



Tier 5 Rulemaking Workshop II
Amendments to the
Off-Road Diesel New Engine Regulations
October 30-31, 2023

2-Day Workshop Outline

- Tier 5 Introduction
- Implementation Schedule
- Standards
- Certification Requirements
- Off-Road In-Use Testing (ORIUT) Provisions
- Useful Life, Warranty, and Defects Reporting
- On-Board Diagnostics and Monitoring (OBD/OBM)
- Incentives and Flexibility Provisions
- Miscellaneous Amendments
- Off-Road Inventory Methodology



Introduction



Need for Tier 5 Standards

- Current Tier 4 final off-road diesel standards for new engines do not reflect the latest generations of emission control technologies
 - Over 50% of Tier 4 final engine families are certified without Diesel Particulate Filters (DPF)
- Additional emissions reductions are needed for attainment of federal and State ambient air quality standards
- Off-road emissions often disproportionately affect disadvantaged communities due to the locations of construction sites where diesel off-road equipment operate
- Current certification test cycles do not adequately demonstrate emissions control during low-load or idle operation

Applicability

- Tier 5 regulations would be applicable to manufacturers of new off-road diesel engines
- Equipment manufacturers and end-users are not the targets of the Tier 5 engine regulation; however, they would be impacted
- Engines used in Transport Refrigeration Units would be excluded from Tier 5 engine requirements in favor of more stringent zero-emission requirements

Changes Since the 11/3/2021 Workshop (1 of 3)

1. Standards would be phased-in by power category for up to five years before Tier 5 final standards become effective
2. The stringency of standards for engines < 19 kW has been reduced
3. The stringency of standards for engines $19 \leq \text{kW} < 56$ has been reduced
4. The stringency of Tier 5 standards for engines in mobile machines > 560 kW has been reduced
5. The stringency of the PM standard for engines in Gen Sets > 560 kW is being increased from 0.015 to 0.008 g/kW-hr
6. The stringency of the NMHC standard has been increased on the NRTC and Steady-State certification cycles for some power categories
7. A compliance margin is being afforded within the proposed certification NO_x standard

NO_x = oxides of nitrogen, PM = particulate matter, NMHC = non-methane hydrocarbon, kW = kilowatt, g/kW-hr = grams per kilowatt-hour, NRTC = non-road transient certification cycle

Changes Since the 11/3/2021 Workshop (2 of 3)

8. The stringency of the N₂O capping standard is reduced to 0.15 g/kW-hr
9. The stringency of the CH₄ capping standard is reduced to 0.13 g/kW-hr
10. The capping standards baseline was updated to be based on the 80th percentile of CO₂ emissions from Tier 4 final engines instead of the average
11. Interim standards would not require CO₂, idle, or LLC certification
12. Separate CO₂ standards for child variants within an engine family would not be required
13. A single ABT averaging set would be available in Tier 5 to provide more flexibility
14. Manufacturers could certify some Tier 4 final engines after Tier 5 begins

**CO₂ = carbon dioxide, N₂O = nitrous oxide, CH₄ = methane,
LLC = low load cycle, ABT = averaging, banking, and trading**

Changes Since the 11/3/2021 Workshop (3 of 3)

15. A Tier 5 zero-emission credit program is being proposed
16. A Tier 5 CA-TPEM program is being proposed for equipment manufacturers
17. Useful life and warranty hourly periods would not be increased
18. PEMS testing would be the default ORIUT option for small and very small engine families
19. A two-year screening pilot program for REAL would occur prior to enforcement
20. Inducements would not be extended beyond DEF and SCR monitoring
21. The use of biodiesel fuel blends for durability testing would not be required
22. A more stringent LLC standard than 0.100 g/kW-hr is proposed for NO_x

**CA-TPEM = California transition program for equipment manufacturers,
PEMS = portable emissions measurement system, REAL = real emissions assessment and logging,
DEF = diesel exhaust fluid, SCR = selective catalytic reduction**

Tier 5 Implementation



Tier 5 Implementation Schedule

REQUIREMENTS		INTERIM				
		< 19 kW	19 ≤ kW < 56	56 ≤ kW < 130	130 ≤ kW ≤ 560	> 560 kW
Criteria Pollutant Standards* (NO _x , PM, NMHC ¹ , and CO) DAAAC Aging* SCR Inducements*, ** Longer Useful Life and Warranty* Enhanced Defects Reporting*		2031-2033			2029-2032	2030-2033
GHG Standards (CO ₂ , N ₂ O, and CH ₄)	Capping	n/a				
	Reducing	n/a				
LLC Certification** , ***		n/a				
Idle Reduction Provisions***		n/a				
In-Use Testing Program* , **	Pilot	n/a	2031-2032	2029-2030	n/a	
	Enforceable	n/a				

DAAAC = Diesel Aftertreatment Accelerated Aging Cycle
 NMHC = nonmethane hydrocarbon CO = carbon monoxide

* Does not apply to Tier 4 final phase-out engines in Option #2
 ** Only applies to engines certified with SCR or similar NO_x aftertreatment
 *** Does not apply to steady-state engine families
¹ NMHC Interim standards are the same as Tier 4 final NMHC standards

Tier 5 Implementation Schedule

REQUIREMENTS		FINAL				
		< 19 kW	19 ≤ kW < 56	56 ≤ kW < 130	130 ≤ kW ≤ 560	> 560 kW
Criteria Pollutant Standards* (NO _x , PM, NMHC, and CO) DAAAC Aging* SCR Inducements*, ** Longer Useful Life and Warranty* Enhanced Defects Reporting*		2034+, or 2033+ (Op 4)			2033+, or 2031+ (Op 4)	2034+, or 2032+ (Op 4)
GHG Standards (CO ₂ , N ₂ O, and CH ₄)	Capping	n/a	2034+, or 2033+ (Op 4)	n/a		2034+, or 2032+ (Op 4)
	Reducing	n/a		2034+, or 2033+ (Op 4)	2033+, or 2031+ (Op 4)	n/a
LLC Certification** , ***		n/a		2034+, or 2033+ (Op 4)	2033+, or 2031+ (Op 4)	n/a
Idle Reduction Provisions***		n/a	2034+, or 2033+ (Op 4)		2033+, or 2031+ (Op 4)	2034+, or 2032+ (Op 4)
In-Use Testing Program* , **	Pilot	n/a				
	Enforceable	n/a		2033+	2031+	n/a

"Op 4" refers to the earlier Tier 5f start date in Option #4

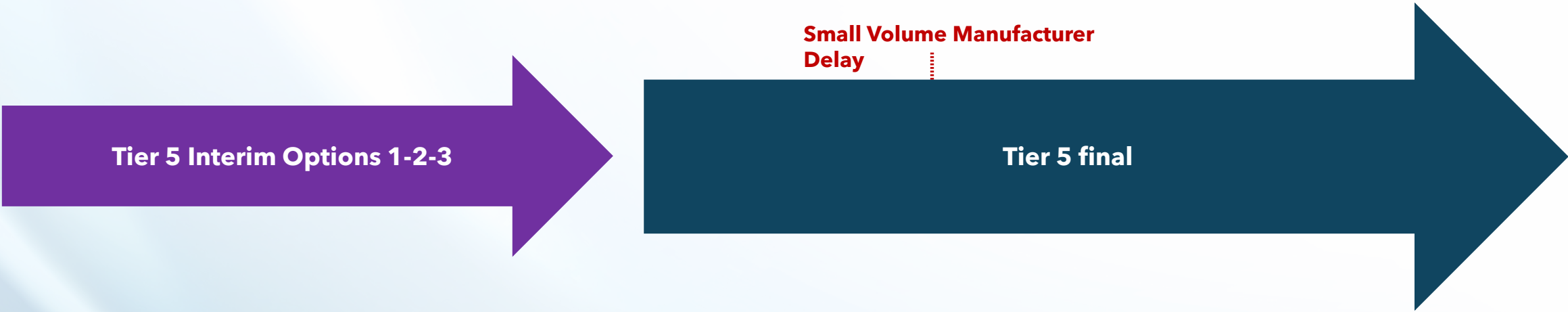
* Does not apply to Tier 4 final phase-out engines in Option #2
 ** Only applies to engines certified with SCR or similar NOx aftertreatment
 *** Does not apply to steady-state engine families

Tier 5 Standards Phase-In for < 130 kW

by Model Year

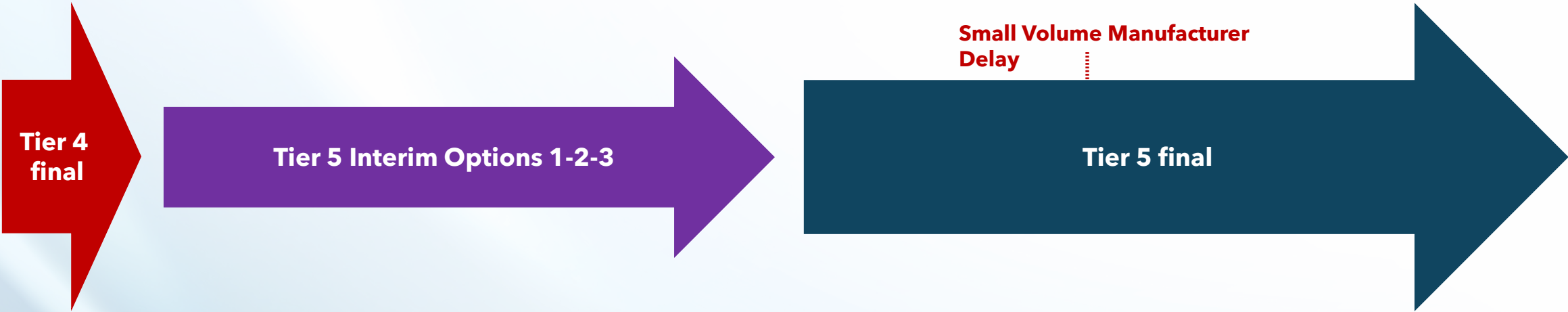


Tier 5 Standards Phase-In for $130 \leq kW \leq 560$ by Model Year



Tier 5 Standards Phase-In for > 560 kW

by Model Year



Tier 5 Interim Options

Option #1

Direct compliance with Tier 5i standards

Option #2

Phase-in/out compliance with 50% of engine sales at the Tier 5f level and 50% at the Tier 4f level

Option #3

Direct compliance with Tier 5i standards using CA-ABT credits

Option #4

Longer continuance of Tier 4f compliant engines in exchange for earlier introduction of Tier 5f compliant engines