

# **Proposed California Phase 2 Greenhouse Gas (GHG) Regulations for Heavy-Duty Engines and Vehicles**

## **Introduction and Overview**

**Public Workshop**  
February 6, 2017  
Sacramento, California

California Environmental Protection Agency  
 **Air Resources Board**

## **Presentation Outline**

- \* Background
- \* Overview of Federal Phase 2 GHG Regulations
- \* California Proposing to Adopt Phase 2 Regulation that Harmonizes with Federal Phase 2
- \* Areas Where California Phase 2 May Differ from Federal Phase 2
- \* California Phase 2 Timeline
- \* Staff Contact Information

## Background: Lower –Emitting Trucks Needed to Meet Ambitious GHG Targets in California

- \* Assembly Bill (AB) 32 –1990 levels by 2020
- \* Senate Bill (SB) 32–40% below 1990 levels by 2030
- \* Executive Order S-3-05 –80% below 1990 levels by 2050
- \* Governor Brown’s Inaugural Address - Reduce petroleum use in cars and trucks by up to 50% by 2030

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## Background: ARB GHG Rules Currently In Place

- \* Tractor-Trailer GHG Regulation (In-use fleet rule)
  - ☐ Adopted Jan 1, 2010
  - ☐ Long-haul tractor and trailer aerodynamics
  - ☐ Low rolling resistance tires
- \* California Phase 1 GHG Regulations (manufacturer rule)
  - ☐ Harmonized with Federal Phase 1 Program (December 2013)
  - ☐ Began 2014, fully phased in by 2018
  - ☐ Manufacturers ability to certify in California (Deemed to comply with California Phase 1, if certified federally)
  - ☐ ARB ability to enforce regulatory requirements

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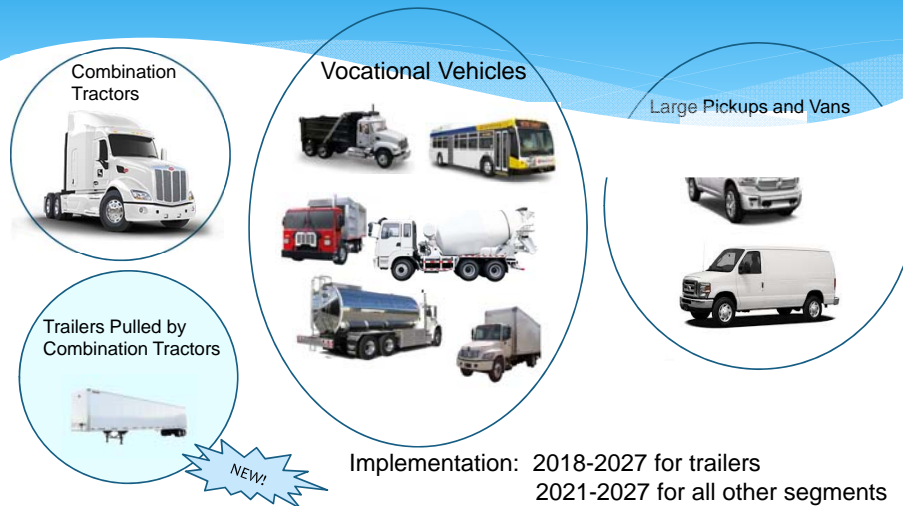
## U.S. EPA Adopted Federal Phase 2 GHG Regulations

- \* Second phase of federal heavy-duty GHG standards for vehicle manufacturers
  - Final rulemaking published Oct. 2016
- \* Establishes technology forcing standards for engines and vehicles
  - Combination Tractors
  - Trailers (not regulated in Phase 1)
  - Vocational Vehicles
  - HD Pick-ups and Vans
- \* Phase in model year 2021 to 2027 (from 2018 for trailers)
- \* Average payback: 2 to 4 years

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## Federal Phase 2 Rule Structure



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## Federal Phase 2: Separate Engine Standards

- \* Up to 5% reduction in GHG emissions from Phase 1 for combination tractor engines
- \* Up to 4% reduction in GHG emissions from Phase 1 for vocational engines



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## Federal Phase 2: Combination Tractors

- \* Biggest contributor to GHG emissions
- \* Up to 25% reduction in GHG emissions from Phase 1
- \* Vehicle standard includes use of:
  - ☐ Aerodynamic improvements
  - ☐ Engine, transmission, and driveline improvements
  - ☐ Lower tire rolling resistance
  - ☐ Idle reduction



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## Federal Phase 2: Box-Type Trailers

- \* Trailers regulated at federal level for the first time
- \* Aerodynamic devices applied to long and short box trailers only
- \* Low rolling resistance tires and automatic tire inflation/monitoring technology
- \* Up to 9% reduction in GHG emissions



Box Trailers (50'+)

Short Box Trailers (<50'+)



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## Federal Phase 2: Other Trailers

- \* Low rolling resistance tires and automatic tire inflation/monitoring only
- \* Up to 3% reduction in GHG emissions

Non-box trailers (flat beds, tankers, container chassis, etc.)



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## Federal Phase 2: Vocational Vehicles

- \* Class 2b-8 trucks performing a variety of functions
- \* Up to 24% reduction in GHG emissions beyond Phase 1
- \* Vehicle standard includes use of:

- ☐ Engine and transmission improvements (including Hybrids)
- ☐ Low rolling resistance tires
- ☐ Axle improvements
- ☐ Workday idle reduction
- ☐ Weight reduction
- ☐ Electrified accessories
- ☐ Tire monitoring systems



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## Federal Phase 2: Pickups & Vans

- \* Up to 16% reduction in GHG emissions beyond Phase 1
- \* Vehicle standard includes use of:

- ☐ Engine and transmission improvements
- ☐ Aerodynamic
- ☐ Gasoline hybr



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## Phase 2 Vehicle Costs and Payback for 2027 MY Standards

	Phase 2 Projected Average Cost Increase per Vehicle	Payback in Years
<b>Tractors</b>	~\$12,300	<b>2</b>
<b>Trailers</b>	~\$1,085	
<b>Vocational Vehicles</b>	~\$2,680	<b>4</b>
<b>Pick-ups/Vans</b>	~\$1,350	<b>3</b>

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## ARB Proposing to Adopt California Phase 2 Regulation that Harmonizes with Federal Phase 2

- \* Harmonize with the federal rules in structure, timing and stringency
  - ☐ Enables California to certify vehicles and engines
  - ☐ Enables California to enforce requirements
  - ☐ If Federal Phase 2 is revoked, ensures California requirements will remain in place
- \* Not “Deemed to Comply” with California Phase 2 if federally certified
- \* California differences to facilitate enforcement, align with existing California programs, and provide additional incentive for advanced technologies

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## Areas Where California Phase 2 may Differ from Federal Phase 2

### \* Credit Provisions

- ☐ Additional credits for use of Low-Global Warming Refrigerants
- ☐ Additional requirements for Plug-in Hybrid Electric Vehicles (PHEVs) to qualify for advanced technology credit multiplier
- ☐ Other credit provision changes under consideration

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## Areas Where California Phase 2 may Differ from Federal Phase 2 (continued)

### \* Label Information

- ☐ Considering additional information to be included in vehicle and trailer labels to aid in enforcement
  - ☐ Require “light-duty style” consumer labels for heavy duty pick ups and vans (provides fuel efficiency and environmental performance scores)
- \* Exclude transit buses and refuse trucks from the custom chassis provisions

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## Areas Where California Phase 2 may Differ from Federal Phase 2 (continued)

- \* Hybrids must demonstrate no NO<sub>x</sub> increases to qualify for Advanced Technology Credit multiplier
- \* Alternate emission standards for specialty vehicles

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## Areas Where California Phase 2 may Differ from Federal Phase 2 (continued)

- \* Engine and Vehicle Certification Requirements
  - ☐ Require vehicle manufacturers to include engine family for each certified vehicle in end-of-year report
  - ☐ Require vehicle manufacturers to provide additional air conditioning system information to support A/C leakage standard
  - ☐ Establish zero emission vehicle certification procedures

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## Areas Where California Phase 2 may Differ from Federal Phase 2 (continued)

- \* Natural Gas Engine Requirements
  - ☐ Continue to include ethane in the hydrocarbon emission standards for natural gas compression-ignition engines
- \* Other Things Worth Noting
  - \* Adopting tampering and selective enforcement audit Provisions of Phase 2 (didn't for California Phase 1)
  - \* Sunsetting provisions of Tractor-Trailer GHG Rule that impact model year 2018 and newer trailers

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## California Phase 2 Timeline

- \* Second public workshop Spring 2017
- \* Draft regulatory language Summer 2017
- \* Public comment on staff report begins Sept. 2017
- \* Board consideration of California Phase 2 proposal Oct. 2017

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## Staff Contact

Comments and questions can be directed to:

- \* Alex Santos, Staff Air Pollution Specialist  
(626) 575-6682  
[alex.santos@arb.ca.gov](mailto:alex.santos@arb.ca.gov)
- \* Mitzi Magtoto, Air Resources Engineer  
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WEBCAST PARTICIPANTS - PLEASE E-MAIL  
COMMENTS TO THE FOLLOWING ADDRESS:

[coastalm@calepa.ca.gov](mailto:coastalm@calepa.ca.gov)

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## Breakout Session Slides

### Additional Credits for Low- Global Warming Potential Refrigerants

## Adopted Federal Phase 2 Standards

- \* Federal Phase 2 Standards include a air conditioning (A/C) refrigerant leakage standard that set a maximum cap for refrigerant leak rate.
- \* Federal Phase 2 Standards do not include any requirement or credit incentive for the use of low-Global Warming Potential (GWP) refrigerants.

Credits

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## Low-GWP Refrigerants: Light-Duty Vehicle Fleet Status

- \* Regulations
  - ☐ Incentives (A/C credits in ARB and U.S. EPA vehicle GHG regulations)
  - ☐ Requirements (European Union MAC Directive, U.S. EPA high-GWP refrigerants status change to “unacceptable”)
- \* HFC-134a (GWP=1300) is the prevalent refrigerant currently in use in light-duty vehicles.
- \* Low-GWP alternatives (approved by U.S. EPA Significant New Alternatives Policy (SNAP) program)
  - ☐ HFO-1234yf (GWP<1): being used in millions of newer vehicles
  - ☐ CO<sub>2</sub> (R-744) (GWP=1): reportedly being offered by at least 1 OEM
  - ☐ HFC-152a (in secondary-loop system) (GWP=138): being developed by industry

Credits

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## Low-GWP Refrigerants: Medium-/Heavy-Duty Vehicle Fleet Status

### \* Regulatory status

- ☐ No requirement or incentive in U.S. EPA Phase 2 Standards
  - ✓ Lack of commercially available alternatives
  - ✓ Relatively small refrigerant emissions as compared with tailpipe CO<sub>2</sub> emissions – likely insufficient incentive
- ☐ ARB Short-lived Climate Pollutants Plan called for state-level measures on this issue, if no federal actions

### \* Low-GWP alternatives status

- ☐ HFO-1234yf: SNAP-approved for classes 2b and 3; Chemours preparing SNAP application for heavier classes
- ☐ CO<sub>2</sub> (R-744) and HFC-152a: SNAP-approved for all MVAC, including for MDV/HDV
- ☐ Lack of industry movement to adopt low-GWP alternatives

Credits

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## Proposed CA Phase 2 Low-GWP Refrigerant Credit

- \* We are proposing to offer a credit of **0.84 Megagram(Mg)/year/vehicle** (preliminary value) for the use of a low-GWP refrigerant (GWP≤150)
  - ☐ Credit corresponds to GHG benefit of switching from HFC-134a (GWP=1300) to GWP=150 for an A/C system with average leak rate (257 g/yr), multiplied by 2.8 (preliminary value).
  - ☐ Credit multiplier of 2.8 is ratio of estimated lifetime cost of an HFO-1234yf system (leading alternative refrigerant technology) to estimated lifetime cost of an HFC-134a system.

Credits

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## Proposed CA Phase 2 Low-GWP Refrigerant Credit (cont.)

- \* Low-GWP refrigerant credit would be phased down to 0.30 Mg/year/vehicle in 4 model years after one original equipment manufacturer (OEM) adopts a low-GWP alternative.
  - ☐ Full credit of 0.84 Mg/year/vehicle would promote adoption of climate-friendly refrigerants at a near-term GHG disbenefit of 0.54 million gCO<sub>2</sub>e/year/vehicle.
  - ☐ Credit would be phased down to 0.30 Mg/year/vehicle (actual GHG benefit for using a low-GWP refrigerant) in 4 model years after one OEM offers for sale a model using a low-GWP (GWP<sub>≤150</sub>) refrigerant.

Credits

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## Workgroup Discussion

- \* Any new development in SNAP application for HFO-1234yf for vehicle classes 4 through 8?
- \* Any update on industry status or plan of adopting low-GWP refrigerants?
- \* Any comments on the proposed low-GWP refrigerant credit amount?

Credits

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## Workgroup Discussion (cont.)

- \* Any comments on the proposed phase-down of low-GWP refrigerant credit?
- \* Any other recommendations or comments on the proposed low-GWP credit scheme?

Contact: Tao Zhan, ARB Phase 2 team member  
[tzhan@arb.ca.gov](mailto:tzhan@arb.ca.gov) or tel. (916)445-9495

Credits

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## Proposed Modifications to California Tractor-Trailer Greenhouse Gas (TTGHG) Regulation

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## California TTGHG Regulation

- \* Effective January 1, 2010
- \* Fleet Rule. Applies to owners and operators
- \* Reduces GHG emissions from long-haul tractor-trailers
  - Based on elements of U.S. EPA SmartWay Program
  - 53'+ box-type trailer aerodynamics
    - ✓ Side skirts, front gap fairings, rear trailer fairings
  - Low rolling resistance tires
  - Tractor requirements
    - ✓ Low rolling resistance (LRR) tires (2013 and older MY)
    - ✓ Aerodynamics: Streamlined hood, sleeper cab roof fairings, gap fairings, fuel tank fairings, aerodynamic bumper & mirrors (2011-2013 MY Sleepers only)
    - ✓ Changes to tractor requirements made in 2013 to harmonize with Phase 1

Trailers

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## California TTGHG Regulation (Cont.)

- \* Regulation website:  
<http://www.arb.ca.gov/cc/hdghg/hdghg.htm>

Trailers

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## Overlapping Phase 2/TTGHG Trailer Requirements

- \* Effective January 1, 2018
- \* Manufacturer Rule
- \* Applies to manufacturers of all lengths of box-type trailers (aero/LRR tire/automatic tire inflation system (ATIS)) and flatbeds, tankers and container chassis (LRR tire /ATIS, no aero)

Trailers

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## Overlapping Phase 2 Trailer Requirements (Cont.)

- \* 40 CFR §1037.107 establishes progressively more stringent CO<sub>2</sub> grams/ton payload standards for 50'+ box-type trailers (All standards assume ATIS)
  - 2018MY through 2020MY standards
    - ✓ Met with single SmartWay-verified aero device (Bin III) and LRR tires (Level 3)
  - 2021 MY through 2023 MY standards
    - ✓ Met with Bin IV aero equipment and LRR tires (Level 4)
  - 2024 MY through 2026 MY standards
    - ✓ Met with Bin V aero equipment and LRR tires (Level 4)
  - 2027 MY+ standards (averaging allowed)
    - ✓ Fleet average equivalent to use of Bin V and VI equipment and LRR tires (Level 4)
- \* <https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-greenhouse-gas-emissions-and-fuel-efficiency>

Trailers

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## Comparison of TTGHG Requirements to Similar Phase 2 Requirements

Types of trailers with aero and LRR tire requirements	53'+ box-type(dry vans and refrigerated vans) <ul style="list-style-type: none"> <li>• Bin III aero</li> <li>• Level 3 tires</li> <li>• No ATIS</li> </ul>	All lengths of box-type (dry vans, refrigerated vans) <ul style="list-style-type: none"> <li>• Up to Bin VI aero</li> <li>• Up to Level 4 tires</li> <li>• ATIS</li> </ul>
Model years subject to requirements	All MY's	<ul style="list-style-type: none"> <li>• Trailers built after 1/1/2018</li> </ul>

Trailers

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## Proposed Modifications to California TTGHG Requirements to Harmonize with Phase 2 Requirements

- \* Sunset requirements for aerodynamic technologies and low-rolling resistance tires on 53' or longer box-type trailers built after January 1, 2018

Contact: Alex Santos, ARB Phase 2 lead staff  
[Alex.Santos@arb.ca.gov](mailto:Alex.Santos@arb.ca.gov) or tel. (626)575-6682

Trailers

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# California Enforcement

## Tampering and Selective Enforcement Audit

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## Tampering

- \* Adopt federal tampering provisions as part of the California Phase 2 regulation, with specified base penalties
- \* Vehicle inspections will identify tampering or defective emissions control systems
- \* Ensures that all certified engines, vehicles, and trailers are operating in their certified configuration

Labeling

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## Selective Enforcement Audit

- \* Proposed adoption of federal “Selective Enforcement Auditing” provisions as part of the California Phase 2 regulation
- \* ARB will require compliance testing on identified engine and vehicle families
- \* Testing conducted with ARB oversight – either in-house or by a third-party testing group

Other minor differences

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## Staff Contact for Enforcement

Contact: Heather Brown  
Chief, Diesel Program Enforcement Branch  
[hbrown@arb.ca.gov](mailto:hbrown@arb.ca.gov) or tel. (916)229-0865

Enforcement

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## Vehicle and Trailer Labeling

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## Adopted Federal Phase 2 Standards Label Requirements for Tractors and Vocational Vehicles

- \* Emission control identifiers required on the label for certified trailers but optional for tractors and vocational vehicles
  - ☐ Due to increase in the number of emission control systems available to meet Phase 2 tractor and vocational vehicle standards

Labeling

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## Proposed California Phase 2 Label Requirements for Tractors and Vocational Vehicles

- \* Require emission control identifiers on the label for certified tractors and vocational vehicles in California
  - ☐ Enforcement staff must be able to identify required emission control system components during a vehicle inspection
- \* Potential additional requests:
  - ☐ Include barcode or QR code on the label that identify emission control system identifiers when scanned
  - ☐ Identify control system components in owner's manual and/or warranty pamphlet
  - ☐ Label must clearly identify the "responsible party" (i.e., the manufacturer)
  - ☐ Label must be legible, and attached in a location that is readily visible to the average person after the vehicle assembly is complete
  - ☐ Label required on every Phase 2 California certified engine, vehicle, and trailer that operates in California

Labeling

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## Workgroup Discussion

- \* Any questions or comments on the proposed labeling requirements for tractors and vocational vehicles?
- \* Do you have comments on our potential additional requests?

Contact: Heather Brown

Chief, Diesel Program Enforcement Branch  
[hbrown@arb.ca.gov](mailto:hbrown@arb.ca.gov) or tel. (916)229-0865

Certification Provisions

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## Trailer Label

Include Additional Tire Info

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## Adopted Federal Phase 2 Standards

- \* Tire rolling resistance classified into Levels 1-4 in Preamble of Final Rulemaking document
- \* Low rolling resistance tires treated as an emission control system in Phase 2
  - ☐ Must be reported on Emission Control Labels of trailers
  - ☐ U.S. EPA trailer label requirements: Only 1 code – LRRR means Low Rolling Resistance Tires (all, including trailers)

Labeling

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## Possible California Phase 2 Addition to Trailer Labeling Requirement

- \* Include rolling resistance level in the code for LRR tires
  - ☐ LRR A1 - Low Rolling Resistance Tires (all, including trailers) Level 1
  - ☐ LRR A2 - Low Rolling Resistance Tires (all, including trailers) Level 2
  - ☐ LRR A3 - Low Rolling Resistance Tires (all, including trailers) Level 3
  - ☐ LRR A4 - Low Rolling Resistance Tires (all, including trailers) Level 4
- \* Allows for enforcement of correct rolling resistance level of tires
  - \* Procedure for enforcement still being developed
  - \* EPA will not be releasing a public database of tires

Labeling

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## Workgroup Discussion

- \* How should enforcement be conducted to ensure that benefits from the use of low rolling resistance tires are maintained in use?
  - \* Method of determining that the proper tire is used
  - \* Method for end-users to identify the proper tires to purchase
  - \* What is an acceptable replacement tire?
  - \* Possibility of developing a tire list to look up coefficient of rolling resistance
    - \* Inclusion of tires not used by trailer OEMs
  - \* Tire vendors' understanding of requirements
- \* Any questions or comments on the proposed tire information requirement for trailer labels?
- \* Any other suggestions for facilitating enforcement of tire requirements?

Labeling

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## Staff Contact for Trailer

Contact: Henry Cheung, ARB Phase 2 team member  
[hcheung@arb.ca.gov](mailto:hcheung@arb.ca.gov) or tel. (626)575-6673

Credits

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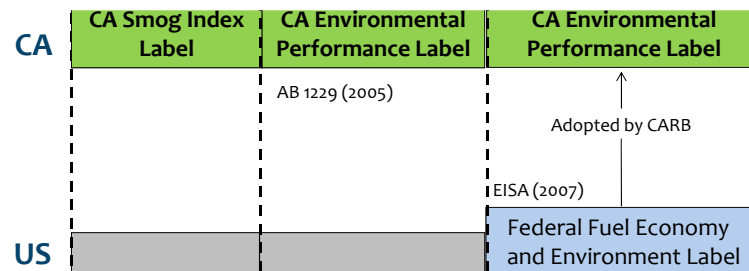
## Consumer Window Labels

Heavy-Duty (HD) Pickups and Vans

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## Background

### Light-duty consumer window labels



Labeling

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## Background (Cont.)

- \* U.S. EPA and NHTSA required window labels for new MY 2013 and later light-duty vehicles
- \* Federal Phase 1 GHG final rulemaking (FRM) in 2011
  - \* U.S. EPA intended to consider requiring similar window labels for heavy-duty pickups and vans as part of the Phase 2 proposal.
- \* Federal Phase 2 notice of proposed rulemaking (NPRM) and FRM
  - \* Did not include window label requirements

Labeling

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## Adopted Federal Phase 2 Standards

- \* Excluded window label requirements
- \* U.S. EPA's rationale
  - ☐ Not proposed such provisions in NPRM
  - ☐ Considered the issue to be outside the scope of Phase 2 rulemaking

Labeling

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## Current Federal Fuel Economy and Environment Label for Light Duty Vehicles (LDVs)

- \* Not currently considered for HD pickups and vans: need to modify the federal label for California only use



Labeling

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## Proposed California Phase 2

- \* Proposing to require consumer labels for HD pickup and vans to MY 2021+
- \* Rationale:
  - ☐ Would provide fuel efficiency and environmental impact information to vehicle buyers
  - ☐ Would give buyers better, more complete information to consider when purchasing new vehicles
  - ☐ Would increase the likelihood that the more efficient, lower GHG emitting vehicles are purchased by consumers

Labeling

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## Current ARB Environmental Performance Label for LDVs and medium duty passenger vehicles (MDPVs)

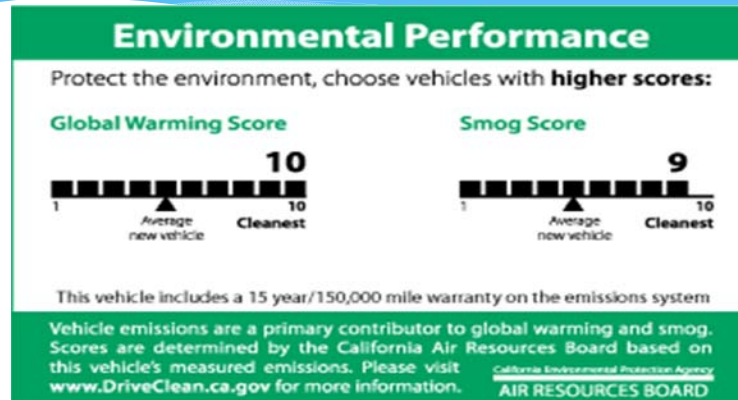
- \* No future plans to sunset ARB's Environmental Performance label
  - ☐ Light-duty manufacturers are allowed to still use ARB's label in addition to the federal label
- \* Light-duty manufacturers have the specifications and ability to print such label

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## Current ARB Environmental Performance Label for LDVs and MDPVs (Cont.)



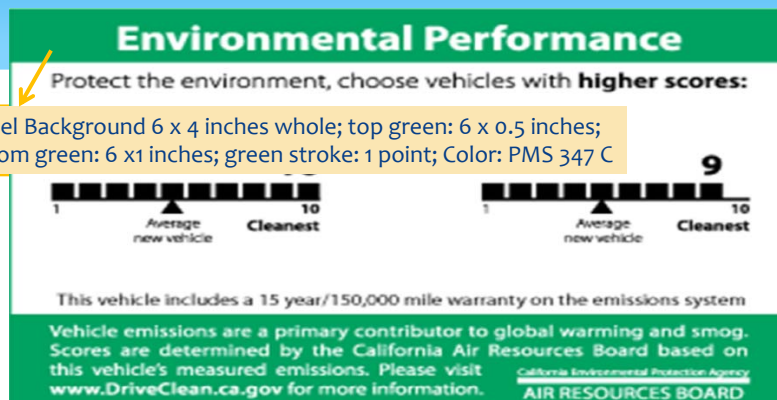
- \* Global Warming Score and a Smog Score
- Scores from 1 to 10, with 10 being cleanest

Labeling

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## Current ARB Label Style Requirements

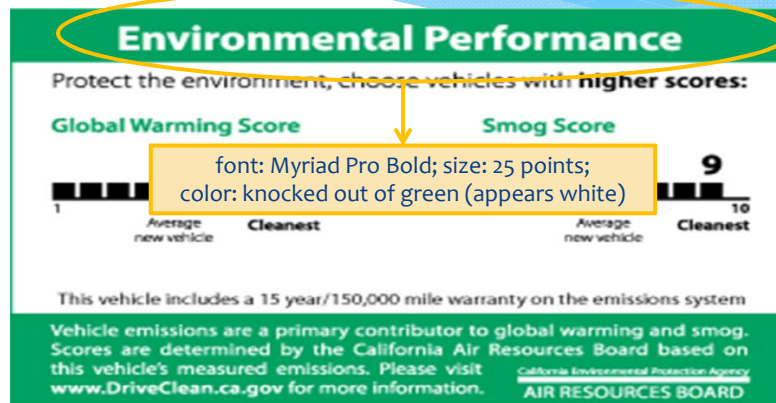


Labeling

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## Current ARB Label Style Requirements (Cont.)



Labeling

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## Current ARB Label Placement

- \* On either side window to the rear of driver



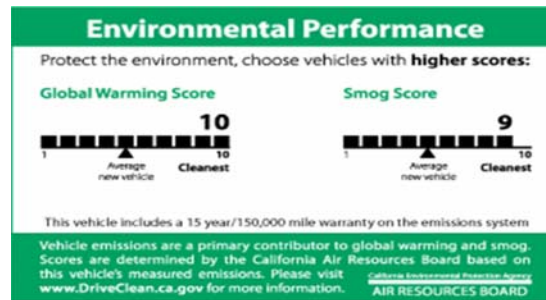
Labeling

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## Suggested Provision for California Adoption of Phase 2 Labeling for 2b/3s

- \* Use ARB's Environmental Performance label
  - ☐ HD Pickup and Van manufacturers have the specifications and ability to print such label
  - ☐ Label placement: similar to light-duty



Labeling

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## Proposed Approval of Environmental Performance Label

- \* Require manufacturers to submit labels to the ARB for review and approval prior to display of the Environmental Performance label
  - ☐ Include data necessary to determine the Global Warming and Smog scores
- \* May require submission of sample labels periodically for compliance purposes

Labeling

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## Workgroup Discussion (Cont.)

- \* What are stakeholders' thoughts on the proposal? If ARB proceeds with this requirement, how do you recommend it be constructed?
- \* Should we add other information in the label?
- \* Do you have information on how consumers purchase heavy-duty pick ups and vans? What are the factors that influence their purchasing decision?

Labeling

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## Workgroup Discussion (Cont.)

- \* Any suggestions on the placement of window labels?
- \* Our understanding is light-duty manufacturers print their own window labels. If window labels were required, would you print your own labels or contract with a third party?
- \* What would the cost implications to you? Do you have cost information that you would be willing to share with ARB?

Labeling

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## Workgroup Discussion (Cont.)

- \* In the future, what do you think of developing an online information website for consumers of heavy-duty pickups and vans and eventually for all classes of heavy-duty vehicles?

Contact: Mitzi Magtoto, ARB Phase 2 co-lead staff  
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## Vocational Custom Chassis Provisions

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## Adopted Federal Phase 2 Standards Vocational Custom Chassis Provisions

- \* Vocational custom chassis manufacturers have an option to certify with less stringent standards than the primary vocational standards through a simplified GEM process.
- \* Motor homes, coach buses, transit buses, school buses, refuse trucks, cement mixers, and emergency vehicles

Custom Chassis Category	Technology Package
Transit bus	<ul style="list-style-type: none"> <li>• Workday idle reduction (neutral idle, stop-start)</li> <li>• Tire pressure system (TPMS or ATIS)</li> <li>• Low rolling resistance tires</li> <li>• Weight reduction</li> </ul>
Refuse truck	<ul style="list-style-type: none"> <li>• Workday idle reduction (neutral idle, stop-start)</li> <li>• Tire pressure system (TPMS or ATIS)</li> <li>• Low rolling resistance tires</li> </ul>

Flexibility Provisions

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## Proposed California Phase 2: Exclude Transit Buses and Refuse Trucks from the Custom Chassis Provisions

In order to certify transit buses and refuse trucks with the primary vocational standards, manufacturers have the following options (in addition to the technologies laid out in the custom chassis provisions):

- \* Advanced transmission technologies - Automatic Transmission (AT), Automated Manual Transmission (AMT), and Dual Clutch Transmission (DCT);
- \* Hybrid powertrain - Hybrid transit buses and refuse trucks are commercially available.
- \* Electric vehicles - Full electric transit buses are currently available from all U.S. transit bus manufacturers. Electric refuse trucks are being demonstrated on road.

Flexibility Provisions

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## Electric Bus Availability by Manufacturer

### U.S. Transit Bus Manufacturers

OEMs	Size	Market Share	Advanced Technology Manufacturer?
New Flyer	Large	45%	Yes, commercially available
Gillig Corporation	Middle Size with 500-999 employees	33%	In demonstration
Volvo (Nova Bus)	Large	15%	In demonstration and ready for production in U.S. and Canada
Others (BYD, Proterra, El Dorado, etc.)	Small	5%	Yes, commercially available

- \* Credits generated from production of electric vehicles can possibly meet primary vocational standards

Flexibility Provisions

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## Workgroup Discussion

- \* Transmission improvement technologies

- ☐ Different types of transmissions are commercially available

In the federal Phase 2, manufacturers are allowed to use a transmission efficiency test to claim transmission improvement credit. Transmission efficiency testing provides a cheaper alternative to powertrain testing to get credit for improved transmissions. What are the challenges associated with using transmission efficiency testing?

Flexibility Provisions

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## Workgroup Discussion (Cont.)

### \* Transmission improvement technologies (cont.)

- ☐ Staff understands the powertrain test cost burden. Are there other challenges in addition to the high powertrain test cost for hybrid systems?
- ☐ What is the market acceptance level for hybrid buses and refuse trucks?

Flexibility Provisions

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## Workgroup Discussion (Cont.)

### \* Full electric transit buses and refuse trucks:

- ☐ What are the challenges of producing a portion of full electric vehicles and using advanced technology multipliers to make up for other conventional vehicles in order to comply with the primary standards?
- ☐ Given the potential “clean transit rule”, demand for electric transit buses may significantly increase in California. Are manufacturers projecting a significant amount of full electric vehicle production (specifically transit bus and refuse truck) in the future?

Flexibility Provisions

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## Workgroup Discussion (Cont.)

- \* What would be the impact on manufacturers due to this potential CA Phase 2 difference from the federal Phase 2?
- \* What is the CA-specific market for transit buses and refuse trucks as compared to national market?

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Flexibility Provisions

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## Hybrid Credits Provisions

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## Credits for Hybrid Vehicles Federal Phase 2 Provisions

- \* Class-8 hybrid vehicles with light or medium heavy-duty engines may optionally be certified to compression-ignition standards for the heavy heavy-duty vehicle service class
  - The lighter engines would have to comply with CO<sub>2</sub> standards and useful life of the heavier vehicle service class (>26,000 pounds GVWR)
- \* Advanced technology credits for plug-in hybrid electric vehicles (PHEVs)

Hybrid

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## Adopted Federal Phase 2 Standards

- \* Reinstated multipliers in accordance with ARB's recommendations

Advanced Technology Multipliers	
Technology	Multiplier
Plug-in hybrid electric vehicles	<b>3.5</b>
All-electric vehicles	<b>4.5</b>
Fuel cell vehicles	<b>5.5</b>

Credits

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## Possible California Phase 2 Changes on Credits for Hybrids

- \* For PHEVs, **in order to qualify for advanced technology**, must have:
  - \* No NOx increase
  - \* All-electric range (AER) 35 miles (25 miles for fast charge)
  - \* For electric power take off (ePTO): Meet HVIP ePTO duty cycle for typical work day
- \* These requirements are consistent with ARB's requirements for PHEV funding under our incentive programs

Hybrid

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## Workgroup Discussion

- \* LHDE and MHDE in hybrid vehicles certified to HHDE compression ignition standards
  - ☐ Engine durability in heavier service class for lighter engines
  - ☐ Useful life requirements
- \* Comments on proposed no NOx increase, all electric range, and ePTO requirements to qualify for PHEV credit multiplier?

Contact: Robert Nguyen, ARB Phase 2 team member  
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Hybrid

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## Alternate Emission Standards for Specialty Heavy-Duty Vehicles

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## Alternate Emission Standards for Specialty Heavy-Duty Vehicles

- \* Federal Phase 2 Standards allows use of a non-road engine in the following “specialty” heavy-duty vehicle types:
  - ☐ Hybrids (up to 1,000 per manufacturer per model year (MY))
  - ☐ Amphibious or speed-limited vehicles (up to 200 per manufacturer per MY)
- \* Issue: Non-road engines have potential to emit more criteria pollutants than on-road engines, and are typically not equipped with On-Board Diagnostics (OBD)

Hybrid

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## ARB's Innovative Technology Regulation (ITR)

- \* For heavy-duty hybrids with an off-road engine, ARB's ITR addresses these issues
  - ☐ Vehicle must achieve at least 35 miles all-electric range
  - ☐ Hybrid must demonstrate no NOx, HC and CO emission increase, and meet other performance criteria
  - ☐ OBD compliance must be phased-in over time
- \* ITR adopted by Board in October 2016, anticipated Office of Administrative Law (OAL) approval in mid-2017

Hybrid

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## Workgroup Discussion

- \* ITR does not address amphibious and speed limited vehicles. How should CA Phase 2 address these?
  - ☐ Align with the U.S. EPA, but set much lower California-specific sales limits. Any comments or suggestions?

Contact: Joe Calavita, ARB Phase 2 team member  
[jcalavit@arb.ca.gov](mailto:jcalavit@arb.ca.gov) or tel. (916)445-4586

Hybrid

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# Certification

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## Report Additional Data on Engine/Vehicle Family

HEAVY-DUTY TECHNOLOGY  
TRACKING

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## Reporting Requirements



### Engine Manufacturers

#### Federal Phase 2 GHG

##### § 1036.250 - Reporting and recordkeeping for certification.

- Report the production by serial number and engine configuration for each engine family within 90 days after the end of the model year

#### Additional Requests:

- Can engine family for each VIN be provided if the engine manufacturer has VIN information?



### Chassis Manufacturers

#### Federal Phase 2 GHG

##### § 1037.250 - Reporting and recordkeeping for certification.

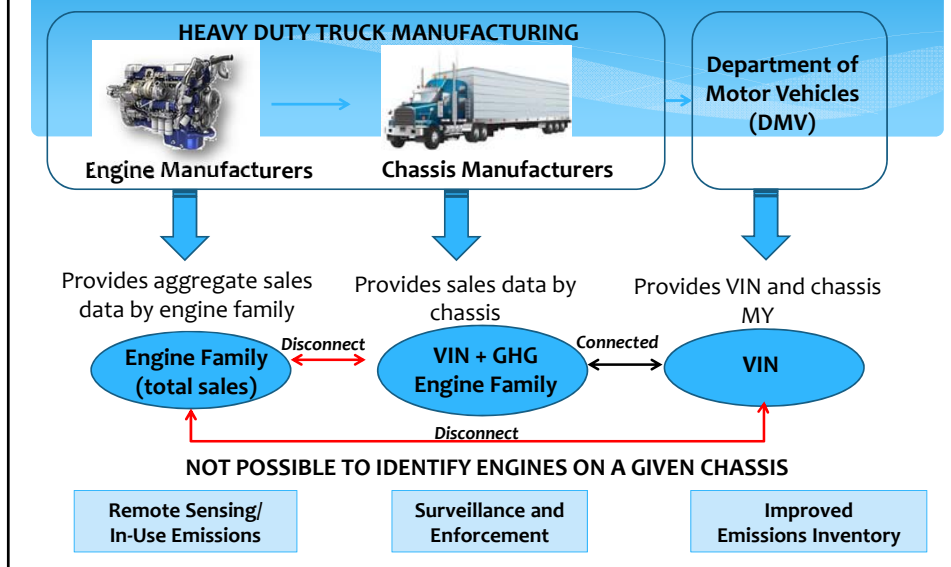
- Report by vehicle identification number (VIN) and vehicle configuration and identify the subfamily identifier within 90 days after the end of the model year

#### Additional Requests:

- Can the engine family for each VIN be provided?

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## Problem Statement



## Remote Sensing Measurements

- ☐ Emissions collected using remote probe
- ☐ License plate matched against DMV database
- ☐ Provides VIN and chassis MY
- ☐ Emissions tied to chassis MY aren't helpful necessarily

☐ Can't get emissions trend associated with engine manufacturer/make/model/MY



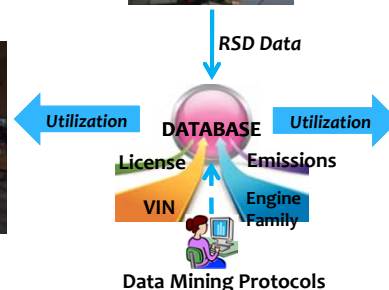
REQUIRES ENGINE FAMILY <sup>89</sup>



## Surveillance and Enforcement



Inform Surveillance Programs

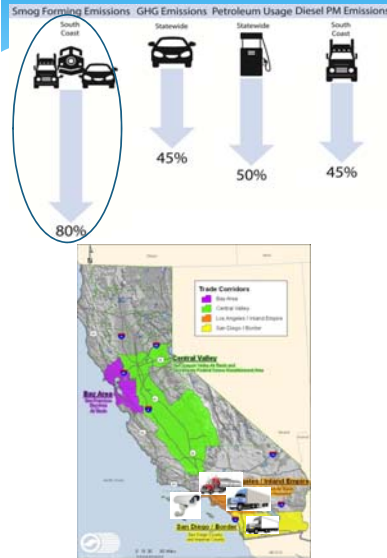


Targeted Enforcement

- ✓ Analyze emission trends
- ✓ Look for systematic emission issues
- ✓ Identify patterns specific to engine make/model

REQUIRES ENGINE FAMILY <sup>90</sup>

## Improved Emissions Inventory



- ❑ Understand regional penetration of technology
- ❑ Better representation of benefits of cleaner engines in non-attainment areas vs. assuming distributed equally throughout the state
- ❑ Collect license plate/location and tie it to certification level

### REQUIRES ENGINE FAMILY

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# VIN + Engine Family Data Reporting

## PROPOSAL FOR CHASSIS MANUFACTURERS

- Can the engine family for each VIN be provided?

## PROPOSAL FOR ENGINE MANUFACTURERS

- Can engine family for each VIN be provided if the engine manufacturer has VIN information?

*This proposal is not a part of the federal Phase 2 rule*

Contact: Chandan Misra, ARB Phase 2 team member  
cmisra@arb.ca.gov or tel. (916)323-1503

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## Require Manufacturers to Submit Detailed System Information as Part of Air Conditioning (A/C) Leakage Standard Certification

Certification

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## Adopted Federal Phase 2 A/C Leakage Standards Certification Requirements

§ 1844-01(d)(7)(iv)

\* Federal Phase 2 Standards require the following information submitted to certify to A/C leakage standards

- ☐ Refrigerant leakage rate (leak score)
- ☐ Type of refrigerant
- ☐ Refrigerant capacity (charge size)

Certification

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## Proposed Additional Information Requirements for CA Phase 2 A/C Leakage Standard Certification

- \* We are proposing to require the following additional information:
  - ☐ Detailed specifications of the system components associated with refrigerant leakage
  - ☐ SAE J2727 calculation leading to the leak rate estimate
- \* Additional information allows us to:
  - ☐ Verify refrigerant containment technology assessment and leak rate calculation
  - ☐ Track technological development
  - ☐ Align with certification requirements in our LEV III regulation for light-duty vehicles

Certification

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## Workgroup Discussion

- \* Any recommendations on how to standardize reporting requirements while still achieving the goal of obtaining adequate system information?

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[tzhan@arb.ca.gov](mailto:tzhan@arb.ca.gov) or tel. (916)445-9495

Certification

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## Zero-Emission Heavy-Duty Vehicle Certification Procedures

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## Development of Zero-Emission Heavy-Duty Vehicle Certification Procedures

- \* CA Phase 2 GHG Standards to include heavy-duty zero-emission vehicle certification procedures
- \* Standardized evaluation criteria would validate zero-emission vehicle performance in order to:
  - ☐ Support development of Advanced Clean Transit, Last Mile Delivery and other technology-advancing ARB regulations
  - ☐ Inform implementation incentive programs
  - ☐ Enable informed decision making by early adopter fleets
- \* Such procedures would be mandatory in order to enable California sale

Certification

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## Certification Procedure Development: Key Questions

- \* What performance criteria should these procedures evaluate?
- \* If zero-emission range is to be evaluated, how should it be quantified?
- \* Should such procedures focus be vehicle/chassis-specific, apply to the zero-emission drive system only (and include retrofits), or a combination of both?
- \* Other stakeholder questions, comments, or suggestions?

Certification

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## Certification Procedure Development: Public Process

- \* Zero-Emission Heavy-Duty Vehicle Certification Procedures Public Work Group meetings to be held in Spring/Summer 2017 (dates tbd)
  - ☐ Detailed discussion of certification procedure development, opportunity for public suggestions and feedback
  - ☐ Open to all interested stakeholders
- \* Ongoing staff discussions with interested stakeholders
- \* Board consideration as part of CA Phase 2 GHG Standards in Fall 2017

Contact: Joe Calavita, ARB lead staff for zero-emission certification,  
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Certification

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## Non-Ethane Hydrocarbon (NEHC) Standards for Natural Gas Engines

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## Non-Ethane Hydrocarbon Standards for Natural Gas Engines

\* As part of Phase 2 rulemaking, U.S. EPA excluded ethane from the hydrocarbon definition for the following compression-ignition categories:

- ☐ Highway Engines
- ☐ Nonroad Engines
- ☐ Locomotives
- ☐ Marine Engines

Natural Gas Engines

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## Non-Ethane Hydrocarbon Standards for Natural Gas Engines (Cont.)

- \* Issue: The elimination of ethane from the hydrocarbon calculation has the potential to reduce the stringency of the current standards by allowing an increase in the toxic and volatile components of HC emissions.

Natural Gas Engines

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## Non-Ethane Hydrocarbon Standards for Natural Gas Engines

- \* Arguments in favor of alignment:
  - ☐ Ethane is non-reactive with respect to criteria pollutants
  - ☐ Ethane has a low global warming potential
  - ☐ The number of engines affected is small
  - ☐ Non-ethane standards already exist for stationary engines

Natural Gas Engines

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## Non-Ethane Hydrocarbon Standards for Natural Gas Engines (Cont.)

### \* Arguments against alignment:

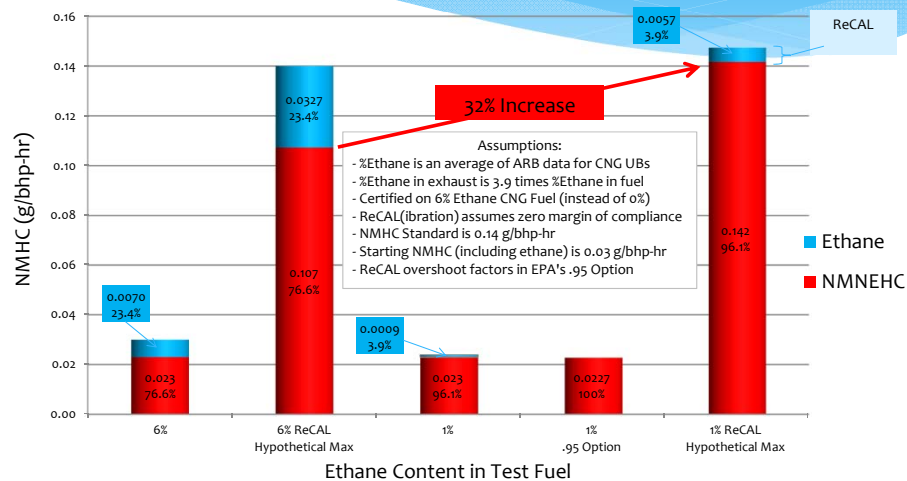
- ☐ Perpetuates less advanced, less stringent engine technologies
- ☐ Has the potential to expand beyond just gaseous fuel categories
- ☐ May allow increases in other hydrocarbons in place of ethane

Natural Gas Engines

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## Hypothetical: In-Use Non-Methane Hydrocarbon (NMHC) w/wo Ethane Dedicated-NG CI-Certified Urban Bus



## Workgroup Discussion

- \* Should ARB align with U.S. EPA's option for Non-Methane Non-Ethane Hydrocarbon (NMNEHC) standards for gaseous fueled compression-ignition engines?
- \* Potential alternatives:
  - ☐ Do not align
    - Gaseous fueled compression-ignition engine families in California still need to certify to existing NMHC standards
  - ☐ Limit NMNEHC standards to Locomotives
    - Non-locomotive engine families still need to certify to existing NMHC standards

Natural Gas Engines

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## Staff Contact for Non-Ethane Hydrocarbon Standards

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Credits

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