Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles – Phase 3

Overview Briefing of the Final Rule for GRPE

US EPA, OFFICE OF TRANSPORTATION AND AIR QUALITY

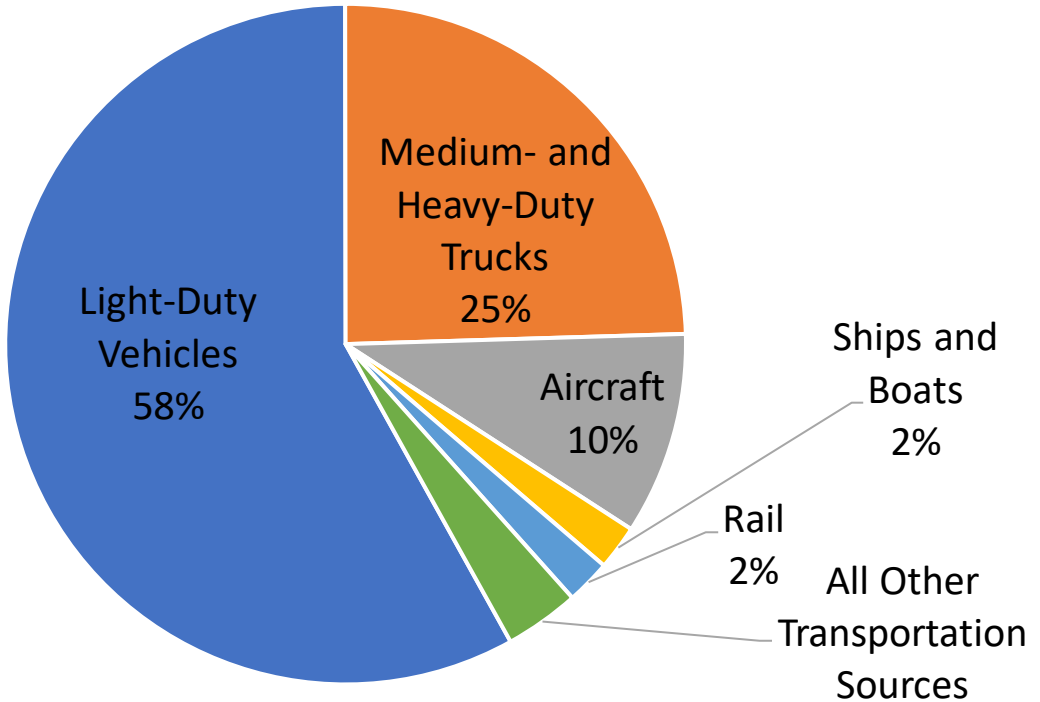
MAY 23RD, 2024

Background: Key Statutory Provisions and Importance of Reducing HD Air Pollution

Clean Air Act Statutory Authority

- Section 202(a)(1) of the Clean Air Act (CAA) requires the EPA to "*by regulation prescribe (and from time to time revise) . . . standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines. . ., which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.*"
- Standards take effect "*after such period as the Administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period*."
- **EPA also must consider issues of technological feasibility, compliance cost, and lead time. EPA may consider other factors.**

HD is the 2nd largest source of GHG emissions in the transportation sector, and a significant source of local & regional air pollution



"Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020," EPA 430-R-22-003

Background: HD GHG Phases 1 and 2 Program Highlights

- Standards set by heavy-duty regulatory categories, e.g., tractors, vocational vehicles, large pickups/vans
- Phase 1 vehicle standards implemented 2014 through 2018; Phase 2 program started in 2021, fully phase in by 2027

When designing program in 2016, EPA envisioned these technologies *could* be used to meet Phase 2:

- Engine, transmission, and driveline improvements
- Extended and workday idle reduction technologies
- Aerodynamic devices
- Lower rolling resistance tires
- Automatic tire inflation systems
- Weight reduction
- Engine stop start
- Powertrain hybridization
- Combustion optimization
- Improved air handling
- Reduced friction within the engine
- Improved emissions after-treatment technologies
- Engine waste heat recovery

Scope of the Phase 3 Final Rule

HD GHG Phase 3

Vocational Vehicles





Short-haul Tractors

Long-haul Tractors

Light- and Medium-Duty Multi-Pollutant Final Rule

Light-Duty



Medium-Duty


The Clean Trucks Plan

EPA's Clean Trucks Plan represents the **most protective set of EPA regulations ever for the on-road sector**, significantly reducing pollution, protecting public health, and responding to the urgency of climate change.

The Heavy-Duty GHG Phase 3 final rule signed in March 2024 completes the Clean Trucks Plan.

It follows the completion of these two rules:

- The **Control of Air Pollution from Heavy-Duty Engines and Vehicles** signed in December 2022, which focuses on reducing emissions that form smog and soot and will apply to heavy-duty engines and vehicles beginning in model year 2027.
- The **Multi-Pollutant Emission Standards for Model Years 2027 and Later for Light- and Medium-Duty Vehicles** rule that was signed in March 2024 addresses greenhouse gas emissions and emissions that form smog and soot from commercial pickup trucks and vans, in addition to light-duty vehicles.

HD GHG Phase 3 Highlights

- Achievable and flexible **greenhouse gas standards for model years 2027-2032** that completes the Clean Trucks Plan

- Will deliver **one billion metric tons of net CO_2 emission reductions** between 2027 and 2055

- Projected increased use of ZEVs and advanced ICE vehicle technologies will **decrease criteria pollutants and air toxics from vehicles and refineries**
  - Reduced pollution (e.g., $PM_{2.5}$, NO_2) near roadways, where over 72 million people live, including communities with EJ concerns

- **$13 billion in annualized net benefits** to society from climate and public health benefits and savings for truck owners and operators

HD GHG Phase 3 Highlights

- **Technology-neutral, performance-based standards**
  - Manufacturers can meet the standards with a **variety of technologies, including:**
    - Advanced internal combustion engine vehicles
    - Hybrid vehicles
    - Plug-in hybrid vehicles
    - Battery electric vehicles
    - Hydrogen fuel cell vehicles
- Final standards will **save vehicle owners billions of dollars**
  - Heavy-duty industry will see **annualized savings of $3.5 billion, compared to annualized costs of $1.1 billion**
  - With vehicle purchase tax credits provided under the IRA, typical buyers in 2032 will save money on the upfront cost of the vehicles and recoup any additional costs in:
    - 2-4 years for vocational vehicles and day cabs
    - 5 years for sleeper cabs

Phase 3 Builds off Phase 2's Program Structure

- **Phase 3 standards maintain the flexible structure** created in EPA's Phase 2 GHG program, which is designed to reflect the diverse nature of the heavy-duty industry

- **Performance-based and technology-neutral** standards are first differentiated between tractors and vocational vehicles
  - Vocational vehicles are divided into 23 different subcategories for setting standards – 8 are for specialized vehicles
  - For tractors, standards are divided into 10 different subcategories for standards
  - In total, there are 33 unique HD vehicle subcategories for standards for each model year of the program

- CO_2 Emissions Averaging, Banking and Trading (ABT) program
  - Allows emissions credits to be generated and used to meet the standards
  - 5-year credit life, 3-year deficit carry forward

Final Phase 3 Standards and Requirements

- We made **numerous changes** to the final program based on our review of public comments on the proposal and our updated technical assessment, including:

  - **More time in the early years of the program**
    - Day cab program starts one year later (2028); heavy-heavy vocational vehicles start two years later (2029)

  - **Lower starting point and more gradual phase-in**
    - Less stringent standards for all vehicle categories in MY 2027-2030
      - MY 2031 also less stringent for sleeper cab tractors
      - Less stringent every year for heavy-heavy vocational

  - **Emission credit program changes**
    - Interim, transitional flexibility during 2027 through 2032 that will allow broader use of credits generated from heavy-duty vehicles across averaging sets
    - Maintains the Phase 2 program's advanced technology credit multiplier in 2027 (which we proposed to eliminate for PHEVs and BEVs), but with additional guardrails to constrain the use and life of these credits

  - **Stronger end-point standards for key truck categories**
    - MY 2032 and beyond standards for light and medium-duty vocational vehicles and day cab tractors more stringent than proposed

Stringency of Standards for the Final Rule

% Reduction from the Phase 2 CO_2 Standards						
Model Year:	2027	2028	2029	2030	2031	2032
Light Heavy-Duty Vocational: Final Rule	**17%**	**22%**	**27%**	**32%**	**46%**	**60%**
Proposal	22%	28%	34%	39%	45%	57%
Medium Heavy-Duty Vocational: Final Rule	**13%**	**16%**	**19%**	**22%**	**31%**	**40%**
Proposal	19%	21%	24%	27%	30%	35%
Heavy Heavy-Duty Vocational: Final Rule			**13%**	**15%**	**23%**	**30%**
Proposal	16%	18%	19%	30%	33%	40%
Day Cab Tractors: Final Rule		**8%**	**12%**	**16%**	**28%**	**40%**
Proposal	10%	12%	15%	20%	30%	34%
Sleeper Cab Tractors: Final Rule				**6%**	**12%**	**25%**
Proposal				10%	20%	25%

Stronger standards in long term vs proposal

Stronger standards in long term vs proposal

More time in early years for technology and infrastructure development and deployment

Durability Monitoring and Warranty Requirements for Advanced Technologies

- Battery durability monitoring requirements for battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs)
  - Includes new 40 CFR 1037.115(f) that require manufacturers to **install a customer-accessible state of health (SOH) monitor** for the battery
  - The SOH monitor estimates, monitors, and communicates the vehicle's state of certified energy (SOCE)
    - For BEVs we did not finalize a specific test procedure to determine usable battery energy (UBE)
    - For PHEVs manufacturers would use the existing powertrain test procedures defined in 40 CFR 1036.545 to determine UBE or developed their own procedure that meets the requirements in 40 CFR 1037.115(f)

- Final rule also includes **warranty requirements for BEV and fuel cell electric vehicles (FCEVs)**; and clarifies how warranty applies to hybrid vehicles

Post-Rule Commitment

- EPA carefully assessed the technologies and infrastructure and concluded **they will support the feasibility of the final standards**.
- EPA commits to **actively engage with a range of stakeholders** to monitor both manufacturer compliance and the heavy-duty ZEV infrastructure.
- EPA will **coordinate with DOE and DOT** to monitor the implementation of electric vehicle charging and hydrogen fueling infrastructure designed to serve HD vehicles.
- EPA will release **periodic status reports**, beginning as early as 2026, which may support the current program or indicate a need for guidance documents or future regulatory action.

Stakeholders such as:

HD vehicle manufacturers

Trucking fleets and trade associations

Heavy-duty vehicle owner-operators

State and local governments

Communities with EJ concerns

Non-governmental organizations

Workers & labor unions

Utilities (investor-owned, publicly-owned, and cooperatives)

Infrastructure providers, installers

Additional Information

- See our website for more information: https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-greenhouse-gas-emissions-commercial-trucks