pursuant to this section from any regulated entities subject to this Locomotive Regulation that remain unaffected by the court order.

Rationale

Section 2478.11 is necessary for CARB to recover the cost of implementation and enforcement of the Proposed Regulation as allowed by SB 854¹⁷¹ and Health & Safety Code section 38597. This section is needed to specify who would be required to pay the administrative payment (the locomotive operator), when the payment would be due (July 1 of each year starting July 1, 2024, and the amount to be paid. It sets the annual administrative payment as \$175 for diesel-powered locomotives and ZE capable locomotives operated in California during the previous calendar year. This amount is based on the following: the direct labor cost of staff that would be needed to implement and enforce the Proposed Regulation; the indirect labor cost of management, administrative, and information technology resources; and operational costs that would be needed to support enforcement efforts (surveillance system equipment, data storage, etc.).

There would be no charge for historic locomotives, ZE locomotives, and ZE rail equipment. Historic locomotives would likely be exempt from the Spending Account and In-Use Operational Requirements pursuant to the Historic Railroad Low-Use Exemption section. Therefore, CARB would expend significantly less direct labor to administer the Proposed Regulation in the context of historic locomotives. Similarly, ZE locomotives and ZE rail equipment are not required to report to CARB under the Proposed Regulation unless requesting ZE credit in the years 2024 to 2030. Therefore, there would be significantly less costs associated with administering the Proposed Regulation for ZE locomotives and ZE rail equipment.

In addition, it is also necessary to specify that the Executive Officer would continue to assess and collect administrative payments in the event that a court strikes some, but not all, of these administrative payment provisions. Otherwise, there could be confusion as to whether CARB intended to assess the payment against unaffected entities or would rather prefer to re-do the entire administrative payment requirements.

¹⁷¹ Ca. Health and Safety Code §43019.1, Division 26, Senate Bill No. 854, June 27, 2019. (weblink: https://leginfo.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC§ionNum=43019.1).

M. Section 2478.12. Historic Railroad Low-Use Exemption.

Purpose

The purpose of section 2478.12 is to establish an exemption for historic railroads from the requirements of the Spending Account and IUOR sections.

Rationale

Subsection 2478.12 is necessary because the preservation of a historic locomotive in its original state is key to educate, preserve, or interpret historical experiences. In order to preserve the original condition of these locomotives, historic railroads may retain the diesel engines that were historically used without being subject to the requirements in the Spending Account and IUOR sections.

1. Subsection 2478.12(a). Historic Railroad Low-Use Exemption.

Purpose

Subsection 2478.12(a) sets forth the requirements for a historic railroad fleet to be exempt from the Spending Account and IUOR sections pursuant to the Historic Railroad Low-Use Exemption. A historic locomotive operator could apply for a Historic Railroad Low-Use Exemption if: (1) the historic railroad meets the definition of "historic railroad" in the Definitions section of the Proposed Regulation; and (2) the operator's entire historic railroad fleet does not use more than 10,000 gallons of fuel collectively during each calendar year.

Rationale

Subsection 2478.12(a) is necessary to set forth the requirements of the Historic Railroad Low-Use Exemption. Staff surveyed California historic railroads to determine the average usage amounts historic railroads typically require to carry out their objectives. From the survey data, it was determined that providing an exemption to historic railroads that use 10,000 gallons or less of fuel annually will permit historic railroads to operate while still limiting diesel emissions produced.

2. Subsection 2478.12(b). Historic Railroad Low-Use Exemption.

Purpose

The purpose of subsection 2478.12(b) is to establish that historic locomotive operators would need to apply for the exemption at least 90 calendar days prior to when they would like the exemption to begin.

Rationale

Subsection 2478.12(b) is necessary to set forth the timeline operators would need to submit the application for exemption. The timeline was chosen to provide CARB staff at least 90 calendar days to validate and issue a Historic Railroad Low-Use Exemption. Although there are few historic railroads and historic locomotives in California, staff believes 90 days would be necessary to ensure historic railroads submit the required information and to verify that information.

3. Subsection 2478.12(c). Historic Railroad Low-Use Exemption.

Purpose

Subsection 2478.12(c) sets forth the information that a historic railroad would need to submit to apply for the Historic Railroad Low-Use Exemption. Subsection (1) would require the historic railroad submit the locomotive operator's business name, as registered with the government (such as the California Secretary of State). Subsection (2) would require the following information to be submitted for each historic locomotive: (A) locomotive serial number; (B) engine serial number; (C) engine's rated horsepower; and (D) average or predicted annual fuel usage.

Rationale

Subsection 2478.12(c) is necessary to list the information that would need to be included in the application so that staff could substantiate that historic railroad fleets seeking exemption from the Spending Account and IUOR sections meet the criteria for a Historic Railroad Low-Use Exemption. Subsection (1) would be required to connect the application to the locomotive operator seeking the exemption. Under subsection (2)(A)–(D), CARB would require the locomotive's serial number and locomotive engine number for identification purposes and the locomotive horsepower and the annual average or projected fuel use amount so that staff could confirm that the historic railroad fleet meets the requirement that it does not exceed 10,000 gallons of fuel used per year.

4. Subsection 2478.12(d). Historic Railroad Low-Use Exemption.

Purpose

The purpose of subsection 2478.12(d) is to set forth the process for when a Historic Railroad Low-Use Exemption application is deficient. If an application for a Historic Railroad Low-Use Exemption is incomplete, inaccurate, or is not submitted as required by the Submittals to CARB section, the Executive Office will issue notify the applicant of the deficiency within 30 calendar days. If the applicant does not correct the deficiency and resubmit the application within 30 calendar days from the notification of the deficiency, the application will be denied.

Rationale

Subsection (d) is necessary to establish the process for when an application is incomplete, inaccurate, or is not submitted as required by the Submittals to CARB section (such as, for example, if the report does not include the required attestation). CARB would notify the applicant of the deficiency within 30 calendar days of receipt of the application. Staff determined that 30 days is the appropriate amount of time for CARB to evaluate the application and identify any deficiencies. The applicant would have 30 calendar days from the notice of deficiency to correct the deficiencies and resubmit an application, or it would automatically be denied. Staff believes 30 days to be sufficient time for applicants to correct, gather the requested data, and resubmit to CARB.

5. Subsection 2478.12(e). Historic Railroad Low-Use Exemption.

Purpose

The purpose of section 2478.12(e) is to establish the requirements and timeline for approval of a Historic Railroad Low-Use Exemption application. If CARB determines that the application was complete, accurate, and timely submitted as required by the Historic Railroad Low-Use Exemption section and the Submittals to CARB section and all standards for eligibility listed in subsection (a) were met, CARB would approve a Historic Railroad Low-Use Exemption. The Executive Officer would notify the applicant of the approval within 90 calendar days of the date the application is received by CARB.

Rationale

Subsection (e) is necessary to establish the requirements and timeline for approval of a Historic Railroad Low-Use Exemption application. Since the application for the exemption must be submitted 90 calendar days prior to when the historic railroad would like to begin to use the Historic Railroad Low-Use Exemption, CARB selected 90 calendar days as the timeframe within which CARB will notify the applicant whether the application was approved.

6. Subsection 2478.12(f). Historic Railroad Low-Use Exemption.

Purpose

The purpose of subsection 2478.12(f) is to set forth the process for CARB denying an application for a Historic Railroad Low-Use Exemption. This subsection establishes that if CARB determines the application was untimely or if the application did not satisfy all the requirements to be eligible, CARB would deny the applicant the Historic Railroad Low-Use Exemption. The Executive Officer would notify the applicant of a denial within 90 calendar days of the date the application was received by CARB.

Rationale

Subsection (f) is necessary to establish the reasons CARB would deny an application for the Historic Railroad Low-Use Exemption and set forth the procedures for notifying a historic railroad that their application did not meet the requirements and was denied. Staff believes 90 days would be necessary to ensure staff has time to review and verify information submitted, determine whether the eligibility requirements are satisfied, and prepare a notice of denial for a Historic Railroad Low-Use Exemption.

7. Subsection 2478.12(g). Historic Railroad Low-Use Exemption.

Purpose

The purpose of subsection 2478.12(g) is to set forth the Historic Locomotive Low-Use Exemption validity and expiration requirements. An approved Historic Railroad Low-Use Exemption does not expire, but CARB may revoke it at any time if any historic locomotive in the applicant's fleet does not meet the requirements of the Historic Railroad Low-Use exemption or violates any other requirements of the Proposed Regulation.

Rationale

Subsection (g) is necessary to establish that the Historic Locomotive Low-Use Exemption would not expire because historic locomotive fleets rarely change and are generally low-use. Therefore, it would not be necessary for a historic railroad to apply for a new exemption each calendar year. This would save processing time for both the regulated community and CARB. However, it is necessary for CARB to be able to revoke an exemption at any time if the fleet no longer met the requirements of the exemption or violates other requirements of the Proposed Regulation.

8. Subsection 2478.12(h). Historic Railroad Low-Use Exemption.

Purpose

The purpose of subsection 2478.12(h) is to establish that no person would be able to comply using a Historic Low-Use Exemption unless it has been formally approved in writing by the Executive Officer.

Rationale

Subsection (h) is necessary so applicants would know that they were subject to the Spending Account and In-Use Operational Requirements unless they had an approval for the exemption.

9. Subsection 2478.12(i). Historic Railroad Low-Use Exemption.

Purpose

The purpose of subsection (i) is to set forth the annual reporting requirements applicable to historic railroad operators. It provides that, by July 1 of each year, the historic railroad operator would need to report to CARB all the information required to be submitted in the Locomotive Emissions Annual Report in section 2478.10(c), the Idling Report in section 2478.10(f), and the Historic Railroad Low-Use Exemption Annual Report in section 2478.10(g). These reports would be due by July 1 of each year.

Rationale

Subsection (i) is necessary to specify the annual reports required to be submitted by historic railroad operators, which includes the Locomotive Emissions Annual Report, the Idling Annual Report, and the Historic Railroad Low-Use Exemption Annual Report. It is necessary for historic railroad operators to submit a Locomotive Emissions Annual Report to determine if they have exceeded the 10,000 gallon of fuel annual limit as required. It is necessary for historic railroad operators to submit an Idling Annual Report because historic locomotives are not exempt from the idling requirement, and CARB needs the Idling Annual Report to verify whether historic locomotives are excessively idling. CARB will need to review the information required to be submitted in the Historic Railroad Low-Use Exemption Annual Report to ensure that the exemption is being properly applied. Specifically, CARB would verify that the operator met the definition of historic railroad and that the historic railroad fleet did not use more than 10,000 gallons of fuel during each calendar year for which the exemption applies. Staff selected an annual due date of July 1 to be consistent with all of the reporting requirements of the Proposed Regulation.

10. Subsection 2478.12(j). Historic Railroad Low-Use Exemption.

Purpose

The purpose of subsection (j) is to establish that the Historic Locomotive Low-Use Exemption only exempts historic railroad operators from the Spending Account and IUOR sections of the Proposed Regulation (as provided in subsection (a)). All other requirements of the Proposed Regulation remain applicable.

Rationale

Subsection (j) is necessary to provide clarity regarding the scope of the exemption, which would only exempt historic railroads from the Spending Account and IUOR sections. For example, historic railroads would still be required to limit idling to reduce harmful emissions and report locomotive information as per the requirements of the Proposed Regulation, so CARB can stay informed of the locomotives operating in California annually.

N. Section 2478.13. Small Business Hardship Extension.

Purpose

The purpose of section 2478.13 is to set forth the criteria and the deadline for small businesses to request an extension of regulation requirements based on financial hardship.

Rationale

Section 2478.13 is necessary because small businesses may need additional time to come into compliance with the Spending Account and the IUOR sections.

1. Subsection 2478.13(a). Small Business Hardship Extension.

Purpose

The purpose of 2478.13(a) is to set forth the requirements for a small business to qualify for the Small Business Hardship Extension as well as the deadline for the application. Specifically, locomotive operators whose gross revenue did not exceed a gross revenue cap of five million dollars annually, adjusted for inflation, in each of the three years preceding the application could submit an application to the Executive Officer requesting a hardship extension. Requests for hardship extensions would need to be submitted by March 1 of the year following the calendar year for which the extension is sought. For example, a small business that wished to submit a Small Business Hardship Extension petition to extend the applicable requirements in the Spending Account section for the 2024 calendar year would be required to submit the petition to the Executive Officer by March 1, 2025. The applications must be submitted following the requirements set forth in the Submittals to CARB section of the Proposed Regulation.

Subsection (1) would require that the annual inflation adjustment would be made using the five-million-dollar cap following the methodology: Inflation Adjusted Gross Revenue Cap = \$5,000,000 * (U.S. Consumer Price Index [reference year]/U.S. Consumer Price Index [2019]).

Subsection (2) would require the gross revenue cap to be adjusted annually using the Bureau of Labor Statistics' Consumer Price Index for All Urban Consumers.

Rationale

Subsection 2478.13(a) is necessary to define which businesses could apply for the Small Business Hardship Extensions. Staff modeled the estimated costs of compliance with the Proposed Regulation for the smallest operators: Class III and industrial locomotive operators. Staff identified that operators that have an average annual revenue over five million dollars are already buying new locomotives using their revenue and often grants. Businesses with less than five million dollars in revenue per year rarely, if ever, purchased new locomotives and primarily operate pre-Tier 0 engines, which have the highest emissions and would also incur the highest Spending Account charges. These businesses may need additional time and flexibility in order to come into compliance with the Spending Account or the IUOR sections.

Staff assessed the costs of the Proposed Regulation to a small business as a percent of their annual revenue. Recognizing that the Proposed Regulation's requirements may challenge some small businesses, especially those operating the oldest locomotives, staff has included a Small Business Hardship Extension provision. The provision would apply to operators that can demonstrate to CARB that full payment of Spending Account charges and/or application of the requirements in the IUOR section, would prevent the locomotive operator from meeting other financial obligations as they come due or would cause bankruptcy or the closure of their business.

CARB is requesting applications be submitted by March 1 because it would allow time for CARB to process and evaluate the application prior to the annual Spending Account deposit date (July 1).

2. Subsection 2478.13(b). Small Business Hardship Extension.

Purpose

The purpose of subsection 2478.13(b) is to set forth the extensions and reduction of funds that can be provided to a small business if a request is approved, the parameters of which would be specified in the Executive Order approving the Small Business Hardship Extension. Specifically, approval could grant the applicant any of the following: (1) up to a three-year extension in the time required to set aside funds into the Spending Account; (2) a reduction in the amount of funds required to be set aside in the Spending Account for up to three-years; and (3) up to a three-year extension in the time allowed to operate a locomotive that does not comply with the In-Use Operational Requirements. The approval could grant one of the three forms of relief or could grant any combination thereof, including two of the three or all three.

Rationale

Subsection 2478.13(b) would be necessary to establish the relief that could be provided pursuant to the Small Business Hardship Extension section. Subsections (1)-(3) set forth the relief that may be granted if the application for a Small Business Hardship Extension were to be approved. The Executive Order approving the application would specify which of these forms of relief apply and would include the parameters of that relief per subsection (f). CARB anticipates that offering flexibility regarding these requirements of the Proposed Regulation for up to three years would allow small businesses time to seek grant assistance and to explore alternatives such as smaller switchers, railcar movers, renting, leasing, etcetera, in

order to come into compliance with the applicable sections. Therefore, CARB requires the extensions would be granted for no longer than three years at a time.

Subsection (1) would allow CARB to grant the applicant up to a three-year extension in the time needed to deposit the funding requirement into the Spending Account. This provision was included because small businesses may require additional time to collect and deposit the required funding into the Spending Account. Staff would evaluate the financial hardship documentation submitted along with the application to determine whether to grant this extension. The Executive Order approving the application would specify the amount of time for which the extension would apply and the date when the Spending Account funding requirement must be deposited once the extension expires.

Subsection (2) would allow CARB to reduce the amount of funds required to be set aside in the Spending Account for up to three years. This provision was included because small businesses may not have sufficient funds to set aside the funding required by the Spending Account section. Staff would evaluate the financial hardship documentation submitted along with the application to determine whether to grant this reduction in the Spending Account funding requirement. The Executive Order approving the application would specify the amount of the reduction allowed.

Subsection (3) would allow an extension of the ability to operate an otherwise non-compliant locomotive under the IUOR section for up to three additional years. This provision was included because small businesses may not have the funds available to purchase newer locomotives that cannot be operated in California pursuant to the IUOR section.

3. Subsection 2478.13(c). Small Business Hardship Extension.

Purpose

Subsection 2478.13(c) lists the requirements regarding what would need to be submitted in an application for a Small Business Hardship Extension by a locomotive operator who met the requirements of subsection (a).

Subsection (1) would require financial documentation demonstrating gross revenue for the three years prior to the submission of the application per subsection (a). For example, if the application is submitted in 2024, this would require records for the full years of 2021, 2022, and 2023.

Subsection (2) would require an identification of the type of relief that the operator requests per subsection (b). The operator would need to indicate whether they are applying for the type of relief specified in subsection (b)(1), (2), or (3), or some combination thereof.

Subsection (2)(A)–(C) would require information related to the specific type of relief sought.

Subsection (2)(A) provides that, if the operator were to seek an extension of the deadline for the deposit of funds in the Spending Account, they would need to provide the amount of time requested for the extension, an explanation of why that additional time was needed, and evidence demonstrating that setting aside funds into the Spending Account by the deadline required by the Spending Account section would prevent the locomotive operator from meeting financial obligations that would cause bankruptcy or the closure of their business.

Subsection (2)(B) provides that, if the operator were to seek a reduction in the amount of funds required to be deposited in the Spending Account, they would be required to provide the amount of the reduction requested, the timeframe over which they would like the reduction to apply, an explanation of why the reduction was needed throughout that timeframe, and evidence demonstrating that setting aside funds into the Spending Account as required by the Spending Account section would prevent the Locomotive Operator from meeting financial obligations that would cause bankruptcy or the closure of their business.

Subsection (2)(C) provides that, if the operator were to seek an extension of the time they are allowed to operate a locomotive in California that does not comply with the IUOR section, they would need to provide the amount of time requested for the extension, an explanation of why that additional time is needed, evidence demonstrating that the application of the applicable requirements from the IUOR section would prevent the locomotive operator from meeting financial obligations that would cause bankruptcy or the closure of a business, and a list of the locomotives that the locomotive operator would like to continue to operate in California under the extension that identifies the locomotive road number and serial number.

Subsection 2(D) would require a minimum of three years of the operator's tax data and lists the forms that this may cover depending on the corporate structure of the operator.

Subsection 2(E) requires any other evidence necessary to demonstrate hardship, including, where applicable: financial statements prepared by an outside accounting firm, budgets and year-to-date results, asset ledgers, and real estate and property tax records.

Rationale

Subsection 2478.13(c) is necessary to specify the information and documentation that must be submitted in a Small Business Hardship Extension application. This application must be submitted as required in the Submittals to CARB section and include the information listed in subsections (c)(1)–(2).

Subsection (1)'s requirement for financial documentation demonstrating gross revenue for three years would be necessary to ensure that the locomotive operator satisfies the requirements of subsection (a), which provides that gross revenues for the last three years may not exceed five million dollars annually in order to apply for the extension. It would be necessary for CARB to analyze an applicant's ability to comply before granting the Small Business Hardship Extension. To assist in the determination of financial hardship, CARB would request three years of tax data because three years of tax data would be sufficient to demonstrate the financial condition of the applicant and whether they are eligible for the extension.

Subsection 2 is necessary so that CARB would be aware of the type of relief sought and would have the information and evidence needed to evaluate whether to approve the application and to determine the parameters to be set forth in the Executive Order approving the application. Subsection (A) is necessary because, if the application is for an extension to the Spending Account funding obligation, CARB would need to know the amount of time requested, an explanation of why that additional time is necessary, and evidence demonstrating compliance with the Spending Account section's timeframe would not be financially feasible. Subsection (B) is necessary because, if the application is for a reduction in the Spending Account funding obligation, CARB would need to know the amount of the reduction requested, how long the reduction will remain in place, an explanation of why that reduction is necessary, and evidence demonstrating compliance with

the amount of funds required to be set aside in the Spending Account section would not be financially feasible. Subsection (C) is necessary because, if the application is for an extension to the IUOR section, CARB would need to know the amount of time requested, an explanation of why that additional time would be necessary, evidence demonstrating compliance with the IUOR section's timeframe would not be financially feasible, and a list of the locomotives they would like to continue to operate in California under the extension. This list is necessary so CARB would be able to identify the locomotives requested to be covered.

The documentation required by subsection (D) would be necessary for staff to evaluate the financial condition of the locomotive operator to verify that relief should be granted. Subsections (D)1.-7. specify the forms to be submitted, depending on the corporate structure or type of entity that the locomotive operator is. Subsection (E) is necessary to demonstrate the financial hardship faced by the locomotive operator, and requires documentation necessary to substantiate claims of financial hardship that may be applicable on a case-by-case basis.

4. Subsection 2478.13(d). Small Business Hardship Extension.

Purpose

The purpose of subsection 2478.13(d) is to set forth the framework for the Executive Officer's approval of applications for a Small Business Hardship Extension. To be approved, the applications must be complete, accurate and timely, and the submittal must follow the requirements set forth in the Submittals to CARB section. The Executive Officer would evaluate the information and documentation submitted with the application in determining whether to approve or disapprove the application and in determining what relief was appropriate.

Rationale

Subsection 2478.13(d) is necessary to establish the process for the Executive Officer's approval of a Small Business Hardship Extension. It is necessary to provide that approval is contingent on submittal of a complete and accurate application by the March 1 deadline specified in subsection (a) and that the submittal followed the requirements in the Submittals to CARB section (including the attestation requirement). The March 1 deadline is necessary to ensure that CARB receives the application in time to be able to issue a decision prior to the July 1, Spending Account deposit. It is necessary to specify that the Executive Officer's evaluation of the application includes a determination regarding what relief will be granted because the extension may result in an extension to the Spending Account funding requirement, a reduction in the funding requirement, or an extension to the IUOR section, or any combination thereof.

5. Subsection 2478.13(e). Small Business Hardship Extension.

Purpose

Subsection 2478.13(e) is necessary to set forth the computer models CARB will use to determine whether financial hardship justifies approval of an application for a Small Business Hardship Extension. The three models set forth in subsections (1)-(3) would be used depending on the operator's corporate form or type of entity.

Rationale

Subsection 2478.13(e) is necessary to specify the computer model CARB would use to analyze the financial hardship claims presented in the Small Business Hardship Extension application, which would depend on the locomotive operator's corporate form or type of entity. The use of computer models ABEL, INDIPAY, and MUNIPAY would enable staff to thoroughly model the financial challenges of the small business, and to reach a well-informed opinion supported by recognized modeling that would indicate whether to grant an extension. These are the same penalty and financial models used by U.S. EPA for analyzing the financial aspects of enforcement actions.¹⁷²

6. Subsection 2478.13(f). Small Business Hardship Extension.

Purpose

The purpose of subsection 2478.13(f) is to set forth the process for the approval or disapproval of a Small Business Hardship Extension application. Within 90 calendar days of the submission of the application, CARB would issue an approval or denial. If the application is approved, the Executive Officer will issue an Executive Order approving the application. If the application is denied, the Executive Office will issue notify the operator in writing of the disapproval.

Subsection (1) provides that, if the application were to be approved, the Executive Order would specify the type of relief granted (whether it is an extension or reduction in the Spending Account or relief from the IUOR section, or any combination thereof). The Executive Order would specify the parameters of that relief, including the start date of the applicability of the extension and the duration of the extension. For example, it could specify that an extension will begin to be applicable on January 1, 2025 and extend for three years. It establishes that, in the event of an approval, the operator would only be granted relief from the specific provisions identified in the Executive Order according to the terms set forth therein. Subsection (A) states that, if an extension to the date of the annual deposit obligation were to be granted, the Executive Order would specify the date when the funds would be due. Subsection (B) states that, if a reduction of the Spending Account funding requirement were to be granted, the Executive Order would specify the amount of the reduction. Subsection (C) states that, if the Executive Order provides relief to the IUOR Section, the Executive Order will specify the timeframe, up to three years, the locomotives may continue to operate in California without penalty

Subsection (2) allows the Executive Officer to disapprove of an application if the operator is out of compliance with the Proposed Regulation.

Rationale

Subsection 2478.13(f) is necessary to establish the process for the approval or disapproval of an application for a Small Business Hardship Extension. Staff chose 90 days following submission as the deadline for CARB's issuance of an approval or disapproval. Because of the complicated nature of financial records and the amount of documentation that will need to

¹⁷² U.S. EPA, Penalty and Financial Models, May 4, 2022, accessed July 18, 2022. (weblink: <https://www.epa.gov/enforcement/penalty-and-financial-models>).

be processed for Small Business Hardship Extensions, staff determined it could take up to 90 days to process and evaluate the application (including running the applicable computer model) and issue an Executive Order or a notice of disapproval.

Subsection (1) is necessary to specify that the Executive Order would provide the type(s) of relief granted so that it is clear whether the relief applies to an extension to the annual funding deposit deadline, a reduction in the amount required to be deposited in the Spending Account, or relief from the requirements of the IUOR section. The start date and duration of the extension is necessary to be included in the Executive Order so that it is clear when the applicable extension will be effective. The information required to be included in Subsections (1)(A)–(B) are necessary so that the locomotive operator has certainty regarding the parameters of the relief granted. Subsection (A) is necessary when the Executive Order approves an extension to the annual funding deposit deadline for the Spending Account so that it is clear the date when the funds will be due following the extension. Subsection (B) is necessary when the Executive Order approves a reduction in the Spending Account funding obligation so that it is clear the amount of the reduction that is granted. Subsection (C) is necessary when the Executive Order provides relief to the IUOR section so that it is clear what that relief entails. For Small Business Hardship Extensions granting some combination of these forms of relief, the Executive Order would need to specify all of the information applicable to the forms of relief granted.

Subsection (2) is necessary for the Executive Officer to retain discretion regarding whether to disapprove of an application if the operator is out of compliance with the Proposed Regulation.

7. Subsection 2478.13(g). Small Business Hardship Extension.

Purpose

The purpose of subsection 2478.13(g) is to set forth the process for CARB to issue a notice of deficiency if an application is inaccurate or incomplete, which must occur within 90 days of the submission of the application. The applicant would then have 30 days following the notification to submit a reapplication correcting the deficiency or the application will be denied.

Rationale

Subsection 2478.13(g) is necessary to establish the process for when an application would be deemed deficient because it was inaccurate or incomplete. If the application were to be found deficient, the applicant would have 30 calendar days from the date of the notice to return a completed application or the application would be denied. This timeline would allow for documentation to be collected but still allow time for the application to be processed prior to the July 1 Spending Account deposit. If the applicant failed to correct the deficiency in that time, the application would be deemed denied.

8. Subsection 2478.13(h). Small Business Hardship Extension.

Purpose

The purpose of subsection 2478.13(h) is to set forth the expiration and revocation process for the Small Business Hardship Extension. A Small Business Hardship Extension that has expired

or been revoked shall not be used for compliance with the Proposed Regulation. Subsection (1) provides that a Small Business Hardship Extension is only valid for the time period specified in the Executive Order approving the extension and expires after the time period specified in the extension. Subsection (2) provides that an approved Small Business Hardship Extension may be revoked at any time by the Executive Officer for any of the following reasons: (A) the operator fails to meet the requirements of the Small Business Hardship Extension section, including the requirement to submit complete, accurate, and timely reports as required by the Recordkeeping and Reporting Requirements section; (B) the operator fails to meet the requirements set forth in the Executive Order granting the Small Business Hardship Extension; and (C) the operator is not in compliance with any other applicable requirement in the Proposed Regulation. Subsection (3) establishes that CARB will provide notice of revocation, including the date of the official revocation, to the applicant in writing at least 30 calendar days prior to the official revocation.

Rationale

Subsection (h) is necessary to establish the process for expiration and revocation of a Small Business Hardship Extension. Subsection (1) provides that an approved Small Business Hardship Extension is only valid for the time period as specified in the Executive Order and expires after the time period specified in the Executive Order. Subsection (2) provides that an approved Small Business Hardship Extension may be revoked at any time by the Executive Officer for any of the reasons listed in subsection (2)(A)–(C). Subsection (2)(A) allows for revocation if the locomotive operator fails to meet the requirements of the Small Business Hardship Extension, including but not limited to submittal of all applicable annual reports required by the Recordkeeping and Reporting section that are complete, accurate, and timely. Subsection (2)(B) allows for revocation if the locomotive operator fails to meet the requirements set forth in the Executive Order granting the Small Business Hardship Extension itself. This is necessary if at any point CARB staff determines a Small Business Hardship Extension is not being used as set forth in the Executive Order. Subsection (2)(C) is necessary to allow for revocation of the Small Business Hardship Extension if the operator is not in compliance with any other applicable requirements in the Proposed Regulation. For example, if the operator uses an extension from the Spending Account requirements but is in violation of the IUOR section, CARB has the discretion to revoke the exemption due to their failure to comply with the IUOR section.

Subsection (3) is necessary because it establishes the process for CARB to issue the notice of revocation to the applicant. It requires that CARB would send notice of revocation in writing at least 30 calendar days prior to the official revocation. The 30 days was chosen as it is a reasonable timeframe to provide notice to the regulated entity while providing CARB enough time. It is also consistent with other CARB regulation timeframes.

O. Section 2478.14. Submittals to CARB.

Purpose

The purpose of this section 2478.14 is to set forth the requirements for submitting documentation to CARB.

Subsection (a)(1) requires submittals to be in writing and in English.

Subsection (a)(2) requires all submittals to CARB required by the Proposed Regulation to include an attestation signed by the operator or responsible official certifying under penalty of perjury that the information contained in the submittal is true, accurate, and complete.

Subsection (a)(3) specifies that submittals may be submitted either by mail to the address provided, via an online reporting system, or by email to the provided email address.

Subsection (a)(4) specifies that if the submittal is via mail, CARB must be notified by email that the submittal is being mailed, including the date it was mailed.

Rationale

Section 2478.14 is necessary to establish the required process for all documentation submitted to CARB for the Proposed Regulation. Consistent and uniform submittals help staff with processing documents in a timely manner. It would be important that the regulated community have clear guidance in where and how to submit documentation required in the Proposed Regulation.

Subsection (a)(1) is necessary to ensure that all submittals would be in writing and would be in English so that CARB would be able to evaluate the submittals without requiring translation.

Subsection (a)(2) is necessary to confirm all submitted information would be true, accurate, and complete, which would help ensure accurate implementation of the Proposed Regulation.

Subsection (a)(3) is necessary to specify the methods for submittal. If the submittal were via mail or email, it is necessary to provide the address or email address to submit to. CARB may develop an online reporting system that operators may use for submittals, so staff would provide this as an avenue for submittal.

Subsection (a)(4) is necessary to require operators that would send submittals by mail to notify CARB by email that the submittal is being mailed. Notification would make it easier for staff to track submitted data and ensure receipt.

P. Subsection 2478.15(a). Non-Compliance, Penalties, and Right of Entry.

Purpose

The purpose of subsection 2478.15 is to set forth specifics regarding violations of the Proposed Regulation and penalties for noncompliance.

Subsection (a)(1) provides that each individual violation of each section, subsection, or provision of the Proposed Regulation is a separate offense.

Subsection (a)(2) provides that, each day during any portion of which a violation occurs is a separate offense.

Subsection (a)(3) provides that each violation of sections 2478.4 through 2478.14 constitutes a separate offense for each locomotive (applicable to provisions that are specific to a locomotive(s)) and for each day during any portion of which a violation occurs. For example, if an operator continues to operate in California three locomotives that are prohibited from

operation in California for a full calendar year, that constitutes 1,095 days of violation (3 locomotives x 365 days).

Subsection (a)(4) provides that penalties are cumulative. If multiple violations occur over multiple days, the associated penalties may be added during an enforcement action.

Penalties for violations of the Proposed Regulation are described in the California Health & Safety Code, section 43016.

Rationale

Subsection 2478.15(a) is necessary so that CARB would be able to factor in the number of violations, the number of locomotives in violation, and the days during which these violations occurred when assessing penalties. For example, CARB would assess a larger penalty for an operator who continues to operate numerous locomotives in California for a full year beyond the date when that locomotive was prohibited from operation in California by the IUOR section than would be assessed for an operator who operates one locomotive for one day beyond that date. Therefore, CARB has established each day or portion of a day in which a violation occurs would be a separate offense and each locomotive in violation would constitute a separate offense for each day in which a violation occurs. It is necessary that penalties are cumulative so that CARB would be able to assess penalties based on the cumulative total of all violations by all locomotives over all the days in which those violations occurred.

1. Subsection 2478.15(b). Non-Compliance, Penalties, and Right of Entry.

Purpose

The purpose of subsection 2478.15(b) is to provide CARB with the right of entry to inspect any locomotive, vehicle, vessel, or premises in California on which an air pollution source is located for the purposes of inspecting that source, including taking samples.

Rationale

Subsection 2478.15(b) is necessary to ensure that CARB would be able to gain access to sources of air pollution to inspect them and ascertain information that may be necessary to substantiate compliance with the Proposed Regulation. Thus, the right of entry subsection has been included so that CARB would be able to inspect any locomotive, vehicle, vessel, or premises that is a source of air pollution, including taking samples. This provision is necessary to provide CARB with the information required to analyze whether an operator is in compliance and to take the appropriate enforcement action.

Q. Section 2478.16. Severability.

Purpose

The purpose of section 2478.16 is to establish that the Proposed Regulation is severable.

Section 2478.16 provides that, if any section, subsection, paragraph, subparagraph, sentence, clause, phrase, or portion of the Proposed Regulation (or application thereof to any person or circumstances) is, for any reason, held invalid, unconstitutional, or

unenforceable by any court of competent jurisdiction, that portion or application would be deemed separate, distinct, and independent, and would not affect the validity of the remaining applications or portions of the Proposed Regulation.

Rationale

Subsection 2478.16 is necessary to ensure that the purpose of the Proposed Regulation (to achieve emission reductions from locomotives in California) would still be met to the fullest extent possible even if some portions of the Proposed Regulation were stricken or if some applications of the Proposed Regulation to certain circumstances are held to be invalid, unconstitutional, or unenforceable. As such, it is necessary to ensure that if any portion of the Proposed Regulation were severed by court action or if its application to certain circumstances is invalidated, the remaining portions of the Proposed Regulation or circumstances to which it could be applied would remain in effect.

IV. Benefits Anticipated from the Regulatory Action, Including the Benefits or Goals Provided in the Authorizing Statute

A. Health Benefits

This section provides a summary of the health benefits due to reduction in emissions from diesel-powered locomotives through the Proposed Regulation. For more detailed information on the health impacts, see Appendix H: Health Analyses.

Exposure to emissions from diesel-powered locomotives has both potential cancer and noncancer health impacts. For the Proposed Regulation, CARB staff conducted a Health Risk Characterization (HRC) to evaluate the impacts of the Proposed Regulation on potential cancer risks from direct exposure to diesel particulate matter (PM) from diesel-powered locomotives. Staff also conducted a study of mortality and illness to understand the non-cancer health impacts associated with exposure to ambient levels of directly emitted particulate matter of 2.5 microns or less (PM_{2.5}) and secondary PM_{2.5} formed in the atmosphere from locomotive oxides of nitrogen (NO_x) emissions.

B. Reduction in Potential Cancer Risk

Between 2005 and 2008, CARB staff conducted Health Risk Analyses at 18 major railyards throughout the state to assess risk from exposure to emissions from diesel-powered locomotives.¹⁷³ The Health Risk Analyses illustrated that emissions from railyards increase cancer risk for people who live in surrounding communities (for more information on cancer impacts related to diesel engine emissions, see Appendix H: Health Analyses). To assess risk for the Proposed Regulation, staff built on the previous Health Risk Analyses to perform the HRC.

The HRC involved the scaling of prior studies to reflect current conditions. The work was meant to assess if there is a need to do new facility-specific assessments. Staff concluded that the HRC provided an adequate assessment of the cancer risk reduction that could be

¹⁷³ CARB, Health Risks Assessments of 18 Major Railyards in CA, 2007 – 2008, accessed July 19, 2022. (weblink: <https://ww2.arb.ca.gov/resources/documents/railyard-health-risk-assessments-and-mitigation-measures>).

obtained by reaching a Tier 4 average of locomotive emissions. The HRC analyzed the results under the conservative assumption of an all Tier 4 locomotive fleet by the year 2045.

The HRC focused on diesel PM (DPM) emitted from diesel engines that power locomotives and evaluated the cancer risks associated with DPM emissions from locomotives operating at railyards. Staff studied two representative railyards, one in Southern California, referred to as "Railyard A" and one in Northern California, referred to as "Railyard B."

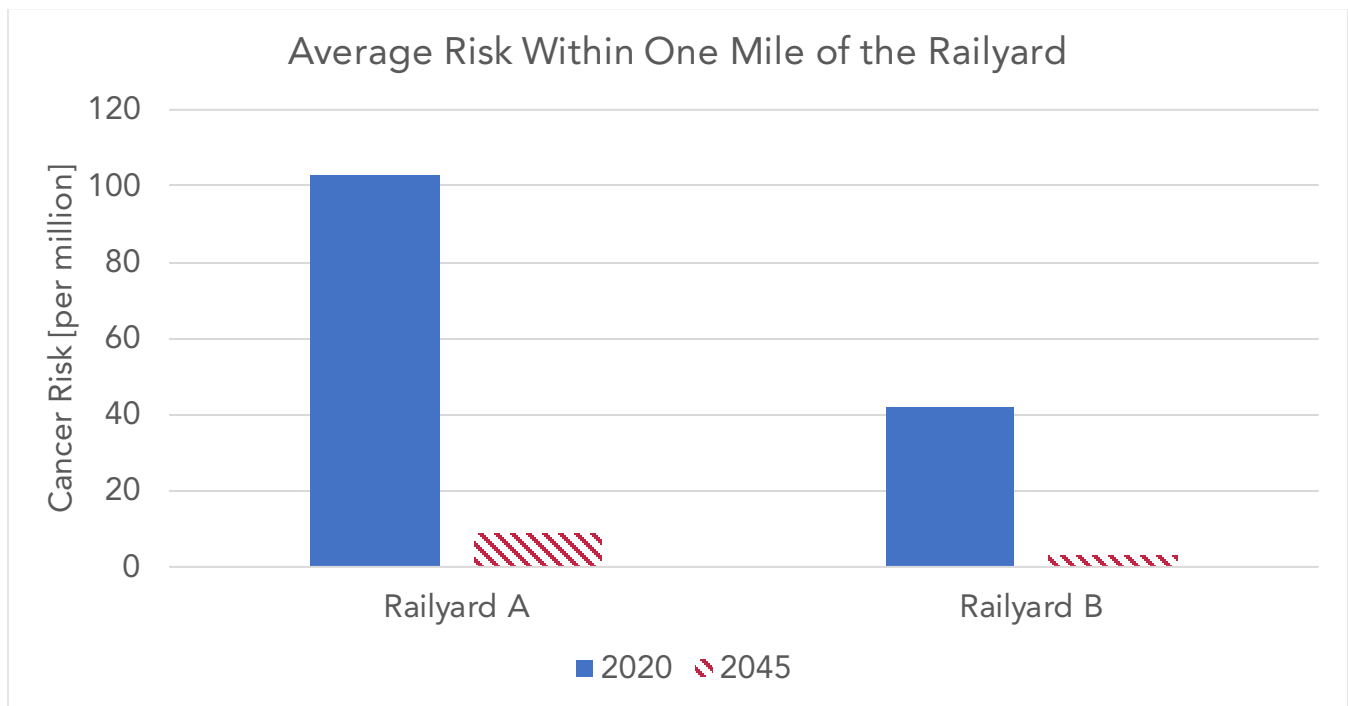
The HRC was intended to characterize the reductions in health risks for a representative railyard facility, and not a specific facility. Cancer risk was presented as the average cancer risk for residential receptors over a geographic area out to one mile from the railyard boundaries, rather than identifying specific receptors, such as a point of maximum impact or a maximally exposed individual resident.

C. Individual Residential Cancer Risk

Pursuant to the guidance in the 2015 OEHHA Cancer Risk Guidance Manual,¹⁷⁴ the average cancer risk was based on an assumed 30-year exposure duration. Figure 18 shows that the individual residential cancer risk due to locomotive operations for residents within one mile of the railyard is estimated to be reduced by approximately 91 to 93 percent in representative Railyards A and B respectively, if all locomotives in California had a Tier 4 emissions average. This corresponds to a reduction in cancer risk cause by diesel-powered locomotive DPM from 103 chances per million residents to 9 chances per million residents within one mile of Railyard A, and a reduction in risk from 42 chances per million residents to 3 chances per million residents within one mile of Railyard B. This result is commensurate with the projected change in average emissions from 2020 to 2045. The Proposed Regulation would eventually transition all locomotive operations to ZE, which would cause cancer risk from locomotive engine emissions to approach zero. However, the HRC provides a conservative estimation of cancer risk reduction by using locomotive activity averages at a Tier 4 emission rate.

¹⁷⁴ Air, Community, and Environmental Research Branch Office of Environmental Health Hazard Assessment California Environmental Protection Agency, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, February 2015. (weblink: <https://oehha.ca.gov/media/downloads/cnr/2015guidancemanual.pdf>).

Figure 18: Cancer Risk Near Railyards Studied in the Health Risk Characterization



D. Non-Cancer Health Impacts and Valuations

CARB staff evaluated the statewide non-cancer health impacts associated with exposure to NO_x and PM_{2.5} emissions from locomotives. NO_x includes nitrogen dioxide, a potent lung irritant, but its most serious impact on human health occurs when atmospheric processes convert NO_x into fine particles of ammonium nitrate. PM_{2.5} formed in this manner is termed secondary PM_{2.5}. Both directly emitted PM_{2.5} and secondary PM_{2.5} from locomotives are associated with adverse health outcomes such as cardiopulmonary mortality, hospitalizations for cardiovascular illness and respiratory illness, as well as emergency room visits for respiratory illness and asthma. As a result, reductions in NO_x and PM_{2.5} emissions are associated with reductions in these health outcomes. Detailed explanations of staff calculations of incidences of health outcomes per ton of emission can be found in Appendix H: Health Analyses. Staff estimated that the total number of cases statewide that would be reduced (from 2024 to 2050) from implementation of the Proposed Regulation are as follows:

- 3,233 avoided premature deaths.
- 500 avoided hospitalizations for cardiovascular illness.
- 597 avoided hospitalizations for respiratory illness.
- 1,486 avoided emergency room visits.

1. Monetization of Health Impacts

In accordance with U.S. EPA practice,¹⁷⁵ statewide valuations of health benefits from the Proposed Regulation were calculated by multiplying the avoided non-cancer health outcomes above by the valuation per incident. The total statewide valuation due to avoided health outcomes (from 2024 to 2050) are summarized in Table 9. The largest estimated health benefits correspond to regions in California with the most locomotive activity: South Coast, San Joaquin Valley, and Mojave Desert air basins. The estimated total statewide health benefits for the Proposed Regulation are estimated to be \$32 billion.

Table 9: Statewide Valuation from Avoided Adverse Health Outcomes Between 2024 and 2050 as a Result of the Proposed Regulation (2019\$)

Outcome	Valuation*
Avoided Premature Deaths	\$31,895,938,673
Avoided Hospitalizations	\$59,477,776
Avoided Emergency Room Visits	\$1,239,324
Total	\$31,956,655,772

* Values have been rounded and are based on the 2019-year dollar.

E. Air Quality and Climate Benefits

1. PM2.5 and NOx

The State Implementation Plan (SIP) Strategy describes how California is working toward attainment of federal ambient air quality standards, which are established to protect even the most sensitive individuals. The Proposed Regulation would gradually reduce the use of older, dirty locomotives in California and, in later years, require any locomotives operating in California to operate in a ZE configuration. This would achieve PM2.5 and NOx emission reductions and reduce ambient levels of ozone and PM2.5, helping to meet commitments outlined in the 2017 SIP Strategy¹⁷⁶ and the 2022 SIP Strategy: Draft Measures document.¹⁷⁷

Cumulatively from 2024 to 2050, the Proposed Regulation is estimated to achieve 7,455 tons of PM2.5 and 389,630 tons of NOx emission reductions as compared to the BAU baseline.

¹⁷⁵ U.S. EPA, Mortality Risk Valuation – What does it mean to place a value on a life? Accessed July 19, 2022. (weblink: <https://www.epa.gov/environmental-economics/mortality-risk-valuation#means>).

¹⁷⁶ CARB, Revised Proposed 2016 State Strategy for the State Implementation Plan, March 7, 2017. (weblink: <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>).

¹⁷⁷ CARB, Draft 2022 State Strategy for the State Implementation Plan, January 31, 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf).

Chapter V provides a detailed summary of the air quality benefits of the Proposed Regulation.

2. Greenhouse Gases

The benefit of greenhouse gas (GHG) reductions achieved by the Proposed Regulation can be estimated using the social cost of carbon (SC-CO₂), which provides a dollar valuation of the damages caused by one ton of carbon pollution and represents the monetary benefit today of reducing carbon emissions in the future.

The Council of Economic Advisors and the Office of Management and Budget assembled an Interagency Working Group on the Social Cost of Greenhouse Gases (IWG) to develop a methodology for estimating the SC-CO₂. The methodology relies on a standardized range of assumptions and can be used consistently when estimating the benefits of regulations across agencies and around the world.¹⁷⁸ Staff utilized the current IWG-supported SC-CO₂ values to consider the social costs of actions taken to reduce GHG emissions. This is consistent with the approach presented in the Revised 2017 Climate Change Scoping Plan, in line with the Office of Management and Budget Circular A-4 of September 17, 2003 and reflects the best available science in the estimation of the socioeconomic impacts of carbon.^{179, 180}

The IWG describes the social cost of carbon as follows:

The social cost of carbon (SC-CO₂) for a given year is an estimate, in dollars, of the present discounted value of the future damage caused by a 1-metric ton increase in carbon dioxide (CO₂) emissions into the atmosphere in that year, or equivalently, the benefits of reducing CO₂ emissions by the same amount in that year. The SC-CO₂ is intended to provide a comprehensive measure of the net damages - that is, the monetized value of the net impacts from global climate change that result from an additional ton of CO₂.

These damages include, but are not limited to, changes in net agricultural productivity, energy use, human health, property damage from increased flood risk, as well as nonmarket damages, such as the services that natural ecosystems provide to society. Many of these damages from CO₂ emissions today will affect economic outcomes throughout the next several centuries.¹⁸¹

The SC-CO₂ is year-specific and is highly sensitive to the discount rate used to adjust the value of the damages in the future due to CO₂. The SC-CO₂ increases over time as systems become more stressed from the aggregate impacts of climate change and future emissions

¹⁷⁸ Additional technical detail on the IWG process is available in the Technical Updates of the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866 (by the Interagency Working Group on Social Cost of Greenhouse Gases, United States Government). (weblink: <https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/scc-tds-final-july-2015.pdf>, and https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/scc_tsd_final_clean_8_26_16.pdf).

¹⁷⁹ CARB, California's 2017 Climate Change Scoping Plan, November 2017. (weblink: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf).

¹⁸⁰ Office of Management and Budgets, Circular A-4, September 17, 2003. (weblink: <https://www.transportation.gov/sites/dot.gov/files/docs/OMB%20Circular%20No.%20A-4.pdf>).

¹⁸¹ National Academies of Sciences, Engineering, Medicine, Valuing Climate Damages, Updating Estimation of Carbon Dioxide, 2017. (weblink: <http://www.nap.edu/24651>).

cause incrementally larger damages. A higher discount rate decreases the value today of future environmental damages. This analysis uses the IWG standardized range of discount rates from 2.5 to 5 percent to represent varying valuation of future damages. Table 10 shows the range of IWG SC-CO2 values used in California’s regulatory assessments.^{182, 183} For cost calculations, staff linearly interpolated values between the years identified.

Table 10: Social Cost of Carbon (2019\$/Metric Ton)

Year	5.0 Percent Discount Rate	3.0 Percent Discount Rate	2.5 Percent Discount Rate
2025	\$18	\$59	\$88
2030	\$21	\$65	\$94
2035	\$23	\$71	\$101
2040	\$27	\$77	\$108
2045	\$29	\$83	\$115
2050	\$34	\$89	\$123

The avoided SC-CO2 in a given year is the total emission reductions in metric tons of carbon dioxide equivalent (MTCO2e) multiplied by the SC-CO2 (in \$/MTCO2e) for that year. The GHG emissions are calculated considering both tailpipe and upstream emissions to allow direct comparison between the global impact of diesel and ZE locomotive technologies. The upstream emissions, or well-to-tank (WTT) emissions, were quantified using the same approach as the 2020 Mobile Source Strategy¹⁸⁴ with updated assumptions for fuel and energy supply. WTT emissions include sources from fuel production facilities such as electric power plants, hydrogen, biofuel production, and refineries, in addition to fuel feedstock collection (e.g., crude oil extraction from in-state wells) and finished fuel product transportation and distribution. The WTT emission factors capture GHG emission sources within the scope of AB 32.¹⁸⁵ WTT emission factors for gasoline, diesel, and hydrogen fuels were developed based on California-specific data, including Low Carbon Fuel Standard

¹⁸² The SC-CO2 values are from July 2015 and are available at: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis - Under Executive Order 12866, revised July 2015. (weblink: <https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf>).

¹⁸³ The IWG SC-CO2 values in 2007 dollars. Staff adjusted from 2007 to 2019 dollars using the California Department of Finance Consumer Price Index (CPI-U). (weblink: https://dof.ca.gov/wp-content/uploads/Forecasting/Economics/Documents/CPI_All_Item_Monthly.xlsx).

¹⁸⁴ California Air Resources Board, Proposed 2020 Mobile Source Strategy, Appendix A – Upstream Energy Emission Factors for Scenario Modeling, September 28, 2021. (weblink: https://ww2.arb.ca.gov/sites/default/files/2021-09/Proposed_2020_Mobile_Source_Strategy.pdf).

¹⁸⁵ California Assembly Bill 32, 2006, accessed August 4, 2022. (weblink: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32).

(LCFS) data,¹⁸⁶ California Emissions Inventory Data Analysis and Reporting System (CEIDARS),¹⁸⁷ California Emissions Projection Analysis Model (CEPAM),¹⁸⁸ and the California Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model (CA-GREET),¹⁸⁹ while considering LCFS compliance scenarios that require fuel production with decreasing carbon intensities and SB 1505, which requires at least 33.3 percent of the hydrogen dispensed by fueling stations that receive state funds be made from eligible renewable energy resources. Based on current hydrogen supply from LCFS reporting data and future production investments, the supply of renewable hydrogen can be, at least, maintained at 40 percent of hydrogen fuel demand.¹⁹⁰

Electricity emission factors reflect compliance with SB 100 Renewable Portfolio Standard targets; SB 100 requires renewable energy and zero-carbon resources supply 100 percent of electric retail sales to end-use customers by 2045.¹⁹¹ The Proposed Regulation increases electricity and hydrogen consumption while reducing diesel fuel consumption compared to the baseline. The annual emission reductions from the Proposed Regulation and the estimated benefits are shown in Table 11. The total benefits range between \$604 million to \$2.38 billion from 2023 to 2050, depending on the discount rate.

Table 11: Avoided Social Cost of CO2 from 2023 to 2050 (Million 2019\$)

Year	GHG Emission Reductions (MMTCO2e)	5 Percent Discount Rate	3 Percent Discount Rate	2.5 Percent Discount Rate
2023	0.00	\$0	\$0	\$0
2024	0.00	\$0	\$0	\$0
2025	0.00	\$0	\$0	\$0
2026	0.00	\$0	\$0	\$0
2027	0.00	\$0	\$0	\$0

¹⁸⁶ CARB, Data for crude supply, carbon intensity, and in-state production from CARB LCFS data dashboard and LCFS compliance scenario, accessed July 20, 2022. (weblinks: <https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm>, and https://www.arb.ca.gov/fuels/lcfs/2018-0815_illustrative_compliance_scenario_calc.xlsx).

¹⁸⁷ CARB, California Emissions Inventory Data Analysis and Reporting System (CEIDARS) portal, accessed July 19, 2022. (weblink: <https://ww3.arb.ca.gov/ei/drei/maintain/dbstruct.htm>).

¹⁸⁸ CARB, California Emissions Projection Analysis Model (CEPAM) portal, accessed August 4, 2022. (weblink: <https://ww2.arb.ca.gov/applications/cepam2019v103-standard-emission-tool>).

¹⁸⁹ CARB, CA-GREET3.0 Model, accessed July 19, 2022. (weblink: <https://www.arb.ca.gov/fuels/lcfs/ca-greet/ca-greet30-corrected.xlsm>).

¹⁹⁰ CA Senate Bill 1505 (Lowenthal, Stats. 2006, ch. 877), September 30, 2006, accessed July 19, 2022. (weblink: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200520060SB1505).

¹⁹¹ Senate Bill 100 (De León, Stats. 2018, ch. 312), September 10, 2018, accessed July 19, 2022. (weblink: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100).

Year	GHG Emission Reductions (MMTCO₂e)	5 Percent Discount Rate	3 Percent Discount Rate	2.5 Percent Discount Rate
2028	0.00	\$0	\$0	\$0
2029	0.00	\$0	\$0	\$0
2030	0.09	\$2	\$5	\$8
2031	0.10	\$2	\$7	\$9
2032	0.11	\$2	\$7	\$10
2033	0.12	\$3	\$8	\$11
2034	0.13	\$3	\$8	\$12
2035	0.40	\$9	\$27	\$38
2036	0.58	\$14	\$40	\$57
2037	0.80	\$18	\$56	\$79
2038	0.87	\$21	\$62	\$87
2039	0.99	\$24	\$72	\$101
2040	1.08	\$28	\$80	\$112
2041	1.17	\$30	\$88	\$122
2042	1.32	\$35	\$101	\$140
2043	1.41	\$38	\$110	\$152
2044	1.51	\$41	\$119	\$164
2045	1.61	\$45	\$127	\$177
2046	1.69	\$48	\$135	\$187
2047	1.73	\$50	\$141	\$197

Year	GHG Emission Reductions (MMTCO ₂ e)	5 Percent Discount Rate	3 Percent Discount Rate	2.5 Percent Discount Rate
2048	1.87	\$55	\$155	\$215
2049	2.04	\$63	\$172	\$237
2050	2.24	\$72	\$190	\$262
Total	21.86	\$604	\$1,711	\$2,378

SC-CO₂, while intended to be a comprehensive estimate of the damages caused by carbon globally, does not represent the cumulative cost of climate change and air pollution to society. There are additional costs to society outside of the SC-CO₂, including costs associated with changes in co-pollutants, the social cost of other GHGs including methane and nitrous oxide, and costs that cannot be included due to modeling and data limitations. The Intergovernmental Panel on Climate Change has stated that the IWG SC-CO₂ estimates are likely underestimated due to the omission of impacts that cannot be accurately monetized, including important physical, ecological, and economic impacts.¹⁹²

F. Other Benefits

1. Establishing Zero Emission Technology for Locomotives

The Proposed Regulation would start the transition to ZE for locomotives operating in California. In the short term, locomotive switchers (Class I, Class III, and industrial) provide a unique opportunity to accelerate the deployment of ZE technology in the off-road sector. Unlike line haul locomotives, which may travel throughout the country and return to a base only for periodic maintenance, switchers are generally used for railyard operations or local and regional delivery, returning to a railyard or home base each night. Due to their daily operational characteristics and the operating range of current ZE technologies, switchers are well suited for ZE pilots in California.^{193, 194, 195}

Passenger operators are also beginning to implement ZE technology and are expected to have access to commercially available ZE locomotives by 2030 (see Appendix F: Locomotive Technology Feasibility Assessment for further details). Even within line haul service, UP and

¹⁹² Intergovernmental Panel on Climate Change, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007, accessed July 19, 2022. (weblink: https://www.ipcc.ch/site/assets/uploads/2018/03/ar4_wg3_full_report-1.pdf).

¹⁹³ U.S. House of Representatives, House Committee on Transportation and Infrastructure, "The Business Case for Climate Solutions." May 17, 2021. (weblink: <https://transportation.house.gov/download/santana-testimony>).

¹⁹⁴ Canadian Pacific, "CP to employ Ballard fuel cells in Hydrogen Locomotive Project." March 9, 2021, accessed July 27, 2022. (<https://www.cpr.ca/en/media/cp-to-employ-ballard-fuel-cells-in-hydrogen-locomotive-project>).

¹⁹⁵ Railway Age, "Zero-Emission Locomotives on U.S. Railways?" February, 2021, accessed July 19, 2022. (weblink: <https://www.railwayage.com/news/zero-emission-locomotives-on-u-s-railways/>).

BNSF have committed to integrating ZE technology.^{196,197} As use of ZE technologies expands, technical capabilities will improve, and they are expected to operate comparably with diesel technology. Additionally, as ZE switchers are increasingly adopted, industry acceptance of advanced technologies is improving. The current state of ZE locomotive technology is expected to progress and expand into extended range applications, as well as other off-road sectors.

2. Infrastructure

The Proposed Regulation would increase the demand for electric charging and hydrogen fueling infrastructure needed to support the use of ZE locomotives and ZE capable locomotives. Additional installations of electric charging and hydrogen fueling infrastructure would support the use of these technologies, as well as other advanced technology equipment and vehicles.

The increased use of electric charging infrastructure will also increase the demand for electricity supplied by utility providers and help the state's investor-owned utilities meet the goals of SB 350.¹⁹⁸ SB 350 requires the state's investor-owned utilities to develop programs to accelerate widespread transportation electrification with goals to reduce dependence on petroleum, increase the uptake of ZE technologies, help meet air quality standards, and reduce GHGs. The three large investor-owned utilities in the state, Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison, have either proposed or have been approved to establish new business electricity rate options that make charging more affordable during certain times of the day. Although not required by SB 350, several publicly owned utilities have taken similar action. For example, Los Angeles Department of Water and Power and Sacramento Municipal Utility District have made ready charging infrastructure programs and new commercial rates for charging. The Proposed Regulation supports the utilities' programs and the goals of SB 350 by increasing the number of ZE locomotives in the state to make use of these utility investments and rates, where feasible.

For hydrogen fuel cell line haul locomotives to operate with the same duty cycle as diesel line haul locomotives, each locomotive is expected to need a carrying capacity of approximately 2,500 kg of liquid hydrogen split between on-board tanks and a fuel tender. Staff expects that up to 100 locomotives could be fueled by a fueling station with capacity between 200,000 and 375,000 kg liquid hydrogen per day (depending on companies' refueling practices).

The Proposed Regulation is expected to increase U.S. hydrogen demand from use of line haul and passenger locomotives to about 1.9 million metric tons between 2030 and 2050. This increase in hydrogen would require more rapid growth in hydrogen supply than the California Energy Commission's 2021 Integrated Energy Policy Report "High Demand Forecast," projects but is an expected portion of total demand forecasted by the U.S.

¹⁹⁶ Trains: The Magazine of Railroading, "Union Pacific Sees Battery-Electric Locomotives as the Future." May, 2021, accessed July 19, 2022. (weblink: <https://www.trains.com/trn/union-pacific-sees-battery-electric-locomotives-as-the-future/>).

¹⁹⁷ BNSF, "Orange is the New Green." April 21, 2021, accessed July 19, 2022. (weblink: <https://www.bnsf.com/news-media/railtalk/community/orange-new-green.html>).

¹⁹⁸ California Legislature, Senate Bill No. 350, signed October 7, 2015, accessed July 19, 2022. (weblink: https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB350).

Department of Energy (U.S. DOE).^{199,200} While this level of demand is increasing more rapidly than previous estimates, it would help support California’s transition to clean transportation, the U.S. DOE Energy Earthshots goals, and the Biden Administration’s energy goals.²⁰¹ The amount of hydrogen required to fuel ZE locomotives would encourage continued pairing of renewable energy and hydrogen production. Hydrogen production offers additional value when linked to renewable energy production facilities since excess renewable energy produced during the day can be converted into hydrogen for storage and later use.

Benefits in Disadvantaged Communities

The Proposed Regulation would reduce PM2.5 and NOx emissions, resulting in health benefits for Californians, including those in disadvantaged and low-income communities. Many of the communities near facilities where locomotives operate bear a disproportionate health burden due to their proximity to emissions from the diesel engines that power locomotives. Approximately 50 percent of all California railyards are in areas identified as Disadvantaged Communities per CalEnviroScreen designation.²⁰² Under the Proposed Regulation, older and higher-emitting locomotives would become the most expensive to operate, creating incentive for turnover as quickly as possible. Switchers are often among the oldest and highest-emitting locomotives and operate continuously in railyards, freight facilities, or over short routes. Due to their continuous operation in the same locations, switchers can have particularly harmful effects on the communities nearby. These older, higher-emitting locomotives would be banned from operation in the state beginning in 2030; this would be especially impactful in the communities that surround railyards and other facilities where switchers operate.

The Proposed Regulation is designed to promote early use of ZE locomotives in Disadvantaged Communities. Prior to January 1, 2030, locomotive operators may receive a credit for operation of a ZE locomotive, ZE rail equipment, or use of wayside power. The ZE credit reduces the locomotive operator’s Spending Account obligation under the Proposed Regulation. In addition, all ZE locomotive operations in a designated Disadvantaged Community can receive double the ZE locomotive credit until 2030. The credits can only be used toward Spending Account obligations and do not have any monetary value. To receive double ZE credits, operators must report usage information on the ZE locomotives that operated within the boundaries of any Disadvantaged Communities boundary and report it to CARB.

By allowing double ZE credit, the Proposed Regulation would provide an incentive for the use of ZE locomotives in the most impacted communities in California. The double credit provision would incentivize expedited and increased emission reductions in Disadvantaged Communities. However, due to the uncertainty of early adoption of ZE locomotives, staff has not assumed credit generation or early emission reductions from the ZE locomotive credit in

¹⁹⁹ California Energy Commission, Final 2021 Integrated Energy Policy Report Volume IV California Energy Demand Forecast, February 17, 2022. (weblink: <https://efiling.energy.ca.gov/GetDocument.aspx?tn=241581>).

²⁰⁰ Department of Energy, Hydrogen Program Plan, November 2020, accessed July 19, 2022. (weblink: <https://www.hydrogen.energy.gov/pdfs/hydrogen-program-plan-2020.pdf>).

²⁰¹ Department of Energy, Hydrogen Shot. 2021, accessed July 19, 2022. (weblink: <https://www.energy.gov/eere/fuelcells/hydrogen-shot>).

²⁰² Office of Environmental Health Hazard Assessment, CalEnviroScreen 4.0, October 20, 2021, accessed July 19, 2022. (weblink: <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40>).

the Emission Inventory, and did not assume early adoption would result from the ZE locomotive credit in the cost analysis.

3. Job Opportunities

The Proposed Regulation calls on locomotive manufacturers to continue to develop and deploy ZE locomotive technologies. The expansion in ZE locomotive development and manufacturing, as well as plug-in, electric charging, and fueling infrastructure, would benefit suppliers, equipment installers, and electricians. The Proposed Regulation also provides opportunities for design, engineering, construction, and project management firms to design new and expanded infrastructure at railyards, seaports, and industrial facilities statewide. All installations would be in California, and some of the infrastructure equipment may be manufactured in California. For a full analysis of the employment impacts projected for the proposed regulation, see Appendix B: Standardized Regulatory Impact Assessment.

4. Noise

The Proposed Regulation may provide noise reduction benefits through operation of locomotives with ZE technology. Diesel-powered locomotive engines produce a substantial amount of noise, which results in adverse health impacts. This is of concern when locomotives operate near places where people live, work, and play. Railway noise is known to disturb sleep^{203, 204, 205, 206} and is associated with poor sleep quality,²⁰⁷ psychological distress,²⁰⁸ and

²⁰³ Elmenhorst EM, Griefahn B, Rolny V, Basner M. Comparing the effects of road, railway, and aircraft noise on sleep: Exposure–response relationships from pooled data of three laboratory studies. *International Journal of Environmental Research and Public Health*. 2019, 16(6). doi:10.3390/ijerph16061073, published online March 26, 2019. (weblink: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6466444/>).

²⁰⁴ Elmenhorst EM, Pennig S, Rolny V, et al. 2012, Examining nocturnal railway noise and aircraft noise in the field: Sleep, psychomotor performance, and annoyance. *Science of the Total Environment*. 2012;424:48-56. doi:10.1016/j.scitotenv.2012.02.024. published online March 21, 2012. (weblink: <https://www.sciencedirect.com/science/article/abs/pii/S0048969712002343>).

²⁰⁵ Sahu P, Galhotra A, Raj U, Ranjan R. 2020, A study of self-reported health problems of the people living near railway tracks in Raipur city. *J Fam Med Prim Care*. 2020;9(2):740. doi:10.4103/jfmprc.jfmprc_1029_19. Published online February 28, 2020. (weblink: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7114011/>).

²⁰⁶ Tassi P. et al. 2010, Living alongside railway tracks: Long-term effects of nocturnal noise on sleep and cardiovascular reactivity as a function of age, *Environment International*, May 2010. (weblink: <https://pubmed.ncbi.nlm.nih.gov/20569986/>).

²⁰⁷ Basner M, Müller U, Elmenhorst EM. 2011, Single and Combined Effects of Air, Road, and Rail Traffic noise on Sleep and Recuperation. *Sleep*. 2011;34(1):11-23. doi:10.1093/sleep/34.1.11. Published online January 1, 2011. (weblink: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3001788/>).

²⁰⁸ Klompmaker JO, Hoek G, Bloemasma LD, et al. 2019, Associations of combined exposures to surrounding green, air pollution and traffic noise on mental health. *Environ Int*. 2019;129:525-537. doi:10.1016/j.envint.2019.05.040. Published online August 8, 2019. (weblink: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6792364/>).

depression,²⁰⁹ but additional studies on the mental and other health effects of railway noise are needed.²¹⁰

Staff has received several noise complaints related to locomotive activity near schools, hospitals, elder care facilities, and residential neighborhoods. The Proposed Regulation encourages use of ZE technology such as battery electric, which produces less engine noise than diesel engines.

V. Air Quality

A. Objectives

CARB programs focus on three distinct emission reduction goals: (1) reduce localized potential cancer risk from toxic air contaminants (TAC), (2) control PM_{2.5}, NO_x, and criteria pollutants to meet local, regional, and state standards, and National Ambient Air Quality Standards (NAAQS), and (3) limit GHGs that contribute to the global burden of climate change.

The Proposed Regulation is intended to further protect the health of the residents of California by reducing emissions from locomotives operating in the state. This section summarizes the expected air quality benefits in California that will result from the Proposed Regulation and includes the following elements: (1) description of the business as usual (BAU) baseline used to estimate emission benefits of the Proposed Regulation; (2) an overview of the emission inventory methods; and (3) a summary of emission benefits expected from the Proposed Regulation. For specific health benefits resulting from the air quality impacts, see Chapter IV: Benefits Anticipated from the Regulatory Action, Including the Benefits or Goals Provided in Authorizing Statute.

B. Baseline “Business as Usual” Information

Compliance in response to the Proposed Regulation is compared against a BAU baseline. The BAU baseline reflects the current regulatory setting and includes the effects of any existing state and federal regulations. To estimate the impacts of the Proposed Regulation, a BAU scenario was developed, which serves as the baseline throughout the Proposed Regulation. Staff used the latest available data on population, activity, and in-use emissions from locomotives operating in California to estimate the BAU baseline emissions and assess the impact of the Proposed Regulation and alternative scenarios on both criteria and GHG emissions. Individual emission inventories for line haul, Class I switchers, Class III (shortline), military, industrial, and passenger locomotives were combined to create the emission inventory for the Proposed Regulation. More details on the BAU baseline are discussed in

²⁰⁹ Seidler A, et al. Association between Aircraft, Road and Railway Traffic Noise and Depression in a Large Case-Control Study Based on Secondary Data, National Library of Medicine, 2018. (weblink: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6122263/>).

²¹⁰ Hegewald J, Schubert M, Freiberg A, et al. 2020, Traffic noise and mental health: A systematic review and meta-analysis. *Int J Environ Res Public Health*. 2020;17(17):1-26. doi:10.3390/ijerph17176175. Published online August 25, 2020. (weblink: <https://www.mdpi.com/1660-4601/17/17/6175>).

C. PM and NOx Emission Inventory Methods

Because data sources and projection methodologies for each locomotive category (line haul, Class I switcher, Class III (shortline), industrial, and passenger) are specific to each category, staff developed emission inventories for each locomotive category independently.

The Proposed Regulation's emission inventory estimates rely on the best available locomotive data. The Proposed Regulation's emission inventory was updated using CARB MOU data between 2010 and 2019 and other data reported by railroads to project future baseline and emission control scenarios for each locomotive type and pollutant. The Proposed Regulation emission inventory includes the following updates:

1. Added emissions projections for the Proposed Regulation scenario and alternative scenarios.
2. Updated switcher emissions projections based on UP and BNSF provided data.
3. Newly-developed military and industrial locomotive inventory.

The Proposed Regulation emissions inventory reflects all updates made to the locomotive emission inventories to date. The locomotive emissions inventories have been published on the CARB website.²¹¹

Since there are currently no requirements to operate a locomotive at certain emission standards, there are locomotives of all Tiers (Pre-Tier 0 to Tier 4) operating throughout California. To determine the tier breakdown for each individual locomotive inventory, staff used data provided by the 1998 Locomotive NOx Fleet Average Emissions Agreement in the South Coast Air Basin (1998 MOU), surveys, and other data resources. The tier breakdown is a reasonable approximation of what can be found in each locomotive fleet. Staff used tier information to determine locomotive emission factors, which were used to calculate the emissions inventory. For more information on tier breakdowns for each locomotive category, see Appendix G of this ISOR.

The PM and NOx emission inventory for any given year is calculated by combining MWh of locomotive engine activity, emission factors, and conversion factors, in the following equation:

²¹¹ CARB, MSEI - Documentation - Off-Road - Diesel Equipment, accessed July 20, 2022. (weblink: <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-road>).

Equation 1: PM and NOx Emissions Inventory Calculation for Diesel Locomotives

$(Emissions) = (Engine\ activity\ [MWh]) \times (Emission\ Factor\ [g/bhp - hr]) \times (conversion\ factor)$		
<u>Where,</u>		<u>Units</u>
Emissions	= Daily emissions from the locomotive in California	ton per day (tpd)
Engine activity	= Annual engine activity in California	MWh
Emission Factor	= Locomotive emissions factors for each Tier	g/bhp-hr
Conversion factor	= Conversion factors for unit consistency	

Emission reductions are achieved from the Proposed Regulation by: (1) Spending Account funds being used toward newer cleaner locomotives that replace the operations of older locomotives; and (2) In-Use Operational Requirements removing the oldest locomotives from California operations and introducing ZE locomotive requirements in 2030 and 2035. Assumptions made for modeling emission reductions are included below.

D. GHG Emissions Inventory Methods

Unlike criteria pollutants (PM_{2.5} and NO_x), GHG emissions for the Proposed Regulation are calculated considering both tailpipe and upstream emissions to allow for the best direct comparison between the global impact of diesel and ZE locomotives. The upstream emissions, or well-to-tank (WTT) emissions, were quantified using the same approach as the 2020 Mobile Source Strategy²¹² with updated assumptions for fuel and energy supply. WTT emissions include sources from fuel production facilities such as electricity power plants, hydrogen plants, biofuel production plants, and refineries, in addition to fuel feedstock collection (e.g., crude oil extraction from in-state wells) and finished fuel product transportation and distribution. The WTT emission factors capture GHG emission sources within the scope of AB 32. WTT emission factors for gasoline, diesel, and hydrogen fuels were developed based on California-specific data, including Low Carbon Fuel Standard (LCFS) data,²¹³ CEIDARS,²¹⁴ CEPAM,²¹⁵ and CA-GREET,²¹⁶ while considering LCFS compliance scenarios that require fuel production with decreasing carbon intensities and SB 1505, which requires at least 33.3 percent of the hydrogen dispensed by fueling stations that receive state funds be made from eligible renewable energy resources. In addition, based on current hydrogen supply from LCFS reporting data and future production investments, the supply of

²¹² CARB, Proposed 2020 Mobile Source Strategy, Appendix A, Upstream Energy Emission Factors for Scenario Modeling, September 28, 2021. (weblink: https://ww2.arb.ca.gov/sites/default/files/2021-09/Proposed_2020_Mobile_Source_Strategy.pdf).

²¹³ CARB, Data for crude supply, carbon intensity, and in-state production from CARB LCFS data dashboard and LCFS compliance scenario, accessed July 20, 2022. (weblinks: <https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm>, and https://www.arb.ca.gov/fuels/lcfs/2018-0815_illustrative_compliance_scenario_calc.xlsx).

²¹⁴ CARB, California Emissions Inventory Data Analysis and Reporting System (CEIDARS) website, accessed July 20, 2022. (weblink: <https://ww3.arb.ca.gov/ei/drei/maintain/dbstruct.htm>).

²¹⁵ CARB, California Emissions Projection Analysis Model (CEPAM) portal, accessed August 4, 2022. (weblink: <https://ww2.arb.ca.gov/applications/cepam2019v103-standard-emission-tool>).

²¹⁶ CARB, CA-GREET3.0 Model, 2019. (weblink: <https://www.arb.ca.gov/fuels/lcfs/ca-greet/ca-greet30-corrected.xlsm>).

renewable hydrogen can be, at least, maintained at 40% of hydrogen fuel demand.²¹⁷ Electricity emission factors reflect compliance with SB 100 Renewable Portfolio Standard targets; SB 100 requires renewable energy and zero-carbon resources supply 100 percent of electric retail sales to end-use customers by 2045.²¹⁸ The Proposed Regulation compared to the BAU baseline increases electricity and hydrogen consumption while reducing diesel fuel consumption.

Well-to-wheel (WTW) GHG emissions inventory of diesel locomotives for any given year is calculated by combining MWh of locomotive engine activity, carbon intensity of the fuel, and conversion factors, in the following equation:

Equation 2: GHG Emissions Inventory Calculation for Diesel Locomotives

<i>(GHG Emissions [kgCO2e])</i>		
<i>= (Diesel consumption [gallon]) × (Carbon intensity [kgCO2e/gallon])</i>		
Where,		<u>Units</u>
GHG Emissions	= Annual GHG emissions from the locomotive in California	kgCO2e
Diesel consumption	= Annual diesel consumption in California	gallon
Carbon intensity	= Carbon intensity of diesel	kgCO2e/gallon

Staff used fuel consumption data supplied by locomotive operators of Class III, passenger, and industrial locomotives. Staff assumed that diesel consumption and engine activity remain constant throughout the analysis timeframe of 2024 to 2050.

Staff used the following equation to calculate diesel consumption from engine activities of Class I locomotives.

Equation 3: Diesel Consumption Calculation for Class I Locomotives

<i>(Diesel consumption [gallon])</i>		
<i>= (Engine activity [MWh]) × (Fuel efficiency [gallon/MWh])</i>		
Where,		<u>Units</u>
Diesel consumption	= Annual diesel consumption in California	gallon
Engine activity	= Annual engine activity in California	MWh
Fuel efficiency	= Diesel used for one MWh of engine activity	gallon/MWh

Staff used engine activity in MWh to calculate PM and NOx emissions. For more details on the calculation of PM and NOx emissions, see Appendix G of this ISOR.

Fuel efficiency determines the gallons of diesel consumed per MWh of engine activity. Table 12 shows the fuel efficiency values for Class I locomotives used to calculate diesel consumption per MWh.

²¹⁷ State of California, Senate Bill (SB) 1505 (2005-2006), accessed July 20, 2022. (weblink: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200520060SB1505).

²¹⁸ State of California, Senate Bill (SB) 100 (2017-2018), accessed July 20, 2022. (weblink: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100).

Table 12: Fuel Efficiency for Class I Locomotives to Calculate Diesel Consumption Per MWh Of Engine Activity²¹⁹

Locomotive Type	Fuel Efficiency (gal/MWh)
Class I Line Haul	64.5
Class I Switcher	88.2

The GHG emission inventory of battery-electric and hydrogen fuel cell locomotives for any given year is calculated by combining diesel consumption of the equivalent diesel-powered locomotive, carbon intensity of the fuel, energy efficiency ratio (EER) of the powertrain compared to diesel-electric powertrain, and conversion factors, as shown in Equation 4.

Equation 4: GHG Emissions Inventory Calculation for Battery-Electric and Hydrogen Fuel Cell Locomotives

$$(GHG\ Emissions\ [kgCO_2e]) = (Diesel\ consumption\ [gallons]) \times (1/EER) \times (H_2\ or\ electricity\ consumption\ [fuel\ unit/gallon]) \times (Carbon\ intensity\ [kgCO_2e/fuel\ unit])$$

Where,		<u>Units</u>
GHG Emissions	= Annual GHG emissions from the locomotive in California	kgCO ₂ e
Diesel consumption	= Diesel consumption of a diesel-powered locomotive counterpart	gallon
EER	= EER of the powertrain compared to the diesel locomotive	unitless
H ₂ or electricity consumption	= hydrogen or electricity consumption	hydrogen: kgH ₂ /gallon electricity: kWh/gallon
Carbon intensity kgCO ₂ e/kgH ₂	= Carbon intensity of the fuel	hydrogen: Electricity:
kgCO ₂ e/kWh		

For battery-electric and hydrogen fuel cell locomotives, diesel consumption represents how many diesel gallons would be consumed if a diesel-powered locomotive was used in the same application. Staff used fuel consumption data supplied by locomotive operators for Class III, passenger, and industrial locomotives, and Equation 3 for Class I locomotives.

EER is the relative energy efficiency of a battery-electric or hydrogen fuel cell locomotive compared to a diesel-powered locomotive in the same application. Values greater than one mean a locomotive is more energy efficient and uses less energy to perform the same amount of work as a diesel-powered locomotive. Values less than one mean a locomotive is less energy efficient and uses more energy to perform the same amount of work as a

²¹⁹ U.S. EPA, Technical Highlights, Emission Factors for Locomotives, April 2009. (weblink: <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100500B.PDF?Dockkey=P100500B.PDF>).

diesel-powered locomotive. Table 13 shows the EERs of battery-electric and hydrogen locomotives based on their application and energy source.

Table 13: Energy Efficiency Ratio of Zero Emission Locomotives Compared to Diesel-Powered Locomotives

Fuel and technology	Locomotive Type	EER
Hydrogen fuel cell ²²⁰	Class I line haul	1.30
Hydrogen fuel cell ²²¹	Passenger	1.37
Battery electric ²²²	Class I switcher Class III Industrial	2.21

Diesel fuel consumption in gallons can be converted to hydrogen consumption in kgH₂ or electricity consumption in kWh. Table 14 shows the values staff used to convert diesel consumption to hydrogen and electricity consumption.

Table 14: Conversion to Hydrogen and Electricity Consumption from Diesel Consumption

Fuel	Hydrogen or Electricity Consumption
Hydrogen ²²³	1.18 kgH ₂ /gallon
Electricity ²²⁴	37.0 kWh/gallon

Table 15 shows the carbon intensity values for diesel, hydrogen, and electricity, which include upstream emissions (WTW). Hydrogen and electricity do not result in tailpipe emissions, and therefore their WTW emissions are equal to their WTT emissions.

²²⁰ Ahluwalia, Papadias, Wang, U.S. Department of Energy, Rail and Maritime Metrics, 2020 Annual Merit Review and Peer Evaluation Meeting, Project TA034, pages 12-14, 2020. (weblink: https://www.hydrogen.energy.gov/pdfs/review20/ta034_ahluwalia_2020_o.pdf).

²²¹ Ahluwalia, Papadias, Wang, U.S. Department of Energy, Rail and Maritime Metrics, 2020 Annual Merit Review and Peer Evaluation Meeting, Project TA034, pages 12-14, 2020. (weblink: https://www.hydrogen.energy.gov/pdfs/review20/ta034_ahluwalia_2020_o.pdf).

²²² CARB, "Transitioning to a Zero or Near-Zero Emission Line-Haul Freight Rail System in California: Operational and Economic Considerations Final Report," Railtec, 2016. (weblink: https://ww2.arb.ca.gov/sites/default/files/classic/railyard/docs/uo_i_rpt_06222016.pdf).

²²³ California Energy Commission, Fuel Price Forecasts, November 16, 2021. (email communication).

²²⁴ U.S. DOE, Alternative Fuels Data Center Fuel Properties Comparison, January 2021. (weblink: https://afdc.energy.gov/files/u/publication/fuel_comparison_chart.pdf).

Table 15: WTW Carbon Intensity of Diesel, Hydrogen, And Electricity

Year	Diesel (kgCO ₂ e/gal)	Hydrogen (kgCO ₂ e/kgH ₂)	Electricity (kgCO ₂ e/kWh)
2024	12.01	4.88	0.189
2025	12.01	4.88	0.189
2026	12.01	4.85	0.198
2027	12.01	4.81	0.196
2028	12.01	4.76	0.193
2029	12.01	4.71	0.190
2030	12.01	4.66	0.188
2031	12.01	4.60	0.177
2032	12.01	4.54	0.167
2033	12.01	4.47	0.158
2034	12.01	4.40	0.149
2035	12.01	4.32	0.140
2036	12.00	4.24	0.132
2037	12.00	4.14	0.124
2038	12.00	4.04	0.117
2039	11.99	3.93	0.109
2040	11.98	3.81	0.102
2041	11.98	3.69	0.096
2042	11.97	3.57	0.089
2043	11.97	3.42	0.083

Year	Diesel (kgCO2e/gal)	Hydrogen (kgCO2e/kgH ₂)	Electricity (kgCO2e/kWh)
2044	11.96	3.25	0.077
2045	11.95	3.08	0.071
2046	11.94	3.08	0.071
2047	11.93	3.08	0.071
2048	11.93	3.08	0.071
2049	11.92	3.08	0.071
2050	11.91	3.08	0.071

E. Proposed Regulation Emissions Modeling Assumptions

Emission reductions are achieved from the Proposed Regulation by: (1) Spending Account funds being used toward newer cleaner locomotives that replace the operations of older locomotives; and (2) In-Use Operational Requirements removing the oldest locomotives from California operations and introducing ZE locomotive requirements in 2030 and 2035. Assumptions made for modeling emission reductions are included below.

1. General Locomotive Assumption

Generally, a locomotive is ordered/purchased prior to being manufactured. Therefore, the analysis assumed that a new locomotive will enter service one year after it is purchased to accommodate locomotive manufacturing.

2. Spending Account Assumptions

Beginning in 2024, emission reductions from the Proposed Regulation are achieved via compliance with the Spending Account. Staff made assumptions for locomotive purchases based on the following:

- Because there is an economic incentive to decrease the funding obligation in future years by decreasing usage of diesel locomotives and to use Spending Account funds as soon as possible, the analysis assumes locomotive operators will expend Spending Account funds within one year of the sufficient accumulation of funds to purchase cleaner locomotives.
- Unless a locomotive purchase results in the retirement of Tier 4 locomotives less than 23 years old, operators will expend Spending Account funds on locomotive purchases as soon as the accumulation of sufficient funds to purchase a new locomotive until their entire fleet is ZE.

- From 2029 through 2033, Class I railroads will purchase ZE switchers and ZE line haul infrastructure and save remaining Spending Account funds until 2034 when ZE line haul locomotives are expected to be commercially available.
- Locomotives purchased with Spending Account funds replace activity equal to the locomotive operator's fleet average from the prior calendar year.

3. In-Use Operational Requirements Assumptions

To account for current fleet management practices and the interchangeability of locomotives within each fleet, staff assumes that each operator's entire fleet would comply with the Proposed Regulation, allowing all locomotives to operate as needed in California. Staff made the following assumptions:

- Class III, industrial, and passenger operators purchase Tier 4 locomotives until December 31, 2028.
- To prepare for the switcher, industrial, and passenger locomotives ZE requirements, staff assumes Class III, industrial, and passenger operators purchase ZE locomotives beginning January 1, 2029.
- Class I locomotive operators purchase Tier 4 switchers until December 31, 2028. To prepare for the switcher Zero Emission Operational Requirement, staff assumes that Class I operators will purchase ZE switchers beginning January 1, 2029.
- Class I locomotive operators purchase Tier 4 line haul locomotives until December 31, 2033. To prepare for the freight line haul Zero Emission Operational Requirement, staff assumes that Class I operators will purchase ZE line haul locomotives beginning January 1, 2034.
- Class I locomotive operators purchase Tier 4 locomotives with both Spending Account and non-Spending Account funds until December 31, 2029. The use of Spending Account funds is restricted to ZE locomotive purchases beginning January 1, 2030.

Class I, Class III, industrial, and passenger operators are assumed to purchase locomotives with both Spending Account and non-Spending Account funds. Purchases made with non-Spending Account funds are often needed when industry growth or retirement projections exceed the number of locomotives that can be purchased with the funds solely in the Spending Account. The Spending Account purchases and non-Spending Account purchases for the Proposed Regulation are modeled as shown in Table 16.

Table 16: Proposed Regulation Emission Inventory Modeling Assumptions

	2023-2028	2029-2033	2034-2050
Class I line haul – Spending Account funds	Tier 4	No Spending Account line haul locomotive purchases. Up to 50% on ZE infrastructure Up to 50% deposits used on Class I switchers until full ZE conversion.	ZE locomotives
Class I line haul – non-Spending Account funds	Tier 4	Tier 4	ZE locomotives
Class I switcher, Class III, industrial, passenger – all funds	Tier 4	ZE infrastructure and locomotives	ZE infrastructure and locomotives

F. Air Quality Impacts

Staff projected PM, NO_x, and GHG emissions from locomotives from 2024 to 2050. The Proposed Regulation scenario assumes: 1) No new federal requirements would be imposed between 2024 and 2050 and 2) The Proposed Regulation would achieve emission reductions through compliance with the Spending Account and In-Use Operational Requirements.

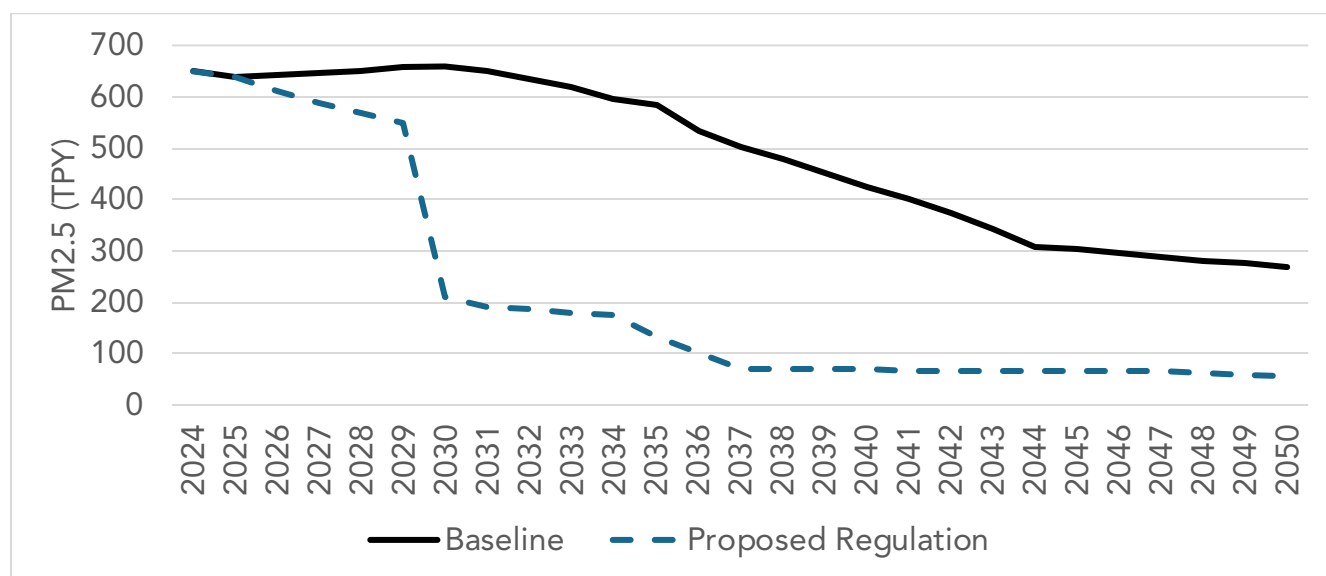
The BAU baseline emissions presented in Figure 19, Figure 20, and Figure 21 show a steady increase in PM_{2.5} and NO_x emissions from 2024 until around 2031. This persistent increase in criteria emissions is from projected growth of locomotive activity in California. From 2032 to 2050, BAU baseline PM_{2.5} and NO_x emissions consistently decline due to natural locomotive turnover. As locomotives reach an age where they can no longer be remanufactured, or it is not beneficial to do so, locomotive operators will need to purchase new locomotives (Tier 4). The BAU baseline GHG emissions are projected to increase continually from 2024 to 2050. Unlike PM_{2.5} and NO_x emissions, which decline with the use of Tier 4 locomotives, there are no GHG emission reduction benefits for a Tier 4 locomotive. Tier 4 locomotives reduce criteria emissions utilizing combustion strategies and exhaust gas aftertreatment technologies such as exhaust gas recirculation (EGR), diesel particulate filters (DPF), and selective catalytic reduction (SCR). No aftertreatment control technologies are projected to be used on diesel-powered locomotives to reduce GHG emissions, so without transitioning to ZE locomotives there would be no GHG emission reductions achieved using diesel-powered locomotives over time.

The projected emission reductions for the Proposed Regulation are summarized below. From 2024 to 2030 as funds accumulate in locomotive operators' Spending Accounts, older locomotives are replaced by Tier 4 locomotives. The introduction of Tier 4 locomotives replaces the use of older locomotives and leads to a steady decline of PM2.5 and NOx emissions. The greatest emission reductions are achieved after December 31, 2029, when the In-Use Operational Requirements begin. As part of the In-Use Operational Requirements, many of the oldest and dirtiest locomotives would no longer be permitted to operate in California. The start of the In-Use Operational Requirements leads to a steep decline in emissions in 2030, then a steadier decline in emissions happens as locomotives reach 23 years old and no longer operate in California or when older locomotives are replaced by new locomotives purchased with Spending Account funds. The air quality benefits shown below are a quantitative demonstration of the changes in locomotive emissions associated with the BAU baseline and the Proposed Regulation.

1. PM2.5 Emissions

Figure 19 presents projected PM2.5 emissions from 2024 to 2050. From 2024 to 2050, the Proposed Regulation would reduce approximately 7,455 tons of PM2.5, an over 50 percent reduction from the BAU baseline.

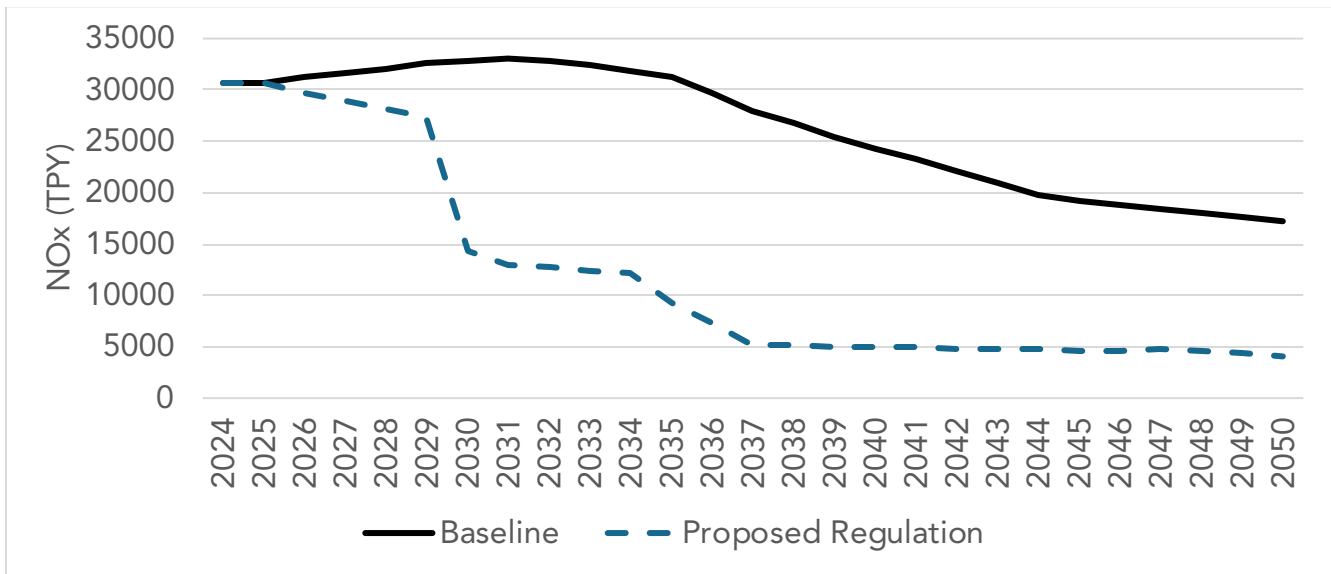
Figure 19: Projected Annual PM2.5 Emissions from Locomotives Operating in California



2. NOx Emissions

Figure 20 presents projected NOx emissions from 2024 to 2050 for the Proposed Regulation. Relative to the BAU baseline, the Proposed Regulation is projected to reduce a cumulative total of 389,630 tons of NOx, an over 50 percent reduction from the BAU baseline.

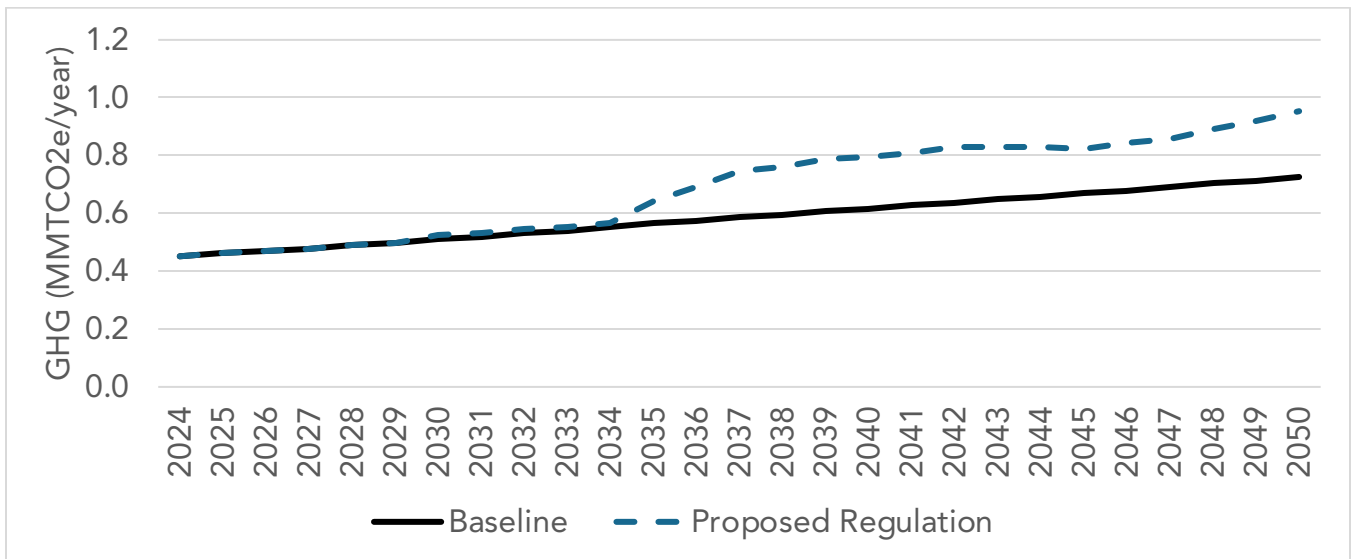
Figure 20: Projected Annual NOx Emissions from Locomotives Operating in California



3. Greenhouse Gases

Total WTW GHG emissions can be separated into two components. One is the upstream emissions, or WTT GHG emissions, and the other is the tailpipe emissions, or tank-to-wheel (TTW) GHG emissions. Figure 21 shows projected annual WTT GHG emissions from the BAU baseline and the Proposed Regulation. Hydrogen and electricity have higher WTT GHG emissions compared to diesel. This results in an WTT GHG emissions increase from 2030 as ZE locomotives enter the service.

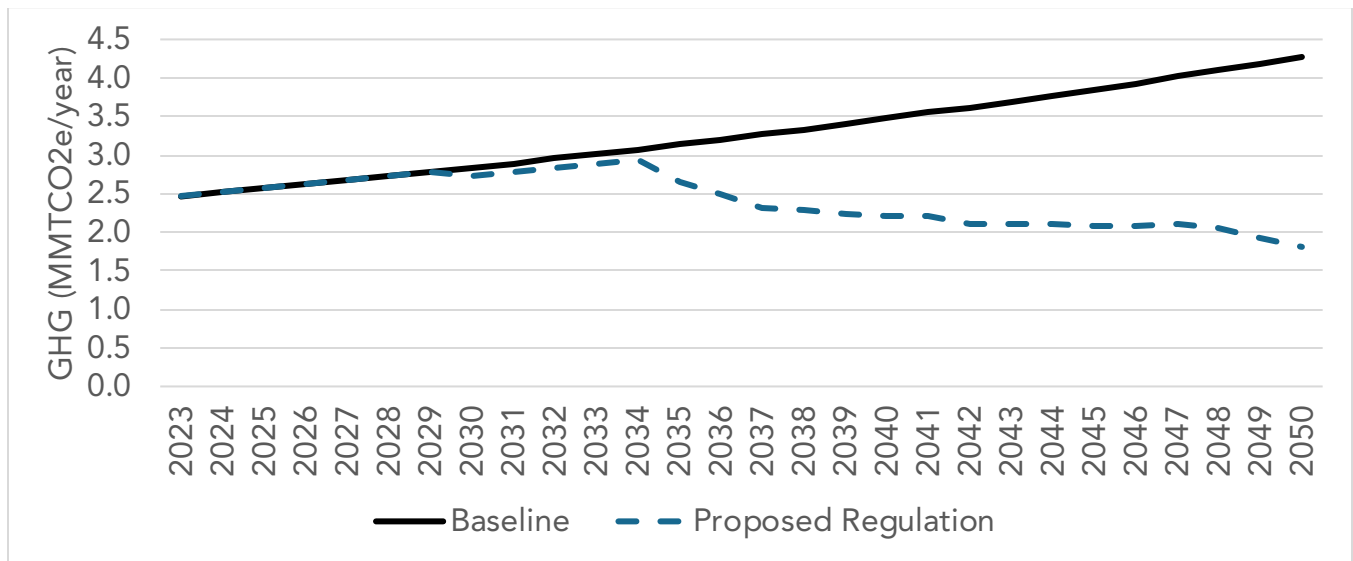
Figure 21: Projected Annual Well-to-Tank GHG Emissions from Locomotives Operating in California



While battery-electric and hydrogen fuel cell locomotives increase WTT GHG emissions, they decrease the total projected WTW GHG emissions (shown in Figure 23) because the reduction in the tailpipe GHG emission is greater than the increase in the upstream GHG emissions.

Figure 22 shows projected TTW GHG emissions from the BAU baseline and the Proposed Regulation. Starting in 2030, the Proposed Regulation reduces TTW GHG emissions as ZE locomotives are put into service. Both battery-electric and hydrogen fuel cell locomotives have zero TTW GHG emissions, so the increasing usage of ZE locomotives removes all TTW GHG emissions from diesel-powered locomotives in the BAU baseline.

Figure 22: Projected Annual Tank-to-Wheel GHG Emissions from Locomotives Operating in California

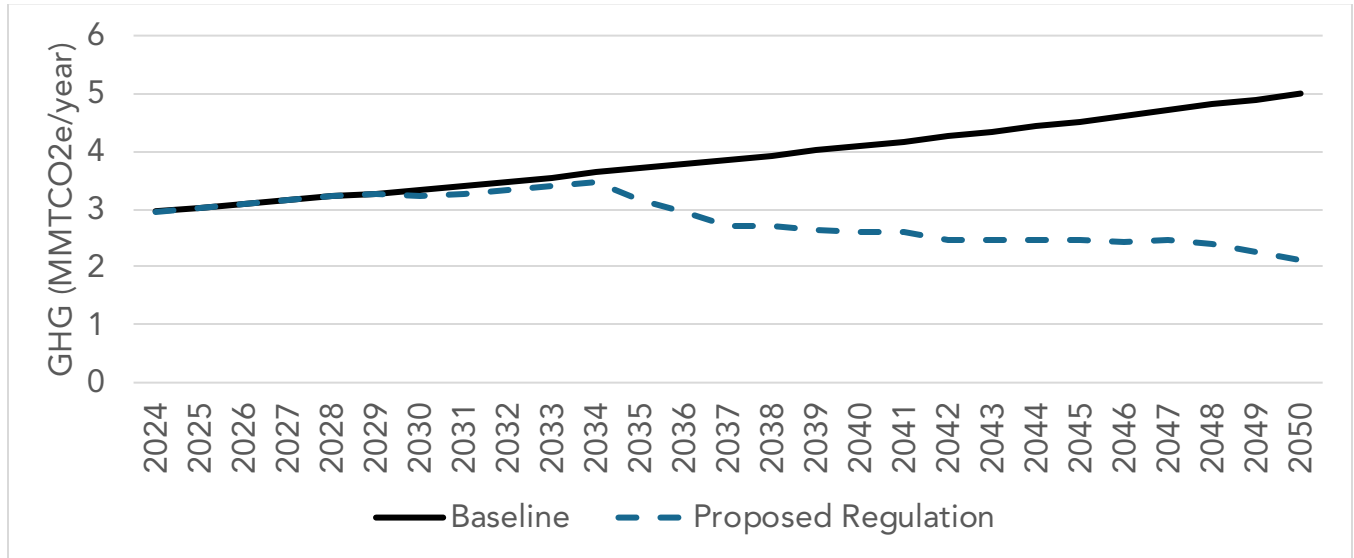


Baseline GHG emissions come entirely from diesel-powered locomotives, and WTT GHG emissions account for about 15 percent of the WTW GHG emissions, while 85 percent of the WTW GHG emissions is from the tailpipe. Because battery-electric and hydrogen fuel cell locomotives have no TTW GHG emissions, even with higher WTT GHG emissions compared to diesel-powered locomotives, they reduce total WTW GHG emissions.

Figure 23 presents projected WTW GHG (CO₂, CH₄ and N₂O) emissions from 2024 to 2050. The overall trend of annual GHG emissions for the BAU baseline is expected to rise slightly between 2024 and 2050 due to the annual projected growth of locomotive²²⁵ activity in California. The annual GHG emissions for the Proposed Regulation scenario are projected to remain similar to the BAU baseline until 2030. Locomotives being replaced by the Spending Account prior to 2030 are assumed to be Tier 4 diesel locomotives. Although Tier 4 locomotives emit fewer PM_{2.5} and NO_x emissions than older Tiers through emission control systems, there are no GHG emission reduction benefits. GHG emissions begin to decline compared to the BAU baseline in 2030 when ZE locomotives are first introduced from compliance with the Spending Account and the In-Use Operational Requirements. Starting in 2035, as the In-Use Operational Requirements require line haul locomotives with original engine build dates of 2035 or older to be ZE to operate in California, GHG emissions start to steadily decline compared to the BAU baseline and continue to be reduced as more ZE locomotives are put into service. The Proposed Regulation is projected to reduce approximately 21.9 MMT of GHG from 2024 to 2050.

²²⁵ Appendix G: CARB’s 2022 In-Use Locomotive Emission Inventory: Regulatory Proposal and Scenarios.

Figure 23: Projected Annual Well-to-Wheel GHG Emissions from Locomotives Operating in California



G. PM_{2.5} and NO_x Emissions per Locomotive Type

Figure 24 and Figure 25 show the contribution to statewide locomotive PM_{2.5} and NO_x emissions for each locomotive category (Class I linehaul, Class I switcher, Class III, industrial, and passenger locomotives) under the BAU baseline and the Proposed Regulation in 2025, 2030, and 2040. The figures show the greatest emission reductions achieved by the Proposed Regulation will come from Class I line haul locomotives due to their population size. However, when looking at emission reduction percentages compared to the BAU baseline, switcher, Class III, and industrial locomotives reduce more emissions than other locomotive types because of their age and emission levels. Emissions from switchers, Class III, and industrial locomotives are projected to be reduced by over 95 percent under the Proposed Regulation in 2040. Switchers, Class III, and industrial locomotives are the dirtiest locomotives in the state, and without the Proposed Regulation, these locomotives are projected to account for 13 percent of NO_x emissions and 14 percent of PM_{2.5} emissions from locomotive activities in California in 2040, even though they account for only 4 percent of the activities.

Figure 24: Statewide Locomotive PM2.5 Emissions by Locomotive Type

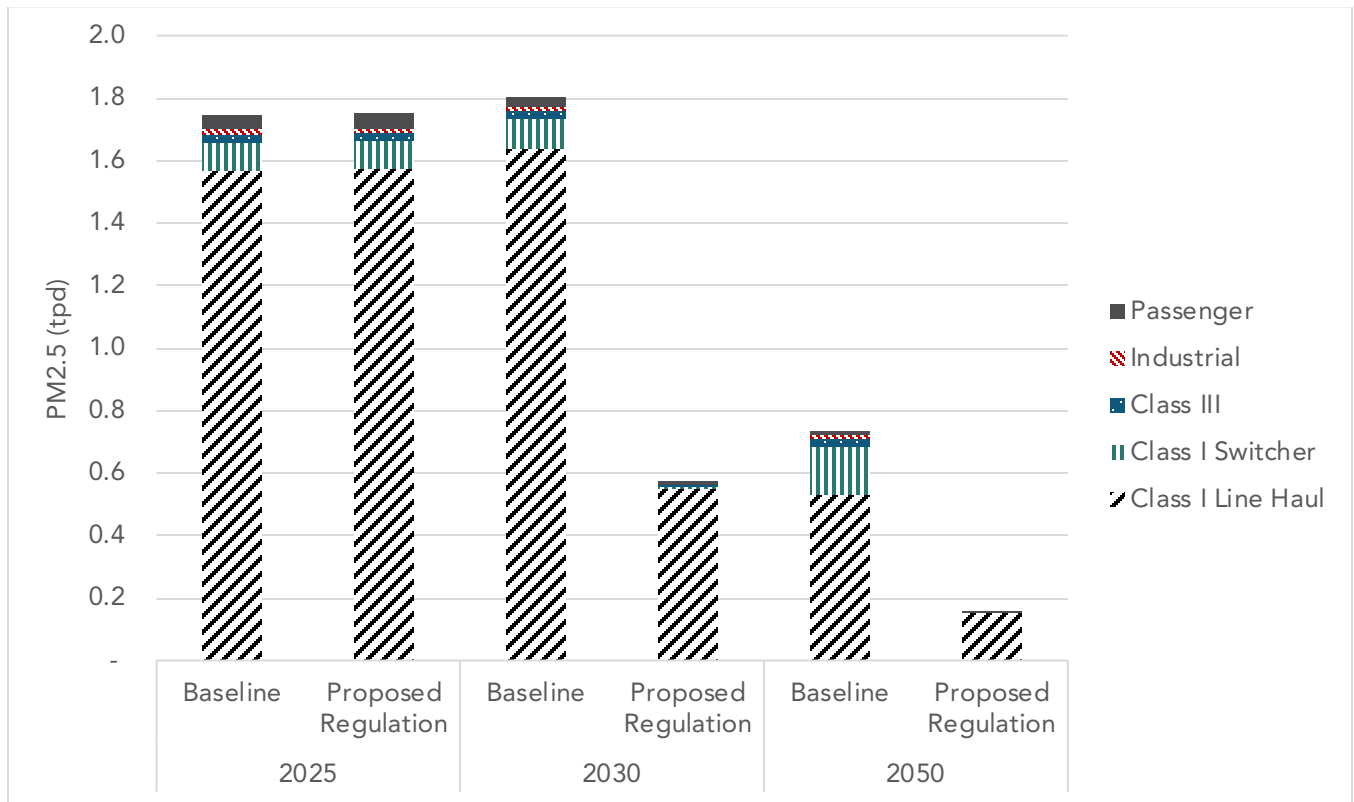
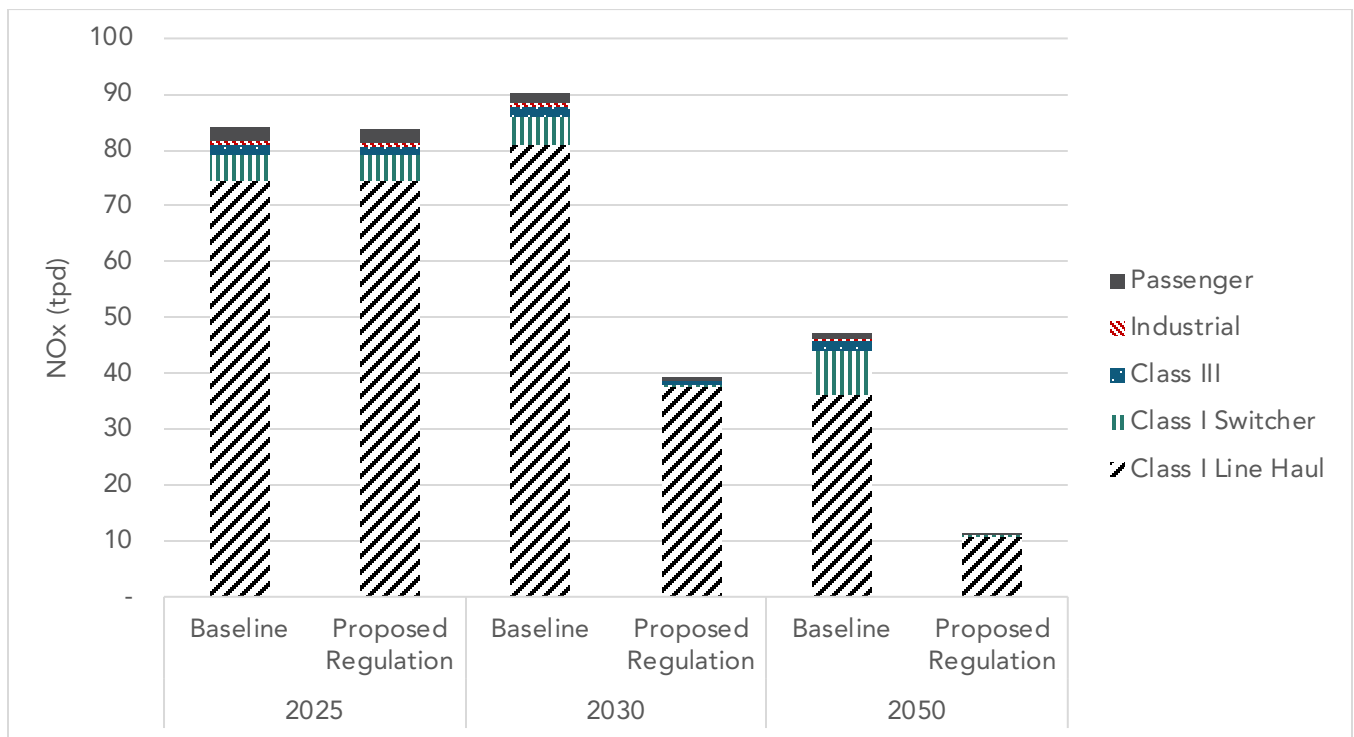


Figure 25: Statewide Locomotive NOx Emission by Locomotive Type



VI. Environmental Analysis

CARB, as the lead agency for the Proposed Regulation, has prepared an Environmental Analysis (EA) under its certified regulatory program (Title 17, CCR § 60000 through 60005) to comply with the requirements of the California Environmental Quality Act (CEQA). CARB's regulatory program, which involves the adoption, approval, amendment, or repeal of standards, rules, regulations, or plans for the protection and enhancement of the State's ambient air quality, has been certified by the California Secretary for Natural Resources under Public Resources Code § 21080.5 of CEQA (Title 14, CCR § 15251(d)). As a lead agency, CARB prepares a substitute environmental document (referred to as an "Environmental Analysis" or "EA") as part of the Staff Report to comply with CEQA (Title 17, CCR § 60004.2).

CARB has prepared a Draft EA to assess the potential for significant adverse and beneficial environmental impacts associated with the Proposed Regulation, as required by CARB's certified regulatory program (Title 17, CCR § 60004.2). CARB used the resource areas from the CEQA Guidelines Environmental Checklist as a framework for assessing the potential for significant impacts. For the purpose of determining whether the Proposed Regulation will have a potential adverse effect on the environment, CARB evaluated the possible physical changes to the environment resulting from the most reasonably foreseeable compliance scenarios.

Implementation of the Proposed Regulation could result in the construction and operation of new or expanded manufacturing facilities for locomotives; the construction of supporting infrastructure, such as electric chargers and hydrogen fueling stations; increased demand for electricity, requiring more electricity generation; the displacement of fossil fuel extraction, refinement, manufacture, distribution, and combustion; new or modified recycling or refurbishment facilities to accommodate battery disposal; and increased demand for the extraction of raw minerals used in the production of batteries and fuel cells, such as lithium and platinum from source countries and states.

While many impacts associated with the compliance with the Proposed Regulation could be reduced to less-than-significant levels through conditions of approval applied and mitigation measures to project-specific development, the authority to apply that mitigation lies with land use agencies or other agencies approving the development projects, not with CARB. Consequently, the Draft EA takes a conservative approach in its significance conclusions and discloses for CEQA compliance purposes that potentially significant environmental impacts may be unavoidable. Table 17 summarizes the potential environmental impacts of the Proposed Regulation.

Table 17: Summary of Potential Environmental Impacts

Resource Area	Impact Significance
Short-Term Construction-Related Impacts on Aesthetics	Potentially significant and unavoidable
Long-Term Operational Impacts on Aesthetics	Potentially significant and unavoidable

Resource Area	Impact Significance
Short-Term Construction-Related and Long-Term Operation-Related Effects to Agriculture and Forestry Resources	Potentially significant and unavoidable
Short-Term Construction-Related Impacts on Air Quality	Potentially significant and unavoidable
Long-Term Operational-Related Impacts on Air Quality	Beneficial
Short-Term Construction-Related Impacts on Biological Resources	Potentially significant and unavoidable
Long-Term Operational Impacts on Biological Resources	Potentially significant and unavoidable
Short-Term Construction-Related and Long-Term Operational Impacts on Cultural Resources	Potentially significant and unavoidable
Short-Term Construction-Related Effects on Energy Demand	Less than significant
Long-Term Operational-Related Impacts to Energy Resources	Less than significant
Short-Term Construction-Related and Long-term Operation-Related Impacts on Geology and Soils	Potentially significant and unavoidable
Short-Term Construction-Related and Long-Term Operation-Related Impacts on Greenhouse Gases	Beneficial
Short-Term Construction-Related Impacts on Hazards and Hazardous Materials	Potentially significant and unavoidable
Long-Term Operational Impacts on Hazards and Hazardous Materials	Potentially significant and unavoidable
Short-Term Construction-Related Impacts on Hydrology and Water Quality	Potentially significant and unavoidable
Long-Term Operational Impacts on Hydrology and Water Quality	Potentially significant and unavoidable

Resource Area	Impact Significance
Short-Term Construction-Related and Long-Term Operation-Related Impacts on Land Use and Planning	Less than significant
Short-Term Construction-Related and Long-Term Operation-Related Impacts on Mineral Resources	Potentially significant and unavoidable
Short-Term Construction Related Impacts to Noise	Potentially significant and unavoidable
Long-Term Operational Impacts on Noise	Potentially significant and unavoidable
Short-Term Construction-Related and Long-Term Operation-Related Effects to Population and Housing	Less than significant
Short-Term Construction-Related and Long-Term Operation-Related Impacts on Public Services	Less than significant
Short-Term Construction-Related and Long-Term Operation-Related Impacts on Recreation	Less than significant
Short-Term Construction-Related Effects to Transportation	Potentially significant and unavoidable
Long-Term Operation-Related Effects to Transportation	Potentially significant and unavoidable
Short-Term Construction-Related and Long-Term Operational Impacts on Tribal Cultural Resources	Potentially significant and unavoidable
Short-Term Construction-Related and Long-Term Operational Impacts on Utilities and Service Systems	Potentially significant and unavoidable
Short-Term Construction-Related and Long-Term Operation-Related Impacts on Wildfire	Less than significant

Staff prepared a Notice of Preparation and made it available for review and comment for 30 days, per the CEQA Guidelines (title 14, CCR, section 15082(b)). The comment period for the Notice of Preparation began on October 27, 2020 and ended on November 25, 2020. CARB held public workshops that also served as CEQA scoping meetings to solicit input on the scope and content of the Draft EA on October 30, 2020 and March 30, 2021. Written comments on the Draft EA will be accepted starting September 23, 2022, through 12:00 a.m. on November 7, 2022. The Board will consider the Final EA and responses to comments received on the Draft EA before taking action to adopt the Proposed Regulation.

VII. Environmental Justice

State law defines environmental justice as the fair treatment and meaningful involvement of people of all races, cultures, incomes, and national origins, with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (Gov. Code, § 65040.12, subd. (e)(1)). Environmental justice includes, but is not limited to, all of the following: (A) The availability of a healthy environment for all people. (B) The deterrence, reduction, and elimination of pollution burdens for populations and communities experiencing the adverse effects of that pollution, so that the effects of the pollution are not disproportionately borne by those populations and communities. (C) Governmental entities engaging and providing technical assistance to populations and communities most impacted by pollution to promote their meaningful participation in all phases of the environmental and land use decision making process. (D) At a minimum, the meaningful consideration of recommendations from populations and communities most impacted by pollution into environmental and land use decisions (Gov. Code, § 65040.12, subd. (e)(2)). The Board approved its Environmental Justice Policies and Actions (Policies) on December 13, 2001, to establish a framework for incorporating environmental justice into CARB's programs consistent with the directives of State law. These policies apply to all communities in California but are intended to address the disproportionate environmental exposure burden borne by low-income communities and communities of color. Environmental justice is one of CARB's core values and fundamental to achieving its mission.

Locomotives emit harmful pollutants while in transit and while idling. Locomotive routes and locomotive railyards are often located near sensitive receptors such as schools, hospitals, elder care facilities, and residential neighborhoods. The communities in and around facilities where locomotives operate are exposed to dangerous emissions from diesel-powered locomotives.

The impacts and burden from elevated air pollution in these communities can be and have been measured. Many of the communities near rail operations throughout California are classified as disadvantaged by the California Environmental Protection Agency (CalEPA), using the California Communities Environmental Health Screening Tool (CalEnviroScreen), Version 4.0, developed by the Office of Environmental Health Hazard Assessment (OEHHA).²²⁶ Economic disadvantage, environmental pollution, and increased health risks are closely tied. For example, while exposure to cancer-causing diesel particles has decreased statewide, CalEnviroScreen shows exposure to diesel particles in disproportionately affected communities is on average twice that experienced in other communities.²²⁷

California is placing additional emphasis on protecting heavily impacted disproportionately affected communities. In July 2017, Governor Jerry Brown signed Assembly Bill (AB) 617 (C. Garcia, Chapter 136, Statutes of 2017) into law. The bill requires air districts, through community-focused and community-driven action, to reduce air pollution and improve public health in communities that experience disproportionate burdens from exposure to air

²²⁶ Office of Environmental Health Hazard Assessment, CalEnviroScreen 4.0, accessed July 20, 2021. (weblink: <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40>).

²²⁷ CARB, Air Quality Progress in California Communities, July 23, 2016. (weblink: <https://www.arb.ca.gov/board/books/2016/062316/16-6-2pres.pdf>).

pollutants.²²⁸ AB 617 also requires CARB to assess and identify communities with high cumulative exposure burdens for toxic air contaminants and criteria air pollutants, prioritizing disadvantaged communities and sensitive receptor locations.

The Proposed Regulation is consistent with the environmental justice goals of CARB because it would reduce exposure to air pollutants and reduce adverse health impacts associated with toxic air contaminants. As discussed in Section V: Air Quality, the Proposed Regulation would reduce criteria pollutants, toxic air contaminants, GHG emissions, and community risk from regional air pollution. The emission reductions and associated improvements to air quality are designed to help protect all Californians and would be of particular benefit to those in heavily burdened and disproportionately affected communities.

During the development of the Proposed Regulation, staff engaged the community to ensure that the Proposed Regulation and other freight programs are aligned with community needs. Staff have conducted four public workshops and one public railyard listening session,²²⁹ as well as attended 8 AB 617 Community Steering Committee²³⁰ meetings and 12 meetings with environmental justice groups such as Earthjustice and the Coalition for Clean Air to specifically discuss the Proposed Regulation. Through the engagement, staff sought to better understand the impacts of freight activities, including locomotive activities at railyards, in California communities.

As a result of engagement with community members, environmental justice advocates, and community-based organizations, staff received feedback on ways the Proposed Regulation could best help address their concerns. Community stakeholders described how locomotives idle for excessive periods in local communities. Under the idling limits of the Proposed Regulation, locomotive operators would not be able to idle longer than 30 minutes (unless for an exempt reason). Community members would be encouraged to report idling complaints to CARB for possible enforcement action.

Community members also asked how to better understand the emissions occurring near them. The Proposed Regulation would require locomotive operators to report their activity and emission levels annually, and to specify the air district where the emissions occurred. CARB is committed to quantifying and presenting data to help the community better understand emissions occurring near them.

Community members expressed concern about the harmful effects of diesel emissions from locomotives. The Proposed Regulation would require locomotive operators to invest in cleaner combustion locomotives, and beginning in 2030, in zero emission (ZE) locomotives. By removing the oldest and dirtiest locomotives from operating in California and transitioning locomotives to ZE, the Proposed Regulation is projected to reduce emissions by 7,450 tons of particulate matter of 2.5 microns or less (PM_{2.5}) and 389,600 tons of oxides of nitrogen (NO_x), cumulatively by 2050. Staff expects the Proposed Regulation would also reduce 21.9 million metric tons of greenhouse gases (GHG) emissions from 2024 to 2050.

²²⁸ AB-617 Nonvehicular air pollution: criteria air pollutants and toxic air contaminants, 2017, accessed July 20, 2022. (weblink:https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB617).

²²⁹ CARB, Locomotives and Railyards Meetings & Workshops, accessed July 20, 2022. (weblink:<https://ww2.arb.ca.gov/our-work/programs/reducing-rail-emissions-california/locomotives-and-railyards-meetings-workshops>).

²³⁰ CARB, Community Air Protection Program Communities web page, accessed July 20, 2022. (weblink:<https://ww2.arb.ca.gov/capp-communities>).

These expected reductions represent a 92 percent decrease in PM2.5 and 87 percent decrease in NOx by 2050, as compared to the business-as-usual scenario. Shorter-term emission improvements are also expected: a 67 percent decrease in PM2.5 and a 53 percent decrease in NOx by 2030.

VIII. Standardized Regulatory Impact Analysis

This section summarizes results from the SRIA that estimate the cost and benefit impacts of the Proposed Regulation. While the direct compliance costs of the Proposed Regulation are large, by the time the impacts of the regulation work their way through the economy, the macroeconomic modeling shows a small impact on economic indicators such as Gross State Product (GSP), employment, output, and the personal income of individuals in California, as described in detail in this section. Thus, this regulatory action will not have a significant adverse economic impact on businesses. This section summarizes the economic impact of the Proposed Regulation as presented in the SRIA, which can be found in Appendix B, as well as on the Department of Finance (DOF) website. CARB responses to comments received from DOF can be found in Appendix C.

A. Direct Costs

The total net cost of the Proposed Regulation from 2023 to 2050 is estimated to be \$13.8 billion. Direct costs include capital costs for locomotives and zero emission locomotive supporting infrastructure, locomotive maintenance costs, infrastructure maintenance costs, electricity usage, CARB administrative payments, locomotive operator administrative costs for registration and reporting, as well as opportunity costs. Cost savings include ZE locomotive maintenance cost savings, diesel fuel savings, and locomotive salvage and sales revenue. The actual cost of the Proposed Regulation may be lower if locomotive operators take advantage of existing funding programs.

B. Changes since the Release of the SRIA

The Proposed Regulation has been updated since the release of the SRIA on May 26, 2022. The changes and their potential impacts on the economic analysis are found below.

1. Changes to all Scenarios

a) Linking of Class I Line Haul and Switcher Spending Accounts and Inventory

Separately modeled Class I line haul and switcher Spending Accounts were linked to represent presumed business practices for Class I locomotive operators. The revision supports the assumption that between 2030 and 2034, Class I locomotive operators would spend up to 50 percent of their total Spending Account funds to pay for ZE switchers and related infrastructure by combining Spending Account funds collected from both Class I line haul and road switchers. Linking the Class I line haul and switcher Spending Account funds within the inventory models resulted in faster uptake of ZE switchers and approximately \$2 billion reduction in opportunity costs – approximately an 80 percent decrease in opportunity costs – since there are less funds held within the Spending Account over multiple years.

b) Regulation Effective Date Change and Related Inventory Update

Staff adjusted the Proposed Regulation's locomotive inventories (for the Proposed Regulation, Alternative 1, Alternative 2, and Alternative 3) to account for the Proposed Regulation becoming effective in Quarter 4 of 2023, leading to a 75 percent reduction in Spending Account balances and related locomotive purchases in 2024 as compared to the SRIA. This also resulted in slightly fewer Tier 4 locomotive purchases and more ZE locomotive purchases since operators' Spending Accounts accrued fewer funds prior to the 2030 and 2035 ZE In-Use Operational Requirement.

c) Change of Class I Tier 4 Switchers from Yard to Road Switchers

To correct an error, staff replaced Class I Tier 4 yard switcher purchases with Tier 4 road switcher purchases at an increased unamortized cost of \$540,000 per locomotive. This led to slightly slower uptake of Tier 4 locomotives and an increase in ZE switcher uptake.

d) Correction of Sales Tax Calculation

Staff removed ZE line haul locomotives from sales tax calculations since there are currently no line haul locomotive manufacturers in California, and sales tax does not apply to most out-of-state locomotive purchases. This resulted in lower tax revenues for both local and state government.

e) Update to Consumer Price Index

Staff revised the values of the California Consumer Price Index to reflect the 2021 update from the Department of Industrial Relations.²³¹ This resulted in an approximately 0.01 percent increase in costs for the Proposed Regulation and all alternatives.

f) Addition of Personnel

To sufficiently implement and enforce the Proposed Regulation, staff removed 1.0 PY for an Air Resources Technician, and added 0.5 PY for an Air Resources Supervisor II and 1.0 PY for a Staff Services Analyst. These changes resulted in a \$5 increase in the annual administrative payment per diesel and ZE capable locomotive.

g) REMI National and Regional Control Updates

Staff updated the REMI National and Regional Control to conform to the most recent California DOF economic forecast, which was released with the 2022-23 May Revision to the Governor's Budget revised on May 13, 2022.^{232,233,234} Staff assumed that post-2025, the

²³¹ Department of Industrial Relations, California Consumer Price Index chart, 2022. (weblink: <https://www.dir.ca.gov/OPRL/CPI/EntireCCPI.PDF>).

²³² California Department of Finance. Economic Research Unit. National Economic Forecast – Annual & Quarterly. Sacramento: California. April 2022.

²³³ California Department of Finance. Economic Research Unit. California Economic Forecast – Annual & Quarterly. Sacramento: California. April 2022.

²³⁴ California Department of Finance. Economic Research Unit. National Deflators: Calendar Year averages: from 1929, April 2021. Sacramento: California. May 2022.

economic variables would continue to grow at the same rate projected in the REMI baseline forecasts.

2. Changes in Individual Scenarios

a) Correction to Alternative 1 Only – Class I Switcher, Class III, and Passenger Spending Account and Population Inventories

In modeling the SRIA Class III and passenger Spending Account funding requirements and locomotive populations, Spending Account deposits in 2024 were not expended nor accounted for in the opportunity cost calculation. Accounting for opportunity costs resulted in an increase in opportunity costs by \$275,621.

b) Correction to Alternative 1 Only – Fixed Opportunity Cost Calculation Error

Staff corrected an error in coding that previously double counted the Spending Account balance and had resulted in \$10.58 billion extra opportunity costs. This change accounted for over 80 percent of the drop in the cost of Alternative 1 between the SRIA and ISOR. This edit did not change the position of Alternative 1 relative to the other alternatives based on the benefit to cost ratio, nor the relative cost effectiveness, and therefore does not impact the rationale for rejecting this alternative.

c) Correction to Alternative 3 Only – Class III and Passenger Purchases

Staff fixed an error in purchases after 2030 to reflect the assumption that Spending Account funds would be used to purchase ZE locomotives. Previously, after 2030, Spending Account funds were used to purchase Tier 4 locomotives that were needed for compliance with the IUOR requirement. This change increased the number of ZE locomotives and decreased the number of Tier 4 locomotives purchased.

d) Correction to Small Business Costs

Staff fixed an error in the cost model related to battery-electric locomotive calculations that prevented the battery-electric locomotive cost from appearing. The fix resulted in an increase in total costs and a higher maximum, unamortized cost to small businesses.

C. Cumulative Cost Impact of Changes since SRIA

Table 18 shows the changes in net cost of each scenario due to the changes listed above. Table 19 shows the total net cost of the Proposed Regulation.

Table 18: Change in Net Costs per Scenario due to Changes Since SRIA

Scenario	Net Cost – SRIA	Net Cost – 399	Percent Change (%)	Updated Cost Effectiveness (\$/weighted ton)
Proposed Regulation	\$15,911,000,000	\$13,806,000,000	- 13.2	\$25,627
Alternative 1	\$26,262,000,000	\$15,550,000,000	- 40.8	\$29,361
Alternative 2	\$14,500,000,000	\$12,594,000,000	- 13.4	\$33,167
Alternative 3	\$7,118,000,000	\$7,839,000,000	+ 10.1	\$15,848

Table 19: Total Net Cost of Proposed Regulation to All Locomotive Operators from 2023 to 2050

Year	Equipment Capital Costs	Equipment Maintenance Costs	Infra-structure Capital Costs	Infra-structure Maintenance Costs	Diesel Fuel Costs	Electricity Fuel Costs	Hydrogen Fuel Costs	Geo-tracking Subscription Costs	Salvage Revenue	Sale Revenue	Reporting Costs	Admin Costs	Opportunity Costs	Total Net Cost
2023	\$0	-\$5,062,759	\$0	\$0	\$1	\$0	\$0	\$11,106,600	-\$1,769,000	\$0	\$0	\$0	\$0	\$4,274,842
2024	\$7,831,212	-\$13,245,380	\$0	\$0	\$2	\$0	\$0	\$381,600	-\$5,083,200	\$0	\$1,441,897	\$3,070,200	\$229,971	-\$5,373,699
2025	\$49,906,064	-\$11,869,927	\$0	\$0	-\$1	\$0	\$0	\$381,600	\$1,199,600	\$0	\$1,441,897	\$3,023,825	\$491,467	\$44,574,525
2026	\$86,661,197	-\$7,626,731	\$0	\$0	-\$1	\$0	\$0	\$381,600	-\$4,503,800	\$0	\$1,441,897	\$3,031,700	\$560,240	\$79,946,102
2027	\$125,340,005	-\$3,706,363	\$0	\$0	\$0	\$0	\$0	\$381,600	-\$4,463,930	\$0	\$1,441,897	\$3,054,975	\$797,687	\$122,845,869
2028	\$163,165,851	\$209,232	\$0	\$0	\$1	\$0	\$0	\$381,600	-\$3,935,400	\$0	\$1,441,897	\$3,070,725	\$794,141	\$165,128,047
2029	\$567,508,428	\$4,089,246	\$14,500,638	\$0	\$1	\$0	\$0	\$381,600	-\$48,329,400	-\$199,902,400	\$1,441,897	\$3,104,325	\$2,496,952	\$345,291,286
2030	\$637,119,449	\$42,764,180	\$17,773,733	\$2,790,000	-\$41,937,832	\$28,392,886	\$23,043,548	\$381,600	-\$4,140,172	-\$17,569,600	\$1,441,897	\$2,748,200	\$65,072,389	\$757,880,279
2031	\$645,020,613	\$52,797,343	\$19,141,067	\$3,217,500	-\$49,483,670	\$34,881,105	\$21,669,861	\$381,600	\$1,611,400	\$0	\$1,441,897	\$2,810,150	\$107,078,133	\$840,566,998
2032	\$655,560,762	\$55,505,605	\$20,481,920	\$3,244,500	-\$50,717,020	\$36,193,046	\$20,373,373	\$381,600	\$1,568,000	-\$13,952,000	\$1,441,897	\$2,876,825	\$146,969,134	\$879,927,642
2033	\$653,766,838	\$57,284,027	\$21,338,109	\$3,429,000	-\$55,333,156	\$40,655,752	\$19,076,886	\$381,600	\$4,051,688	-\$11,070,400	\$1,441,897	\$2,938,950	\$187,728,405	\$925,689,597
2034	\$617,804,867	\$57,695,697	\$21,813,947	\$3,474,000	-\$56,987,973	\$42,515,051	\$18,336,036	\$381,600	-\$11,937,000	\$0	\$1,441,897	\$3,008,775	\$805,512	\$698,352,409
2035	\$657,900,197	\$59,267,796	\$22,227,197	\$4,084,800	-\$197,640,420	\$43,725,143	\$305,699,463	\$381,600	-\$3,479,856	\$0	\$1,441,897	\$2,703,750	\$833,480	\$897,145,048
2036	\$684,202,057	\$57,381,993	\$22,649,273	\$4,503,000	-\$296,897,131	\$44,168,651	\$486,069,569	\$381,600	\$10,251,600	-\$48,080,000	\$1,441,897	\$2,518,425	\$709,041	\$969,299,973
2037	\$623,256,591	\$56,815,726	\$23,224,612	\$4,969,200	-\$407,138,095	\$44,899,963	\$673,201,655	\$381,600	\$12,238,000	-\$2,227,200	\$1,441,897	\$2,307,725	\$771,425	\$1,034,143,098
2038	\$584,086,429	\$52,738,791	\$23,616,196	\$5,137,500	-\$443,494,258	\$46,090,429	\$706,955,407	\$381,600	\$3,392,698	\$0	\$1,441,897	\$2,297,400	\$1,042,108	\$983,686,196
2039	\$543,555,593	\$50,046,848	\$24,330,355	\$5,367,600	-\$503,091,857	\$46,542,357	\$777,167,896	\$381,600	\$6,113,000	\$0	\$1,441,897	\$2,233,000	\$878,931	\$954,967,221
2040	\$496,509,089	\$47,371,950	\$24,739,592	\$5,595,000	-\$545,598,560	\$48,049,731	\$815,988,850	\$381,600	\$5,799,600	\$0	\$1,441,897	\$2,203,425	\$1,121,253	\$903,603,427

Year	Equipment Capital Costs	Equipment Maintenance Costs	Infra-structure Capital Costs	Infra-structure Maintenance Costs	Diesel Fuel Costs	Electricity Fuel Costs	Hydrogen Fuel Costs	Geo-tracking Subscription Costs	Salvage Revenue	Sale Revenue	Reporting Costs	Admin Costs	Opportunity Costs	Total Net Cost
2041	\$162,383,407	\$44,184,667	\$31,735,943	\$5,740,500	-\$585,086,563	\$48,557,255	\$840,821,949	\$381,600	-\$135,400	\$0	\$1,441,897	\$2,191,175	\$1,314,660	\$553,531,090
2042	\$77,411,770	\$40,985,177	\$32,475,780	\$8,404,800	-\$665,404,119	\$49,387,614	\$911,630,863	\$381,600	\$6,307,800	\$0	\$1,441,897	\$2,174,025	\$1,377,717	\$466,574,924
2043	\$54,276,920	\$37,479,367	\$33,361,658	\$8,547,900	-\$705,567,637	\$49,993,597	\$924,560,608	\$381,600	\$6,868,800	\$0	\$1,441,897	\$2,166,675	\$1,504,469	\$415,015,853
2044	\$42,959,403	\$33,925,122	\$34,265,190	\$8,694,300	-\$748,350,630	\$50,616,135	\$934,278,084	\$381,600	\$6,868,200	\$0	\$1,441,897	\$2,158,800	\$1,724,837	\$368,962,937
2045	\$44,078,631	\$31,613,590	\$34,265,190	\$8,844,300	-\$797,280,439	\$51,347,838	\$940,642,777	\$381,600	\$2,765,600	\$0	\$1,441,897	\$2,150,925	\$2,054,941	\$322,306,850
2046	\$72,256,213	\$29,211,567	\$34,265,190	\$8,997,300	-\$837,321,541	\$52,200,179	\$943,514,226	\$381,600	\$3,307,000	\$0	\$1,441,897	\$2,142,525	\$2,168,509	\$312,564,664
2047	\$54,701,144	\$26,777,479	\$34,265,190	\$9,084,000	-\$868,237,848	\$53,120,696	\$922,214,804	\$381,600	-\$2,120,000	\$0	\$1,441,897	\$2,174,900	\$2,309,043	\$236,112,903
2048	\$62,090,080	\$24,371,324	\$34,891,082	\$9,360,600	-\$947,387,528	\$53,757,013	\$950,995,635	\$381,600	-\$5,895,800	\$0	\$1,441,897	\$2,098,250	\$726,744	\$186,830,896
2049	\$147,164,388	\$22,015,904	\$22,725,503	\$9,853,800	-\$1,042,545,559	\$56,379,698	\$986,503,076	\$381,600	-\$2,399,600	\$0	\$1,441,897	\$1,988,525	\$470,461	\$203,979,692
2050	\$149,579,416	\$19,749,298	\$19,452,408	\$10,830,600	-\$1,147,476,190	\$61,938,610	\$1,016,408,086	\$381,600	\$3,425,400	\$0	\$1,441,897	\$1,869,350	\$292,012	\$137,892,486
Total	\$8,666,096,614	\$862,770,770	\$567,539,771	\$134,170,200	-\$10,992,978,024	\$983,412,748	\$13,239,152,651	\$21,409,800	-\$22,424,172	-\$292,801,600	\$38,931,209	\$68,117,525	\$532,323,661	\$13,805,721,152

D. The Creation or Elimination of Jobs within the State of California.

Table 20 presents the impacts of the Proposed Regulation on total employment in California across all private industries, the public sector, and for directly impacted industry. Figure 26: Change in Employment Between 2023-2050 Associated with Proposed Regulation illustrates the trends for each calendar year by major sector. Employment comprises estimates of the number of jobs, full-time plus part-time, by place of work for all industries. Full-time and part-time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included, but unpaid family workers and volunteers are not included. The employment impacts represent the net change in employment across the economy, which is composed of positive impacts for some industries and negative impacts for others.

The Proposed Regulation is estimated to result in a decrease in employment growth in California most years of the assessment. These changes in employment represent less than 0.01 percent of baseline California employment in 2025, grow to represent a decrease of 0.05 percent of baseline California employment in 2040, and diminishes to be approximately 0.01 percent of baseline California employment by 2050. The patterns of decreasing employment growth closely track the annual costs of the Proposed Regulation as the direct impacts of the Proposed Regulation more broadly impact businesses and individuals in California. In 2023, 2024, and 2025, the modeled results show an increase in employment. This is primarily associated with increase revenue from the sale and scrappage of locomotives and the associated decrease in maintenance costs in those years.

The rail transportation industry in California bears the greatest direct cost of the Proposed Regulation and is also estimated to see the greatest impact to employment growth. As shown in Table 20: Employment Changes of Proposed Regulation 2023-2050, the Proposed Regulation results in a decrease in employment growth in 2025 of 8 jobs, a decrease in employment growth in 2040 of 249 jobs, and a decrease in employment growth in 2050 of 64 jobs; a decrease of about two percent is estimated for the years of greatest impact.

The Proposed Regulation is anticipated to result in an increase in demand for several industries including: railroad and rolling stock manufacturing; construction; natural gas distribution (for hydrogen supply); electric equipment manufacturing; electric power generation, transmission, and distribution; basic chemical manufacturing; office administrative services; navigational instruments manufacturing; management, scientific, and technical consulting services; and computer systems design and related services. In general, increased demand in a specific industry will be associated with increases in employment growth. However, rail transportation is an intermediate input for many of these industries and will be impacted as the costs of the Proposed Regulation are passed on. As a result, the annual impacts to these industries are mixed with increased employment growth in some years and decreases in employment growth in others.

For example, the Proposed Regulation is anticipated to increase demand in the construction sector starting in 2030 as new electric and hydrogen infrastructure is installed. However, the construction sector also relies heavily on rail transportation as an intermediate input. As shown in Figure 26 the Proposed Regulation is estimated to have positive impacts on employment within the construction sector from 2043 through 2050. In 2034, the magnitude

of the negative impact is significantly lower than other years, which is associated more generally with additional revenue to the rail transportation industry associated with scrap and sale of older locomotives. From 2043 through 2050, the increases in employment growth are a result of increased demand for construction outweighing the negative impacts of increased costs to rail transportation in general.

Industries that are anticipated to face a reduction in demand because of the Proposed Regulation are also anticipated to see a decrease in employment growth. If these industries also rely on rail transportation as an intermediate good, there will be additional decreases in employment growth associated with the direct costs of the regulation. The petroleum and coal products manufacturing industry is anticipated to see a decrease in employment growth for both of these reasons. The anticipated decrease in employment, relative to the baseline, is 0.67 percent in 2050.

Table 20: Employment Changes of Proposed Regulation 2023-2050

Industry	Units	2025	2030	2035	2040	2045	2050
CA statewide	Total Employment (millions)	25.7	25.8	26.0	26.6	27.4	28.4
CA statewide	Percent change	0.00%	-0.03%	-0.05%	-0.05%	-0.02%	-0.01%
CA statewide	Change in jobs	130	-7,158	-12,201	-13,964	-5,077	-3,118
Rail transportation	Percent change	-0.07%	-0.91%	-2.13%	-2.29%	-1.15%	-0.61%
Rail transportation	Change in jobs	-8	-106	-239	-249	-122	-64
Railroad rolling stock manufacturing	Percent change	0.16%	0.19%	-0.04%	-0.27%	-0.13%	-0.06%
Railroad rolling stock manufacturing	Change in jobs	1	1	0	-2	-1	0
Construction	Percent change	0.00%	-0.09%	-0.14%	-0.11%	0.02%	0.02%
Construction	Change in jobs	1	-1,176	-1,776	-1,506	250	251
Natural gas distribution	Percent change	0.00%	0.00%	-0.04%	-0.04%	-0.02%	-0.01%
Natural gas distribution	Change in jobs	0	0	-5	-5	-2	-1
Electric equipment manufacturing	Percent change	0.00%	0.02%	-0.05%	-0.06%	-0.03%	-0.01%

Industry	Units	2025	2030	2035	2040	2045	2050
Electric equipment manufacturing	Change in jobs	0	2	-4	-4	-2	-1
Electric power generation, transmission, and distribution	Percent change	0.00%	0.00%	-0.01%	-0.02%	0.03%	0.06%
Electric power generation, transmission, and distribution	Change in jobs	0	-1	-3	-5	10	18
Basic chemical manufacturing	Percent change	0.00%	0.01%	0.53%	1.44%	1.58%	1.58%
Basic chemical manufacturing	Change in jobs	0	1	40	110	124	128
Petroleum and coal products manufacturing	Percent change	0.00%	-0.08%	-0.24%	-0.48%	-0.54%	-0.67%
Petroleum and coal products manufacturing	Change in jobs	0	-10	-28	-54	-59	-70
Office administrative services; facilities support services	Percent change	0.01%	-0.01%	-0.03%	-0.03%	-0.01%	-0.01%
Office administrative services; facilities support services	Change in jobs	8	-15	-34	-44	-16	-9
Navigational, measuring, electromedical and control instruments manufacturing	Percent change	0.00%	-0.01%	-0.02%	-0.02%	-0.01%	0.00%
Navigational, measuring, electromedical and control instruments manufacturing	Change in jobs	0	-10	-17	-19	-8	-3

Industry	Units	2025	2030	2035	2040	2045	2050
Management, scientific, and technical consulting services	Percent change	0.00%	-0.02%	-0.03%	-0.04%	-0.02%	-0.01%
Management, scientific, and technical consulting services	Change in jobs	1	-69	-125	-153	-71	-48
Computer systems design and related services	Percent change	0.00%	-0.01%	-0.02%	-0.03%	-0.02%	-0.01%
Computer systems design and related services	Change in jobs	2	-58	-149	-225	-162	-128
State and local government	Percent change	0.01%	-0.02%	-0.07%	-0.10%	-0.05%	-0.04%
State and local government	Change in jobs	175	-407	-1,621	-2,493	-1,217	-1,073

Figure 26: Change in Employment Between 2023-2050 Associated with Proposed Regulation

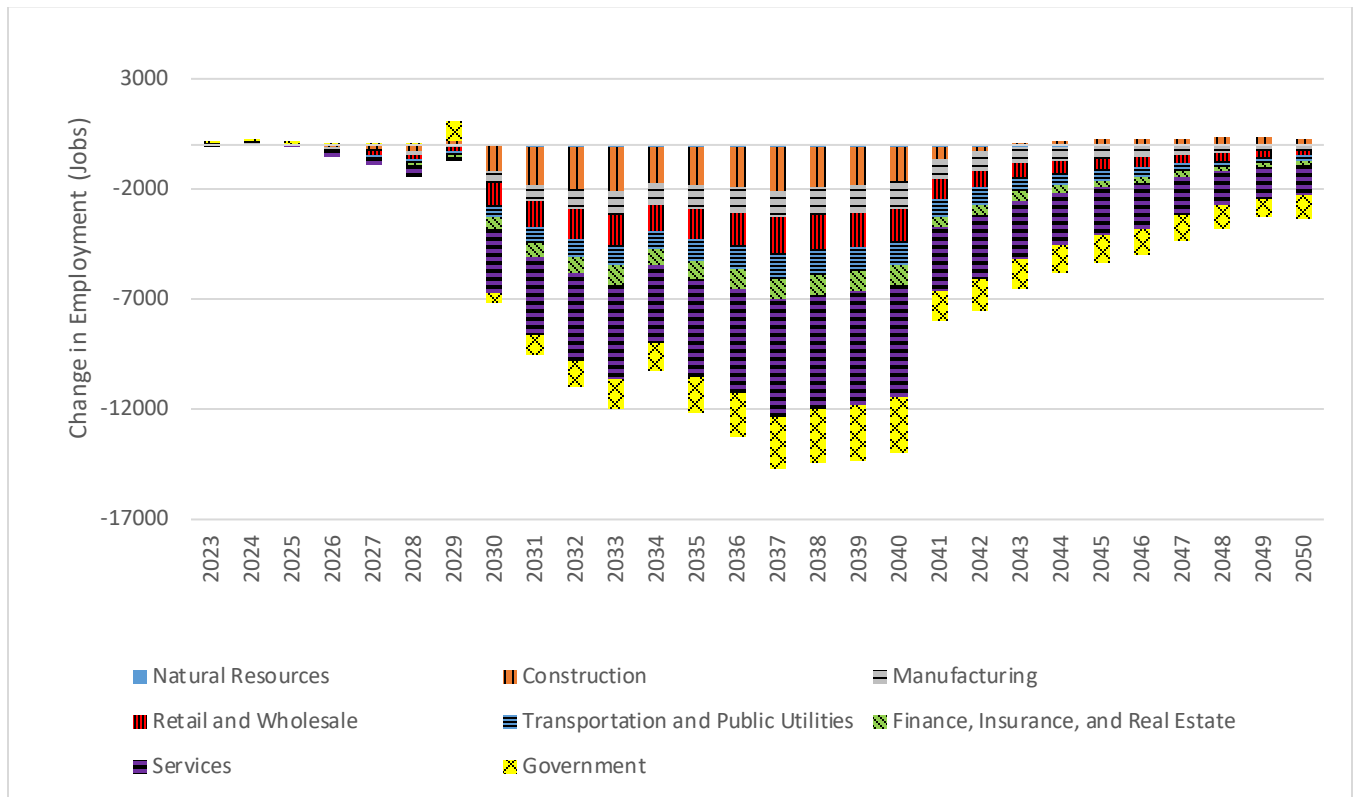


Figure 26 illustrates the changes in employment by major sector. Some major sectors will see gains in employment growth, while other major sectors may see decreases in employment growth. In 2050, there is estimated to be an increase of 251 jobs in the construction sector and a decrease of 3,370 jobs within the natural resources; manufacturing; retail and wholesale; finance, insurance, and real estate; services; transportation and public utilities; and government sectors.

E. The Creation of New Business or the Elimination of Existing Businesses within the State of California.

The Proposed Regulation does not directly result in business creation or elimination and the REMI model cannot directly estimate the creation or elimination of businesses. However, changes in the jobs and output for California and the overall costs to directly impacted businesses and to California can be used to understand some of the potential impacts.

Reductions in output growth could indicate the elimination of businesses, relative to the baseline. Conversely, increased output within an industry could signal the potential for additional business creation if existing businesses cannot accommodate all future demands. There is no threshold that identifies the creation or elimination of individual businesses.

Based on the modeling of changes in output and employment, businesses involved in the manufacture and installation of hydrogen infrastructure, as well as hydrogen manufacturing, may see expansions in business. To the degree that any California businesses are involved in the manufacture of new locomotives, these businesses may also expand to meet demands.

The greatest impacts to output and employment occur in the rail transportation industry. A large portion of the costs will be borne by Class I operators. The Class I operators are large national corporations and are not anticipated to experience business elimination because of the Proposed Regulation. It is likely that these operators will be able to pass on costs of the Proposed Regulation across the nation. Some smaller Class III locomotive operators in California may face significant compliance costs. If these businesses are unable to pass on the costs of the Proposed Regulation to customers or if there is a significant change in demand for services, it is possible some of these businesses would be eliminated. If small businesses face cost pressures that could cause bankruptcy, CARB may issue an extension in the time required to set aside funds into the Spending Account, reduce the Spending Account contribution requirement, or after 2030, provide an extension of eligibility to operate a locomotive older than 23 years old by up to three years.

F. The Expansion of Businesses Currently Doing Business within the State of California.

1. Benefits to Typical Businesses

The Proposed Regulation may benefit locomotive manufacturers, firms offering locomotive conversions to ZE or ZE capable operation, engineering and construction firms, and project management firms. The Proposed Regulation would increase demand for Tier 4 locomotives, repowers, and remanufactures in California due to the Spending Account and IUOR. Staff anticipates increased demand for Tier 4 locomotives in California will result in additional production of Tier 4 locomotives or additional production associated with Tier 4 repowers and remanufactures, along with associated labor increases.

Staff anticipates that the requirements of the Proposed Regulation will also result in increases in the production of ZE locomotives, ZE repowers, or ZE remanufactures. The Proposed Regulation does not impose requirements on locomotive manufacturers, but staff anticipates that manufacturers will offer options for the conversion to ZE or ZE capable locomotives. Manufacturers may be well-positioned to offer such conversion services, but other firms could offer competitive products as well. Thus, an increase in production may benefit ZE locomotive manufacturers, as well as various businesses in the ZE locomotive supply chain, including those involved in battery, fuel cell, and renewable energy technology throughout the state.

Individual businesses that operate ZE locomotives may also be able to lower their total cost of ownership with operational and maintenance cost savings, and credits generated under the Low Carbon Fuel Standard (LCFS) Regulation. LCFS is a regulation designed to reduce the carbon intensity of California's transportation fuel and provide an increasing range of low-carbon and renewable alternatives, which reduce petroleum dependency and achieve air quality benefits. For battery electric charging or hydrogen fuel production, the owner of electric charging infrastructure or hydrogen production facilities where electricity or fuel is dispensed are eligible to generate LCFS credits.²³⁵

²³⁵ California Air Resources Board, Unofficial electronic version of the Low Carbon Fuel Standard Regulation, July 2020, (weblink: https://ww2.arb.ca.gov/sites/default/files/2020-07/2020_lcfs_fro_oal-approved_unofficial_06302020.pdf).

Advanced technologies such as ZE locomotives provide opportunities for design, engineering, construction, and project management firms to create new and expanded infrastructure to serve the needs of ZE locomotives. Increases in the demand for ZE charging and fueling infrastructure could also benefit suppliers, equipment installers, and electricians. Additionally, some of the infrastructure equipment may be manufactured in California.

2. Benefits to Small Businesses

Electricians; engineering, construction, and project management companies; parts and components businesses; and others involved in designing, installing, and maintaining electric and fueling infrastructure equipment may fall into the small business category. The benefits to locomotive manufacturers and other related businesses discussed above may also apply to small businesses.

G. Significant Statewide Adverse Economic Impact Directly Affecting Business, Including Ability to Compete

The Executive Officer has made an initial determination that the proposed regulatory action would not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons.

H. The Competitive Advantages or Disadvantages for Businesses Currently Doing Business within the State

There could be indirect competitive disadvantages to California businesses that depend primarily on rail transport. California producers and their products compete with producers and products from other states and nations. The extent and nature of that competition depends on commodity type. For example, some California products are differentiated by source or brand, such as Napa Valley wines, California raisins, or Tesla autos. Since customers may not see wines, raisins, or autos from elsewhere as perfect substitutes, differentiated products can often command a somewhat higher price and have a greater ability to absorb transportation cost differences without losing market share. Other California products dominate their industry due to production volume and are somewhat shielded from competition because other sources cannot satisfy the market demand. However, California products that are not differentiated by source or brand must compete on delivered price and reliability of supply. Some California businesses may therefore face increased competition to the extent that their product prices are affected by increased shipping costs associated with the Proposed Regulation.

I. The Increase or Decrease of Investment in the State

Gross domestic private investment consists of purchases of residential and non-residential structures and of equipment and software by private businesses and nonprofit institutions. It is used as a proxy for impacts on investments in California because it provides an indicator of the future productive capacity of the economy.

Table 21 shows the changes in private investment as a result of the Proposed Regulation. Under the Proposed Regulation, private investment is anticipated to decrease by \$7 million

in 2025, decrease by \$673 million in 2040, and decrease by \$96 million in 2050. These impacts to private investment range between a decrease of less than 0.01 percent to a decrease of about 0.11 percent.

Table 21: Private Investment Changes 2023-2050

	2025	2030	2035	2040	2045	2050
Private Investment (2019B\$)	502	538	577	629	687	751
Percent Change	0.00%	-0.07%	-0.11%	-0.11%	-0.03%	-0.01%
Change (2019M\$)	-7	-357	-628	-673	-179	-96

1. Establishing ZE Technology in the Off-Road Sector

The Proposed Regulation would start the transition to ZE for locomotives operating in California. In the short term, locomotive switchers (Class I, Class III, and industrial) provide a unique opportunity to accelerate the deployment of ZE technology in the off-road sector. Unlike line haul locomotives, which may travel throughout the country and return to a base only for periodic maintenance, switchers are generally used for railyard operations or local and regional delivery, returning to a railyard or home base each night. Due to their daily operational characteristics and the operating range of current ZE technologies, switchers are well suited for ZE pilots in California.^{236, 237, 238} Passenger operators are also beginning to implement ZE technology and are expected to have access to commercially available ZE locomotives by 2030 (see Technology Assessment within the ISOR for further details). Even with line haul locomotives, UP and BNSF have committed to integrating ZE technology.^{239, 240} As use of ZE technologies expand, technical capabilities will improve, and the ZE technologies are expected to operate comparably with diesel technology. Additionally, as ZE switchers are increasingly adopted, industry acceptance of advanced technologies is improving. The current state of ZE locomotive technology is expected to progress and expand into extended range applications, as well as other off-road sectors.

²³⁶ U.S. House of Representatives, House Committee on Transportation and Infrastructure, "The Business Case for Climate Solutions." May 2021. (weblink: <https://transportation.house.gov/imo/media/doc/Santana%20Testimony.pdf>).

²³⁷ Canadian Pacific, "CP to employ Ballard fuel cells in Hydrogen Locomotive Project." March 2021, accessed August 4, 2022. (weblink: <https://www.cpr.ca/en/media/cp-to-employ-ballard-fuel-cells-in-hydrogen-locomotive-project>).

²³⁸ Railway Age, "Zero-Emission Locomotives on U.S. Railways?" February 2021, accessed August 4, 2022. (weblink: <https://www.railwayage.com/news/zero-emission-locomotives-on-u-s-railways/>).

²³⁹ Trains: *The Magazine of Railroading*, "Union Pacific Sees Battery-Electric Locomotives as the Future." May 2021, accessed August 4, 2022. (weblink: <https://www.trains.com/trn/union-pacific-sees-battery-electric-locomotives-as-the-future/>).

²⁴⁰ BNSF, "Orange is the New Green." April 2021, accessed August 4, 2022. (weblink: <https://www.bnsf.com/news-media/railtalk/community/orange-new-green.html>).

2. Infrastructure

The Proposed Regulation would increase the installation of electric charging and hydrogen fueling infrastructure needed to support the use of ZE locomotives. ZE technologies are underutilized due, in part, to limited access to supporting infrastructure at facilities where locomotives operate. Additional installations of electric charging and hydrogen fueling infrastructure will support the use of these technologies, as well as other advanced technology equipment and vehicles.

The increased use of electric charging infrastructure will also increase the amount of electricity supplied by utility providers and help the state's investor-owned utilities meet the goals of SB 350.²⁴¹ SB 350 requires the State's investor-owned utilities to develop programs to accelerate widespread transportation electrification with goals to reduce dependence on petroleum, increase the uptake of ZE vehicles and equipment, help meet air quality standards, and reduce GHGs. The three large investor-owned utilities in the state, Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison, have either proposed or have been approved to establish new business electricity rate options that make charging more affordable during certain times of the day. Although not required by SB 350, several publicly owned utilities have taken similar action. For example, Los Angeles Department of Water and Power and Sacramento Municipal Utility District have made ready charging infrastructure programs and new commercial rates for charging. The Proposed Regulation supports the utilities' programs and the goals of SB 350 by increasing the number of ZE locomotives in the state to make use of these utility investments and rates, where feasible.

Hydrogen use by the line haul and passenger locomotives under this regulation is expected to increase U.S. hydrogen demand by about 1.9 million metric tons between 2030 and 2050. For hydrogen fuel cell line haul locomotives to operate with the same duty cycle as diesel line-haul locomotives, each locomotive is expected to need a carrying capacity of approximately 4,000 kg of liquid hydrogen split between on-board tanks and a fuel tender. Assuming a liquid hydrogen fuel tender can carry close to 8,000 kg, each tender could service two locomotives. Staff expect that up to 100 locomotives could be fueled by a fueling station with capacity between 200,000 and 375,000 kg liquid hydrogen per day (depending on companies' refueling practices). Staff assume that pipeline delivery would be prioritized for Class I, given the scale of daily demand, while passenger operators could either receive hydrogen via truck or generate hydrogen on-site, if and where space allows. This level of demand falls within the projected demand in California Energy Commission's (CEC) 2021 Integrated Energy Policy Report "Transportation Demand Forecasts,"²⁴² and is an expected portion of total demand projected by the United States Department of Energy (U.S. DOE).²⁴³ This level of demand will help support California's transition to clean transportation, the U.S.

²⁴¹ California Legislature, Senate Bill No. 350, signed October 7, 2015. (weblink: https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB350).

²⁴² California Energy Commission, Integrated Energy Policy Report 2021, Presentation – Transportation Energy Demand Forecast, TN 240934. (weblink: <https://efiling.energy.ca.gov/GetDocument.aspx?tn=240934&DocumentContentId=74780>).

²⁴³ Department of Energy, Hydrogen Program Plan, 2020. (weblink: <https://www.hydrogen.energy.gov/pdfs/hydrogen-program-plan-2020.pdf>).

DOE Energy Earthshots goals,²⁴⁴ and the Biden Administration’s energy goals. The amount of hydrogen required to fuel ZE locomotives can encourage continued pairing of renewable energy and hydrogen production. Hydrogen production offers additional value when linked to renewable energy production facilities since excess renewable energy produced during the day can be converted into hydrogen for storage and later use instead of being curtailed.

J. The Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State’s Environment.

The Proposed Regulation is designed to reduce toxic air contaminant, criteria pollutant, and GHG emissions by transitioning old, highly polluting locomotives to the cleanest diesel-powered locomotives available and ZE locomotives. Cumulatively, from 2023 to 2050, the Proposed Regulation is expected to reduce statewide locomotive emissions by approximately 7,455 tons of PM_{2.5} and 389,630 tons of NO_x relative to the baseline. The total statewide valuation of avoided health outcomes from 2023 to 2050 is approximately \$31.96 billion. For detailed information on health and emissions benefits of the Proposed Regulation, see Chapters IV and V.

IX. Evaluation of Regulatory Alternatives

Government Code section 11346.2, subdivision (b)(4) requires the California Air Resources Board (CARB) to consider and evaluate reasonable alternatives to the proposed regulatory action and provide reasons for rejecting those alternatives. This section discusses alternatives evaluated and provides reasons why these alternatives were not included in the proposal. As explained below, no alternative proposed was found to be less burdensome and equally effective in achieving the purposes of the regulation in a manner than ensures full compliance with the authorizing law. The Board has not identified any reasonable alternatives that would lessen any adverse impact on small business.

Staff solicited public input regarding alternatives to the Proposed Regulation throughout the development process and specifically at public workshops held on October 29, 2020, October 30, 2020, and March 30, 2021. The workshops were webcast with the ability to submit questions online to ensure the opportunity for broader public participation. In addition, staff conducted informal meetings, phone calls, and site visits with a broad group of stakeholders. For more information on outreach for the Proposed Regulation, see Chapter XI: Public Process for the Proposed Action. Staff evaluated four alternatives as described below.

A. Alternative 1: Spending Account Purchases for Zero Emission Locomotives Start 2024.

Alternative 1 is a more stringent requirement for locomotives operating in California. Under this alternative, all the Proposed Regulation requirements remain the same except the date by which Spending Account funds would be dedicated to zero emission (ZE) locomotives and associated infrastructure. For this Alternative, Spending Account funds would be used for ZE

²⁴⁴ Department of Energy. Hydrogen Shot. 2021, accessed August 4, 2022. (weblink: <https://www.energy.gov/eere/fuelcells/hydrogen-shot>).

locomotives and infrastructure solely starting July 1, 2024. In comparison, the Proposed Regulation requires Spending Account funds to be used to purchase ZE locomotives or infrastructure solely starting on January 1, 2030.

Alternative 1 would result in higher costs compared to the Proposed Regulation. Alternative 1 is estimated to cost approximately \$15.5 billion compared to the baseline, whereas the Proposed Regulation is estimated to cost approximately \$13.8 billion compared to the baseline. The higher cost of Alternative 1 is largely due to the increased opportunity costs, because funds will be idle while regulated parties wait for commercial availability of ZE locomotives.

Alternative 1 would result in fewer emission reductions than the Proposed Regulation from 2023 through 2030. Staff assume that ZE locomotive availability will be limited from 2024 through 2030, and that under Alternative 1, a typical operator would keep funds in their Spending Account until ZE locomotives become available. This causes emissions to decline more dramatically than in the Proposed Regulation in 2030 for switcher, industrial, and passenger locomotives and in 2035 for line haul locomotives, because operators would have larger Spending Account reserves to spend on ZE locomotives. However, Tier 4 locomotives are readily available and are cheaper than ZE locomotives. Purchasing Tier 4 locomotives under the Proposed Regulation would result in immediate emission reductions starting in 2025.

Figure 27, Figure 28, and Figure 30 show the comparison of particulate matter of 2.5 microns or less (PM_{2.5}), oxides of nitrogen (NO_x), and greenhouse gas (GHG) emissions for Alternative 1 to the Proposed Regulation and baseline. Figure 27 and Figure 28 show decreased PM_{2.5} and NO_x emissions in 2034 to 2037 resulting from greater ZE purchases under Alternative 1; these decreases do not make up for the increased PM_{2.5} and NO_x emissions between 2024 and 2030, and thus Alternative 1 would result in fewer total PM_{2.5} and NO_x emission reductions than the Proposed Regulation. GHG reductions under Alternative 1 are higher than the Proposed Regulation during some of the years analyzed, due to earlier uptake of ZE locomotives.

Figure 27: Statewide PM2.5 Emissions from Locomotives under the Baseline, Proposed Regulation, and Alternative 1

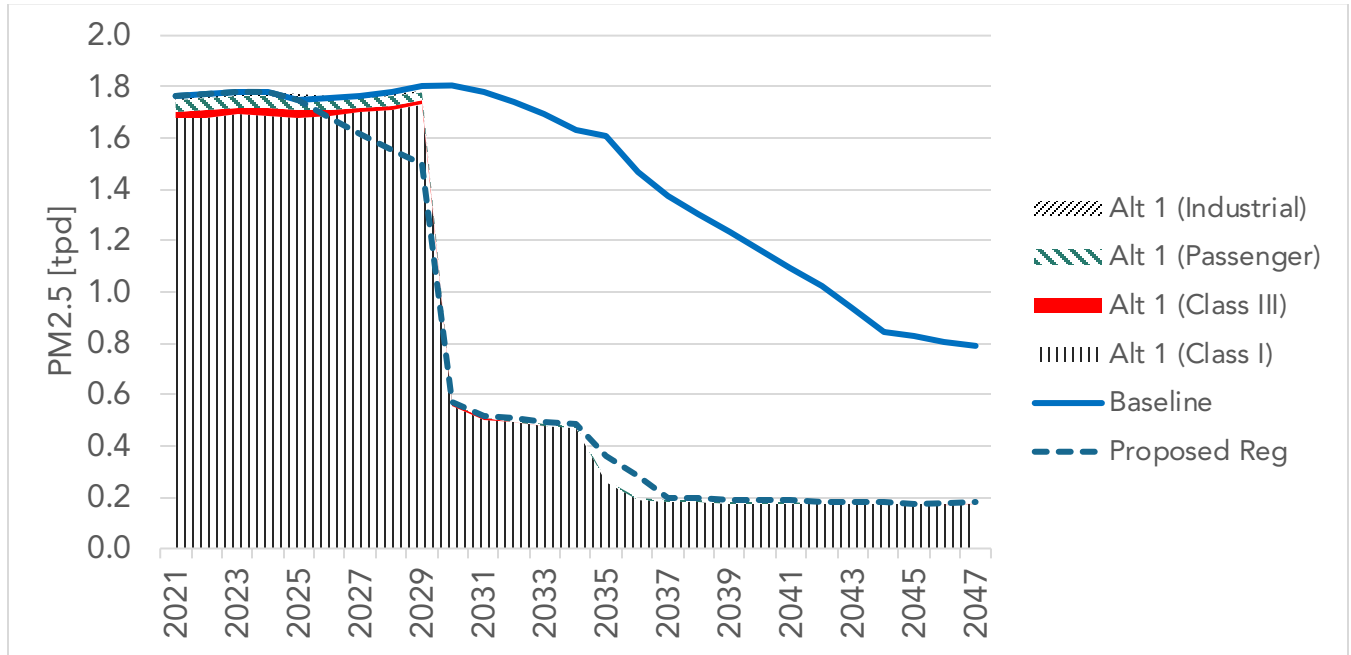


Figure 28: Statewide NOx Emissions of Locomotives under the Baseline, Proposed Regulation, and Alternative 1

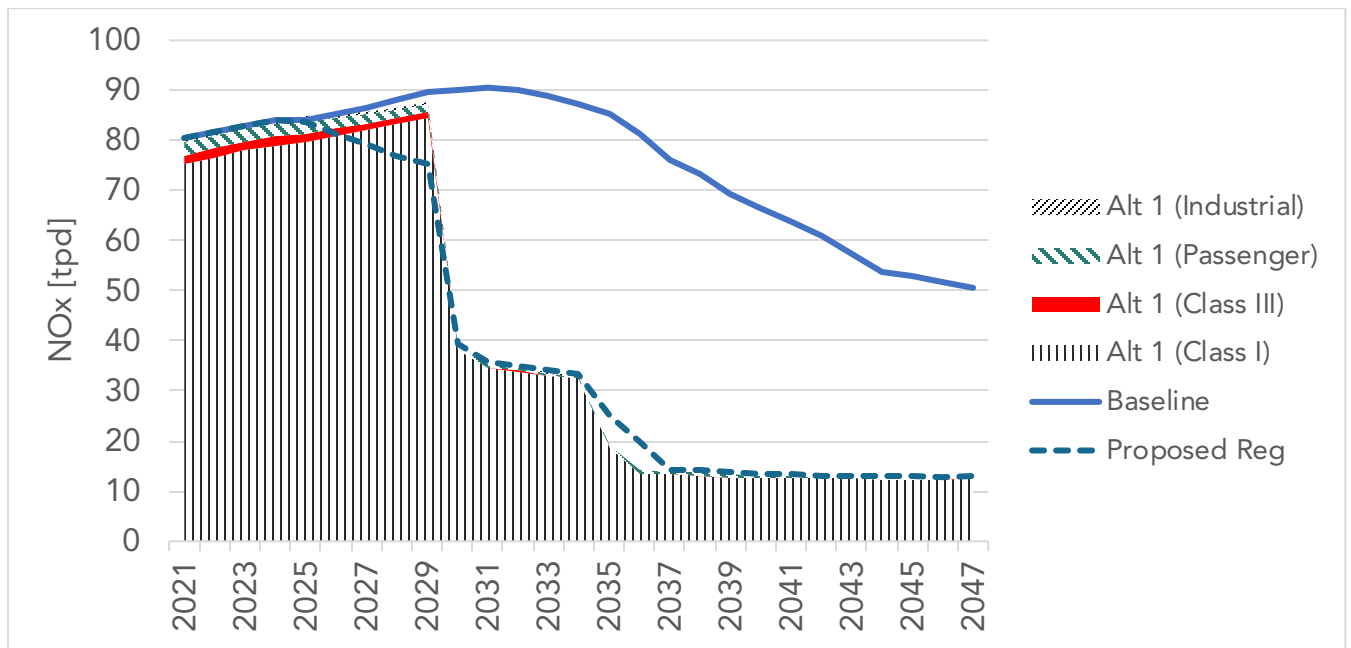
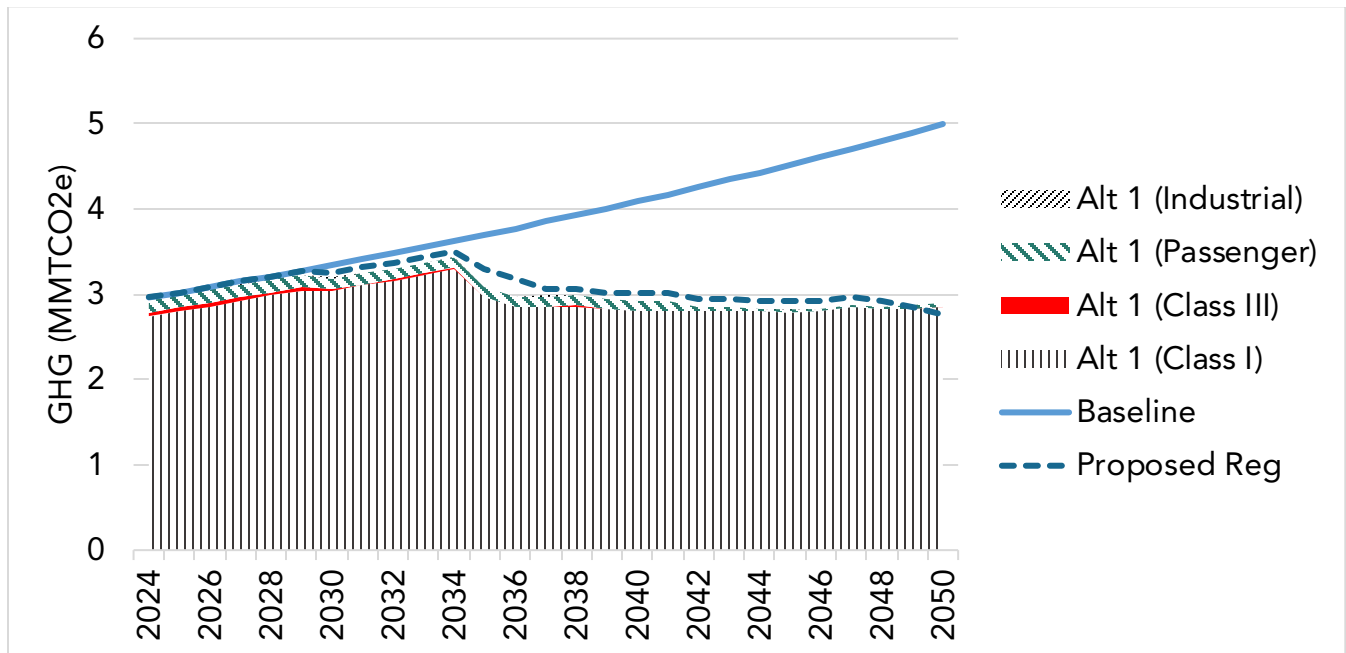


Figure 29: Statewide GHG Emissions from Locomotives under the Baseline, Proposed Regulation, and Alternative 1



Staff rejected Alternative 1 because it is less cost effective to implement than the Proposed Regulation and leads to less near-term reductions. ZE technologies may not be readily commercially available at large scale for most locomotive types by 2025. Locomotive operators waiting for fully commercially available ZE technologies in large quantities from 2025 through 2030 would cause a delay in the immediate emission reductions that operators could achieve by prompt purchase of Tier 4 and maximum usage of Tier 4 locomotives in the state. These immediate emission reductions are critically important to communities located near railyards and other locomotive operations.

B. Alternative 2: In-Use Operational Requirements - Locomotives Retire from California Operations at 35 years

Alternative 2 is a less stringent requirement for locomotives operating in California. Under this alternative, all the Proposed Regulation requirements remain the same except for the amount of time a locomotive is allowed to operate in California under the In-Use Operational Requirements (IUOR). Under Alternative 2, starting in 2030, locomotives may continue to operate in California until they reach 35 years old, compared to 23 years old in the Proposed Regulation. This alternative aligns with proposals from stakeholders advocating for longer use of locomotives before requiring the locomotive be retired from California operation.

Alternative 2 would result in lower costs compared to the Proposed Regulation. Alternative 2 is estimated to cost approximately \$12.5 billion compared to the baseline, whereas the Proposed Regulation is estimated to cost approximately \$13.8 billion compared to the baseline. The lower overall cost for Alternative 2 is due to allowing locomotives to operate 35 years rather than 23 years, which would result in fewer purchases of locomotives compared to the Proposed Regulation.

Alternative 2 would result in fewer PM2.5 and NOx emission reductions, but slightly greater GHG emission reductions, than the Proposed Regulation. Figure 30 and Figure 31 show

PM2.5 and NOx emissions remaining significantly higher under Alternative 2 compared to the Proposed Regulation due to the longer use of older, higher emitting locomotives. Figure 32 shows from 2024 through 2037, GHG emissions under Alternative 2 are similar to GHG emissions under the Proposed Regulation. However, starting in 2038, Alternative 2 results in more GHG emission reductions than the Proposed Regulation. Alternative 2 would provide greater GHG reductions overall as a result of allowing locomotives to operate longer than 23 years which leads to fewer purchases of Tier 4 diesel locomotives and a slightly greater uptake of ZE locomotives compared to the Proposed Regulation.

Figure 30: Statewide PM2.5 Emissions from Locomotives under the Baseline, Proposed Regulation, and Alternative 2

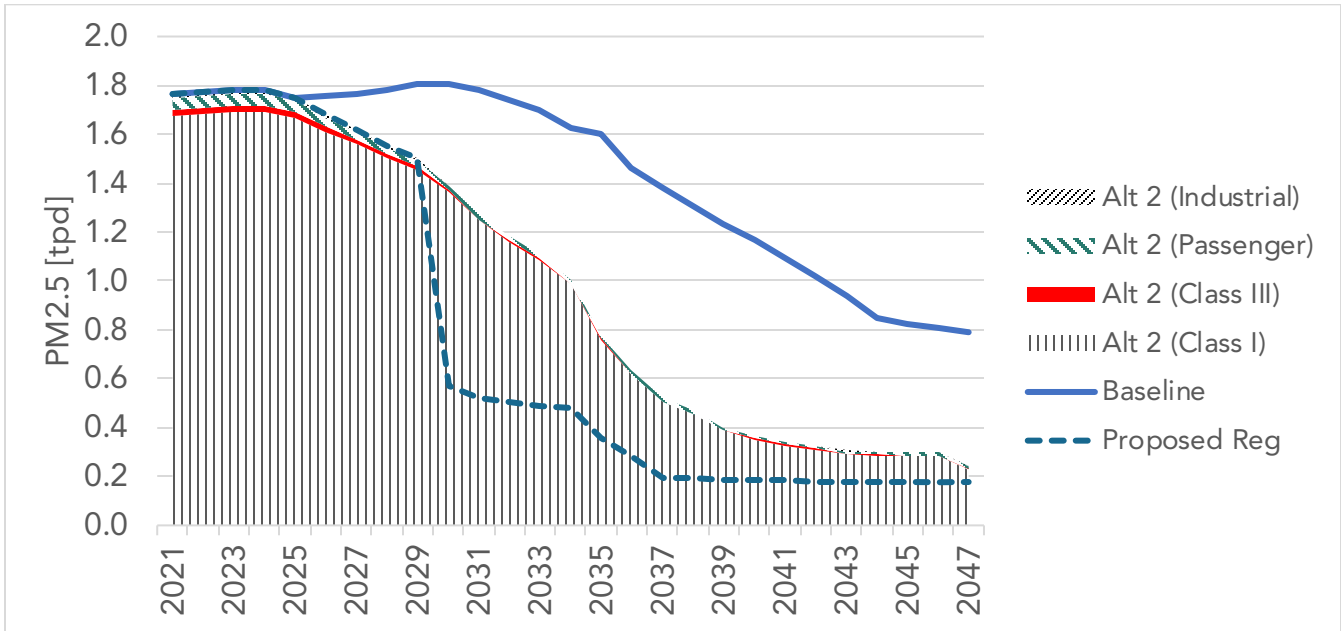


Figure 31: Statewide NOx Emissions from Locomotives under the Baseline, Proposed Regulation, and Alternative 2

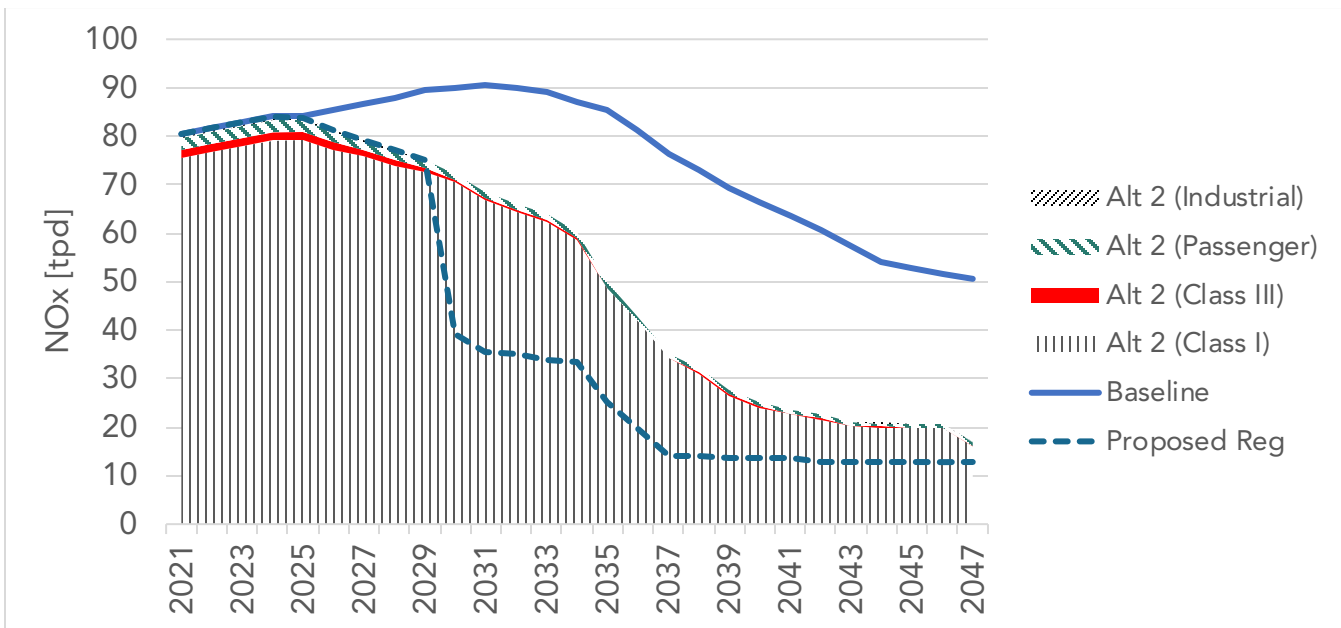
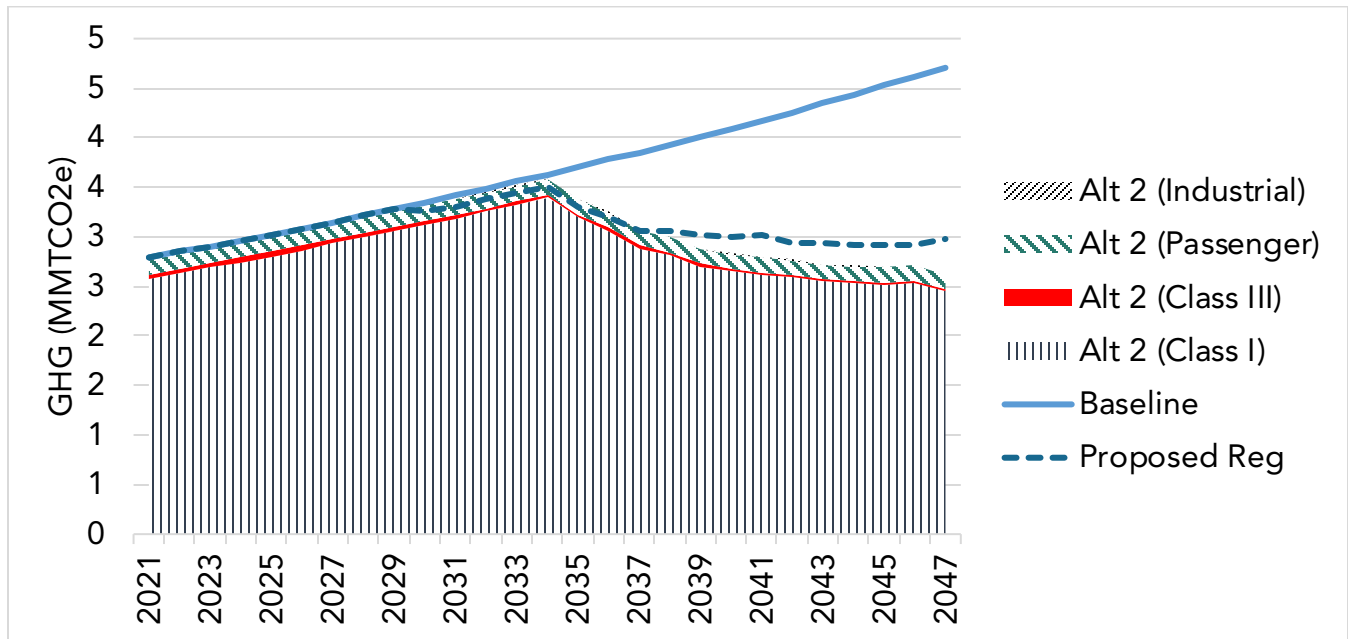


Figure 32: Statewide GHG Emissions from Locomotives under the Baseline, Proposed Regulation, and Alternative 2



Staff rejected Alternative 2, considering it would result in extended use of diesel-powered locomotives and would delay needed emission reductions. Alternative 2 would result in fewer PM_{2.5} and NO_x emission reductions than the Proposed Regulation and would have negative environmental and health impacts on communities surrounding locomotive operations.

Alternative 2 also provides fewer emission reductions from locomotives than are needed to help meet state risk reduction and air quality goals. Alternative 2 would provide less of the NO_x reductions needed to meet SIP attainment goals. Alternative 2 also fails to meet the goals of Governor Newsom’s Executive Order N-79-20, which set a goal for 100 percent ZE off-road vehicles and equipment in the state by 2035.

C. Alternative 3: Sensitivity Analysis - No Zero Emission In-Use Operating Requirements

As a bounding exercise, staff ran a sensitivity analysis to determine how locomotive operator fleets and costs would change if the ZE component of the IUOR did not take effect, and operators are allowed to operate Tier 4 locomotives in California with an original build date after 2030, or 2035 for line haul. As such, Alternative 3 is a less stringent requirement for locomotives operating in California. Under Alternative 3, all other requirements of the Proposed Regulation remain the same. Spending Account purchases after 2030 would still be restricted to ZE locomotives, although non-Spending Account purchases would be the cleanest federally established standard (staff assumed Tier 4 for modeling purposes).

Alternative 3 would result in lower costs compared to the Proposed Regulation. Alternative 3 is estimated to cost approximately \$7.8 billion compared to the baseline, whereas the Proposed Regulation is estimated to cost approximately \$13.8 billion compared to the baseline. The lower cost is associated with fewer ZE locomotive and infrastructure purchases.

Alternative 3 would result in fewer emission reductions than the Proposed Regulation starting in 2037. Alternative 3 would result in slower uptake of ZE locomotives than in the Proposed

Regulation since operators would continue to purchase and use Tier 4 locomotives beyond 2030. Figure 33, Figure 34, and Figure 35 show the comparison of PM2.5, NOx, and GHG emissions from Alternative 3 to the Proposed Regulation and baseline. Figure 33 and Figure 34 show PM2.5 and NOx emissions for Alternative 3 and the Proposed Regulation are relatively the same until 2037. However, due to the increased uptake of ZE from the IUOR ZE requirements of the Proposed Regulation, more emission reductions are achieved by the Proposed Regulation than Alternative 3 from 2037 through 2050. Alternative 3 results in fewer GHG emission reductions than the Proposed Regulation starting in 2030 when the first ZE IUOR requirements would begin.

Figure 33: Statewide PM2.5 Emissions from Locomotives under the Baseline, Proposed Regulation, and Alternative 3 – Sensitivity Analysis

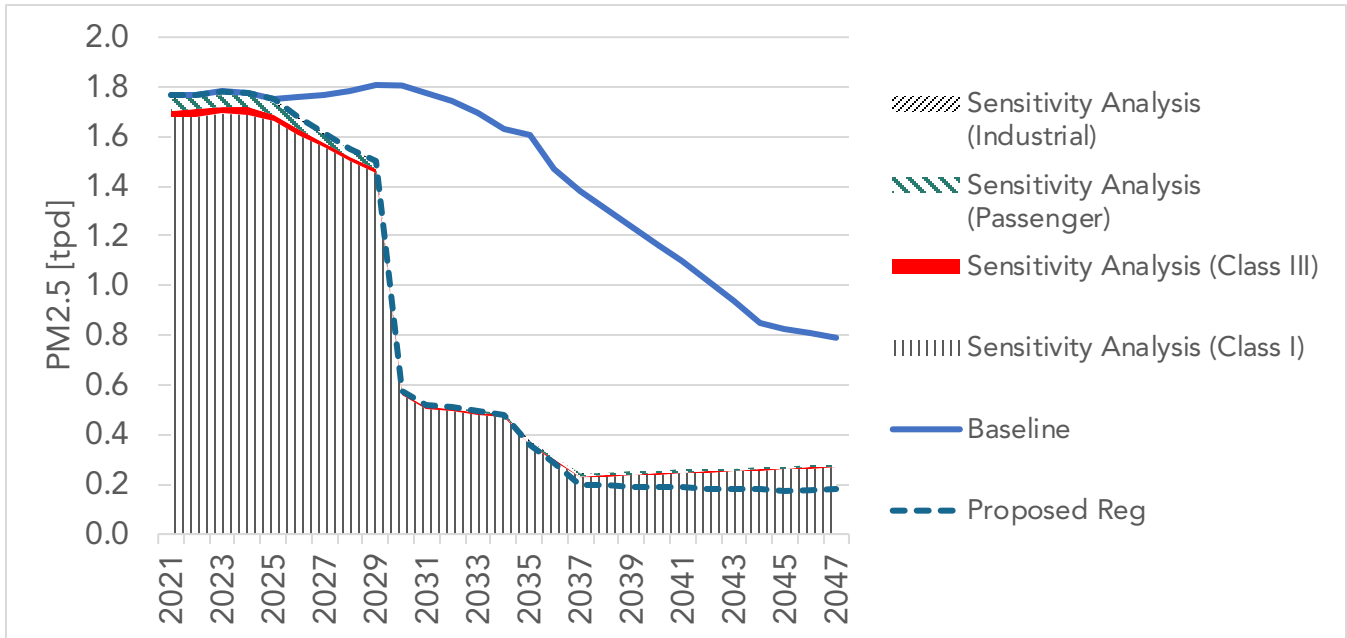


Figure 34: Statewide NOx Emissions from Locomotives under the Baseline, Proposed Regulation, and Alternative 3 – Sensitivity Analysis

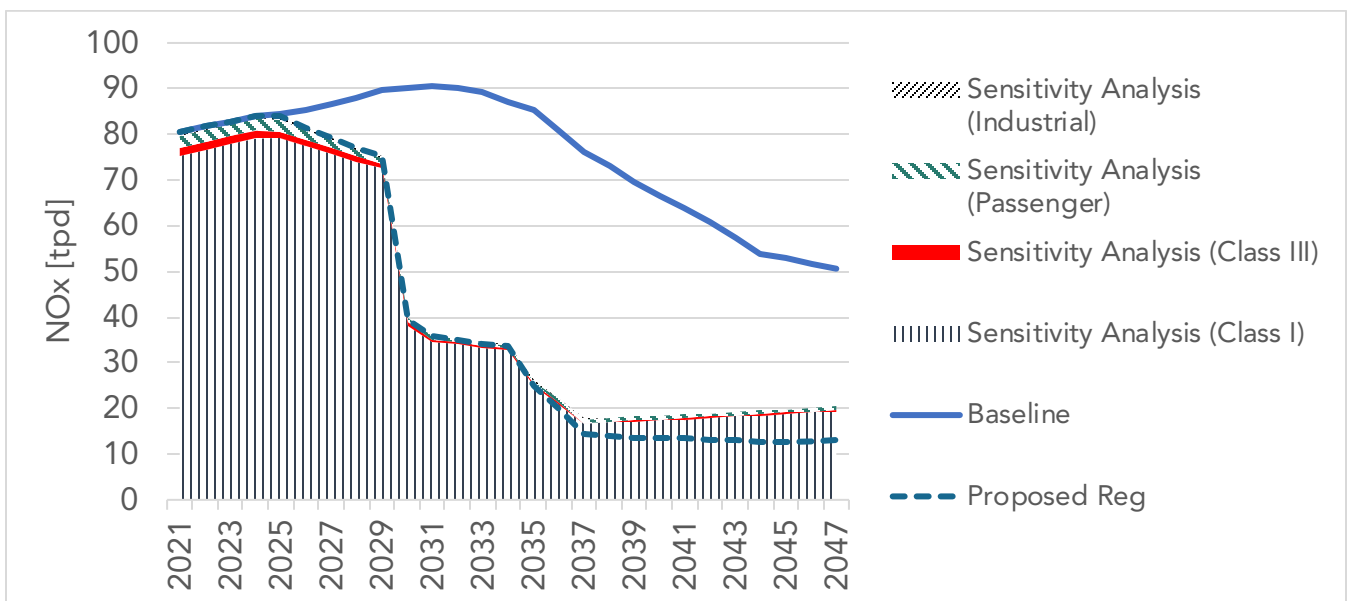
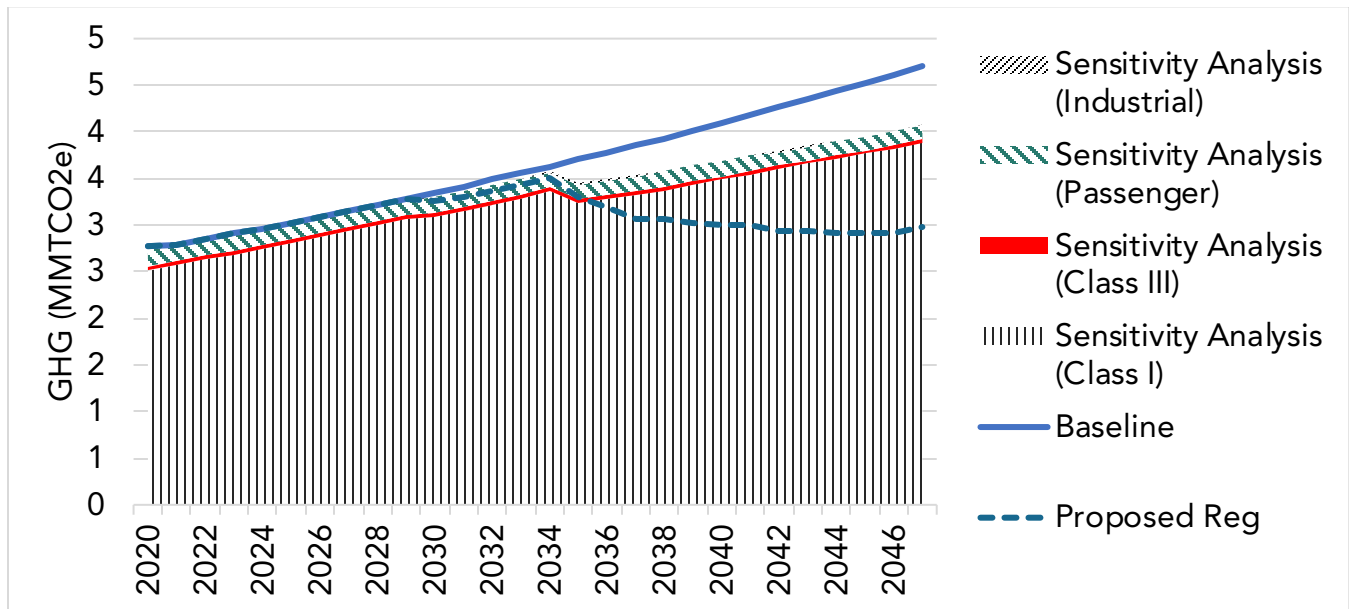


Figure 35: Statewide GHG Emissions from Locomotives under the Baseline, Proposed Regulation, and Alternative 3 – Sensitivity Analysis



Staff rejected Alternative 3 because it provides fewer PM_{2.5}, NO_x, and GHG emission reductions and prevents fewer adverse health outcomes than the Proposed Regulation. Alternative 3 is more cost effective per ton of weighted emissions to implement than the Proposed Regulation (see Appendix B: SRIA). However, staff rejected Alternative 3 because it would result in extended use of diesel-powered locomotives, which would delay needed emission reductions. Alternative 3 also does not provide maximum criteria pollutant reductions needed for the SIP and fails to support the State’s GHG emission reduction goals and the Governor’s Executive Order N-79-20 for ZE adoption.

Additionally, freight truck operators in California, which may be direct competitors to locomotive operators in the type of freight they haul, have been subject to regulations requiring them to address their diesel emission by accelerating turnover to cleaner combustion since 2008. CARB is developing the Advanced Clean Fleets Regulation, a medium and heavy-duty ZE regulation²⁴⁵ with the goal of achieving a ZE truck and bus California fleet by 2045 everywhere feasible and significantly earlier for certain market segments such as last mile delivery and drayage applications. Locomotives, by contrast, have been allowed to compete for much of the same freight business as trucks with no regulatory constraints on what they operate. Truck operators have been working to address the harmful emissions from their operations and will continue to do so under the Proposed Regulation, locomotive operators will now be asked to do the same.

²⁴⁵ CARB, Fact Sheet, CARB Advanced Clean Fleets Regulation, June 2022. (weblink: https://ww2.arb.ca.gov/sites/default/files/2022-03/ACF%20Fact%20Sheet_ADA.pdf).

D. Alternative 4 “Sierra’s Proposal” Provided by Noyes Law Corporation for Sierra Railroad on December 23, 2020

Alternative 4, submitted by Sierra Railroad, would change the way CARB regulates Class III (shortline) locomotive operators under the Proposed Regulation. Specific elements of Alternative 4 are outlined below.

1. Allow Locomotives to be upgraded to Tier 3 rather than Tier 4 and provide funding.

According to Sierra’s proposal many pre-Tier 0 locomotives could be upgraded to Tier 3 locomotives for approximately ten percent of the cost to upgrade to a Tier 4 locomotive while still reducing PM10 emissions by 75 percent and NOx emissions by 62 percent. This proposal requests modifications to the applicability requirements of the Carl Moyer Program. Specifically, Alternative 4 would allow Carl Moyer Program funding for the purchase of Tier 3 locomotives.

Alternative 4 suggests that by allowing Tier 3 locomotives to be purchased in place of Tier 4 locomotives, emission reductions would be greater and come earlier than with the Proposed Regulation. Because Tier 3 locomotives can be purchased in the used market at a significantly lower cost, locomotive operators would be able to replace the oldest locomotives sooner than if required to purchase Tier 4 or cleaner locomotives.

2. Allow Tier 3 Locomotives to operate in California longer than 23 years.

Alternative 4 would also allow Tier 3 locomotives to operate in California longer than the 23 years under the IUOR.

3. Alternative 4 Analysis.

Alternative 4 may result in reduced costs to the locomotive operator relative to the Proposed Regulation due to:

- Lower cost to purchase a locomotive if grant funds were extended to Tier 3 purchases.
- Increased life of a locomotive due to the extension beyond 23 years of operation.

Compared to the Proposed Regulation, Alternative 4 would achieve substantially less emission reductions for PM2.5 and NOx. In addition, Alternative 4 would produce even fewer emission reductions than Alternative 3, an Alternative already rejected in this analysis because it would provide fewer emission reductions than the Proposed Regulation. As a result, Alternative 4 would fail to provide significant public health benefits, including to communities adjacent to railyards and freight facilities throughout the state, due to:

- Tier 3 locomotive emissions of PM2.5 are over three times higher than Tier 4 locomotive emissions.
- Tier 3 locomotive emissions of NOx are over four times higher than Tier 4 locomotive emissions.

Alternative 4 does not give a date for when Tier 3 locomotives would be turned over to Tier 4 or ZE. This disables a key effect of the Proposed Regulation: to move locomotive operations to cleaner emission levels at the earliest feasible dates.

Although Alternative 4 provides limited cost benefits to locomotive operators in a case where incentives are made available for older, higher-polluting technologies, it does not provide additional health benefits to California residents. In this case, the proposal to use grant funding for Tier 3 is also in conflict with CARB grant funding objectives: CARB public grant funds are provided by the citizens of California and must be used to fund the most cost-effective projects, from an emission reduction standpoint. CARB incentives may not be used to pay for compliance, limiting the scope of incentives applicability to the years before the IUOR trigger date of 2030. Alternative 4 does not meet the requirements of being less burdensome and equally effective in achieving the purposes of the Proposed Regulation.

E. Alternative 5 “Metrolink Revised Draft Regulation Order” Provided by Metrolink September 2021

Passenger transportation agency, Metrolink, submitted a proposal for an alternative to the Proposed Regulation. Alternative 5 would involve changing the regulatory language of the Proposed Regulation to accommodate Metrolink’s need for flexibility in the Spending Account funding dates. Specific elements of the revised draft which constitute alternatives to the Proposed Regulation are outlined below.

1. Allow the use of grant-funded Locomotives to support compliance with an Alternative Compliance Plan, and to count for ZE Credit.

The Proposed Regulation provides Alternative Compliance Plan (ACP) provisions, which allow approved applicants to use their own proposed strategies to reduce emissions from the operation of locomotives, provided the emission reductions are equal or greater reductions than would have been achieved by following the Spending Account and the IUOR. Idling and reporting requirements would still apply. Alternative 5 proposes that emission reductions counted in an ACP could be generated through the operation of grant-funded locomotives.

Under the Proposed Regulation, ZE credit is issued for the use of ZE locomotives, or connection to wayside power resulting in ZE operation. ZE credit offsets the funding obligation for the Spending Account. The ZE credit is intended to incentivize the regulated community to invest Spending Account funds in ZE technologies as early as possible. The Proposed Regulation states that the usage of grant funded locomotives may not be counted in the calculation of the ZE Credit. Alternative 5 proposes that ZE credit should be extended to grant-funded locomotives.

2. Create a public transportation alternative plan framework with no requirements to reduce emissions by a specific amount.

Alternative 5 proposes public transportation agencies should operate with specialized plans which pursue adoption of the cleanest available technologies, including ZE technologies, but that they should not be required to reduce emissions by any specific amount.

3. Alternative 5 Analysis

Alternative 5 may result in reduced costs to the locomotive operator relative to the Proposed Regulation due to:

- Ability to delay Spending Account obligations.
- Ability to leverage public funds to comply with the IUOR.
- Ability to follow a framework with no requirements to reduce emissions by a specific amount.

Compared to the Proposed Regulation, Alternative 5 would achieve substantially less emission reductions for PM_{2.5}, NO_x, and GHGs. As a result, it would provide less public health benefits than the Proposed Regulation, which are especially needed for communities adjacent to railyards and freight facilities throughout the state, due to:

Air quality grant funds intended to reduce emissions to meet SIP commitments would be used to reduce emissions for the Proposed Regulation; this would result in double-counting proposed emission reductions in calculating compliance with the SIP.

The use of air quality grant-funded equipment to offset Spending Account obligations would delay Spending Account attributed emission reductions.

The alternative plan framework with no requirements to reduce emissions by a specific amount would not provide the emission reductions that would be achieved by the Proposed Regulation.

To avoid double-counting of SIP-credited emission reductions, it was necessary to reject the proposal to use air quality grant-funded equipment to comply with the regulation. Because the proposal to eliminate emission reduction requirements does not provide health benefits, it was necessary to reject the proposal to eliminate emission reduction requirements.

Although Alternative 5 provides cost benefits to locomotive operators, it does not provide health benefits to California residents. Alternative 5 also proposes that CARB incentives could be used to pay for compliance, which is not feasible under CARB air quality grant requirements. Alternative 5 does not meet the requirements of being less burdensome and equally effective in achieving the purposes of the Proposed Regulation.

F. Small Business Alternative

Although Alternative 2 would have a lesser impact on small businesses (defined as companies with less than \$5 million in revenue per year), staff rejected Alternative 2 because it would result in fewer emission reductions than the Proposed Regulation. Alternative 2 increases PM_{2.5} emissions when compared to the Proposed Regulation. It would have negative environmental and health impacts on communities surrounding locomotive operations and would provide less NO_x reductions, which are needed to help meet SIP attainment goals. Additionally, Alternative 2 fails to align with the goals of Executive Order N-79-20.

The Board has not identified any reasonable alternatives that would lessen any adverse impact on small business, therefore, staff are incorporating relief measures within the Proposed Regulation.

Recognizing that the Proposed Regulation requirements may challenge some small businesses, especially those operating Pre-Tier 0 locomotives, staff has included a Small Business Hardship Extension provision. The provision would apply to operators that can demonstrate to CARB that full payment of Spending Account charges and/or restriction of a locomotive use resulting from the IUOR will prevent the locomotive operator from meeting other financial obligations as they come due or will cause the taking of property or the closing and eliminating of a business.

If an extension is approved, CARB may grant the applicant up to a three-year extension in the time required to deposit the Spending Account charge, a reduced Spending Account payment for up to three years, an extension of eligibility to operate under the IUOR by up to three years, or a combination of these relief options. The Proposed Regulation also includes an Alternative Compliance Plan provision that would allow locomotive operators to design their own emission reduction measures to comply with the emission reduction requirements in either the Spending Account, the IUOR, or both. Lastly, grants and utility infrastructure programs can further reduce the upfront costs to operators that act early.

G. Performance Standards in Place of Prescriptive Standards

Government Code sections 11346.2(b)(4)(A) and 11346.2(b)(1)172 contain requirements for proposed regulations that would mandate the use of specific technologies or equipment. However, because the Proposed Regulation includes performance-based requirements and does not mandate the use of specific technologies or equipment, these Government Code requirements are not applicable.

H. Health and Safety Code section 57005 Major Regulation Alternatives

CARB estimates the Proposed Regulation will have an economic impact on the state's business enterprises of more than \$10 million in one or more years of implementation. CARB will evaluate alternatives submitted to CARB and consider whether there is a less costly alternative or combination of alternatives that would be equally as effective in achieving increments of environmental protection in full compliance with statutory mandates within the same amount of time as the proposed regulatory requirements, as required by Health and Safety Code section 57005.

X. Justification for Adoption of Regulations Different from Federal Regulations Contained in the Code of Federal Regulations

Government Code section 11346.2 sets forth procedures an agency must follow when preparing a notice of a proposed rulemaking. In those procedures, section 11346(b) requires this initial statement of reasons, and (b)(6) requires CARB to describe "its efforts, in connection with a proposed rulemaking action, to avoid unnecessary duplication or conflicts with federal regulations contained in the Code of Federal Regulations addressing the same issues." CARB may adopt regulations that differ from federal regulations if "[t]he differing state regulations are authorized by law" or "[t]he cost of differing state regulations is justified by the benefit to human health, public safety, public welfare, or the environment."

A. Definitions

The Proposed Regulation classifies six categories of locomotives: freight line haul, switch, industrial, passenger locomotives, historic, and military locomotives. It is important to specifically define locomotive types because the Proposed Regulation has distinct requirements that apply to different types of locomotives. For example, the Spending Account section assigns specific emission factors to be used for freight line haul locomotives if a locomotive operator does not have emission factor information and assigns a specific fuel usage conversion factor to freight line haul locomotives. As another example, the IUOR section sets forth the specific requirements applicable for freight line haul locomotive engines operating in California.

By defining freight line haul, industrial, passenger, historic, and military locomotives separately, the Proposed Regulation can set requirements for these locomotive operators appropriately and remove ambiguity between the U.S. EPA definition of "line haul" locomotive and "freight line haul locomotive" as defined in the Proposed Regulation. U.S. EPA 40 C.F.R. § 1033.901 defines "line haul locomotive" and "switch locomotive." "Switch locomotive" is defined as "a locomotive that is powered by an engine with a maximum rated power ... of 2,300 hp or less." "Line haul locomotive" is defined as "a locomotive that does not meet the definition of switch locomotive." Note that this federal definition includes both freight and passenger locomotives, as well as any industrial locomotive over 2,300 hp.

By creating only two categories of locomotives, and by basing the categorization only on engine size, U.S. EPA groups locomotives with different operational characteristics into either the "switch" or "line haul" category. For example, a Class I locomotive that runs interstate routes, an industrial locomotive over 2,301 hp working in a cement factory, and a passenger locomotive running commuter routes are all included in the U.S. EPA definition of a line haul locomotive. While U.S. EPA's definition of "line haul," includes passenger and industrial locomotives if they are 2,301 hp or greater, CARB acknowledges that these locomotives operate differently than typical freight line haul locomotives.

Additionally, CARB assesses that different ZE technologies may be suitable for freight line haul locomotives, industrial locomotives, and passenger locomotives.

B. Spending Account

Currently, there are no federal regulations which address the same issues as the Spending Account in the Proposed Regulation. The Spending Account requirements do not duplicate or conflict with federal regulations and to the extent it is different from existing federal regulations it is authorized by law and is justified by their benefits to human health, public welfare, and the environment.

C. In-Use Operational Requirements

U.S. EPA does not regulate operators regarding emissions of the locomotives they operate. Instead, U.S. EPA has set emission standards for newly-manufactured and remanufactured locomotives and locomotive engines. Therefore, the CARB In-Use Operational Requirements (IUOR) do not duplicate or conflict with existing federal regulations.

In its 1998 regulations²⁴⁶ setting locomotive emission standards, it described its inclusion of “remanufactured” in the definition of “new”, stating that its definition of “new locomotive” “is consistent with” its definition of “new” promulgated in 1994;²⁴⁷ however, before 1998 “new” was never defined as remanufactured. U.S. EPA did not discuss emission impacts of prolonging the life of a locomotive indefinitely while relying on older emission technologies, nor did U.S. EPA suggest that locomotive operators be permitted to rely on older, dirtier emission controls indefinitely.

In 2008, U.S. EPA amended certain existing standards and added standards for locomotives built in later years; this regulation requires that remanufacture kits meet a slightly higher standard, while not disallowing the use of older remanufacture kits or remanufacture processes that simply return a locomotive to its as-built standard.²⁴⁸ In an effort to prevent railroads from circumventing the standards applicable to freshly manufactured locomotives through remanufacturing, the 2008 regulation included a new definition of “refurbish”²⁴⁹ but evidence indicates that this has not been successful. The IUOR addresses this issue, by prohibiting older, dirtier locomotives to operate indefinitely in California. The IUOR provision in the Proposed Regulation is justified by the benefit to human health, public welfare, and the environment.

As described in more detail in Section IV: Benefits Anticipated from the Regulatory Action, Including the Benefits or Goals Provided in the Authorizing Statute, from 2024 to 2050, CARB staff estimate the Proposed Regulation will reduce 3,233 premature mortalities, 1,097 hospital admissions for cardiovascular or respiratory illness, and 1,486 emergency room visits in California alone. These benefits result from the Proposed Regulation reducing 7,455 tons of particulate matter measuring 2.5 microns or less (PM_{2.5}), 389,630 tons of oxides of nitrogen (NO_x), and 21.9 million metric tons of carbon dioxide equivalent (MMTCO_{2e}) of greenhouse gas (GHG) emissions by 2050 in California. For additional information on the air quality benefits of the Proposed Regulation, see Section V: Air Quality.

The CARB IUOR specifies that starting in 2030, locomotives must be less than 23 years old to operate in California. This measure is designed to address the health effects from continued use of locomotives operating with older, less-effective emission control technologies. The IUOR differs from federal regulation in that federal regulation is limited to establishing emissions standards for “new” locomotives and locomotives engines, which apply to manufacturers or remanufacturers at the point of manufacture or remanufacture. In contrast, the IUOR imposes a requirement on operators to remove a locomotive from operation in California once it exceeds 23 years in age.

CARB is also proposing that switch, industrial, and passenger locomotives with an engine build date of 2030 or later operate only in a zero emission configuration in California. For line haul locomotives, CARB is proposing that those with an engine build date of 2035 or later

²⁴⁶ U.S. EPA, 40 C.F.R. Parts 85, 89, and 92, 73 Federal Register 18980, April 16, 1998. (weblink: <https://www.govinfo.gov/content/pkg/FR-1998-04-16/pdf/98-7769.pdf>).

²⁴⁷ U.S. EPA, 40 C.F.R. Part 85, Summary, 59 Federal Register 36969 and 36970, July 20, 1994. (weblink: https://archives.federalregister.gov/issue_slice/1994/7/20/36944-36987.pdf#page=26).

²⁴⁸ U.S. EPA, 40 C.F.R. § 1033.101, 73 Federal Register 37197, June 30, 2008. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-B/section-1033.101>).

²⁴⁹ U.S. EPA, 40 C.F.R. §1033.640, 73 Fed. Reg. 37096, 37150-51, June 30, 2008, accessed July 18, 2022. (weblink: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-U/part-1033/subpart-G/section-1033.640>).

operate only in a zero emission configuration in California. This requirement does not duplicate existing federal regulations because U.S. EPA has not promulgated a comparable regulation. This requirement also does not conflict with U.S. EPA's authority to set emission standards on locomotives because CARB is imposing a requirement to operate locomotives in electric-only mode, not a requirement to design and manufacture locomotives to a certain emissions standard.

CARB is not requiring locomotive manufacturers to meet any specific emission standard. Locomotives are already propelled by electric motors. While manufacturers could well rely solely on a ZE technology to power the motors, employing a switch to a ZE mode is also something that can be done by locomotive operators or owners to existing locomotives within the timeframe provided in the Proposed Regulation and subject to future CARB staff assessments of technology readiness; CARB staff have determined that the technology necessary to do so exists today and is near the commercial development phase. CARB staff will continue to assess progress made as the 2030 and 2035 ZE deadlines approach.

To assess technological progress, CARB is proposing that "[b]y December 1, 2027, CARB staff shall publish an assessment of the progress made in ZE technologies for use with Switch, Industrial, and Passenger Locomotives, as well as the status of infrastructure improvements that may be needed to support ZE Locomotives and make the assessment available for public review at least 30 calendar days prior to presenting the report to the Board at a public meeting. If staff finds that the compliance deadlines under this Locomotive Regulation need to be adjusted forward or backward in time, the report will include recommendations to initiate staff's development of potential formal regulatory amendments." Staff will also publish an assessment in 2032 for the IUOR ZE line haul locomotive requirement.

D. Idling Requirements

In title 40 C.F.R. section 1033.115, U.S. EPA required manufactures to install idle controls for new locomotives. In the supplementary information for this regulation, U.S. EPA stated:

"Locomotives spend a substantial amount of time idling, during which they emit harmful pollutants, consume fuel, create noise, and increase maintenance costs. We are requiring that idle controls, such as Automatic Engine Stop/Start Systems (AESS), be included on all newly -built Tier 3 and Tier 4 Locomotives. We are also are requiring that they be installed on all existing locomotives that are subject to the new remanufactured engine standards, at the point of first remanufacture under the standards, unless already equipped with idle controls."²⁵⁰

Although U.S. EPA identified hazards and nuisances associated with all locomotive engine idling, and introduced equipment requirements for most locomotives, it did not require operational changes, such as requiring that operators *not* bypass automatic shutoff functions for any non-exempt reason. U.S. EPA did require that manufacturers "limit the physical range of adjustability to the maximum extent practicable to the range that is necessary for proper operation of the locomotive or locomotive engine" (40 C.F.R. § 1033.115(b)(2)) and did bar

²⁵⁰ U.S. EPA, Control of Emissions of Air Pollution From Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder; Republication, June 30, 2008. (weblink: <https://www.federalregister.gov/d/R8-7999/p-78>).

manufacturers from equipping the locomotive with an emissions “defeat device” (40 C.F.R. § 1033.115(f)) but did not impose explicit restrictions on operators.

Bypassing idle controls may occur for exempt reasons, such as controlling climate in the driver cab, or maintaining air-brake pressure. For example, until 2020, a Federal Railway Administration (FRA) regulation required brake inspection when brakes were off-air for more than four hours. This measure resulted in long idle times which were exempted from the 30-minute idling requirement. In December 2020, the FRA updated inspection requirements by expanding the window of time freight cars may be off-air before performing a new brake test, from four hours off-air to 24 hours off-air.²⁵¹ This change represents a substantial drop in exempt reasons for continuous idling.

The Proposed Regulation states:

A locomotive operator shall ensure an AESS equipped locomotive engine is shut off no more than 30 minutes after the locomotive becomes stationary. A locomotive may exceed 30 minutes of idling for only the following reasons:

- To prevent engine damage such as to prevent the engine coolant from freezing.
- To maintain air pressure for brakes or starter, or to recharge the locomotive battery.
- To perform necessary maintenance, including necessary passenger rail car/passenger compartment environmental conditioning.
- To otherwise comply with federal or state regulations.
- The locomotive is a ZE locomotive or ZE capable locomotive operating in a ZE configuration.

To support enforcement, the Proposed Regulation requires locomotive operators to report:

- Whether the locomotive has an AESS,
- The time, date, location, and duration of each instance when a locomotive idled for longer than 30 minutes in California,
- The reason for idling for each instance when a locomotive idled for longer than 30 minutes in California.

This Proposed Regulation differs from existing federal regulations in several ways:

- It applies to locomotive operators, not manufacturers/remanufacturers, and requires no changes to the design or manufacture/remanufacture of locomotives.
- The provision allowing idling for necessary maintenance includes passenger compartment environmental conditioning.
- The exemptions include an allowance for idling over 30 minutes if the locomotive is a ZE locomotive or ZE capable locomotive operating in ZE configuration.
- The Proposed Regulation will be enforced by the State of California.
- CARB will support enforcement of the regulation by collecting data on every exceedance of idling for more than 30 minutes.

²⁵¹ 85 Fed. Reg. 80544 (Dec. 11, 2020), Miscellaneous Amendments to Brake System Safety Standards and Codification of Waivers by the Federal Railway Administration, December 11, 2020. (weblink: <https://www.govinfo.gov/content/pkg/FR-2020-12-11/pdf/2020-25817.pdf>).

It is important to note that from 2005 to 2015, the Class I railroads operating in California voluntarily agreed to limit unnecessary locomotive engine idling in all cases where feasible, and to implement manual shutoff when necessary, to maintain their commitment. Through the ARB/Railroad Statewide Agreement Particulate Emissions Reduction Program at California Rail Yards²⁵² (Agreement), CARB, Union Pacific (UP), and BNSF Railway (BNSF) acknowledged “the environmental impacts associated with California's goods movement must be managed to ensure the protection of public health.” They also recognized “that emissions from rail yards are a matter of state concern.”

Within the agreement, UP and BNSF committed to implement locomotive operational idling reduction procedures in California. The idling limit in this voluntary agreement was 15 minutes, except for models where excessive engine component failure was at risk. The Agreement also included railroad staff training, reporting, and visits by CARB enforcement to ensure compliance.

Since the expiration of the 2005 Agreement, CARB has received community complaints about excessive idling of locomotive engines. To supplement existing federal enforcement of rules limiting all unnecessary locomotive idling, CARB is implementing a statewide requirement to eliminate unnecessary in-use idling over 30 minutes.

To further avoid conflict, CARB has closely aligned the idling requirements in the Proposed Regulation with current federal idling restrictions. CARB has included the idling requirements because the cost of differing state regulations is justified by the benefit to human health, public safety, public welfare, and the environment.

E. Registration, Recordkeeping, and Reporting

Currently, there are no federal regulations which address the same issues as the Registration, Recordkeeping, and Reporting provisions in the Proposed Regulation, so the Proposed Regulation requirements for Registration, Recordkeeping, and Reporting do not conflict with nor duplicate any federal regulations.

XI. Public Process for Development of the Proposed Action (Pre-Regulatory Information)

Consistent with Government Code sections 11346, subdivision (b), and 11346.45, subdivision (a), and with the Board’s long-standing practice, CARB staff held public workshops and had other meetings with interested persons during the development of the Proposed Regulation. These informal pre-rulemaking discussions provided staff with useful information that was considered during development of the regulation that is now being proposed for formal public comment.

²⁵² CARB, ARB/Railroad Statewide Agreement Particulate Emissions Reduction Program at California Rail Yards, 2005. (weblink: <https://ww2.arb.ca.gov/sites/default/files/2020-06/2005%20MOU%20Remediated%203102020.pdf>).

A. Public Engagement for Rulemaking Process

To ensure an open and transparent rulemaking, staff engaged in an extensive public process since development of the Proposed Regulation began in 2019. Staff conducted more than 250 meetings with members of impacted communities, environmental justice advocates, air districts, industry stakeholders (including locomotive owners and operators, locomotive manufacturers, and locomotive leasing companies), and other interested parties. Meeting formats included public workshops, joint public workshops, community meetings, informal meetings, phone calls, and web meetings. Throughout the rulemaking process, access to information including meeting notices, slide presentations, and contact information were available on the CARB Reducing Rail Emissions in California webpage.²⁵³

B. Public Workshops

Staff conducted four public workshops to solicit stakeholder feedback and discuss regulatory concepts, data used to develop the emission inventory and cost assumptions, and electric and fueling infrastructure considerations. Staff notified stakeholders of all upcoming workshops with the issuance of a public notice at least three weeks prior to their occurrence. Staff posted the notices to the Locomotives and Railyards: Meetings and Workshops webpage and distributed them through a public list serve that includes over 40,000 recipients. Each of these workshops was open to all members of the public. Meeting materials, including agendas, slide presentations, and other relevant documents such as the preliminary cost document and draft regulatory language were posted and available to the public on the CARB Locomotives and Railyard Emissions: Meetings and Workshops webpage in advance of the workshops.

CARB held initial workshops with the South Coast Air Quality Management District (SCAQMD) in Southern California. At the workshops, CARB and SCAQMD staff discussed preliminary concepts to reduce emissions from locomotives and railyards. The workshops presented both statewide efforts by CARB and district level efforts by SCAQMD along with discussions as to why a joint approach was needed to address locomotive emissions. Staff held the first joint workshop on November 20, 2019, in Los Angeles, California, and the second on December 11, 2019, in San Bernardino, California. These workshops were held in person, recorded, and posted online for stakeholders who could not attend. During the presentations staff solicited stakeholder feedback and suggestions on additional ideas.

CARB held a two-day public workshop on October 29, 2020, and October 30, 2020, via Zoom. The typical multiple location and in-person format of CARB workshops could not be followed due to state and federal guidelines during the COVID-19 pandemic. Staff turned to virtual platforms such as Zoom to engage stakeholders. At the workshop, staff discussed concepts to reduce emissions from locomotives and solicited stakeholder feedback and suggestions on additional ideas. The workshop was webcast with the ability to submit questions online to ensure all interested parties could access the information and participate in the discussion. The webcast format allowed for additional participants as there was no

²⁵³ CARB, Reducing Rail Emissions in California, accessed July 20, 2022. (weblink: <https://ww2.arb.ca.gov/our-work/programs/reducing-rail-emissions-california>).

need to travel to be part of the workshop. The October 29, 2020, webcast had over 300 participants and the October 30, 2020, webcast had over 200 participants.

Staff conducted an additional workshop on March 30, 2021. This workshop was also conducted via Zoom and had over 270 participants. At the workshop, staff presented Draft Regulatory Language and a Preliminary Cost Document and requested stakeholder input. To facilitate the exchange of information, staff created an informal comment submittal form available to stakeholders to submit comments on the Draft Regulatory Language. The workshop was open to the public and staff encouraged participation by all parties.

C. Community Meetings

Staff held a non-regulatory Railyard Emissions Listening Session on March 4, 2021 via Zoom. This meeting allowed staff to hear directly from community members about their concerns related to railyards and provide input on the Proposed Regulation. Approximately 200 participants attended this listening session. Community members iterated a desire for funds for the communities near railyards to be used to mitigate impacts from railyards, including noise complaints. Additionally, community members spoke of the challenges related to the COVID-19 pandemic, such as children having no choice but to constantly be in their homes exposed to additional emissions and noise from railyards. Community members also voiced that they would like CARB to prioritize public outreach and help inform community members of the rulemaking process and data so they are better informed.

Table 22. In-Use Locomotive Regulation Community Meetings

Date	Event	Objective
November 20, 2019	Joint CARB/SCAQMD Public Workshop	To present statewide and local concepts to reduce locomotive emissions to SCAQMD community members and solicit stakeholder feedback/suggestions on additional ideas.
December 11, 2019	Joint CARB/SCAQMD Public Workshop	To present statewide and local concepts to reduce locomotive emissions to SCAQMD community members and solicit stakeholder feedback/suggestions on additional ideas.
October 29, 2020 and October 30, 2020	CARB Workshop: Concepts for In-Use Locomotive Regulation	To present staff concepts to reduce emissions from locomotives and solicit stakeholder feedback and suggestions on additional ideas.
March 4, 2021	CARB Railyard Emissions Listening Session	To inform community members of what the state is doing to reduce emissions from the freight sector and other programs, and to listen to community questions, thoughts, experiences, and suggestions.
March 30, 2021	CARB Workshop: In-Use Locomotive Regulation Workshop	To present draft regulation language and preliminary cost data to stakeholders and community members as well as to request regulatory alternatives and feedback on these documents.

D. Stakeholder Meetings

Staff conducted more than 250 informal meetings and phone calls with a broad group of stakeholders to develop the Proposed Regulation, discuss concepts, and gather input. This includes members of impacted communities, environmental justice advocates, air districts, Class III locomotive operators, industrial locomotive operators, passenger locomotive operators, historic locomotive operators, locomotive original equipment manufacturers, and other interested parties. For additional information and a comprehensive list of outreach efforts, see Appendix I of this ISOR.

XII. Appendices

- A. Proposed Regulation Order**
- B. Standardized Regulatory Impact Assessment (SRIA)**
- C. Summary and Response to DOF comments on the SRIA**
- D. Draft Environmental Analysis**
- E. Development Process for the Spending Account Equation and Input Methodologies**
- F. Locomotive Technology Feasibility Assessment**
- G. CARB's 2022 In-Use Locomotive Emission Inventory: Regulatory Proposal and Scenarios**
- H. Health Analyses**
- I. List of Public Workshops, Meetings, Conference Calls, Video Conferences, and Site Visits Supporting the Public Process for Development of the Proposed Regulation**
- J. Master List of References for the Initial Statement of Reasons Prepared for the Proposed In-Use Locomotive Regulation**