
Public Workshop
March 11, 2013
Outline

• Background
• Summary of U.S. EPA GHG Phase I Rule
• ARB GHG Phase I Proposal
• Preview of Phase II
• Next Steps
Background: CA Greenhouse Gas Efforts

• Targets and Requirements
  • AB 32 – Achieve 1990 level emissions by 2020
  • E.O. S-05-05 – Achieve 80% below 1990 by 2050

• Major ARB GHG programs in place
  • LEV III and ZEV Light-duty vehicle standards
  • In-Use Tractor Trailer GHG rule
  • Low Carbon Fuel Standard
  • SB 375 Regional Targets
  • Cap and Trade Program
Background: Tractor Trailer GHG Rule

• Adopted Jan 1, 2010
• Requirement using U.S. EPA SmartWay elements
  • Tractor aerodynamics
  • Trailer aerodynamics (side skirts, front & rear fairings)
  • Low rolling resistance (LRR) tires
• Applicability: In-use fleet rule
  • Tractors pulling 53’ or longer trailers
  • 53’ or longer box-type trailers
Background: U.S. EPA Adopts Phase I

- **Adopted August, 2011**

- Combination tractors (no trailers)

- Vocational vehicles (chassis)

- Heavy duty pickups and vans (whole vehicle)
Background: U.S. EPA Phase I Applicability

Class 1: 6,001 lb & less
- Minivan
- Utility van
- Multi-purpose
- Full-size pickup

Class 2b: 8,501 to 10,000 lb
- Full-size pickup
- Step van

Class 3: 10,001 to 14,000 lb
- City delivery

Class 4: 14,001 to 16,000 lb
- City delivery

Class 5: 16,001 to 19,500 lb
- Bucket
- City delivery
- Large walk-in

Class 6: 19,501 to 26,000 lb
- Beverage
- Single-axle van
- School bus
- Rack

Class 7: 26,001 to 33,000 lb
- Refuse
- Furniture
- City transit bus
- Medium conventional

Class 8: 33,001 lb & over
- Dump
- Cement
- Heavy conventional
- COE sleeper

Class 9: 6,001 lb & less
Background: ARB Proposal

• Adopt U.S. EPA Phase I standards
  • Enable ARB to certify vehicles and engines, and enforce in CA

• Harmonize with U.S. EPA standard to allow common compliance strategies

• Benefits of ARB proposal
  • More certainty of higher levels of compliance with U.S. EPA rule in California
  • GHG and criteria emission reductions, fuel savings
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U.S. EPA Phase I: Overview

• Establishes GHG standards for engines, vehicles
• Begins in MY2014, stringency increases to 2018
• Vehicle standards in three categories
  • Combination tractors (class 7 and 8)
  • Vocational vehicles (class 2b – 8)
  • Heavy-duty pickups and vans (class 2b, 3)
• Engine standards: HD gasoline and diesel engines
• Advanced technology and early compliance credits
• Flexibility with averaging, banking, trading (ABT)
• [http://www.epa.gov/otaq/climate/regs-heavy-duty.htm](http://www.epa.gov/otaq/climate/regs-heavy-duty.htm)
U.S. EPA Phase I: Vehicle Standards

- Combination tractors (class 7 and 8)
- Vocational vehicles (class 2b – 8)
- Heavy-duty pickups and vans (class 2b, 3)
U.S. EPA Phase I: Combination Tractors

- Vehicle CO2 standards (gCO2/ton-mile):

<table>
<thead>
<tr>
<th></th>
<th>Class 7</th>
<th>Class 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day Cab</td>
<td>Sleeper Berth</td>
</tr>
<tr>
<td>Low Roof</td>
<td>107</td>
<td>81</td>
</tr>
<tr>
<td>Mid Roof</td>
<td>119</td>
<td>88</td>
</tr>
<tr>
<td>High Roof</td>
<td>124</td>
<td>92</td>
</tr>
<tr>
<td>2014-2016 MY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 7</td>
<td>104</td>
<td>80</td>
</tr>
<tr>
<td>Class 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017 MY and beyond</td>
<td>115</td>
<td>86</td>
</tr>
</tbody>
</table>

- Estimated 10-23% reduction by 2018 vs. 2010
U.S. EPA Phase I: Combination Tractors (cont.)

• Demonstrate compliance with GHG Emissions Model (GEM):
  • U.S. EPA model evaluates impact of tractor strategies

• Input variables include:
  • Coefficient of drag;
  • Tire rolling resistance coefficient;
  • Weight reduction;
  • Vehicle speed limiter;
  • Extended idle reduction strategies
U.S. EPA Phase I: Combination Tractors (cont.)

• Anticipated compliance strategies:
  • Engine improvements
  • Auxiliary power units
  • Mass reduction
  • LRR tires
  • Improved aerodynamics
  • Reduced AC leakage
U.S. EPA Phase I: Vehicle Standards

- Combination tractors (class 7 and 8)
- Vocational vehicles (class 2b – 8)
- Heavy-duty pickups and vans (class 2b, 3)
U.S. EPA Phase I: Vocational Vehicles

- Vehicle CO2 standards (gCO2/ton-mile):
  - Estimated 10% reduction on average by 2018 vs. 2010

<table>
<thead>
<tr>
<th></th>
<th>LHD Class 2b-5</th>
<th>MHD Class 6-7</th>
<th>HHD Class 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2014 MY</strong></td>
<td>388</td>
<td>234</td>
<td>226</td>
</tr>
<tr>
<td><strong>2017 MY</strong></td>
<td>373</td>
<td>225</td>
<td>222</td>
</tr>
</tbody>
</table>

- Examples of vocational vehicles:
  - Delivery, refuse and cement trucks
  - Transit, shuttle and school buses
  - Emergency vehicles, motor homes and tow trucks
U.S. EPA Phase I: Vocational Vehicles (cont.)

• GHG Emissions Model (GEM) Compliance:
  • Standards apply to chassis manufacturer (not vehicle)
  • Input variable: Tire rolling resistance coefficient
  • May alternately certify the same way as Class 2b-3 HD pickup trucks and vans through fleet average standard

• Anticipated compliance strategies:
  • Engine improvements
  • Increased use of LRR tires
U.S. EPA Phase I: Vehicle Standards

• Combination tractors (class 7 and 8)
• Vocational vehicles (class 2b – 8)

• Heavy-duty pickups and vans (class 2b, 3)
U.S. EPA Phase I: HD Pickups and Vans

- Separate CO2 targets for SI and CI powered vehicles
- Estimated 15% lower CO2 by 2018 for CI engines; 10% lower CO2 for SI engines (vs. 2010)
- Fleet average standard for manufacturer that applies to combined HD pickups and vans produced in each model year
- Unique standard for each model year, dependent upon load capacity and production volume of each vehicle model
U.S. EPA Phase I: HD Pickups and Vans (cont.)

- N2O and CH4 standards (1037.104(c)):
  - N2O Vehicle Standard: 0.05 g/mile
  - CH4 Vehicle Standard: 0.05 g/mile

- Effective with 2014 and subsequent MYs

- Light-duty FTP and HFET drive cycle testing

- CO2 credits can be used to offset this requirement
U.S. EPA Phase I: HD Pickups and Vans (cont.)

• Certification:
  • Dynamometer testing
  • No GEM model simulation

• Anticipated compliance strategies:
  • Engine improvements, improved transmissions
  • Reduced accessory loads
  • LRR tires, mass reduction
U.S. EPA Phase I: Engine Standards

• Heavy-duty gasoline and diesel engines
U.S. EPA Phase I: HD Engine CO2 Standards

• Gasoline engine CO2 standard:
  • 627 gCO2/bhp-hr (MY 2016 and beyond)

• Diesel engine CO2 standards (gCO2/bhp-hr):

<table>
<thead>
<tr>
<th></th>
<th>LHD (2b-5)</th>
<th>MHD (Class 6-7)</th>
<th>HHD (Class 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vocational Veh</td>
<td>Tractors</td>
<td>Vocational Veh</td>
</tr>
<tr>
<td>2014-2016 MY</td>
<td>600</td>
<td>600</td>
<td>502</td>
</tr>
<tr>
<td>2017 and Later</td>
<td>576</td>
<td>576</td>
<td>487</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
U.S. EPA Phase I: HD Engine CO2 Standards

- Optional Phase-in of CO2 Standards (1036.150(e))
  - Aligns with OBD phase-in schedule

| Alternate Phase-in, Tractor Engines (g/bhp-hr) | | Alternate Phase-in, Vocational Engines (g/bhp-hr) | |
|-----------------------------------------------|-----------------------------------------------|
| MHD Diesel | HHD Diesel | LHD/MHD Diesel | HHD Diesel |
| 2013-2015 MY | 512 | 485 | 618 | 577 |
| 2016 and Later | 487 | 460 | 576 | 555 |

- Alternate Standards (1036.620), only MY2014-16
  - 2.5%/yr CO2 reduction from MY2011
    - Vocational vehicles in LHD and MHD
  - 3%/yr CO2 reduction from MY2011
    - Vocational vehicles in HHD, and Tractors (MHD, HHD)
U.S. EPA Phase I: HD Engines – Other Pollutants

• N2O and CH4 standards for all HD engines:
  • 0.10 g/bhp-hr (N2O) and 0.10 g/bhp-hr (CH4)
  • Effective for 2014 MY and later CI engines
  • Effective for 2016 MY and later SI engines

• HFC Standards (Tractors, HD Pickups & Vans)
  • Effective for 2014 MY tractors and later
  • A/C systems with a refrigerant capacity greater than 733 grams, the leakage standard is $= 1.5 \% \text{ per year}$
  • A/C systems with a refrigerant capacity of 733 grams or less, the leakage standard is 11.0 grams/year
U.S. EPA Phase I: Standards over Useful Life

• Engines and vehicles must comply with the standards for the useful life

• Useful life definitions:
  • Class 2b - 5 vehicles, and LHD CI and SI engines:  
    • 10 years / 110,000 miles
  • Class 6 - 7 vehicles, and MHD CI engines:  
    • 10 years / 185,000 miles
  • Class 8 vehicles, and HHD CI engines:  
    • 10 years / 435,000 miles
U.S. EPA Phase I: Special Vehicle & Engine Credits

I. Early Credits
• Intent: acknowledge early action and achievement beyond established engine and vehicle standards
• 1.5x credit multiplier
• Generated in MY2013 for use in subsequent years
• Must certify entire subcategory

II. Advanced Technology Credits
• Intent: encourage development of technologies that are not commercially available
• 1.5x credit multiplier
• Eligible technologies include hybrid powertrains, rankine cycle engines, plug-in and fuel cell EVs
U.S. EPA Phase I: Special Vehicle & Engine Credits

III. Innovative Vehicle or Engine Tech. Credits

- Intent: encourage technologies that have CO2 reductions not captured by test procedure or GEM
- No credit multiplier
- Eligible technologies include predictive cruise control, gear-down protection, active aerodynamic features, and adjustable ride height

IV. ABT program

- Intent: Credit for lower CO2 emission levels than standard for one or more vehicles
- Can be used to offset higher emission levels in the same averaging set (e.g. weight class)
- Can be banked/saved for later use
- Can be traded to another manufacturer
U.S. EPA Phase I: Special Vehicle & Engine Credits

V. Low N2O Credits for Engine Manufacturer

• Intent: to encourage N2O reductions

• Manufacturers that certify engines with full useful life N2O FEL emissions less than 0.04 g/bhp-hr could generate 2.98 grams of CO2 credit for each 0.01 grams of N2O reduced

• N2O credits are effective for MY 2014-2016
U.S. EPA Phase I: Small Business Exemptions

- Small businesses are exempt from the Phase 1 regulation
  - Vocation vehicle and engine manufacturers
- Small business as defined by 13CFR121.201 is determined by the max. number of employees
  - HD vehicle manufacturing: max of 1,000 employees
  - HD engine manufacturing: max of 750 employees
- Small volume manufacturers who produce a combined U.S. sales of fewer than 10,000 units may follow special certification procedures
# U.S. EPA Phase I: Costs and Savings

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Cost</th>
<th>Lifetime Fuel Savings</th>
<th>Lifetime Fuel Savings</th>
<th>Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ ton Pickup (e.g. F250)</td>
<td>$1,050</td>
<td>2,500 gallons</td>
<td>$7,200</td>
<td>2 years</td>
</tr>
<tr>
<td>Medium duty vocational</td>
<td>$380</td>
<td>2,000 gallons</td>
<td>$5,900</td>
<td>1 year</td>
</tr>
<tr>
<td>Class 8 Combination Tractor (interstate freight)</td>
<td>$6,220</td>
<td>26,150 gallons</td>
<td>$79,100</td>
<td>1 year</td>
</tr>
</tbody>
</table>

*Based on 2018 standards and net present value 3% discount rate*

Reference: EPA Heavy Duty Program workshop November 10, 2011
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ARB Phase I: Regulation Proposal

• Same structure and stringency levels as U.S. EPA

• For the HD Pickup/Van category, will use national pooling for fleet average standard

• ARB to use U.S. EPA GEM model for vehicle certification

• ARB to maintain Tractor Trailer GHG in-use requirements, as well as Anti-Idling requirements
ARB Phase I: Distinctions from EPA

• Program start date
  • ARB rule not final until fall of 2014

• Initial credits in U.S. EPA rule (MY2013-2014)
  • ARB rule to recognize U.S. EPA compliance credits to ensure harmony of compliance in both rules

• Definition of Urban Bus
  • ARB defines an Urban Bus differently for other California rules.
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Phase II Development

- Phase I was intended as a first step for standards
- Joint Phase II effort: ARB, U.S. EPA, & NHTSA
- More stringent HDV CO2 standards beyond 2018
- Current analysis focusing on technology and cost feasibility for advanced strategies
- Full rulemaking process planned at both the federal agencies and separately at ARB
ARB Phase I: Next Steps

• Public workshop  Mar 11, 2013

• Release draft regulatory language  Summer 2013

• Public comment on staff report begins  Sep 9, 2013

• Board hearing  Oct 24-25, 2013
Next Steps

- Comments and questions can be directed to:

  Joshua Cunningham
  (916) 324-2553
  jcunning@arb.ca.gov
ADDITIONAL MATERIAL
U.S. EPA Phase I: HD Pickups and Vans

Refer to 40 CFR Part 137.104 and 137.150 for full details

Diesel Vehicles

CO2 (grams per mile)

Work Factor (pounds)
U.S. EPA Phase I: HD Pickups and Vans (cont.)

Refer to 40 CFR Part 137.104 and 137.150 for full details.