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Heavy-Duty Low NO_x Omnibus Regulation: Frequently Asked Questions

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The Northeast States for Coordinated Air Use Management (NESCAUM) is the nonprofit association of state air quality agencies in the six New England states, New Jersey, and New York. NESCAUM serves as a technical and policy advisor to its members and works with broader groups of states to develop strategies to achieve air quality and climate goals. For more than three decades, NESCAUM has supported states in using their authority under Section 177 of the Clean Air Act to adopt California's motor vehicle emission standards. Currently, NESCAUM hosts a workgroup for Section 177 states across the country to assist with and coordinate state adoption and implementation of California's clean car and truck standards. While NESCAUM works with the Section 177 states and California to develop common approaches and interpretations of California's clean car and truck standards, each state is ultimately responsible for interpreting and implementing its regulations. NESCAUM also facilitates the Multi-State ZEV Task Force, a unique forum for galvanizing state leadership on complementary policies and programs to accelerate transportation electrification through research and analysis, information sharing, collective strategizing, and coordinated action on shared priorities.

This resource is intended to address key questions related to adoption and implementation of California's Heavy-Duty Low NO_x Omnibus regulation. Under the federal Clean Air Act (CAA), California is the only state permitted to establish emission standards for new motor vehicles. Other states, however, may adopt and enforce California's emission standards, in-lieu of federal standards. States that adopt California's standards are referred to as "Section 177 states," in reference to the CAA provision that grants this authority.

Overview of the On-Road Heavy Duty Engine Program

What is the Heavy-Duty Low NO_x Omnibus (HDO) regulation?

Since 2010, on-road heavy-duty engines delivered for sale in California have been subject to a particulate matter (PM) standard, a nitrogen oxides (NO_x) standard, and a NO_x idling emission standard. To legally sell new engines in California, manufacturers must certify that their engines will comply with applicable emission standards throughout a specified period called the regulatory useful life, which is a defined period or mileage in the regulation. Other components of this regulatory program include warranty requirements for emission related engine components, in-use testing requirements, and testing procedures that measure exhaust emissions during different types of engine operation (called "test cycles"). The HDO regulation, adopted by the California Air Resources Board (CARB) in 2020, contains updates to this long-standing program that reflect years of research and testing demonstrating the feasibility and applicability of lower emission technology for heavy-duty engines.

What vehicles and engines are subject to the HDO regulation?
In California, the HDO regulation applies to model year 2024 and later on-road heavy-duty Otto-cycle and heavy-duty diesel engines used to operate Class 3-8 medium- and heavy-duty vehicles, including drayage trucks, buses (except transit buses), refuse trucks, and other commercial work vehicles (see table below for the starting model years in Section 177 states). Some vehicle manufacturers sell vehicles with engines that are manufactured by a separate entity. In this instance, the vehicle that is delivered for sale in an HDO-participating state must utilize a compliant engine.

Non-road mobile engines and machinery are not subject to the HDO regulation.

Are emergency vehicles subject to the HDO regulation?
The HDO regulation specifically exempts emergency vehicles from the engine idling requirements of the rule.[1] While there is no broad emergency vehicle exemption in the HDO regulation, California law exempts emergency vehicles from regulations regarding "motor vehicle pollution control devices," such as the HDO regulation.[2] Generally speaking, Section 177 states also exempt emergency vehicles.[3]

What changes did the HDO Regulation make?

How do the emission standards for NO_x and PM change in the HDO regulation?
The HDO regulation lowers NO_x and PM emission standards on existing regulatory test cycles and establishes a new NO_x standard on a new low load certification test cycle. The HDO regulation lowers the NO_x standards for on-road heavy-duty engines by 75% below current 2010 standards of 0.20 grams per horsepower-hour (g/hp-hr) beginning in the 2024 model year. The HDO regulation originally proposed to further lower the NOx standard by 90% below current standards in the 2027 model year. The HDO regulation lowers the PM standard by 50% below the current 2007 standards of 0.01 g/hp-hr to 0.005g/hp-hr.

What changes does the HDO regulation make to the heavy-duty in-use testing program?
The regulation amends the heavy-duty in-use testing program to better represent heavy-duty vehicle operations in real world conditions, clarify criteria for engine family pass/fail determination, and require on-board diagnostic data during testing to verify the condition of the test vehicle and sensors.

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[1] 13 CCR 1956.8(a)(6)(B).
[2] California Vehicle Code § 27156.2.
[3] Additionally, California regulates transit buses under its Innovative Clean Transit regulations, therefore transit agencies may apply to the CARB Executive Officer for an exemption from the HDO regulation. Some Section 177 states have similar or more stream-lined exemptions for diesel-fueled transit buses. New Jersey has substituted its own exemption process for transit buses: See New Jersey Administrative Code §7:27-28A.11, https://dep.nj.gov/wp-content/uploads/aqm/sub28a.pdf. Vermont has exempted diesel fueled engines used exclusively in motor buses as referenced by Title 13, California Code of Regulations Section 1956.8(a)(2)(F), for which there is no CARB certification: See Vermont Code of Administrative Rules §12-030-039, https://dec.vermont.gov/sites/dec/files/aqc/laws-regs/documents/Final_Proposed_Rule_Clean_Text_LEV_2023.pdf.

What changes does the HDO regulation make to the criteria pollutant emissions warranty, useful life period, and scheduled maintenance interval requirements?
The regulation extends the criteria pollutant emissions warranty requirements for heavy-duty vehicles and engines to minimize the occurrences of tampering and to ensure emission controls are well-maintained and repaired when needed. The regulation also lengthens the useful life period requirements to provide for more durable emission control systems that comply with applicable emission standards throughout a greater portion of heavy-duty engine and vehicle service lives, resulting in greater overall emission reductions than from the standards alone. In addition, the regulation amends the scheduled maintenance interval provisions to ensure the effectiveness of the lengthened emissions defects warranty for the intended periods so that their associated emission reductions are achieved.

How does the HDO regulation amend the heavy-duty durability demonstration program?
The regulation lengthens the durability requirements and establishes a new standardized testing methodology for demonstrating durability of heavy-duty diesel engines. These amendments help to ensure that future engine and aftertreatment system designs are capable of meeting emission standards over their useful life periods, and that the durability program can more accurately predict the actual emissions of engines and vehicles.

What changes does the HDO regulation make to the emissions warranty information and reporting provisions?
Changes to the emissions warranty information and reporting provisions are designed to identify and correct emission control component problems more expeditiously to prevent or reduce the excess emissions associated with defective components. The changes also require additional information for warranty reporting and tools to verify the accuracy of warranty reports.

How does the HDO regulation compare to and align with EPA's Clean Trucks Plan and corresponding rules?
In December of 2022, EPA finalized the first of three rules that make up its Clean Trucks Plan, which aims to put in place a more protective set of EPA regulations for the on-road sector. The Rule for Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards[4] increases the stringency of the criteria pollutant emissions standards over a wide range of heavy-duty engine operating conditions for vehicles and engines beginning in model year 2027. This increase in stringency largely brings the EPA rules in line with the anticipated changes to the HDO regulation. Regardless of the upcoming program alignment between the CARB and EPA rules in model year 2027, CARB will continue to issue Executive Orders certifying engines pursuant to the HDO regulation in model year 2027 and beyond.

Compliance Flexibility in the HDO Regulation

[4] U.S. Environmental Protection Agency, Final Rule and Related Materials for Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-and-related-materials-control-air-pollution.

How can manufacturers earn early compliance credits under the HDO regulation?
The HDO regulation allows manufacturers to earn credits in California or a Section 177 state for the early introduction of cleaner engines by certifying engines to more stringent emission standards than the currently applicable federal standards before the HDO regulation is implemented. For example, the HDO regulations adopted by Massachusetts and Oregon allow manufacturers to earn early compliance credits beginning in the 2022 model year before the first applicable model year of 2025. Credits can be banked toward future compliance with the HDO regulation.

Credits that are generated as a result of earlier certification of 2022-2030 model year engine families or hybrid powertrain families to later model year (more stringent) HDO emission standards are eligible for application of an early compliance credit multiplier. The weight of the multiplier depends on the stringency of the standard that is being met. Note that credits generated from heavy-duty ZEV families are not eligible for early compliance credit multipliers.

The table below identifies the first applicable model year for HDO implementation and early credit generation in Section 177 states.

State	Applicable Model Year	Early Credit Generation Model Year
California	2024	2022
Colorado	2027	2022
Massachusetts	2025	2022
New Jersey	2027	2022
New Mexico	2027	2022
New York	2026	2022
Oregon	2025	2022
Rhode Island	2027	2022
Vermont	2026	2022
Washington	2026	2022

What is emissions averaging, banking, and trading (ABT), and how does the HDO regulation amend the ABT program?
An ABT program allows manufacturers to bank and trade credits that count toward compliance with a regulation, as well as average the value of credits earned among various engine families in the same averaging set. While an ABT program exists within the federal program, because the HDO regulation

establishes emission standards and other requirements that are more stringent than the corresponding federal heavy-duty emission standards for 2024-2026 model years, a separate California-ABT program was established starting with 2022 model year engines.

The CA-ABT program avoids potential credit accounting discrepancies between the California and federal-ABT programs resulting from the differences in proposed emission standards, certification test procedures, and useful life periods. A limited amount of federal-ABT credits that were generated between the 2010-2021 model years may be transferred to the CA-ABT program starting in the 2022 model year, so long as a manufacturer begins enrollment in the CA-ABT program in 2022. The changes also allow hybrid powertrain engine families and heavy-duty ZEVs to generate NO_x credits in order to incentivize the development, production, and sales of heavy-duty ZEVs from the 2022 to 2026 model years.

Credits may be earned within an averaging set, and each set includes a different set of engines certified to specific standards and test procedures. Credit transfers between averaging sets are not allowed, except that credits from a zero-emission averaging set can be transferred to any other averaging set to cover deficits generated by any certified engine families. Note that averaging sets have been established under the standards and test procedures for both diesel engines and Otto-cycle engines.[5]

What are the limitations on banking and using credits?
Credits from any averaging set except zero-emission credits may be used for up to five model years after the year in which they are generated. For example, zero-emission credits generated in model year 2024 may be used to demonstrate compliance with emission standards only through model year 2029.

Zero-emission NO_x and PM credits can be banked for use in future model years, but only up through model year 2026. For example, credits generated in model year 2024 may be used to demonstrate compliance with emission standards only in model years 2025 and 2026. Therefore, the heavy-duty zero-emission averaging set provisions and credits are only available for the 2022 through 2026 model years. Any banked zero-emission credits would no longer be available in the CA-ABT program for 2027 and subsequent model years.

How will ABT programs work in the Section 177 states?
Section 177 states that implement the HDO regulation prior to model year 2027 will need to establish and maintain their own ABT program that considers the requirements and allowances of the CA-ABT program. Section 177 states may choose to extend the date by which OEMs can transfer federal ABT-credits to a state-ABT program because a state did not establish its own state-ABT program by model year 2022.

What changes were made to the powertrain certification test procedures for heavy-duty hybrid vehicles?

[5] California Air Resources Board, On-Road Heavy-Duty Current Standards, Test Procedures and Regulatory Documents, https://ww2.arb.ca.gov/resources/documents/road-heavy-duty-current-standards-test-procedures-and-regulatory-documents.

The HDO regulation establishes a voluntary option for manufacturers to certify hybrid powertrains to criteria pollutant emission standards. As such, hybrid powertrain families may also participate in an ABT program and should be grouped together with the engine families from the same primary intended service class. These changes align with federal procedures for powertrain testing contained in the U.S. EPA Clean Trucks Plan regulation related to controlling air pollution from new Heavy-duty Engines and Vehicles.[6]

Where can states and manufacturers find reporting instructions and forms for the CA-ABT program?
Information on CA-ABT reporting instructions and reporting templates are available online.[7] In May of 2024, NESCAUM sent a request to manufacturers for HDO early compliance credit information for model years 2022 and 2023 to be sent to the Section 177 states to process, verify, and approve HDO early compliance credits. The request indicated that states would accept early compliance credit reporting through June 30, 2024. The suggested template provided to manufacturers was based on CARB's reporting templates previously shared with the Section 177 states.

Section 177 states implementing the HDO regulation have agreed to work collaboratively to communicate uniform guidance and framework for the implementation of ABT programs in the respective states.

What is the Optional Low-NO_x Program and how does it work?
The optional low NO_x standards were developed to pave the way for more stringent mandatory standards by encouraging manufacturers to develop and certify low NO_x engines. The HDO regulation includes updates to the Optional Low-NO_x Program, which allows a manufacturer to choose to offer an engine that is 50%, 75%, or 90% (or 95% for 2022 and 2023 model year engines) below the 0.20 g/bhp-hr NO_x emission standards for heavy duty engines. For 2024 through 2026 model years, the optional low NO_x standards are 60% or 80% below the corresponding certification standards for the model year.[8] Since 2015, a number of natural gas and liquified petroleum gas fueled heavy duty engines have been certified to the optional low NO_x standards. Financial incentives to potential customers are provided to encourage the purchase of these low NO_x engines through funding programs such as California's Carl Moyer and EPA's Diesel Emission Reduction Act funding programs. However, a manufacturer may not include an engine family certified to the optional NO_x emission standards in state ABT programs for NO_x but may include it for PM.

What are legacy engines?

[6] U.S. Environmental Protection Agency, Final Rule and Related Materials for Control of Air Pollution from New Motor Vehicles: Heavy-duty Engine and Vehicle Standards, https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-and-related-materials-control-air-pollution.
[7] California Air Resources Board, ABT Report Template, https://ww2.arb.ca.gov/resources/documents/abt-report-template.
[8] For model years 2024 through 2026, the certification standards are 0.050 g/bhp-hr NO_x on the Federal Test Procedure and 0.200 g/bhp-hr on the Low Load Cycle.

Legacy engines[9] meet the less stringent pre-HDO standard of 0.20 g/bhp-hr for NO_x.

What are the legacy engine provisions in the HDO regulation?

CARB amended the legacy engine provisions of the HDO regulations, effective May 31, 2024.[10] These provisions create a transitional program, applicable only in the 2024-2026 model years, designed to provide compliance flexibilities to manufacturers and to minimize market disruption as manufacturers adjust to the post-model year 2027 standards. Manufacturers may choose from two options to participate in the legacy engine program. If manufacturers choose to select an option, they must declare which option will be implemented to the relevant state in advance of the relevant model year.

> Option 1: The number of legacy engine sales are limited to 45% for model year 2024, 25% for model year 2025, and 10% for model year 2026. If a manufacturer exceeds the legacy engine sales limits, deficits from the additional 1% sales volume above the limit have to be offset at four times the deficit balance. Any legacy engine sales exceeding the production and sales limits including the additional 1% volume are considered as non-compliant engine sales.
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> Option 2: Medium heavy-duty diesel (MHDD) legacy engine sales are limited to 60% in each of model years 2024 and 2025. The sales limits for the combined light heavy-duty diesel (LHDD) and heavy heavy-duty diesel (HHDD) engines are 15% in model year 2024 and 8% in model year 2025. If a manufacturer exceeds the legacy engine sales limits, deficits from the additional 5% sales volume above the limit for MHDDs and additional 1% sales volume above the limit for LHDDs and HHDDs have to be offset at four times the deficit balance. Any legacy engine sales above the production limits including the additional allowed exceedances are considered as non-compliant engine sales.

Manufacturers electing to use either option must fully offset the emissions increases resulting from sales of legacy engines through the following actions, listed in prioritized order: using heavy-duty zero emission credits, using combustion (NO_x and PM) credits from the same averaging set, or by performing mitigation projects in disadvantaged communities.[11] Legacy engines that are used toward either option must be certified by CARB so that they are eligible to be sold in California or a Section 177 state that is implementing the HDO rule. Manufacturers must use end-of-the-year compliance reporting to demonstrate that they have complied with the option they pre-selected.

What else is important to know about the HDO regulation?

How is model year defined in the HDO regulation?

[9] 13 CCR §1956.8(a)(2)(C)3; Title 13, California Code of Regulations (CCR), Section 1956.8(a)(2)(C)3.
[10] California Air Resources Board, Heavy-Duty Engine and Vehicle Omnibus Regulation Amendments, https://ww2.arb.ca.gov/rulemaking/2023/hdomnibus2023.
[11] California Air Resources Board, Workshop on Criteria for Projects targeted at Disadvantaged Communities to Offset Legacy Engine Emissions; https://ww2.arb.ca.gov/sites/default/files/classic/MSCD/Workshop_Presentation-Projects_Targeted_at_DAC_Oct_24_FINAL.pdf.

Model year is defined in 17 CCR §95662(a)(16), which aligns model year with the year in which the vehicle or engine is manufactured. The definition of model year used here also allows an engine model year to be one year earlier than a vehicle model year. For purposes of determining compliance with the HDO regulation, a vehicle's engine model year will determine whether the vehicle is compliant. For example, Massachusetts, which implements the HDO regulation starting in the 2025 model year, will require that all vehicles registered with an engine model year of 2025 be California-certified. However, a 2025 model year vehicle with a 2024 engine model year does not need to be California-certified to be sold and registered in Massachusetts. Note that the definition of model year is different for the purposes of determining the lead time between rule adoption and implementation, as prescribed in Section 177 of the Clean Air Act. With respect to lead time, EPA's regulations[12] define model year as beginning on January 2 of the prior calendar year.

What is a Manufacturer Certificate of Origin (MCO) and how is it used to determine compliance with the HDO regulation?

The MCO is the documentation generated by a manufacturer that accompanies all new vehicles delivered for sale in the United States. The contents of these documents are regulated by the National Highway Traffic Safety Administration and are required to contain information about a vehicle's model year. State motor vehicle agencies typically use information contained in the MCO when they register a new vehicle within a state. Given the potential for differentiation between a vehicle's model year and a vehicle's engine model year that may not otherwise be indicated on the MCO, some manufacturers are providing language on the MCO that indicates if a vehicle is eligible to be sold and registered in an HDO participating state. For example, some manufacturers will add "blocking language" to MCOs of vehicles that are HDO rule non-compliant. The blocking language will indicate that the vehicle is not allowed to be registered in certain states.

What is the Clean Truck Partnership?

In July of 2023, CARB, leading truck manufacturers,[13] and the Truck and Engine Manufacturers Association announced the Clean Truck Partnership,[14] which "advances the development of zero-emission vehicles for the commercial trucking industry" and "includes flexibility for manufacturers to meet emissions requirements while still reaching the state's climate and emission reduction goals."[15] Through the terms of the Clean Truck Partnership:

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[12] 40 C.F.R. § 85.2302 - § 85.2304; https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-85/subpart-X/section-85.2302.

[13] Truck manufacturers that signed on to the Partnership agreement include: Cummins, Inc., Daimler Truck North America, Ford Motor Company, General Motors Company, Hino Motors Limited, Inc., Isuzu Technical Center of America, Inc., Navistar, Inc., PACCAR Inc., Stellantis N.V., and Volvo Group North America.

[14] California Air Resources Board, CARB and the Truck and Engine Manufacturers Association Agreement, https://ww2.arb.ca.gov/sites/default/files/2023-07/Final%20Agreement%20between%20CARB%20and%20EMA%202023_06_27.pdf.

[15] California Air Resources Board, CARB and truck and engine manufacturers announce unprecedented partnership to meet clean air goals, July 6, 2023, https://ww2.arb.ca.gov/news/carb-and-truck-and-engine-manufacturers-announce-unprecedented-partnership-meet-clean-air.

- CARB agreed to mostly align the HDO regulation with EPA's 2027 regulations for NO_x emissions and has already revised the legacy engine provisions.[16]
- CARB committed to providing no less than four years lead time and at least three years of regulatory stability before imposing new requirements impacting HDO engines and vehicles.
- Truck manufacturers committed to meeting CARB's zero-emission and criteria pollutant regulations in the state regardless of any attempts by other entities to challenge California's authority.

The Clean Truck Partnership did not include any Section 177 state signatories.

Are further amendments to the HDO regulation anticipated?
In March of 2024, CARB held a workshop[17] to discuss potential amendments to the HDO regulation that would implement CARB's commitment in the Clean Truck Partnership to primarily align the Omnibus regulation with the new 2027 and subsequent model year heavy-duty engines with the corresponding provisions of EPA's Clean Trucks Plan. Rulemaking activities related to these potential amendments are ongoing.

Where can I find additional information about the HDO regulations, and their accompanying standards and test procedures?
The core provisions of the HDO regulation are at 13 CCR §1956.8.[18]

Other details about ABT Programs, credit generation, and early compliance can be found within the Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles[19], and the Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines and Vehicles.[20]

Where can I find a list of engines and vehicles that have been certified to meet the requirements of the HDO regulation?
When CARB certifies an engine or vehicle that meets the requirements of a particular regulatory program, it issues an Executive Order which details the results of the testing for the engine or vehicle

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[16] California Air Resources Board, Heavy-Duty Engine and Vehicle Omnibus Regulation Amendments, https://ww2.arb.ca.gov/rulemaking/2023/hdomnibus2023.
[17] California Air Resources Board, Heavy-Duty Low NO_x: Meetings & Workshops, https://ww2.arb.ca.gov/our-work/programs/heavy-duty-low-nox/heavy-duty-low-nox-meetings-workshops.
[18] 13 CCR §1956.8; https://govt.westlaw.com/calregs/Document/I74B90BD0231E11EFBB4F9D4B9025A50C?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default).
[19] California Air Resources Board, Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles; https://ww2.arb.ca.gov/sites/default/files/2022-03/Final%20Omnibus%20HDDiesel%20Engine%20TPS%20COMPLETE%20CLEAN%20ADA_03102022_8.pdf.
[20] California Air Resources Board, Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines and Vehicles; https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/frob-2.pdf.

achieving certification. CARB has published a list of Executive Orders for Medium- and Heavy-duty Engines for model year 2024.[21]

[21] California Air Resources Board, Executive Orders for Medium- and Heavy-duty Engines for MY 2024; https://ww2.arb.ca.gov/new-vehicle-and-engine-certification-executive-orders-my2024-medium-duty-and-heavy-duty-engines.