

California Environmental Protection Agency



Air Resources Board

*Proposed New regulation: Heavy
Duty Greenhouse Gas Standards for
New Vehicle and Engines (Phase I)*

Public Workshop

March 11, 2013

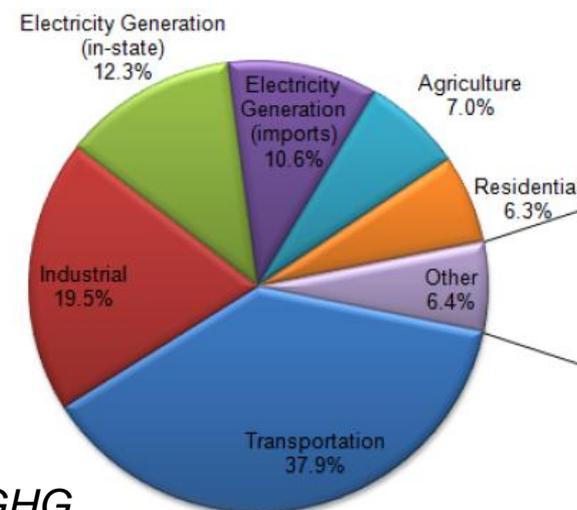


Outline

- 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

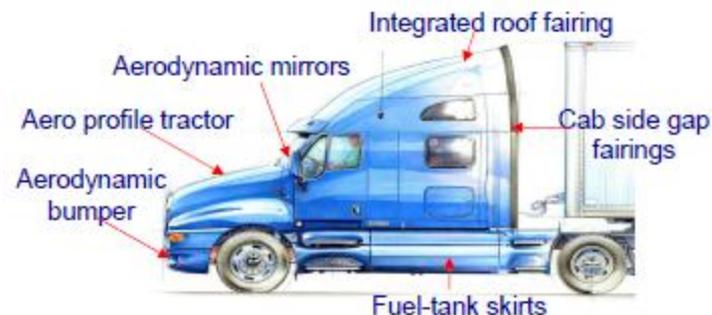
- Targets and Requirements
 - AB 32 – Achieve 1990 level emissions by 2020
 - E.O. S-05-05 – Achieve 80% below 1990 by 2050
- Major ARB GHG programs in place
 - LEV III and ZEV Light-duty vehicle standards
 - In-Use Tractor Trailer GHG rule
 - Low Carbon Fuel Standard
 - SB 375 Regional Targets
 - Cap and Trade Program



2009 CA GHG

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

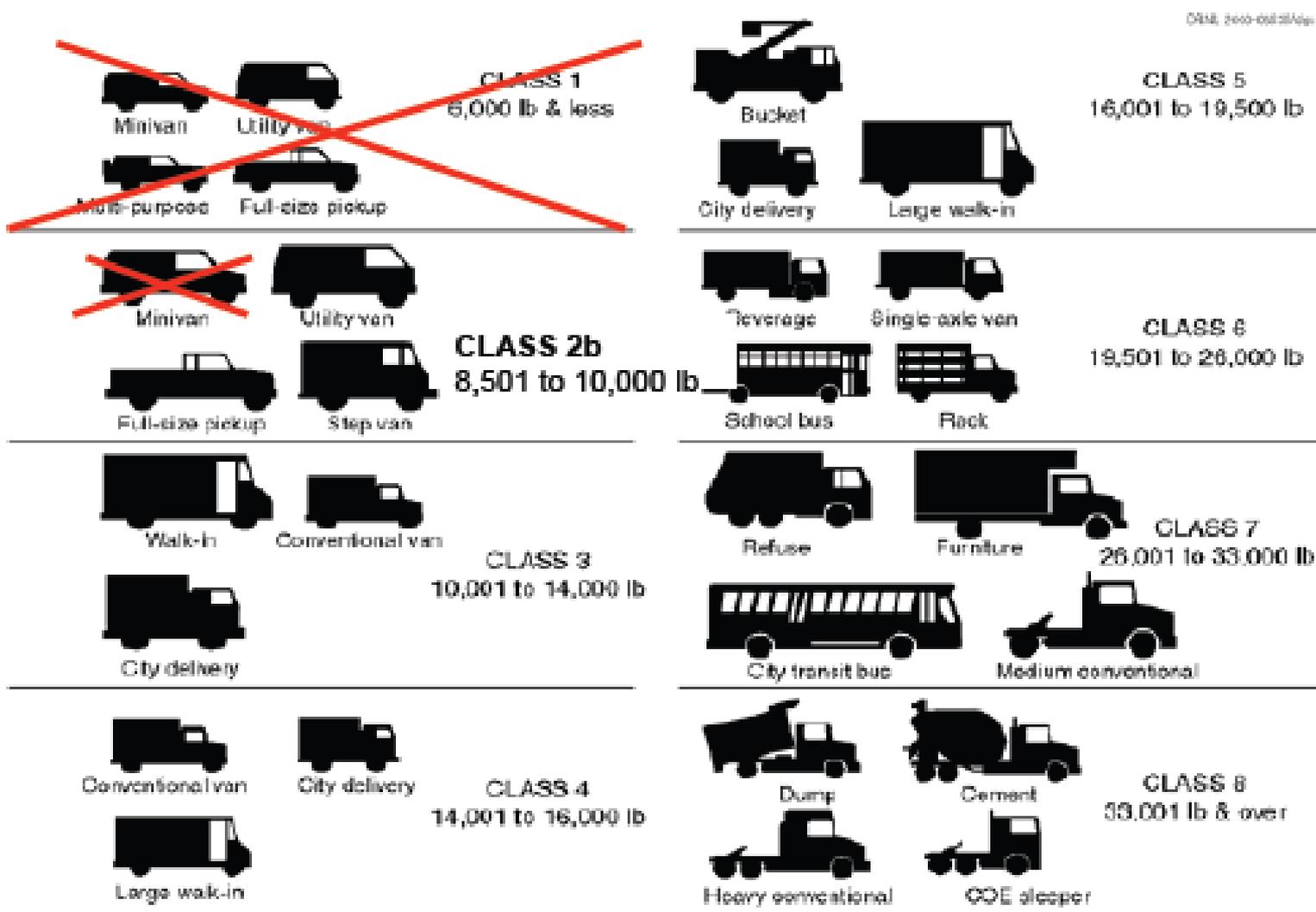


Background: U.S. EPA Adopts Phase I

- *Adopted August, 2011*
- Combination tractors (no trailers)
- Vocational vehicles (chassis)
- Heavy duty pickups and vans (whole vehicle)



Background: U.S. EPA Phase I Applicability



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>

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):

HD Combination Tractor Vehicle Standards (gCO2/ton-mile)						
	2014-2016 MY			2017 MY and beyond		
	Class 7	Class 8		Class 7	Class 8	
		Day Cab	Sleeper Berth		Day Cab	Sleeper Berth
Low Roof	107	81	68	104	80	66
Mid Roof	119	88	76	115	86	73
High Roof	124	92	75	120	89	72

- 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
 - LRR tires
 - Auxiliary power units
 - Improved aerodynamics
 - Mass reduction
 - 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

Vocational Vehicle CO ₂ Standard (gCO ₂ /ton-mile)			
	LHD Class 2b-5	MHD Class 6-7	HHD Class 8
2014 MY	388	234	226
2017 MY	373	225	222

- 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):

Final HD Diesel Engine Standards (gCO2/bhp-hr)

	LHD (2b-5)	MHD (Class 6-7)		HHD (Class 8)	
		Vocational Veh	Tractors	Vocational Veh	Tractors
2014-2016 MY	600	600	502	567	475
2017 and Later	576	576	487	555	460

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	2013-2015 MY	618	577
2016 and Later	487	460	2016 and Later	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 % 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

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

* 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:

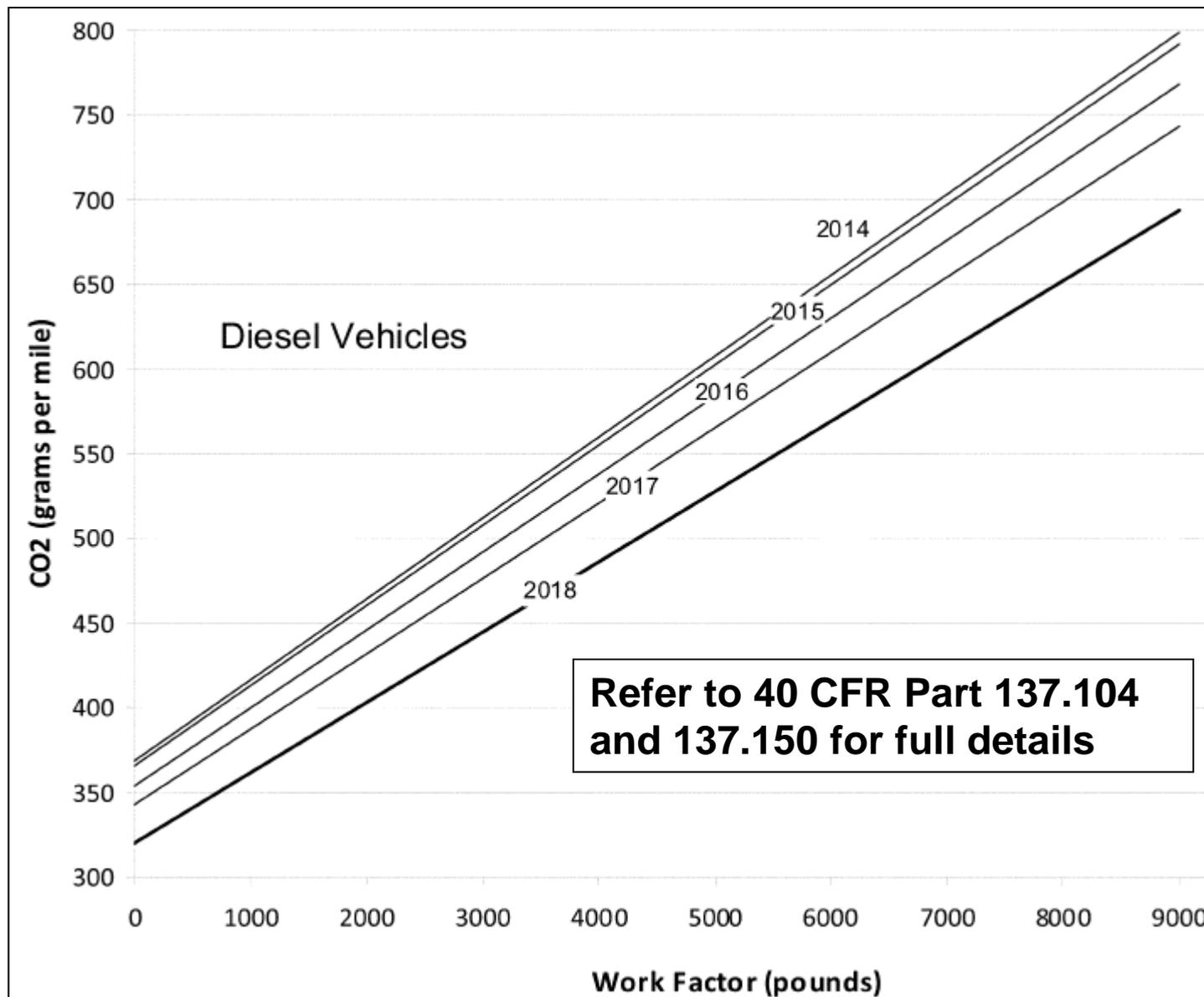
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ADDITIONAL MATERIAL

U.S. EPA Phase I: HD Pickups and Vans



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

