Light/Medium-Duty Vehicle Multipollutant Final Rule

Briefing for National Association of Clean Air Agencies (NACAA)

March 26, 2024

Overview

- Scope
- Public Input
- Final Standards and Program Elements
- Emissions Impacts, Costs and Benefits

Scope of the Rule

Vehicles

- **Light-duty** (passenger cars & light trucks)
- **Medium-duty** (largest pickups & commercial vans)

Air Pollutants

- Performance-based emissions standards for
  - **Greenhouse gases** (GHGs)
  - **Criteria air pollutants**
    - **P**articulate matter (PM), Non-methane organic gases (NMOG), Nitrogen oxides (NOx)

Timeframe

- Standards phase-in beginning in model year (MY) **2027 through 2032** and beyond

Final Rule is Informed by Extensive Public Input

- Proposed rule released in April 2023
- 200+ testifiers at 3-day public hearing
- Over 250,000 public comments
- 100+ meetings with a broad range of stakeholders including manufacturers, labor, EJ groups, states, NGOs, automotive suppliers, and others

EPA Web Link to Final Rule:

- https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-multi-pollutant-emissions-standards-model

Technical Analysis Updates

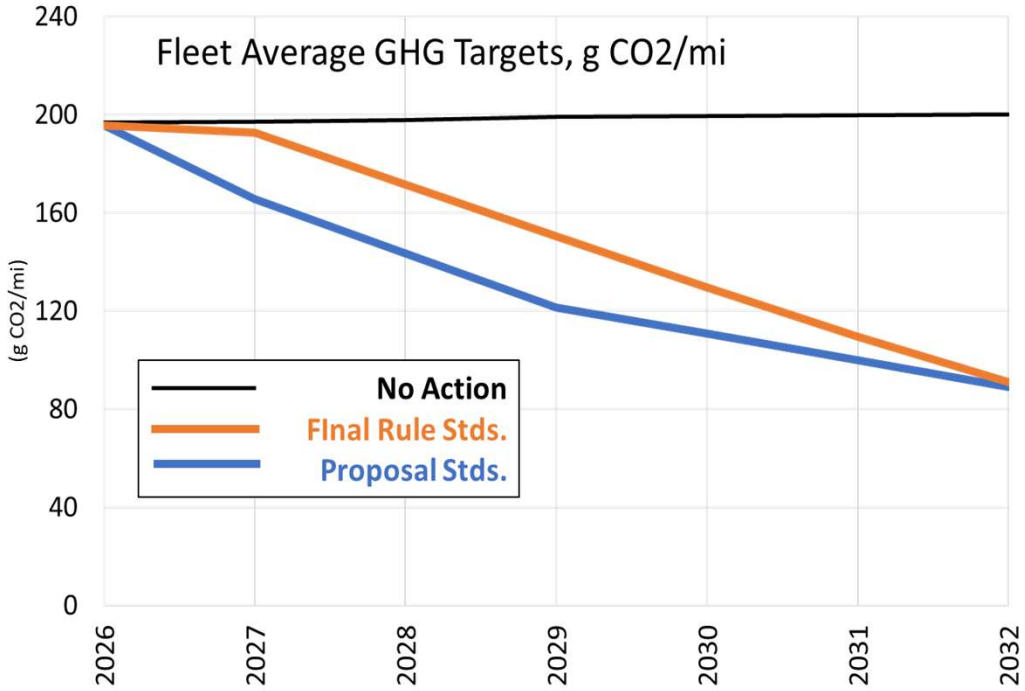
- Our updated technical analysis is more robust than the proposal, based on best available data informed by public comments

- Extensive collaboration with the Department of Transportation, Department of Energy (DOE) & National Laboratories on new studies to inform our updates of **battery costs, critical materials & supply chain, EV charging infrastructure, electric grid impacts, and Inflation Reduction Act (IRA) incentives**

- No Action case updated to reflect more recent third-party estimates which now include IRA impacts
  - Central case No Action reaches 39% PEVs in 2030; range of sensitivity scenarios

- Updated OMEGA modeling and other analysis inputs, including:
  - Dollar year (2022)
  - AEO 2023 vehicle volumes and car/truck mix (truck share increased 10 percentage points, to 70% in 2032)
  - LD Vehicle fleet base year (MY 2022)
  - BEV efficiency
  - Technology cost inputs, including battery costs
  - Electric vehicle supply equipment costs
  - Refueling time and BEV mid-trip charging estimate
  - Power sector impacts (Integrated Planning Model updates)
  - Added state sales tax and insurance costs to effects calculations
  - Included lower discount rate (2 percent, in addition to 3 and 7 percent)
  - Updated Social Cost of GHG (SC-GHG) values

Light-Duty GHG Final Standards



Final Standards:

- Same standards as the proposal's "Alternative 3", plus extended flexibilities in early years (next slide)
- **Lands same as proposal in 2032**
- Less stringent than the proposal in 2027-2031 – provides more gradual transition in early years to allow scale up of clean vehicle technologies

Light-Duty GHG Flexibilities to Ease Lead Time

- Informed by public comments and our updated technical analysis, we are extending the phase-down of two optional credit programs, which also provides additional lead time in the early years of the program.

1) **Off-cycle CO_2 credits**
   - Existing flexibility established in 2010, designed to further reduce real-world CO_2 emissions
   - Proposed to phase-out the "menu" credits from 2028-2030, given concerns that the current credits may be too high for 2032+ vehicles
   - Finalizing an extended phase-out of credits from 2030-2032 to allow OEMs additional transition time and to capture the environmental benefits from existing off-cycle technologies at more appropriate, reduced credit levels
   - Off-cycle credits will not apply to battery electric vehicles (BEVs) starting in 2027

2) **Air conditioning (AC) refrigerant leakage credits**
   - Proposed to phase-out AC leakage credits in 2027, recognizing the Agency's separate rule phasing-out high global warming potential (GWP) HFCs under the American Innovation and Manufacturing (AIM) Act
   - Final rule phases-down leakage credits through 2030, in response to comments and to address lead time
   - For 2031+, retaining a small leakage credit (~2 g/mi CO_2) to incentivize the cleanest refrigerants that are below the GWP threshold of EPA's HFC rule
   - Leakage credits apply to both EVs and ICE vehicles: EVs emit HFC GHGs directly just like ICE vehicles do

Medium-Duty GHG

- Final standards **land in the same place as the proposal in 2032**, but with a **more gradual ramp rate in the earlier years**
  - Similar to the approach for LD, and responsive to comments regarding the need for additional lead time in the early years
  - We project the MD standards will result in a fleet average of **274 grams CO2/mile** by 2032 (represents a **44% reduction** from current standards)

Criteria Pollutant Standards for Light-Duty & Medium-Duty

- **NMOG+NOx fleet-average standards**
  - Light-duty standards: **15 mg/mi by 2032** (represents a **50% reduction** from current standards)
  - Medium-duty standards: **75 mg/mi by 2031** (represents **58-70% reduction** from current standards)
  - Updated assessment of various technologies
- **PM per-vehicle (cap) standards**
  - Finalizing our proposal of **0.5 mg/mile** across three test cycles including a cold temperature (-7°C) test, but with an extension of the phase-in schedule in response to comments about lead time
  - EPA projects the standard will reduce tailpipe PM emissions from ICE vehicles by over **95 percent**
- **Light-duty vehicle NMOG+NOx provisions aligned with CARB ACC II program**
  - PHEV high power cold starts, early drive-away, mid-temperature engine starts
- **In-use standards for medium-duty vehicles with high gross combination weight rating (GCWR)**
  - Requires NOx emissions be adequately controlled under high load conditions

Criteria Pollutant Phase-in

- Final criteria pollutant phase-in schedules are more gradual than proposed in response to comments about lead time (e.g., proposed LDV phase-in was 40/80/100%).
- Light-duty vehicles over 6000 lb GVWR and medium-duty vehicles may choose between default (per Clean Air Act lead time provisions) or optional incentivized early phase-in schedule.
- Criteria pollutant phase-in applies to NMOG+NOx bin structure, PM, -7°C NMOG+NOx, CO, HCHO, -7°C CO, CARB ACC II NMOG+NOx provisions, and in-use standards for MDV.

	Light-duty Vehicles, Light-duty Trucks 1-2 (GVWR ≤ 6000 lb)	Light-duty Trucks 3-4 (GVWR 6001-8500 lb) and Medium-duty Passenger Vehicles (GVWR 8501-14,000 lb)		Medium-duty Vehicles (GVWR 8501-14,000 lb)	
		default	early option	default	early option
2027	20%	0	20%	0	20%
2028	40%	0	40%	0	40%
2029	60%	0	60%	0	60%
2030	100%	100%	100%	0	80%
2031				100%	100%

Other Final Program Elements

- Finalizing the proposed change to the PHEV Utility Factor (UF), based on updated analysis of best available real-world data, effective in MY2031+
  - Additional lead time recognizes the effect on compliance planning for PHEV manufacturers
  - Revised UF results in ~ 30% reduction of the electric operation weighting, compared to existing UF
  - EPA commits to continue assessing real-world data informing the UF, and to revisit if warranted
- Not finalizing proposed limitations on commanded enrichment for gasoline vehicles given need for additional data
  - EPA commits to continued data gathering and stakeholder outreach to inform a future rulemaking
- Finalizing battery durability and warranty provisions
- Continue existing air conditioning efficiency credits but for ICE vehicles only (not BEVs)
- For MDVs, removing the multiplier incentive that was in place under Phase 2 rule for MY2027
- No upstream emissions accounting (i.e., zero g/mile tailpipe) in compliance determinations for BEVs, PHEVs, FCVs, consistent with 2023-2026 and past programs
- Additional lead time for phase-out of unique standards for small volume manufacturers (< 5,000 vehicle sales annually)
- Finalizing small business flexibilities

Technology Penetration Projections

EPA's standards are **performance-based emissions standards**, under which manufacturers choose the mix of technologies best suited for their fleets to meet the standards. In our rule, we project a **range of possible feasible pathways** for compliance, including various mixes of cleaner gasoline vehicles, hybrids (HEVs), PHEVs and BEVs.

Light-Duty Vehicle – Example Pathways

Pathway	Technology	2027	2028	2029	2030	2031	2032
Pathway A - Central Case	ICE	64%	58%	49%	43%	35%	29%
	HEV	4%	5%	5%	4%	3%	3%
	PHEV	6%	6%	8%	9%	11%	13%
	BEV	26%	31%	39%	44%	51%	56%
Pathway B - Lower BEV Production	ICE	62%	56%	49%	39%	28%	21%
	HEV	4%	4%	3%	6%	7%	6%
	PHEV	10%	12%	15%	18%	24%	29%
	BEV	24%	29%	33%	37%	41%	43%
Pathway C - No Additional BEVs	ICE	61%	41%	35%	27%	19%	17%
	HEV	4%	15%	13%	16%	15%	13%
	PHEV	10%	17%	22%	27%	32%	36%
	BEV	24%	26%	30%	31%	34%	35%

Medium-Duty Vehicles – Example Projected PEVs (BEVs+PHEVs)

	2027	2028	2029	2030	2031	2032
Vans	3%	4%	24%	44%	64%	76%
Pickups	3%	4%	8%	17%	15%	26%
Total	3%	4%	14%	27%	32%	43%

PHEVs make up 2/3 of the PEV projections for MD pickups, and 11 % of the total MD fleet PEVs

Emissions Impacts

Pollutant	Vehicle	EGU	Refinery	Net Impact	Net Impact (%)
CO_2	-7,500	550	-280	-7,200	-21%
CH_4	-0.13	0.027	-0.013	-0.12	-15%
N_2O	-0.13	0.0034	-0.0023	-0.13	-23%
CO_{2e}	-7,500	550	-280	**-7,200**	-21%

* Percent changes reflect changes associated with the light- and medium-duty fleet, not total U.S. inventories.

GHG Emissions Impacts cumulative through 2055 (Million metric tons)

Pollutant	Vehicle	EGU	Refinery	Net Impact	Net Impact (%)
$PM_{2.5}$	-8,500	1,500	-1,800	**-8,700**	-22%
NO_X	-35,000	5,500	-7,400	**-36,000**	-25%
VOC	-140,000	930	-5,100	**-150,000**	-46%
SO_X	-1,900	1,300	-2,200	-2,800	-16%
CO	-1,700,000	0	-4,900	-1,700,000	-52%

* EPA did not have data available to calculate CO impacts from EGUs. Percent changes reflect changes associated with the light- and medium-duty fleet, not total U.S. inventories.

Criteria Pollutant Emissions Impacts in 2055 (U.S. tons)

The final rule will also reduce vehicle air toxics emissions.

Manufacturer Cost Impacts

Average per-vehicle costs (incremental to No Action)

Light-Duty Vehicles

	2027	2028	2029	2030	2031	2032	6-year avg
Cars	$135	$348	$552	$968	$849	$934	$631
Trucks	$276	$642	$1,199	$1,703	$2,318	$2,561	$1,450
Total	$232	$552	$1,002	$1,481	$1,875	$2,074	$1,203

Medium-Duty Vehicles

	2027	2028	2029	2030	2031	2032	6-year avg
Vans	$178	$185	$1,443	$2,732	$4,128	$4,915	$2,264
Pickups	$97	$88	$531	$1,432	$1,516	$2,416	$1,013
Total	$125	$122	$847	$1,881	$2,416	$3,275	$1,444

- Note these are technology costs seen by the OEM
- We estimate that on average **consumers will save ~$6,000 over the lifetime of a 2032 vehicle** compared to a vehicle meeting the 2026 standards, due to reduced fuel and operating costs
- Costs in MY2032 are higher than those in the proposal, largely because our updated assessment reflects increased battery costs
- Costs in early years (2027-2029) are much lower than in the later years (2030-2032) due to slower ramp rates and, for LD, the extended phase-out of flexibilities.

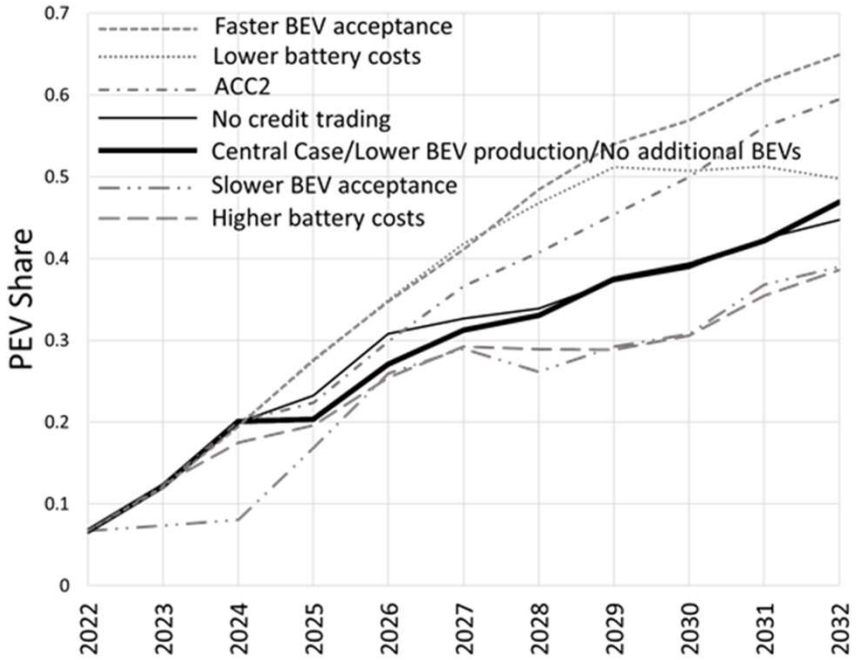
Costs, Benefits, and Net Benefits for Calendar Years 2027 through 2055

(Billions of 2022 dollars)

	PV, 2%	AV, 2%
Vehicle Technology Costs	$870	$40
Maintenance, Repair, Insurance Costs	-$310	-$14
Congestion, Noise Costs	$25	$1.2
Sum of Costs	**$590**	**$27**
Pre-tax Fuel Savings	$1,000	$46
EVSE Port Costs	$190	$9
Sum of Fuel Savings less EVSE Port Costs	**$820**	**$37**
Drive Value, Refueling Benefits	$29	$1.3
Energy Security Benefits	$47	$2.1
Sum of Non-Emission Benefits	**$75**	**$3.4**
Climate Benefits, 2% Near-term Ramsey	$1,600	$72
$PM_{2.5}$ Health Benefits	$240	$13
Sum of Emission Benefits	**$1,800**	**$85**
Net Benefits	**$2,100**	**$99**

Appendix

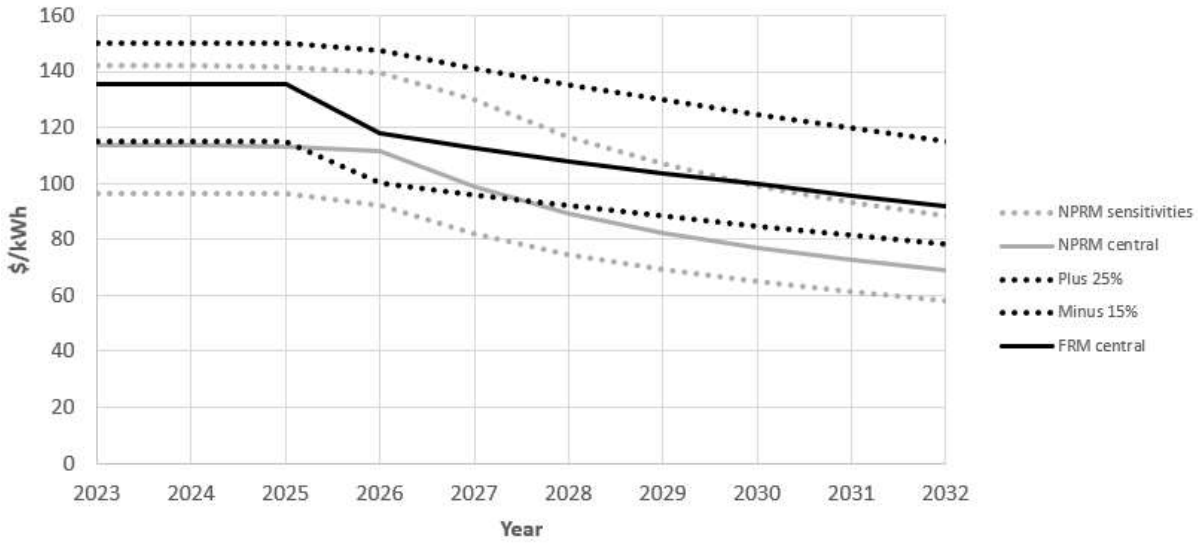
No Action Case



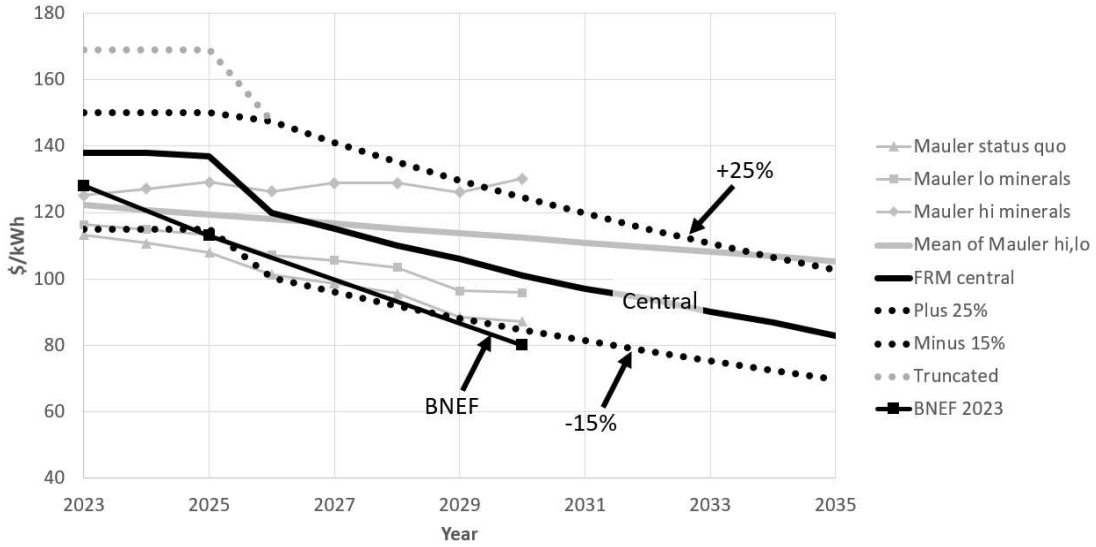
- The No Action central case reflects the following final rules:
  - 2021 LD GHG standards for 2023-2026
  - 2016 Phase 2 GHG standards for MD
  - 2014 Tier 3 criteria pollutant standards for LD/MD
- Updated assessment of No Action case to reflect more recent third-party projections including IRA impacts
  - 2030 PEV projections reach 39% under our central, No Action case.
- We have also assessed a No Action case under a range of sensitivities:
  - The Advanced Clean Car II program adopted by California and several states
  - Scenarios of both higher and lower battery costs
  - Scenarios of both faster and slower BEV acceptance
  - No credit trading across manufacturers

Battery Costs

Comparison of OMEGA input costs for a 100 kWh battery, NPRM to FRM



Battery cost sensitivity ranges in the updated analysis



LD GHG Projected Fleet Targets, Max Credits Available, and Adjusted Fleet Targets (Preamble Section III.C.2.iv.b)

Table 19: Projected fleet-wide CO_2 targets corresponding to the final standards[a,b]

Model Year	Cars CO_2 (g/mile)	Trucks CO_2 (g/mile)	Total Fleet CO_2 (g/mile)
2026	131	184	168
2027	139	184	170
2028	125	165	153
2029	112	146	136
2030	99	128	119
2031	86	109	102
2032 and later	73	90	85

[a] MY 2026 targets are provided for reference. This table does not reflect changes in credit flexibilities such as the phase-out of available off-cycle and A/C credits as finalized for MY 2027.
[b] Fleet CO_2 targets are calculated based on projected car and truck share. Truck share for the fleet is expected to increase to 69 percent by MY 2026 (up from 64 percent in MY 2022) and to 70 percent by MY 2030 and later.

Table 20: Total available credits to manufacturers, final standards, expressed in CO_2 g/mile (*not eligible for BEVs starting in MY 2027)

MY	Off-cycle*	A/C efficiency*		A/C leakage		Total possible			
	Fleet	Car	Truck	Car	Truck	Car (ICE)	Car (BEV)	Truck (ICE)	Truck (BEV)
2026	15.0	5.0	7.2	13.8	17.2	33.8	33.8	39.4	39.4
2027	10.0	5.0	7.2	11.0	13.8	26.0	11.0	31.0	13.8
2028	10.0	5.0	7.2	8.3	10.3	23.3	8.3	27.5	10.3
2029	10.0	5.0	7.2	5.5	6.9	20.5	5.5	24.1	6.9
2030	10.0	5.0	7.2	2.8	3.4	17.8	2.8	20.6	3.4
2031	8.0	5.0	7.2	1.6	2.0	14.6	1.6	17.2	2.0
2032	6.0	5.0	7.2	1.6	2.0	12.6	1.6	15.2	2.0
2033	0.0	5.0	7.2	1.6	2.0	6.6	1.6	9.2	2.0

Table 22: Projected adjusted fleet-wide CO_2 targets corresponding to the final standards

Model Year	Cars CO_2 (g/mile)	Trucks CO_2 (g/mile)	Total Fleet CO_2 (g/mile)
2026	161	220	201
2027	158	209	193
2028	142	186	172
2029	125	163	151
2030	108	141	131
2031	93	118	111
2032 and later	78	98	92

NMOG+NOx Declining Fleet Average Standards

- The final declining fleet average standards for medium-duty vehicles reach their final value one year later than proposed in response to comments about lead time.
- Light-duty vehicles over 6000 lb GVWR and medium-duty vehicles may choose between default (per Clean Air Act lead time provisions) or optional incentivized early phase-in schedule.

	Light-duty Vehicles, Light-duty Trucks 1-2 (GVWR ≤ 6000 lb)	Light-duty Trucks 3-4 (GVWR 6001-8500 lb) and Medium-duty Passenger Vehicles (GVWR 8501-14,000 lb)		Medium-duty Vehicles (GVWR 8501-14,000 lb)	
		default	early option	default	early option
2027	25		25		175
2028	23		23		160
2029	21		21		140
2030	19	15	19		120
2031	17	15	17	75	100
2032	15	15	15		80
2033					75