

TIER 3 MOTOR VEHICLE EMISSION AND FUEL STANDARDS (FINAL RULE)

ICCT POLICY UPDATES

SUMMARIZE

REGULATORY

AND OTHER

DEVELOPMENTS

RELATED TO CLEAN

TRANSPORTATION

WORLDWIDE.

EPA finalized new emission standards for vehicles and fuels on March 3, 2014, commonly referred to as Tier 3 emission standards (Docket No. EPA-HQ-OAR-2011-0135). Once the vehicle and fuel provisions are fully implemented, smog-forming volatile organic compounds and nitrogen oxides will be reduced by 80% from current levels, particulate matter will be reduced by 70%, and fuel vapor emissions will be driven to near zero levels. In addition, the medium- and heavy-duty pickup and work van tailpipe standards represent about a 60% reduction in both fleet average NMOG+NO_x and per-vehicle PM standards. EPA is also extending the regulatory useful life period during which the standards apply from 120,000 miles to 150,000 miles.

Sulfur in gasoline will be reduced to 10 ppm on average from 30 ppm today, bringing gasoline fuel requirements in line with those already in place in California, Europe, Japan, and South Korea. (although these countries have a 10 ppm cap rather than a 10 ppm average, as adopted by EPA). Changes to the fuel used for certification were also adopted, reflecting the widespread use of 10 percent ethanol blends in commercial gasoline.

The standards will reduce both tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles and some heavy-duty vehicles. The standards will be phased in from MY 2017 and fully implemented by MY 2025. The standards treat vehicle and fuel as an integral system, an approach that ICCT views as the best practice for policy development.

EPA made only four significant changes from the proposed rule:

- » Vehicle emission control cost estimates were cut from \$134 per vehicle to \$72 per vehicle in model year 2025, and clean fuel cost estimates, fully phased in over all gasoline, were reduced from 0.89 cents per gallon to 0.65 cents per gallon gasoline.
- » Adopted more stringent standards for Supplemental FTP (SFTP) particulate emissions
- » Changed certification fuel ethanol requirements from 15% to 10%
- » Provided fuel refineries more flexibility in phasing in sulfur reduction

In the following pages, section 1 summarizes the vehicle emission requirements, section 2 summarizes the fuel requirements, section 3 discusses the changes from the proposed to the final rule, section 4 discusses ICCT's comments on the proposed rule and their impact on the final rule, and section 5 summarizes the overall impacts of the rule.

1. TIER 3 VEHICLE EMISSION STANDARDS

This section provides a short summary of the provisions in the final rule. As EPA only made four significant changes from the proposed rule, the requirements are largely unchanged from the requirements proposed by EPA on April 17, 2013. ICCT’s Policy Update of May 2013 contains a comprehensive discussion of the proposed Tier 3 provisions, which should be referenced for more information. http://www.theicct.org/sites/default/files/publications/ICCTupdate_Tier3_NPRM.pdf.

The FTP NMOG+NO_x standards are fleet average standards. The manufacturer must certify each of its vehicles to a per-vehicle “bin” standard and sales-weight these values to calculate its fleet-average NMOG+NO_x emissions for each model year. Each Tier 3 bin has a NMOG+NO_x standard, as well as CO and HCHO standards. These standards apply independent of fuel. As with the Tier 2 program, the proposed standards would apply to all LDVs and LDTs below 8,500 lbs GVWR, and MDPVs (8,500 to 10,000 lbs GVWR). Table 1 shows the proposed phase in schedule for light-duty cars and trucks. Table 2 shows the schedule for complete medium- and heavy-duty trucks up to 14,000 GVWR, typically full size work trucks and work vans.

Table 1. Phase in for LDV, LDT, and MDPV Fleet Average FTP NMOG+NO_x Standards (mg/mi)

Test cycle	Vehicle Class ¹	Tier 2	Model Year								
		2016 ^a	2017 ^b	2018	2019	2020	2021	2022	2023	2024	2025+
FTP	LDV/LDT1 ^b	160	86	79	72	65	58	51	44	37	30
FTP	LDT2,3,4 and MDPV	160	101	92	83	74	65	56	47	38	30

- a. 120,000 mile useful life for Tier 2
- b. Starting with MY2018 for vehicles with GVWR >6,000 lbs
- c. Tier 3 proposed standards apply for a 150,000 mile useful life. Manufacturers could choose to certify all of their LDVs and LDTs to a useful life of 120,000 miles. If any of these families are certified to the shorter useful life, a proportionally lower numerical fleet-average standard would apply, calculated by multiplying the respective 150,000 mile standard by 0.85 and rounding to the nearest mg.

Table 2. Proposed HDV Fleet Average FTP NMOG+NO_x Standards (mg/mi)

Model Year	Voluntary		Required Program				
	2016	2017	2018	2019	2020	2021	2022+
Class 2b ^a	333	310	278	253	228	203	178
Class 3 ^b	548	508	451	400	349	298	247

- a. Complete trucks between 8,501 and 10,000 GVWR
- b. Complete trucks between 10,001 and 14,000 GVWR

SFTP standards for NMOG and NO_x are based upon two additional test cycles: the US06 is designed to simulate higher speeds and higher acceleration rates (and thus higher loads) and the SC03 simulates air conditioning operation at 95°F with full simulated sunload. SFTP NMOG+NO_x standards are based upon a weighted composite value of emissions on the FTP, US06 and the SC03 (0.35 x FTP + 0.28 x US06 + 0.37 x SC03), as is done for the Tier 2 SFTP standards. The SFTP NMOG+NO_x standards are fleet average

1 The LDV category includes all vehicles less than 8500 lb gross vehicle weight rating, GVWR (i.e., vehicle weight plus rated cargo capacity). Light Duty Truck (LDT) category divides trucks into four different weight categories. The MDPV category covers SUVs 10,000 max GVWR.

standards, with the standards phased in as described in Table 3. CO standards are 4200 mg/mile for all years.

Table 3. Phase in for LDV and MDPV Composite Fleet Average SFTP NMOG+NO_x Standards (mg/mi)

Test cycle	Vehicle Class	Model Year								
		2017	2018	2019	2020	2021	2022	2023	2024	2025+
SFTP	NMOG + NO _x (mg/mi)	103 ^a	97	90	83	77	70	63	57	50
SFTP	CO (mg/mi)	4200 ^a								

a. Starting with MY2018 for vehicles with GVWR >6,000 lbs

Particulate matter (PM) standards are the same for each year and apply to each vehicle separately, with a phase-in period based on sales percentages used instead of a fleet average. The FTP PM standards for LDV and MDPV is 3 mg/mile, with a separate in-use FTP PM standard of 6 mg/mi during the phase in period. PM standards were also established for the US06 cycle, with 10 mg/mile for 2017 and 2018 and 6 mg/mile for all subsequent years, also with interim in-use standards for 2019 to 2023. Note that the US06 PM standards are one of the few changes from the proposed rule. The phase-in sales percentages are listed in Table 4.

Table 4. Phase in for LDV, LDT, and MDPV Per-Vehicle PM Standards

Test cycle	Phase In	Tier 2								
		2016 ^a	2017 ^b	2018	2019	2020	2021	2022	2023	2024
	% of US sales		20%	20%	40%	70%	100%	100%		
FTP	Certification, mg/mile	10	3	3	3	3	3	3	3	3
	In-Use, mg/mile		6	6	6	6	6			
US06	Certification, mg/mile	na ^d	10	10	6	6	6	6	6	10
	In-Use, mg/mile			10	10	10	10	10	10	

- a. 120,000 mile useful life for Tier 2
- b. Starting with MY2018 for vehicles with GVW >6,000 lbs
- c. Tier 3 PM standards apply for a 150,000 mile useful life
- d. Tier 2 did not have useful life standards for SFTP particulate emissions

EPA and CARB are updating and harmonizing requirements for the fuel used for certification testing. Changes include using fuel with 10% ethanol, reduction of octane specs to match regular-grade gasoline, and changes in distillation temperatures, aromatics, olefins, sulfur content, and benzene specifications to better match today's in-use fuel and to be consistent with the updated gasoline sulfur and benzene requirements.

Evaporative standards will reduce evaporative emissions by about 50%. They apply to all gasoline light-duty and heavy-duty vehicles and encompasses new evaporative limits, new bleed testing requirements, leak test, and on-board-diagnostics requirements.

The rule provides vehicle manufacturers lead time and compliance flexibilities to minimize the regulatory burden. For example, early compliance and production of ultra-low emitting vehicles will result in manufacturer credits. Also, the requirements are almost completely harmonized with the California Air Resources Board (CARB) Low Emission Vehicle (LEV III) program, allowing automakers to sell the same vehicles in all 50 states.

2. TIER 3 FUEL REQUIREMENTS

The final rule requires a reduction in sulfur content in gasoline, from the current 30-ppm average to 10-ppm average, effective January 1, 2017. While EPA did not back off on the average standard and the effective date from the proposal, they did grant a great deal of flexibility for manufacturers to comply, such as:

- » The existing refinery gate and downstream sulfur caps were retained.
- » Simplified and added flexibility to the Averaging, Banking, and Trading program.
- » Tier 2 sulfur credits from as early as 2012 can be used for Tier 3 compliance.
- » Delayed compliance for small refineries that process 75,000 bbl/day or less crude oil, to January 1, 2020.
- » Hardship provisions and temporary waivers for unforeseen circumstances.

Table 5. Proposed Tier 3 Gasoline Sulfur Standards

	Current Standard	Tier 3 Sulfur Standard	
	Limit	Limit	Effective
Refinery annual average standard	30 ppm	10 ppm	Jan 1 st 2017 ^a
Refinery gate per gallon cap	80 ppm	80 ppm	Current
Downstream per gallon cap	95 ppm	95 ppm	Current

a. Effective January 1, 2020 for eligible small refiners and small volume refineries

EPA also established requirements for oxygenates, such as denatured fuel ethanol, to ensure compatibility with the Tier 3 sulfur requirements and to limit oxygenate concentrations to 3 percent.

3. SIGNIFICANT CHANGES IN THE FINAL RULE

EPA made only 4 significant changes in the Final Rule, compared with the proposed requirements:

Vehicle emission control system cost:

“Through the use of more recent and robust cost analysis, EPA estimates that the cost of the total Tier 3 program (vehicle and fuel standards) will be less than half of what we projected in the proposal.”

Gasoline fuel sulfur:

Despite intense pressure from the fuel producers, EPA maintained the proposed reduction of gasoline sulfur from 30 to 10 ppm on average and the start date of January 1, 2017. However, in response to refiners’ concerns over the necessary capital investments and potential off-cycle turnarounds/shutdowns to make refinery modifications to reduce gasoline sulfur, EPA finalized additional flexibilities beyond those already in the proposal. The most significant of these additional flexibilities is allowing refineries to carry over sulfur credits earned under the Tier 2 ABT program and apply them towards Tier 3 compliance; EPA proposed these ABT programs would be separate.

SFTP particulate standards:

SFTP standards for particulate matter were reduced to 6 mg/mi, starting in 2019, from the proposed level of 10 mg/mile for vehicles up to 6000 gross vehicle weight and 20 mg/mile for vehicles from 6000 to 8500 gross vehicle weight. This is more stringent than the CARB LEV III SFTP particulate standards; CARB has indicated that it will revise its LEV III requirements to harmonize with this requirement.

Certification test fuel ethanol requirement:

The certification test fuel ethanol requirement was reduced to 10% from the proposed 15%. Several factors led EPA to reconsider, including minimal proliferation on a national scale of stations offering E15, the complexities that E15 would introduce for long-term harmonization with California's use of E10 in their LEV VIII program, and a general consensus from auto and oil companies, states, and NGOs that E15 is not appropriate at this time.

4. IMPACT OF ICCT'S COMMENTS

ICCT made six substantive comments on the proposed rule. (For the full text of the comments ICCT submitted, see [www.theicct.org/news/comments-tier-3-motor-vehicles-emissions-and-fuel-standards]. Following is a summary of ICCT's comments and EPA's provisions in the final rule.

4.1 VEHICLE EMISSION CONTROL SYSTEM COST

ICCT submitted extensive analyses on the cost of complying with the emission standard, demonstrating that the cost is only about a third of the proposed costs.²

In the final rule, the EPA:

- » Agreed that their "proposed vehicle cost estimates used dated information and the estimated vehicle costs presented in the proposal were inappropriately high. For the final rule, as described fully in Chapter 2 of the final RIA, we have updated our vehicle cost estimates. In doing so, we have incorporated information from ICCT's study (SAE 2013-01-0534), ICCT's docket comments on the proposal, and a Umicore study (SAE 2012-01-1245). As a result, the vehicle cost estimates in the final rule and, in particular, the catalyst loading costs are considerably lower than in the proposal."
- » Developed a "more robust catalyst loading cost estimate" using the methodology suggested by ICCT.³
- » Concluded that passive rather than active HC adsorbers will be used on vehicles, at considerably less cost, based on comments from both MECA and ICCT, as well as confidential information from Tier 1 suppliers.
- » Decreased the penetration rates of secondary air injection in the later years of the program. EPA stated this was consistent with ICCT's comment that, in the context of LEV II vehicles meeting the LEV III standards, "In some cases it was easier and

² For a full library of ICCT research and analysis on emission control technology costs, see www.theicct.org/issues/emission-control-technologies. In particular, see Francisco Posada Sanchez et al., "Estimated cost of emission reduction technologies for LDVs," www.theicct.org/estimated-cost-emission-reduction-technologies-ldvs.

³ Posada, Francisco, et. al., "Estimated Cost of Emission Control Technologies for Light-Duty Vehicles Part 1 – Gasoline," SAE 2013-01-0534, 4/8/2013

cheaper for manufacturers to add existing hardware [i.e., secondary air injection] than to invest the engineering resources to fully optimize precise air/fuel control and fast light-off strategies, or to develop new hardware.”

4.2 GASOLINE FUEL SULFUR

ICCT submitted results of a MathPro study,⁴ performed under contract to ICCT, demonstrating that the cost for reducing gasoline sulfur from 30 to 10 ppm is only 0.8 to 1.4 cents per gallon. ICCT also submitted a discussion as to why these results are likely to be conservative.

In the final rule, EPA concluded that:

- » “Our assessment of the API study is supported by work performed by The Emissions Control Technology Association (ECTA) which retained personnel within Navigant Economics.⁵ That study assessed the costs of a 10 ppm average gasoline sulfur standard and also evaluated the ICCT and API cost studies. The authors made a number of conclusions. After reviewing both the ICCT and API studies, the authors found that a primary difference in estimated costs between the two studies was the capital costs. The authors contacted vendor companies that license FCC posttreater technologies and surveyed the companies to find out what the capital costs are for a FCC posttreater. As a result of the survey, the report authors concluded that API’s capital costs were too high, and those used in the ICCT study were about right.”
- » “[T]he impact of a 10 ppm gasoline sulfur standard on the average refining cost would likely be closer to the 1 cent per gallon estimate by the ICCT study.”
- » Ultimately EPA revised its fuel cost estimates under the rulemaking; fully phased in over all gasoline, the Tier 3 sulfur control costs were reduced from 0.89 cents per gallon in the proposal to 0.65 cents per gallon in the final rule.

4.3 FTP PARTICULATE STANDARDS

ICCT submitted analyses demonstrating why the proposed SFTP NO_x standards were too lenient and would not be effective. ICCT recommended the NMHC+NO_x standards be set at no more than 20 mg/mile.

EPA finalized the FTP particulate standards exactly as proposed, the only instance where the final outcome was inconsistent with ICCT’s comments.

4.4 SFTP PARTICULATE STANDARDS

ICCT submitted analyses, including supplemental comments, demonstrating why the proposed SFTP PM standards were too lenient and would not be effective. ICCT recommended the standards be set at no more than 6 mg/mile for all categories of light-duty vehicles.

In the final rule, the EPA revised the SFTP PM standards primarily in response to new data from CARB, and at the level recommended by ICCT in its comments, 6 gm/mile.

⁴ “Refining economics of a national low-sulfur, low-RVP gasoline standard,” www.theicct.org/refining-economics-national-low-sulfur-low-rvp-gasoline-standard

⁵ Schink, George R., Singer, Hal J., Economic Analysis of the Implications of Implementing EPA’s Tier 3 Rules, prepared for the Emissions Control Technology Association, June 14, 2012.

4.5 CERTIFICATION TEST FUEL ETHANOL REQUIREMENT

ICCT submitted comments detailing why E15 is not representative of in-use fuel and should not be used for certification fuel. ICCT recommended the use of E10 for certification fuel.

This was the consensus recommendation in comments from stakeholders, and was incorporated into the final rule.

4.6 HEAVY-DUTY VEHICLE REQUIREMENTS:

ICCT submitted comments on HD vehicles, supporting extension of chassis-based emission requirements to all complete vehicles up to 14,000 gross vehicle weight (the only commenter to support that position) and also supporting extending the SFTP requirements to complete vehicles between 8,500 and 14,000 gross vehicle weight.

EPA finalized largely as proposed, although granting a few minor flexibilities.

5. OVERALL IMPACTS OF RULE

Table 6 summarizes the costs and benefits of the rule. The primary costs are for emission control equipment and for cleaner, lower sulfur fuels. The light-duty vehicle emission control equipment costs increase by up to \$72 per vehicle, when the regulation is fully phase in by model year 2025. The primary fuel costs due to refinery upgrades would include an increase in gasoline costs by \$0.0065 per gallon gasoline, averaged over all gasoline.

Based on future year discount rates of 3% to 7% and the human health benefits from the rulemaking, the regulations are estimated by EPA to result in 4.5 to 13 times greater benefits than costs by 2030.

Table 6. Estimated costs and benefits of Tier 3 vehicle emission control and gasoline sulfur standards

		Cost or benefits in 2030 (billion of dollars)
Estimated costs	Vehicle emission control	\$0.76
	Clean fuels	\$0.70
	Total, vehicle plus fuels	\$1.50
Estimated health benefits	3 percent discount rate	\$7.4 - \$19
	7 percent discount rate	\$6.7 - \$18
Net benefits (Total benefits—total costs)	3 percent discount rate	\$5.9 - \$18
	7 percent discount rate	\$5.2 - \$17