



Errata Slides to the Workshop Presentations

October 30-31, 2023

Acronyms Used

Acronym	Definition
CA	California
CH ₄	Methane
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DEF	Diesel Exhaust Fluid
EF	Engine Family
EO	Executive Officer
g/kW-hr	grams per kilowatt hour
kW	kilowatts
NG	Natural Gas
NMHC	Nonmethane Hydrocarbon
N ₂ O	Nitrous Oxide
NO _x	Oxides of Nitrogen
PEMS	Portable Emissions Measurement System
PM	Particulate Matter
SCR	Selective Catalytic Reduction
SOS	Sum Over Sum



Tier 5 Rulemaking Workshop II

Proposed Emission Standards

October 30-31, 2023

Proposed Tier 5 Criteria Standards (g/kW-hr)

Nonroad Transient Test Cycle (NRTC) and Steady-State/Ramped Modal Cycles (RMC)

Power Category	Implementation Period	NO _x Interim	NO _x Final	PM Interim	PM Final	NMHC* Final	CO
< 8 kW (< 11 HP)	2031-2033	6.0*	-	0.3	-	=*	8.0
	2034 +	-	5.0*	-	0.2		
8 ≤ kW < 19 (11 ≤ HP < 25)	2031-2033	5.5*	-	0.2	-	=*	6.6
	2034 +	-	4.0*	-	0.1		
19 ≤ kW < 56 (25 ≤ HP < 75)	2031-2033	3.7	-	0.015	-	0.19	5.0
	2034 +	-	2.5	-	0.008		
56 ≤ kW < 130 (75 ≤ HP < 175)	2031-2033	0.22	-	0.005		<u>0.19</u>	5.0
	2034 +	-	0.040	0.005		0.080 ¹	
130 ≤ kW ≤ 560 (175 ≤ HP ≤ 750)	2029-2032	0.22	-	0.005		<u>0.19</u>	3.5
	2033 +	-	0.040	0.005		0.080 ¹	
> 560 kW (Gen Sets) (> 750 HP)	2030-2033	0.50	-	0.015	-	<u>0.19</u>	3.5
	2034 +	-	0.35	-	0.008	0.080 ¹	
> 560 kW (Mobile) (> 750 HP)	2030-2033	3.5	-	0.040		0.19	3.5
	2034 +	-	3.0				

* NMHC + NO_x - Not applicable

¹ The NMHC standard for lean-burn NG engine families remains at 0.19 g/kW-hr

This is slide # 8 from the Proposed Emissions Standards presentation



Proposed Consolidated Tier 5 Exhaust Standards (g/kW-hr)

Nonroad Transient Test Cycle (NRTC) and Steady-State/Ramped Modal Cycles (RMC)

Power Category	Implementation Period	NO _x Interim Standard	NO _x Final Standard	PM Interim Standard	PM Final Standard	CO ₂ Capping Standard	CO ₂ Reducing Standard	N ₂ O Capping Standard	CH ₄ Capping Standard	NMHC Final Standard	CO
< 8 kW (< 11 HP)	2031-2033	6.0*	-	0.3	-	-	-	-	-	=*	8.0
	2034 +	-	5.0*	-	0.2						
8 ≤ kW < 19 (11 ≤ HP < 25)	2031-2033	5.5*	-	0.2	-	-	-	-	-	=*	6.6
	2034 +	-	4.0*	-	0.1						
19 ≤ kW < 56 (25 ≤ HP < 75)	2031-2033	3.7	-	0.015	-	=	-	=	=	0.19	5.0
	2034 +	-	2.5	-	0.008						
56 ≤ kW < 130 (75 ≤ HP < 175)	2031-2033	0.22	-	0.005		-	-	=	=	<u>0.19</u>	5.0
	2034 +	-	0.040	0.005		-	773.4-724.2**	0.150	0.130	0.080 ¹	
130 ≤ kW ≤ 560 (175 ≤ HP ≤ 750)	2029-2032	0.22	-	0.005		-	-	=	=	<u>0.19</u>	3.5
	2033 +	-	0.040	0.005		-	724.2-690.9**	0.150	0.130	0.080 ¹	
> 560 kW (Gen Sets) (> 750 HP)	2030-2033	0.50	-	0.015	-	=	-	=	=	<u>0.19</u>	3.5
	2034 +	-	0.35	-	0.008						
> 560 kW (Mobile Machines) (> 750 HP)	2030-2033	3.5	-	0.040		=	-	=	=	0.19	3.5
	2034 +	-	3.0								

* NMHC + NO_x

** Calculated using the CO₂ reducing standard equation: CO₂ STD = 677.5 + 2977*[Kilowatts]^(-0.8535)

- Not applicable

1 The NMHC standard for lean-burn NG engine families would be 0.19 g/kW-hr





Tier 5 Rulemaking Workshop II

Off-Road In-Use Program

October 30-31, 2023

Special Cases for NO_x and PM Screening

- If a significantly high number of flagged engines for an EF are observed, engine manufacturers would begin discussion with the EO to investigate the cause
 - Would be triggered if ~~the~~ 80% or greater of reported engines fail the screening for an EF ~~families are not designated clean EFs~~.
- If the NO_x emissions of more than 25% of engines are 10 times higher than the standard in any in-use screening bins, manufacturers would begin discussion with the EO to investigate the cause of extremely high emissions
- If more than 50% of engines data is missing or not reported for a particular EF:
 - EO would have the discretion to determine whether PEMS testing would be required beyond the PEMS testing cap,
 - Engine manufacturers would begin discussions with the EO to develop a feasible plan to improve data reporting in the future.

Proposed ORIUT Engine Family Pass and Fail Criteria for PEMS

- Large EFs
 - Start with 4 engines and if 4 pass, then the EF passes
 - If an engine fails, then test an additional engine (total 5)
 - if 4/5 pass tests → EF passes
 - If 2/5 fail → 5 more engines are tested (total 10)
 - If 3 or greater engine tests fail, the EF would be non-compliant
- Small and Very-Small Engine Families
 - Start with 2 engines and if 2 pass, then the EF passes
 - If an engine fails, then test an additional engine (total 3)
 - If 2/3 pass tests → EF passes
 - If 2/3 fail → 6 more engines are tested (total 10)
 - If 3 or greater engine tests fail, the EF would be non-compliant
 - Very-Small EFs with fewer than 10 CA engines may stop testing at their total sales volume
- If 10 engines are tested and the arithmetic mean of the SOS bin emissions for each bin is less than or equal to the Off-Cycle PEMS in-use thresholds ~~for either the 50-hour stored array or the lifetime array~~, then the EF would be deemed compliant



Tier 5 Rulemaking Workshop II
Selective Catalytic Reduction Inducements and
Fleet Rule Clarification
October 30-31, 2023

SCR Inducement Proposal (2 of 2)

- Proposal applies to all new electronically-controlled engines of all power categories using an SCR system for model year 2029 and beyond.
- Proposal requires inducements for:
 - Diesel Exhaust Fluid (DEF) Level
 - DEF ~~Quantity~~ Quality
 - Tampering
- Encourages operators to take the necessary measures to ensure proper functioning of the SCR system
- For inducements of the SCR only
- Other emission control systems may be independently monitored for performance.

This is slide # 8 from the SCR Inducement and Fleet Rule Clarification presentation



Tier 5 Rulemaking Workshop II

Miscellaneous Amendments

October 30-31, 2023

Diesel Marine Propulsion Engine Exclusion

- Clarify that diesel marine propulsion engines < 37 kW would not be subject to land-based requirements under Tier 5
 - These engines would be regulated by U.S. EPA under 40 CFR 1042 beginning in 2029



- Non-integrated Auxiliary diesel marine engines would still be covered by the land-based requirements in 13 CCR 2423, including Tier 5 as appropriate

Image sources: [Marine engine 1](#) and [Marine engine 2](#)