CALIFORNIA
AIR RESOURCES BOARD

Tier 5 Rulemaking Workshop II

Selective Catalytic Reduction Inducements and Fleet Rule Clarification

October 30-31, 2023

CARB

Outline

- Selective Catalytic Reduction (SCR) Inducements
- Amendment to the In-Use Fleet Rule 13 CCR 2449

Selective Catalytic Reduction Inducements

SCR Inducement Proposal (1 of 2)

- Align with the existing inducement provisions for new off-road compression-ignition engines to provide clarity to engine manufacturers and consistency to operators.
  - Existing SCR inducement provisions for off-road compression-ignition engines are established in the United States Environmental Protection Agency (U.S. EPA) letter "CD-14-10 (HDNR)" dated May 12, 2014, and in guidance from a collaborative U.S. EPA and CARB public workshop conducted in July 2010.
  - Staff proposes to incorporate the SCR inducement provisions into the Off-Road Diesel New Engine Regulations and the California Test Procedures Part I – D (Part 1039).

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
  - 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.

SCR Inducement Schedule

	Monitoring Items	Failure Consequences	Warning/Inducement Activation
SCR	**DEF Level**	Fault Detection (warning activation)	≤15% Tank Capacity
		Initial Inducement Activation (25% Torque Reduction)	≤10% Tank Capacity
		Severe Inducement Activation (40%-60% Torque reduction)[1]	<5% Tank Capacity
		Final Inducement Activation (Idle or engine shutdown)	5% DEF left in the DEF tank; the driver's DEF gauge indicates 0%
	DEF Quality Tampering	Fault Detection (warning activation)	Within 1 hour (hr) of engine operation
		Initial Inducement Activation (25% Torque Reduction)	Immediately on warning activation
		Severe Inducement Activation (40%-60% Torque reduction) [1]	1 hr after warning activation
		Final Inducement Activation (Idle or engine shutdown)	4 hrs after warning activation

[1] Torque reduction depends on the activation conditions

SCR Inducement Proposal

	Tier 5 Proposal
Self-Healing	• The system should be able to restart after the action that triggers inducement is corrected.
Generic Scan Tool	• Using a generic scan tool to clear inducement is not allowed. • Factory or dealership tools are required.
Repeat Offense	• The system should be able to detect a repeat offense within 40 hours of engine operation after engine reaches final inducement activation. • A repeat offense results in a return to the final inducement within 60 minutes, bypassing the usual sequence of inducement stages. • A return to the final inducement would be initiated for DEF Level if the empty tank condition occurs within the 40-hour repeat offense monitoring period.
Safe Harbor Triggers	• The final inducement is triggered once two of the following occur: Refueling, Parked/Idled, Engine Restarted
Freeze Protection	• Demonstrate that the system is capable of dosing within the maximum 70 minutes per U.S. EPA's prescribed method. Additionally, engine manufacturers should provide an attestation that the DEF system is capable of dosing within a maximum of 40 minutes under typical California winter conditions. • Reductant won't refreeze during operation.
Inducements/ Engine Derate Fault Codes	• Codes should be displayed for the operator or retrieved using a generic scan tool.

Current Differences Between U.S. EPA Nonroad Inducement Program and CARB Off-Road Inducement Program

- **Warning Activation:**
  - U.S. EPA: Warning lamp *or* an audible alarm
  - CARB: Warning lamp *and* an audible alarm
- **Repeat offense:**
  - U.S. EPA:
    - Defined as: Same offense occurring again
    - Result: Triggers final inducement after 30 minutes
  - CARB:
    - Defined as: Any second offense, whether the same or different as the initial offense
    - Result: Triggers final inducement after 60 minutes
- **Freeze Protection:**
  - U.S. EPA has a prescribed cold soak at 0°F to freeze/solidify DEF and a prescribed way to operate the engine to demonstrate thawing the frozen DEF within a maximum of 70 minutes
  - CARB: Manufacturer provides staff with data from the U.S. EPA test above and attests that the DEF system is capable of dosing within a maximum of 40 minutes under typical California winter conditions

Inducing Triggering Events (DEF)

Low-Level DEF

- ≤15% Tank Capacity (Warning)
- ≤10% Tank Capacity
- <5% Tank Capacity
- Empty Tank (Final Inducement)

Poor Quality DEF

Oxides of Nitrogen (NOx) Sensor:
The measured NO_x emission level surpasses 0.40 grams per kilowatt-hour (g/kW-hr) (Tier 4 final level)

Urea Quality Sensor:
The measured urea concentration in the DEF Tank corresponds to a NO_x level exceeding 0.40 g/kW-hr

Inducing Triggering Events (Tampering)

Tampering Malfunctions

- Removal of the SCR brick
- Disconnected reductant level sensor
- Blocked reductant line or dosing valve
- Disconnected reductant dosing valve
- Disconnected reductant pump
- Disconnected SCR wiring harness
- Disconnected NO_x sensor that is incorporated with the SCR system
- Disconnected reductant quality sensor
- Disconnected exhaust temperature sensor
- Disconnected reductant temperature sensor

Amendment to the In-Use Fleet Rule 13 CCR 2449

Off-Road Fleet Rule (13 CCR 2449) Amendment

- Staff proposes to add a new subparagraph (I) to the California regulations for in-use off-road diesel-fueled fleets in 13 CCR 2449(d)
- This concept was previously workshopped as part of the in-use off-road diesel amendment rulemaking in 2022
- Subparagraph (I) would require that new engines installed in equipment added to California fleets beginning in 2029 be certified to applicable CARB standards or to identical federal standards after Tier 5 interim/final standards have been implemented
- This amendment would not preclude Tier 4f or Tier 4i used equipment from being added to a fleet so long as the equipment meets existing adding vehicle requirements
- This amendment would help to ensure that only the cleanest engines and equipment are used in California should CARB and U.S. EPA have differing standards after CARB adopts Tier 5
- CARB and federal standards are currently identical for off-road diesel engines

Examples of Adding Vehicles to Fleets starting January 1, 2029

Vehicle produced in 2029+ with CA-certified engine

Vehicle produced before 2029 with CA-certified engine

Vehicle produced before 2029 with EPA-certified engine

May be added to an off-road fleet per allowance of the In-Use Off-Road Fleets Regulation 13 CCR 2449

Vehicle produced in 2029+ with EPA-certified engine

May not be added to an off-road fleet starting 01/01/2029 unless the vehicle's engine is identical in all material respects to a MY2029+ CA engine

Examples of Replacing Engines in Fleets starting January 1, 2029

New replacement engine produced under 13 CCR 2423(j)

May replace an engine in an existing fleet per allowance of the In-Use Off-Road Fleets Regulation 13 CCR 2449

New replacement engine produced under 40 CFR 1068.240

May not replace a MY2029+ CA engine in an existing fleet unless the engine is identical in all material respects to the MY2029+ CA engine being replaced, or lower emitting

Federal or California Used engine

Engine rebuilt according to 13 CCR 2423(l) and 40 CFR 1068.120

May replace an engine in an existing fleet per allowance of the In-Use Off-Road Fleets Regulation 13 CCR 2449, except that a federal engine cannot replace a MY2029+ CA engine unless identical in all material respects, or lower emitting