Update on the Proposed Federal Phase 2 GHG and Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles

July 23, 2015
Sacramento, California
U.S. EPA/NHTSA Phase 2 Proposal: Important Next Step

- Fuel savings of ~77 billion gallons
- Improve mileage for a line haul truck from ~6 to ~9 miles per gallon
- Cuts ~1,040 MMT CO$_2$eq nationally
- Per Union of Concerned Scientists, total Phase 1 and 2 reduction nearly 40%
Some Missed Opportunities

• Advanced technologies only modestly included
• Aerodynamics on vocational vehicles and some trailers not addressed
• PM 2.5 increases from increased APU use should be mitigated
• Lower Mandatory NOx standard should be discussed
Today’s Presentation

- Background
- Federal Proposal Summary
- Staff’s Initial Assessment
- Next Steps
National Mobile Source GHG Emissions

- Medium and Heavy-duty trucks account for 1/5 of transportation sector GHG emissions.
- Fastest growing transportation sector in the US and globally.

California Emissions from Medium and Heavy-Duty Trucks

- 33% of Statewide NOx
- 26% of Statewide diesel PM
- 8% of Statewide GHG emissions
  - 21% of Transportation GHG
Phase 1 Standards

- First national GHG and fuel-efficiency standards for heavy-duty trucks (Class 2b-8)

Phase 1: Class 8 High Roof Sleeper Tractor Standard

- Baseline: 94 grams CO2/ton-mile
- 2014-2016: 75 grams CO2/ton-mile, Over 20% reduction
- 2017+: 72 grams CO2/ton-mile
Phase 1 Covers Three Vehicle Categories

Line-haul Tractors (Class 7-8)

Vocational Vehicles (Class 2b–8)

Pickups & Vans (Class 2b-3)
California Phase 1 GHG Regulations

• ARB harmonized with the federal Phase 1 Program in December 2013
  – Sunset redundant new tractor requirements
  – Maintained California trailer and pre-2010 tractor requirements
• Gave manufacturers ability to certify in California and ARB ability to enforce
• Will reduce CO$_2$ emissions in California by 11.7% in 2030
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ARB Coordination on Phase 2

• Weekly meetings with U.S. EPA and NHTSA Phase 2 teams
  – Late 2013-2014

• ARB commissioned aerodynamic testing of vocational vehicles and pup trailers
  – Up to 8% fuel consumption reduction for vocational aero

• Submitted technical letters
  – Hybrid NOx Check
  – Solar Glazing
Notice of Federal Proposed Rulemaking

• Pre-publication version of the Phase 2 Notice of Proposed Rulemaking (NPRM) issued June 19, 2015

• Final NPRM published July 13
  – Jointly issued by U.S. EPA and NHTSA
  – Triggers 60 day comment period

• Today’s presentation is an initial assessment

• In-depth review on-going
NPRM Structure

• Builds on Phase 1 structure
  – Adds trailers
  – Adds engine/transmission integration
• More ambitious and longer term standards
• Applies to MY 2018+ for trailers and MY 2021+ for engines and vehicles
• Proposed alternative phases in through MY 2027
  – Soliciting comments on phasing in by MY 2024
## Proposed Phase 2 Vehicle Standards: Benefits

<table>
<thead>
<tr>
<th>Category</th>
<th>CO2, Fuel Consumption Reduction vs. 2017 Phase 1 Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line-haul Tractors (including Engine Improvements)</td>
<td>18-24%</td>
</tr>
<tr>
<td>Trailers</td>
<td>3-8%</td>
</tr>
<tr>
<td>Vocational Vehicles (including Engine Improvements)</td>
<td>12-16%</td>
</tr>
<tr>
<td>Pickups and Vans (including Engine Improvements)</td>
<td>16%</td>
</tr>
</tbody>
</table>
• Continuation of Phase 1 separate engine standards
• Staff supports separate engine standards
• Approximately 4% engine improvements for compressed ignition engines compared to Phase 1
• U.S. EPA projects the use of many technologies including:
  – Waste heat recovery
  – Reduction of parasitic losses
  – Air flow Improvements
Line-haul Tractor Requirements

• Line-haul tractors are the biggest contributor to GHG emissions
• 18-24% reduction in CO$_2$ emissions from Phase 1
• Vehicle standard includes the use of:
  – Aerodynamic improvements
  – Engine, transmission, and driveline improvements
  – Lower tire rolling resistance
  – Idle reduction
Box-Type Trailers

- Trailers regulated at federal level for first time
- Aerodynamic devices applied to long and short box trailers only
- Low rolling resistance tires and automatic tire inflation
- Fuel efficiency improvement ~7-8%
Other Trailers

- Low rolling resistance tires and automatic tire inflation only
- Fuel efficiency improvement 3-4%

Non-box trailers
Vocational Vehicles

- Vocational vehicles include Class 2b-8 trucks that perform a variety of functions
- 12-16% reduction in CO$_2$ emissions beyond Phase 1
- Vehicle standard includes the use of:
  - Hybrids
  - Engine and transmission improvements
  - Low rolling resistance tires
Pickups & Vans

• ~16% reduction in CO$_2$ emissions beyond Phase 1
• Vehicle standard includes the use of:
  – Engine and transmission improvements
  – Aerodynamic and weight reduction
  – Gasoline hybrid technology
## Phase 2 NPRM Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No action</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Less Stringent than the Proposed Alternative applying only current off-the-shelf technologies</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Proposed alternative, fully phased-in by 2027 MY</td>
<td>U.S. EPA Preferred Alternative</td>
</tr>
<tr>
<td>4</td>
<td>Pulls ahead the proposed 2027 MY standards to 2024 MY</td>
<td>Comments Requested</td>
</tr>
<tr>
<td>5</td>
<td>Modest market adoption of advanced technologies</td>
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</tbody>
</table>
Both alternatives would result in fuel savings that would “pay” for the cost of the technologies

<table>
<thead>
<tr>
<th></th>
<th>Alternative 3 (MY 2027) [Payback in years]</th>
<th>Alternative 4 (MY 2024) [Payback in years]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line-haul Tractors</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Vocational</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Pickups &amp; Vans</td>
<td>3</td>
<td>4</td>
</tr>
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</table>
Other Improvements in Phase 2

- Removing blanket exemption for small manufacturers
- Close loophole that allowed the use of uncontrolled engines (glider kits)
- Test procedure improvements
  - Road grade added
  - Idle cycle added for vocational vehicles
  - Improved GEM model
  - Other test cycle improvements
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Staff’s Initial Assessment

- Proposal is an important next step but could be strengthened in specific areas:
  - Failed to significantly include advanced technologies
  - Alternative 4 should be chosen
  - Address PM 2.5 from APUs
  - Discuss a lower Mandatory NOx Standard
  - Other Improvements necessary
Advanced Technologies Essential to California’s Air Quality

- Advanced technologies are a critical element of California’s path to achieving GHG and Air Quality goals
- NPRM has modest penetration levels of hybrid technology
- Removes Phase 1 Advanced Technology credits
- Very pessimistic on the outlook for battery and fuel cells
ARB Recommends Alternative 4 at Minimum

• Fully phased-in by 2024
• Technologically feasible
• Standards are technology forcing in 2024 and less so in 2027
• Potential for earlier action on NOx
• Critical to achieving our GHG and petroleum reduction targets for 2030 and 2040
Additional Alternative 4 Benefits

- ~4 MMT more cumulative CO2 benefit by 2030 in California
- 22% reduction in petroleum usage in 2030
Phase 2 Projected to Increase Diesel PM

- Manufacturers are expected to shift to the use of auxiliary power units (APU) to comply with Phase 2
- Projected to increase diesel PM 2.5 outside of California
- APUs are not equipped with diesel particulate filters nationally
- Issue recognized but no action proposed
DPFs Needed on APUs

- U.S. EPA should require DPFs for APUs as part of Phase 2
  - ARB regulations already require DPFs
  - Multiple filters currently verified for APUs

<table>
<thead>
<tr>
<th>PM 2.5 Emissions (tons)</th>
<th>Baseline</th>
<th>Proposed Phase 2-No DPF</th>
<th>Proposed Phase 2-W/DPF Regulation</th>
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<tbody>
<tr>
<td></td>
<td>20000</td>
<td>22000</td>
<td>~9% Decrease</td>
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<tr>
<td></td>
<td>21000</td>
<td>23000</td>
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<td>26000</td>
<td>28000</td>
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10% Increase
Lower Mandatory NOx Standards Should be Addressed

• Proposal lacks a commitment for future NOx control
• GHG/NOx tradeoff can be avoided with a systems based approach
• ARB commissioned work to demonstrate feasibility of low NOx heavy-duty diesel and natural gas engines, while meeting GHG standards
• Staff to formally petition U.S. EPA
Other Potential Areas for Improvements

• Strengthen engine standards in conjunction with a stronger vehicle standard
• Expand trailer standards to include additional trailer types
• Expand use of aerodynamic devices on vocational vehicles
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ARB Staff Next Steps on NPRM

- Continuing in-depth review of the proposal
- Will testify at federal public hearing
- Will submit formal comments in the next 60 days
Next Steps

- Staff will continue to engage with Section 177 States and other stakeholders
- Staff will continue to work with U.S. EPA and NHTSA staff
- Final federal rule expected Spring 2016
California’s Phase 2 Proposal

• Remain committed to a strong and single national program which will support California’s GHG reduction commitments

• Planning to propose a California Phase 2 program approximately 6-12 months after the finalization of a federal rule

• Tentatively mid-2017

• May include California only elements