

Technical Support Document
Vermont Agency of Natural Resources
Proposed Amendments to Vermont Low Emission Vehicle and Zero
Emission Vehicle Rules

This document includes summaries, technical support, and supplemental information for the proposed amendments to the Agency of Natural Resources' Low and Zero Emission Vehicle Rules, which incorporate by reference a suite of motor vehicle emission standards from California, including the "Heavy-Duty Engine and Vehicle Omnibus" or "HD Omnibus" regulation. The HD Omnibus regulation sets standards for emissions of the air pollutants nitrogen oxides (NOx) and particulate matter (PM) from on-road heavy-duty engines used in vehicles delivered for sale in Vermont, which help protect public health and air quality. In this rulemaking, ANR proposes to amend current rules to (1) clarify the existing transit bus exemption from the HD Omnibus regulation, (2) adjust the vehicle model year in which vehicle manufacturers can begin earning early compliance credits under the HD Omnibus regulation, and (3) add the legacy engine provisions that will provide engine manufacturers greater compliance flexibility for model year 2026, while maintaining the originally projected emissions reductions and public health benefits under the HD Omnibus regulation.

ANR has authority to adopt and amend these regulations pursuant to Section 177 of the Clean Air Act (CAA) and 10 V.S.A. §§ 554, 558, and 567 of the Vermont Air Pollution Control Laws, which allow the ANR Secretary to set emission control requirements on sources of air contaminants in Vermont and specifically to control such emissions from motor vehicles through the prescription of requirements for the use of equipment that will reduce or eliminate emissions.

Background

Mobile sources, primarily motor vehicles, are a significant source of several air pollutants including air toxics, the ozone precursors (volatile organic compounds and NOx), and carbon monoxide. NOx are a group of highly reactive compounds that pose direct human health impacts, such as irritation of the respiratory tract, and the worsening or triggering of asthma.¹ These gases are also precursor pollutants that undergo complex chemical reactions in the atmosphere to form other air pollutants of concern, such as PM2.5 and ground-level ozone (also known as smog). Breathing air with elevated concentrations of ozone is especially harmful to children, the elderly, and people of all ages who have asthma and other respiratory impairments. Breathing ozone can trigger a variety of health issues ranging from coughing to chest pain, to reduced lung function or damage.² NOx also contributes to the formation of acid rain³ and visibility impairment (haze)⁴ in Vermont.

PM2.5 is emitted directly from vehicle exhaust and formed through secondary reactions with NOx and other pollutants in the atmosphere. PM2.5 can be inhaled deeply into the lungs and transferred into the

¹ EPA – Basic Information about NO2 webpage: <https://www.epa.gov/no2-pollution/basic-information-about-no2>

² EPA – Health Effects of Ozone Pollution webpage: <https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution>

³ EPA – Acid Rain webpage: <https://www.epa.gov/acidrain>

⁴ EPA – Visibility and Regional Haze website: <https://www.epa.gov/visibility>

bloodstream resulting in significant health problems, such as reduced lung function, worsened asthma, non-fatal heart attacks, and premature death in individuals with heart or lung disease.⁵

In 1967, the federal Clean Air Act (CAA) established the framework for controlling mobile source (i.e., cars, trucks, buses, and other vehicles) emissions in the United States. Although most states were preempted by Section 209 of the CAA from adopting state vehicle emissions standards, California was granted a special exemption to the federal preemption due to the state's long-standing mobile sources program and unique air quality problems.⁶ This exemption gave California the authority to set its own vehicle emission standards if such standards are at least as protective as the federal standards. The California Air Resources Board (CARB) develops and adopts specific rules and regulations needed to achieve healthful air quality and address climate change. The relevant CARB regulations are found in Title 13 (Motor Vehicles) and Title 17 (Public Health) of the California Code of Regulations (CCR).⁷

A subsequent amendment to the CAA added Section 177 that allows other states to adopt the California standards if they are "identical to the California standards" and California receives a waiver of preemption from implementing the federal motor vehicle standards from the U.S. Environmental Protection Agency (EPA).⁸ States may adopt California's standards prior to EPA granting a waiver to California under Clean Air Act Section 209(b).

Pursuant to Section 177, Vermont has the authority to regulate emissions from motor vehicles so long as those regulations are identical to California's. Over the past two decades, Vermont has adopted many of California's regulatory programs for light-, medium- and heavy-duty vehicles, including the Low Emission Vehicle (LEV) program beginning with model year 2000 and Zero Emission Vehicle (ZEV) program for model year 2004 and beyond which were later combined into the Advanced Clean Cars (ACC) program for model years 2015 through 2025. Additionally, in 2022 Vermont adopted California's ACC II, Advanced Clean Trucks (ACT), HD Omnibus, and the Phase 2 Greenhouse Gas regulations all beginning in model year 2026. The adopted requirements include a LEV program which focuses on the emissions of criteria air pollutants and greenhouse gases, and a ZEV program which requires auto manufacturers to deliver a certain percentage of battery electric, hydrogen fuel cell, and/or plug-in hybrid vehicles to Vermont.

In addition to California, Vermont and 16 other states have adopted California motor vehicle emissions standards. Combined, these states represent approximately 36%-40% of U.S. new light-duty vehicle sales.⁹ As of May 2023, eight states have adopted HD Omnibus and several others have proposed adopting.

⁵ EPA – Health and Environmental Effects of Particulate Matter (PM): <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>.

⁶ 42 U.S.C. §7543.

⁷ California Code of Regulations, Title 13, Motor Vehicles, [https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I4CE8D9D05A1E11EC8227000D3A7C4BC3&originationContext=documenttoc&transitionType=Default&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I4CE8D9D05A1E11EC8227000D3A7C4BC3&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)); California Code of Regulations, Title 17, Public Health, [https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I94E0B3505A2011EC8227000D3A7C4BC3&originationContext=documenttoc&transitionType=Default&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I94E0B3505A2011EC8227000D3A7C4BC3&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)).

⁸ 42 U.S.C. § 7507.

⁹ California Air Resources Board – States that have Adopted California's Vehicle Standards under Section 177 of the Federal Clean Air Act: https://ww2.arb.ca.gov/sites/default/files/2022-05/%C2%A7177_states_05132022_NADA_sales_r2_ac.pdf.

Heavy-Duty Engine and Vehicle Omnibus Rule

Background

Adopted in Vermont in 2022, the Heavy-Duty Engine and Vehicle Omnibus Regulation and Associated Amendments (HD Omnibus) require NOx emissions reductions from new on road heavy-duty engines and vehicles and ensure emission reductions are maintained as those engines and vehicles are operated.¹⁰ The HD Omnibus regulation includes exhaust emission standards for NOx and particulate matter (PM) that apply to heavy-duty Otto-cycle and diesel engines intended for use in vehicle service classes with gross vehicle weight ratings (GVWR) greater than 10,000 pounds. The HD Omnibus regulation is legally and substantively complimentary to the compliance and goals of the other LEV and ZEV rules (Advanced Clean Trucks and Phase 2 greenhouse gas regulations) previously adopted in Vermont.

The HD Omnibus regulation requires NOx emission reductions starting in model year 2026, and a 90% reduction for model year 2027 engines. The HD Omnibus includes an emissions averaging, banking, and trading program that allow manufacturers that elect to produce and certify heavy-duty ZEVs to generate NOx credits, to incentivize the sales of heavy-duty ZEVs earlier than would be required by the ACT Regulation.

To legally sell new engines, manufacturers must certify that their engines will comply with applicable emission standards throughout a specified period called the regulatory useful life. This ensures that manufacturers consider deterioration in emissions performance in the initial design of the engine. Manufacturers demonstrate that the emissions from engines meet emission standards at the time of certification using a durability demonstration program (DDP) which simulates heavy-duty engine and emission-related control component aging throughout the applicable useful life period.

To help ensure that emission controls are sufficiently durable to control emissions over applicable useful life periods, and well-maintained and repaired when needed, the HD Omnibus Rule lengthens the criteria pollutant emissions warranty and useful life period requirements for heavy-duty vehicles and engines. For components that fail under warranty, manufacturers may be required to report certain data to CARB and Vermont. If failure rates are high enough, manufacturers are required to conduct corrective actions such as recalling faulty components.

When ANR adopted the HD Omnibus regulation in 2022, the Northeast States for Coordinated Air Use Management (NESCAUM) assisted Vermont in calculating the estimated economic value of the health benefits associated with the adoption of the HD Omnibus regulation using U.S. EPA's CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA).¹¹ Utilizing the COBRA model is generally consistent with EPA practice for estimating avoided health impacts and monetized benefits. The COBRA model estimates impacts to air pollution concentrations, which are translated into health outcomes. Table 1 shows the estimated total avoided costs from avoided premature deaths, hospitalizations for cardiovascular and respiratory illnesses, and emergency room visits due to the reductions in criteria

¹⁰ See, CARB, Title 13, Final Regulation Order for HD Omnibus, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/froa-1.pdf>; see also CARB, Title 17, Final Regulation Order for HD Omnibus, <https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/froa-2.pdf>.

¹¹ U.S. EPA, COBRA model, <https://www.epa.gov/cobra>.

pollutant emissions associated with the adopted HD Omnibus regulation for 2025 through 2050 in Vermont, relative to the baseline.

Table 1: 2025-2050 Statewide estimated Cumulative Health Impacts from HD Omnibus Regulation, in US dollars. Total costs avoided are due to criteria pollutant emission reductions.

Adopted Regulation	Valuation	Years	Total Cumulative Costs Avoided
HD Omnibus Regulation	\$2018 (millions)	2025-2050	\$4.1-\$9.2M

Notes on COBRA modeling:

1. COBRA version 4.1.
2. Emissions baseline year, Phase II Source-Receptor (S-R) Matrix and adjustment factors, and incidence and health effect functions for 2028.
3. Vermont population projection for 2025-2050 utilized the 2017 U.S. Census Bureau National Population Projections as a baseline, which was adjusted at the state and county levels using the COBRA population inventory database.
4. Valuation functions were projected for 2025-2050 using a linear model based on the COBRA valuation inventory database.
5. Discount rate of 3%.

Previously, Vermont partnered with NESCAUM and the International Council on Clean Transportation (ICCT) who commissioned Sonoma Technology, Inc. (STI) to estimate the cumulative avoided NOx emissions beginning in 2026 from the HD Omnibus regulation as shown in Table 2¹², below.

Table 21: Avoided Cumulative Emissions of NOx and PM from HD Omnibus Regulation

Avoided Cumulative Medium- and Heavy-Duty Emissions, 2020-2050	
Adopted HD Omnibus Regulation	NOx (short tons)
	3,960

Proposed Amendments

The proposed amendments to the HD Omnibus Rule include the following changes summarized below:

- Clarify existing transit bus exemption language,
- Adjust the vehicle model year by which manufacturers can begin accruing early compliance credits, and
- Add the legacy engine provisions that will provide engine manufacturers greater compliance flexibility for model year 2026, while maintaining the originally projected emissions reductions.

Clarifying the Transit Bus Exemption

The HD Omnibus regulation previously adopted in Vermont included an exemption of transit buses by incorporating by reference the transit bus exemption provided by CARB within the CA regulation. Transit buses are currently exempt because of significant availability concerns with CARB compliant diesel transit

¹² The ICCT and STI - Benefits of adopting California medium- and heavy-duty vehicle regulations, <https://theicct.org/benefits-ca-multi-state-reg-data/>.

bus engines. Specifically, ANR intended to adopt this exemption from Vermont’s HD Omnibus Rule, Vermont Chapter 40-106(a)(12), by incorporating by reference Title 13 of the California Code of Regulations §1956.8(F) which allows for diesel-fueled transit buses and engines to be exempt if certain conditions are met. However, the intended exemption is problematic as written because it relies on conditions specific to other California regulations not adopted in Vermont. Therefore, Vermont’s HD Omnibus does not clearly exempt diesel-fueled transit buses and engines as intended.

The proposed amendment clarifies the existing language exempting diesel-fueled transit buses and engines from the regulation by adding this vehicle type to the exemption list in Chapter 40-103(d) and ensures compliance with the CAA’s identity requirement. Because this proposed amendment does not change the California NOx emissions standards vehicle manufacturers are already required to comply with, there are no economic or environmental impacts.

For background, Vermont is implementing efforts to further transit bus electrification. VTrans has developed a Zero-Emission Transition Plan¹³, which transitions the state’s fleet of approximately 400 transit vehicles to zero-emission propulsion over the next few decades. Specifically, VTrans’ plans call for 100 percent of the fleet to be powered by renewable energy by 2050. VTrans has applied for multiple Low and No Emissions Bus and Bus Facility Grants from the Federal Transportation Agency (FTA) and has been previously awarded \$12.5 million to for nine new electric transit buses to operate in Vermont.

DEC has supported this transition from diesel to electric transit buses. Recently, DEC has partnered with VTrans to continue electrifying Vermont’s transit bus fleet and provide support for the latest “Low No” grant application in spring of 2023. With support from the Volkswagen (VW) settlement and FTA funds, 17 diesel transit buses will be replaced with electric buses over the next two years. Also, DEC oversaw the Vermont Electric Bus Pilot, which as administered by VEIC on behalf of the State and has funded the replacement of six diesel school buses at three schools and two diesel transit buses with electric buses. All electric buses were delivered and on the road in 2021/2022. Data collected on electric bus operation and performance to help inform future investments has been completed and a final report was issued in June 2023.¹⁴

Early Compliance Credits

Early compliance credits serve as one of many compliance flexibilities provided to manufacturers under the HD Omnibus regulation. When ANR adopted the HD Omnibus regulation in 2022, the period of early credit generation was based on the number of years California allowed when they first adopted. For example, California allowed for two years of early credit generation (model years 2022 and 2023) until the HD Omnibus emissions standards went into effect in California beginning in model year 2024. Vermont followed suit by also allowing for two years of early credit generation (model years 2024 and 2025) until the HD Omnibus emissions standards went into effect in Vermont beginning in model year 2026.

However, following Vermont’s adoption of the HD Omnibus regulation, it became clear that all the other Section 177 states that have adopted the HD Omnibus regulation (CO, MA, NJ, NY, OR, and WA) explicitly

¹³ Vermont Agency of Transportation (VTrans) Zero-Emission Transition Plan (https://vtrans.vermont.gov/sites/aot/files/publictransit/documents/VTrans%20Zero-Emission%20Transition%20Plan_Final01312022.pdf)

¹⁴ Vermont Electric School and Transit Bus Pilot Program Report, June 23, 2023, https://dec.vermont.gov/sites/dec/files/aqc/mobile-sources/documents/VEIC_Final_VT_Electric_Bus_Pilot_Report_and_Appendices.pdf.

allowed for early credit generation beginning in model year 2022. Additional states (CT and RI) have also indicated that their proposed HD Omnibus rules will allow for early credit accrual to begin with model year 2022. Although the reasoning behind ANR's initial decision to begin early credits in model year 2024 is sound, Vermont's rule is not aligned with other Section 177 states.

The proposed amendment includes changing the vehicle model year in which vehicle manufacturers can begin earning early compliance credits from 2024 to 2022 to align with California and other states that explicitly allow for early credit generation beginning in model year 2022 and ensures compliance with the CAA's identity requirement. Adjusting the model years for early compliance credits for the HD Omnibus regulation does not impact previous estimates of emissions reductions or public health benefits, because the modeling completed indirectly factored in early compliance credits based on California's approach. Because this proposed amendment does not change the California NOx emissions standards vehicle manufacturers are already required to comply with, there is no economic impact.

Legacy Engine Provisions

The main purpose of the proposed legacy engine provisions is to assure originally intended engine availability levels and associated emissions reductions and provide a smooth transition as manufacturers adjust to the new lower emission standards. As a result of a recently negotiated agreement, the Clean Truck Partnership¹⁵, between CARB and truck and engine manufacturers, California proposed to amend the legacy engine provisions in the HD Omnibus regulation to provide additional compliance flexibility to assist manufacturers to produce and certify greater number of 2026 model year legacy engines that meet today's federal standards. As California amends its rules, Vermont periodically adopts amendments to maintain consistency with the California standards and the CAA's identity requirement.

Specifically, the proposed legacy engine provisions provide manufacturers the option to certify 2026 model year heavy-duty diesel engines rated below 525 brake horsepower (bhp) to the current NOx and PM exhaust emission standards of 0.20 grams per brake horsepower-hour (g/bhp-hr) (hereinafter, legacy engines), provided they offset any resulting NOx or PM deficits with credits obtained from the HD zero-emission (HD-ZE) averaging set. If enough credits from the HD-ZE averaging set are not available, or such credits are not available below a specified cost threshold, a manufacturer may use credits from the same combustion engine averaging set.

If enough credits from the same combustion engine averaging set are not available, a manufacturer may carryover its NOx or PM deficit balance until the end of the 2026 model year but must then offset 1.25 times the amount of the deficit balance. Manufacturers that fail to offset their deficit balances by the end of the 2026 model year must provide documentation substantiating that they attempted to but were unable to purchase credits at a price below a specified threshold. Such manufacturers must also submit a plan demonstrating that any deficits will be offset in five years and that such reductions must benefit disadvantaged communities.

¹⁵ CARB and truck and engine manufacturers announce unprecedented partnership to meet clean air goals, CARB Press Release, July 6, 2023, <https://ww2.arb.ca.gov/news/carb-and-truck-and-engine-manufacturers-announce-unprecedented-partnership-meet-clean-air>

Furthermore, a manufacturer must certify one or more diesel engine families to the full Omnibus NOx standards specified in 13 CCR §1956.8(a)(2)(C)1 in the same year it is utilizing this option to certify legacy engines.

The proposed legacy engine provisions provide a legacy engine sales limit of 10 percent for model year 2026. If a manufacturer exceeds the legacy engine sales limit, deficits from the additional one percent sales volume above the limit would have to be offset at four times the deficit balance. Any legacy engine sales exceeding the production and sales limits including the additional one percent volume would be considered as non-compliant engine sales.

Legacy Engine Provisions Costs and Benefits

As determined by CARB, this amendment leads to a \$0 net impact over the lifetime of the regulation between 2026 and 2035. It is expected that market forces will control the costs to offset excess emissions and what fleet owners are willing to pay for a legacy heavy-duty diesel engine. It is unlikely that manufacturers would produce legacy engines if the cost of HD-ZE credits exceeded the incremental increase in cost to manufacture an Omnibus-compliant engine in 2026. Therefore, the cost to offset legacy engine emissions must be less than or equal to the technology costs savings from producing a legacy engine to make the legacy engine a viable option. For this reason, the market prices for a 2026 model year legacy engine versus an Omnibus-compliant engine of the same size are anticipated to be similar.¹⁶

Legacy engines are more appealing to fleet owners due to the cost savings from the reduced diesel exhaust fluid (DEF) consumption; therefore, fleet owners may be incentivized to purchase legacy engines at a premium. It is expected that market forces may cause a fleet to be willing to purchase legacy engines at a premium price estimated to be equal to the DEF cost savings per legacy engines. For this reason, there is estimated to be a \$0 net impact on the cost to purchase and operate legacy engines for fleets.¹⁷

The manufacturers, located outside of Vermont, are estimated to have technology costs savings from producing legacy engines in the 2026 model year in lieu of HD Omnibus-compliant engines. In turn, manufacturers must offset those increased emissions; CARB staff estimates the cost to offset these emissions is equal to the cost savings.¹⁸

The proposed legacy engine provisions require manufacturers to offset any excess NOx and/or PM emissions generated from legacy engine sales. As a result, the proposed amendments are emissions-neutral, that is they are not projected to provide any additional emission reductions beyond those projected in the existing HD Omnibus regulation, nor are they expected to result in any emissions increases. The emission benefits expected from the HD Omnibus regulation as initially adopted and described above would remain the same.¹⁹

¹⁶ CARB, HD Omnibus Proposed Amendments Initial Statement of Reasons, available at, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2023/hdomnibus2023/isor.pdf>.

¹⁷ *Id.*

¹⁸ *Id.*

¹⁹ *Id.*

Scientific Information Statement Supplemental Information and Materials Incorporated by Reference

- Chapter 40, Vermont Low Emission Vehicle and Zero Emission Vehicle Rules (eff. Dec. 16, 2022), available at, https://dec.vermont.gov/sites/dec/files/aqc/mobile-sources/documents/Chapter_40_LEV_ZEV_rule_adopted_Linked.pdf
- Title 13, California Code of Regulations, available at, <https://govt.westlaw.com/calregs/Index?transitionType=Default&contextData=%28sc.Default%29>
- Title 17, California Code of Regulations, available at, <https://govt.westlaw.com/calregs/Index?transitionType=Default&contextData=%28sc.Default%29>
- CARB, Title 13, Final Regulation Order for HD Omnibus, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/froa-1.pdf>
- CARB, Title 17, Final Regulation Order for HD Omnibus, <https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/froa-2.pdf>.
- CARB, HD Omnibus Rule Record, available at, <https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox>.
- CARB, HD Omnibus Final Statement of Reasons, available at, <https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf>
- CARB, HD Omnibus Addendum to Final Statement of Reasons, available at, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/fsoraddendum.pdf>.
- CARB, HD Omnibus Proposed Amendments Initial Statement of Reasons, available at, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2023/hdomnibus2023/isor.pdf>.
- ANR, Supplemental Information for Vermont Low Emission Vehicle and Zero Emission Vehicle (2022), available at, https://dec.vermont.gov/sites/dec/files/aqc/laws-regs/documents/ACCII-ACT-LowNOx-TSD_LCAR.pdf.