



# **Greenhouse Gas (GHG) Emission Requirements Heavy-Duty Pickup Trucks and Vans**

Industry/EPA Workshop

Compliance Division

Washtenaw Community College

November 3, 2011



# Organization of Topics

<b>Topics</b>	<b>Slide Numbers</b>
Overview	3-4
Standards	5-16
Application for Certification	17-26
Credits	28-30
Reporting	32-33
Additional Information Sources	34-35



# How Does This Apply to HD Pickup Trucks and Vans?

- Regulations are located at 40 CFR Part 1037
  - §1037.104 – Exhaust Emissions Standards for CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O
  - § 1037.115 – Other Requirements
  - § 1037.150 (a, b, c, e, f, g, h, i, l, m) – Interim Provisions
  - § 1037.740 – Restrictions for Using Emission Credits
  - § 1037.801 - Definitions
- Applicable to 2014 and later model year new heavy-duty Vehicles
  - Specifically regulates emissions of carbon dioxide, nitrous oxide, methane, and hydrofluorocarbons
- Excluded Vehicles include:
  - Vehicles not meeting definition of “motor vehicle” or “heavy-duty vehicle”
  - Medium-duty passenger vehicles
  - Vehicles produced before 2014 model year, unless certified under §1037.150 (except early credits provision)
  - Vehicles subject to light-duty greenhouse gas standards of 40 CFR part 86
  - Small manufacturers qualifying under Small Business Administration regulations at 13 CFR 121



# HD Pickup Truck and Van Program

- In general, the HD pickup truck and van program strongly resembles the existing non-GHG program for these vehicles and the existing LD GHG program
- Today's briefing focuses on the aspects of the program which are unique



# **GHG STANDARDS**

# HD Pickup Truck & Van CO2 Standards

1037.104

- The HD Pickup Truck and Van CO2 emissions standards:
  - Begin in 2014MY
  - Are CO2 standards, not CREE
  - Represent a production-weighted fleet-average standard where all vehicles in this category form a single averaging set

$$\text{Fleet-Average Standard} = \frac{\sum[\text{Target}_i \times \text{Volume}_i]}{\sum[\text{Volume}_i]}$$

- The GHG emission standards for these vehicles apply for a weighted average of 55% FTP City and 45% Highway test cycle (new requirement for Federal HD) where the vehicle is tested at Adjusted Loaded Vehicle Weight (ALVW)



# HD Pickup Truck & Van CO<sub>2</sub> Standards

1037.104

## Spark Ignition

CO<sub>2</sub> Target (g/mile) = 0.0440 x WF + 339

## Compression Ignition

CO<sub>2</sub> Target (g/mile) = 0.0416 x WF + 320

$$WF = 0.75 \times (GVWR - \text{Curb Weight} + xwd) + 0.25 \times (GCWR - GVWR)$$

Where:

$xwd = 500$  pounds if the vehicle has four-wheel drive or all-wheel drive;  $xwd = 0$  pounds for all other vehicles.

# HD Pickup Truck & Van GHG Phase-in

1037.150(b)

**Table 1 to 1037.150**

Model Year and Engine Cycle	Alternate CO <sub>2</sub> Target (g/mile)
2014 Spark-Ignition	$[0.0482 \times (WF)] + 371$
2015 Spark-Ignition	$[0.0479 \times (WF)] + 369$
2016 Spark-Ignition	$[0.0469 \times (WF)] + 362$
2017 Spark-Ignition	$[0.0460 \times (WF)] + 354$
2014 Compression-Ignition	$[0.0478 \times (WF)] + 368$
2015 Compression-Ignition	$[0.0474 \times (WF)] + 366$
2016 Compression-Ignition	$[0.0460 \times (WF)] + 354$
2017 Compression-Ignition	$[0.0445 \times (WF)] + 343$

**Table 2 to 1037.150**

Model Year and Engine Cycle	Alternate CO <sub>2</sub> Target (g/mile)
2014 Spark-Ignition	$[0.0482 \times (WF)] + 371$
2015 Spark-Ignition	$[0.0479 \times (WF)] + 369$
2016-2018 Spark-Ignition	$[0.0456 \times (WF)] + 352$
2014 Compression-Ignition	$[0.0478 \times (WF)] + 368$
2015 Compression-Ignition	$[0.0474 \times (WF)] + 366$
2016-2018 Compression-Ignition	$[0.0440 \times (WF)] + 339$





# Optional Certification under §1037.104 1037.150(I)

- You may certify certain complete or cab-complete vehicles to the standards of §1037.104 (HD Pickup Truck and Van standards), such as:
  - Complete or cab-complete spark-ignition vehicles
  - Cab-complete vehicles based on a complete sister vehicle
  - Class 2b or 3 incomplete vehicles

## Restrictions:

- Generally, does not affect criteria pollutant certification

# HD Chassis-Certification Path #1

## Complete HD Pickup Trucks and Vans

		Class 2b/3 complete
Spark-ignition	Criteria	C
	GHG	
Diesel	Criteria	C or E
	GHG	

**E** = engine-certified (g/hp-hr) for criteria pollutants and treated as a vocational vehicle for GHG with separate engine certification (g/hp-hr) and vehicle certification with GEM (g/ton-mile)

**C** = chassis-certified (g/mile)

**C** or **E** = manufacturer can choose between chassis-certification and engine-certification

- Spark Ignition vehicles must chassis certify for both criteria and GHG emissions
- Diesel vehicles may choose to either:
  - Chassis certify for both criteria and GHG emissions –or–
  - Engine certify for criteria emissions and certify as a vocational vehicle for GHG emissions with separate engine certification and vehicle certification using GEM

# Optional HD Chassis-Certification Path #2

Incomplete HD Pickups and Vans

1037.104(f), 1037.150(l)

		Class 2b/3 Incomplete	
Spark-ignition	Criteria	C	E
	GHG	C <sub>(sister)</sub>	
Diesel	Criteria	C	E
	GHG	C <sub>(sister)</sub>	

**E** = engine-certified (g/hp-hr) for criteria pollutants and treated as a vocational vehicle for GHG with separate engine certification (g/hp-hr) and vehicle certification with GEM (g/ton-mile)

**C** = chassis-certified (g/mile)

**C** and **E** = manufacturer can choose between chassis-certification and engine-certification

- Spark Ignition and Diesel vehicles may choose to either:
  - Chassis certify for both criteria and GHG emissions: further may use a sister vehicle for purposes of GHG compliance
  - or–
  - Engine certify for criteria emissions and certify as a vocational vehicle for GHG emissions with separate engine certification and vehicle certification using GEM



# Optional HD Chassis-Certification Path #3

## Class 4 and Above Vehicles

### 1037.150(I)

		Classes greater than Class 3
Spark-ignition	Criteria	<b>E</b>
	GHG	<b>C or E</b>
Diesel	Criteria	<b>E</b>
	GHG	

**E** = engine-certified (g/hp-hr) for criteria pollutants and treated as a vocational vehicle for GHG with separate engine certification (g/hp-hr) and vehicle certification with GEM (g/ton-mile)  
**C** = chassis-certified (g/mile)  
**C or E** = manufacturer can choose between chassis-certification and engine-certification

- Spark Ignition and Diesel vehicles must engine certify for criteria emissions
- Diesel vehicles must:
  - Certify as a vocational vehicle for GHG emissions with separate engine certification and vehicle certification
- Spark ignition vehicles may choose to either:
  - Chassis certify for GHG emissions (2014MY and later) –or –
  - Certify as a vocational vehicle for GHG emissions with separate engine certification (2016MY and later) and vehicle certification using GEM (2014MY and later)



# Optional HD Chassis-Certification Path #4

## Loose Engine Provision

### 1037.150(m)

		Loose engines (for any HD vehicle class)
Spark- ignition	Criteria	<b>E</b>
	GHG	<b>C</b> (surrogate) or <b>E</b>
Diesel	Criteria	<b>E</b>
	GHG	

**E** = engine-certified (g/hp-hr) for criteria pollutants and treated as a vocational vehicle for GHG with separate engine certification (g/hp-hr) and vehicle certification with GEM (g/ton-mile)

**C** = chassis-certified (g/mile)

**C** or **E** = manufacturer can choose between chassis-certification and engine-certification

- Spark Ignition and Diesel vehicles must engine certify for criteria emissions
- Diesel vehicles must:
  - Certify as a vocational vehicle for GHG emissions with separate engine certification and vehicle certification using GEM
- Spark ignition vehicles may choose to either:
  - Chassis certify for GHG emissions using the highest ETW vehicle powered by the engine as a surrogate GHG result (with maximum of 15,000 engines or 10% of total HD engine production of the family; also not allowed to generate credits) –or –
  - Certify as a vocational vehicle for GHG emissions with separate engine certification and vehicle certification



# HD Pickup Truck and Van N<sub>2</sub>O and CH<sub>4</sub> Standards

1037.104(c)

- The GHG emission standards for these vehicles apply for a weighted average of 55% FTP City and 45% Highway test cycle

HD Pickup Truck and Van Standards (g/mile):

Model Years	CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions
2014 and Later	0.05	0.05

- Use CO<sub>2</sub> credits can be used to offset



# HFC Standards

## 1037.115(c)

- HFC emissions are controlled through a leakage standard, not a credit program
- No averaging, banking, or trading of HFC credits is allowed
- The leakage of refrigerant from an A/C system may not exceed 1.50 percent per year
  - For systems with refrigerant capacities less than 734 grams, the leakage may not exceed 11.0 grams per year



# Dual, Multi, or Flex Fuel Vehicles

## 1037.104(d)(10)

- Perform exhaust testing on each fuel type
- Use either the conventional fueled CO<sub>2</sub> emission rate or a weighted average of the emission results as specified in 40 CFR 600.510-12(k)
- Must meet the N<sub>2</sub>O and CH<sub>4</sub> standards on both fuels or:
  - Certify to an alternate standard for N<sub>2</sub>O or CH<sub>4</sub> emissions (offset by the CO<sub>2</sub> credit provision) and:
  - Not exceed the alternate standard when tested on either fuel.





# CERTIFICATION



# GHG Certification/Compliance Timeline

- Submit pre model year report with cert preview
- 90 days after end of model year:
  - Submit report including production volumes of vehicle subconfigurations
- 270 days after end of model year:
  - Submit final report

GHG Pre Model Year Report Templates will be available at [www.epa.gov/otaq/certdat2.htm](http://www.epa.gov/otaq/certdat2.htm)



# PMY Reports for Class 2b-3 Pickup Trucks and Vans

- Required by EPA and NHTSA in accordance with 40 CFR 1037.104 (EPA) and 49 CFR 535.8 (NHTSA)
- Single submission through EPA database for both agencies
- Reports can be submitted:
  - As early as manufacturer's first pre-certification meeting with EPA and NHTSA
  - As late as manufacturer's first application submission for a certificate of conformity



# PMY Report - Purpose and Contents

- Purposes
  - Built on continuing long-standing process for LD CAFE program
  - Provides early estimates of manufacturers' good faith efforts to comply with GHG and FC standards
  - Pre-requisite for EPA approving manufacturers' applications for certificates of conformity
- Overview of Contents
  - Subconfiguration target and fleet standards
  - Test group and fleet certification results
  - Production volumes
  - Joint approvals for innovative technology
  - Certification statements for EPA and NHTSA
  - Credit plans



# HD Pickup Truck PMY Template



# Subconfigurations

1037.104(a)(4), 1037.104(d)(9)

- May group subconfigurations that have the same equivalent test weight, GVWR, and GCWR. Assume the curb weight equals two times ETW minus GVWR.
- May group together other subconfigurations if use the lowest target value for any of the subconfigurations
- Must test at least the greater of 10 subconfigurations or ten percent of subconfigurations (unless we approve a lower number)
- At least 90 percent of production volume in the configuration level must be represented by test data (actual data, data substituted, or analytically derived)



# Analytically Derived CO<sub>2</sub> (ADC)

1037.104(g)

- Provision allows the use of analytically derived CO<sub>2</sub> emission rates based on baseline test data instead of measured emissions rates
- ADCs are similar to ADFEs used for light-duty vehicles
- Calculated using the equation below, rounded to the nearest 0.1 g/mile

$$ADC = CO_{2base} + 2.18 \cdot \Delta F0 + 37.4 \cdot \Delta F1 + 2257 \cdot \Delta F2 + 189 \cdot \Delta AR + 0.0222 \cdot \Delta ETW$$

- ADC = Analytically derived combined city/highway CO<sub>2</sub> emission rate (g/mile) for a new vehicle.
- CO<sub>2</sub>base = Combined city/highway CO<sub>2</sub> emission rate (g/mile) of a baseline vehicle.
- Road load force coefficients
  - $\Delta F0$  = F0 of the new vehicle – F0 of the baseline vehicle.
  - $\Delta F1$  = F1 of the new vehicle – F1 of the baseline vehicle.
  - $\Delta F2$  = F2 of the new vehicle – F2 of the baseline vehicle.
- $\Delta AR$  = Axle ratio of the new vehicle – axle ratio of the baseline vehicle.
- $\Delta ETW$  = ETW of the new vehicle – ETW of the baseline vehicle.



# ADC Constraints

## 1037.104(g)

- The baseline vehicle must (unless we approve otherwise)
  - Comply with all applicable emission standards in the model year associated with the ADC
  - Include in the pool of tests all official tests of the same or equivalent base engine, transmission class, engine code, transmission code, engine horsepower, dynamometer drive wheels, and compression ratio
  - May supplement the pool with tests associated with the worst-case engine or transmission codes and carryover or carry-across engine families
  - Must eliminate from the pool tests that were previously used during the model year as baseline tests in ten other ADC subconfigurations
  - Select the tested configuration with the smallest absolute difference between the ADC and the test CO<sub>2</sub> emission rate as the baseline subconfiguration
- Downward adjustment of ADC from the baseline is limited to ADC values 20 percent below the baseline emission rate
- Upward adjustment is not limited
- No more than 40 percent of the subconfigurations tested in the final CO<sub>2</sub> submission may be represented by ADCs





# HFC Emissions

1037.115(c)

- An excel file is available to calculate percent leakage and leakage rate of HFC emissions

<b>1. RIGID PIPE CONNECTIONS</b> Enter the number of each type of fitting in the system.		<b>3. FLEXIBLE HOSES</b> Enter the dimensions for each hose, by hose type, in the system.		<b>4. HEAT EXCHANGERS, MUFFLERS, RECEIVER/DRIERS, AND ACCUMULATORS</b> Emission rate for all devices combined assumed to be 0.5 x 0.522. Emission rate for all devices (g/year): <b>0.261</b>																										
<table border="1"> <tr><th>Type of connection</th></tr> <tr><td>Single O ring:</td></tr> <tr><td>Single captured O ring:</td></tr> <tr><td>Multiple O ring:</td></tr> <tr><td>Seal washer:</td></tr> <tr><td>Seal washer with O ring:</td></tr> <tr><td>Metal gasket:</td></tr> <tr><td> </td></tr> <tr><td>Rigid pipe connections emission</td></tr> </table>		Type of connection	Single O ring:	Single captured O ring:	Multiple O ring:	Seal washer:	Seal washer with O ring:	Metal gasket:		Rigid pipe connections emission	<table border="1"> <tr><th>All Rubber Hose</th></tr> <tr><td>High pressure side, hose 1</td></tr> <tr><td>High pressure side, hose 2</td></tr> <tr><td>High pressure side, hose 3</td></tr> <tr><td>High pressure side, hose 4</td></tr> <tr><td>Low pressure side, hose 1</td></tr> <tr><td>Low pressure side, hose 2</td></tr> <tr><td>Low pressure side, hose 3</td></tr> <tr><td>Low pressure side, hose 4</td></tr> </table>		All Rubber Hose	High pressure side, hose 1	High pressure side, hose 2	High pressure side, hose 3	High pressure side, hose 4	Low pressure side, hose 1	Low pressure side, hose 2	Low pressure side, hose 3	Low pressure side, hose 4	<b>5. COMPRESSORS</b> Enter the number of each type of fitting in the appropriate cell below:								
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Single O ring:																														
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Multiple O ring:																														
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<b>2. SERVICE PORTS AND REFRIGERANT CONTROL DEVICES</b> Enter the number of each type of fitting in the system.		<table border="1"> <tr><th>Standard barrier or veneer hose</th></tr> <tr><td>High pressure side, hose 1</td></tr> <tr><td>High pressure side, hose 2</td></tr> <tr><td>High pressure side, hose 3</td></tr> <tr><td>High pressure side, hose 4</td></tr> <tr><td>Low pressure side, hose 1</td></tr> <tr><td>Low pressure side, hose 2</td></tr> <tr><td>Low pressure side, hose 3</td></tr> <tr><td>Low pressure side, hose 4</td></tr> </table>		Standard barrier or veneer hose	High pressure side, hose 1	High pressure side, hose 2	High pressure side, hose 3	High pressure side, hose 4	Low pressure side, hose 1	Low pressure side, hose 2	Low pressure side, hose 3	Low pressure side, hose 4	<table border="1"> <tr><th>Type of Fitting</th><th>No.</th></tr> <tr><td>O-ring housing seals:</td><td>1</td></tr> <tr><td>Molded housing seals:</td><td>1</td></tr> <tr><td>Fitting adapter plates:</td><td>1</td></tr> <tr><td>Gasket housing seals:</td><td> </td></tr> <tr><td>Lips on shaft seal (belt-driven compressors only):</td><td>1</td></tr> <tr><td> </td><td> </td></tr> <tr><td>Compressor emission rate (g/year):</td><td>11.223</td></tr> </table>		Type of Fitting	No.	O-ring housing seals:	1	Molded housing seals:	1	Fitting adapter plates:	1	Gasket housing seals:		Lips on shaft seal (belt-driven compressors only):	1			Compressor emission rate (g/year):	11.223
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				<b>FOR REFRIGERANT CAPACITY FOR SYSTEMS WITH LESS THAN OR EQUAL TO 733 GRAMS</b> <b>TOTAL SYSTEM REFRIGERANT EMISSION RATE (G/YEAR):</b> <b>19.2</b>																										
				<b>FOR REFRIGERANT CAPACITY FOR SYSTEMS WITH GREATER THAN 733 GRAMS</b> <b>TOTAL SYSTEM REFRIGERANT PERCENT LEAKAGE (%/YEAR):</b> <b>1.5%</b>																										





# Production and In-use Standards

## 1037.104(b)

- Each vehicle has an in-use CO<sub>2</sub> standard that is calculated from the test results and applies for selective enforcement audits and in-use testing.
  - The in-use CO<sub>2</sub> standards is equal to the deteriorated emission level \* 1.10, rounded to the nearest 0.1 g/mile
  - For multi-fuel vehicles, must determine in-use CO<sub>2</sub> standards for each fuel
- The in-use N<sub>2</sub>O & CH<sub>4</sub> standards are the FEL (no multiplier)
- Unlike LD GHG IUVP program, manufacturers are not required to perform any GHG measurements or specific tests for HD pickup trucks and vans
- EPA In-use Surveillance Testing
  - EPA may measure CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub> on 2014 and later in-use vehicles
    - FTP and Highway cycles only
  - Any failures or unusual results would need to be addressed by the manufacturer



# CREDITS



# CO2 Credits

Sum of five independent calculations (calculated separately for each averaging set)  
= total credits in a model year

1. Averaging, Banking, and Trading
  - 1037.150(m) – loose engines certified under this provision cannot generate credits
2. Early Credits – 1037.150(a)
3. Innovative Technology Credits – 1037.104(d)(13)
4. Advanced Technology Credits – 1037.150(i)
5. CO2 credits to show compliance with CH4 and/or N2O standards – 1037.104(c)

Credits are always rounded to the nearest whole megagrams (Mg)

# GHG Credit Programs



## Early Credits – 1037.150

### (a)(2):

- 2013 MY only (except electric vehicles)
- Entire fleet
- No multiplier

### Restrictions:

- Credits stay in averaging set – 1037.740(a)
- 5 year credit life - 1037.740(c)

## Advanced Technology Credits – 1037.150(i):

- Vehicles with Rankine cycle, electric vehicles, fuel cell vehicles, and hybrid powertrains
- Only a single certifier may establish credits for an advanced technology, no double counting credits
- 1.5x multiplier – 1037.150(i)

### Restrictions:

- Credits can go into any averaging set, except only 60,000 Mg CO<sub>2</sub> credits can come into a service class from another service class - 1037.740(b)
- 5 year credit life – 1037.740(c)

## Innovative Technology Credits – 1037.104(d)(13):

- Vehicle or engine technology which is not captured on test and not in common use in 2010 MY for heavy-duty pickups and vans
- Do not need justification for not using the 5-cycle
- No multiplier

### Restrictions:

- Credits stay in averaging set – 1037.740(a)
- 5 year credit life - 1037.740(c)



## GHG Credit Programs (cont.)

### CO2 Credits to Offset CH4 and/or N2O FEL – 1037.104(c):

- Calculate the CH4 and/or N2O emission credits needed using the equation:

$$\text{Emission credits needed (Mg)} = (\text{FEL} - \text{Standard}) \cdot (\text{Volume}) \cdot (\text{UL}) \cdot \text{GWP} \cdot (10^{-6})$$

- where GWP of CH4 is 25 and GWP of N2O is 298 Mg

### Restrictions:

- None



# REPORTING





# Compliance Information

- EPA is committed to both protecting CBI and to achieving transparency in implementation of the GHG program
- EPA currently publishes:
  - Compliance Report
  - Certification data (certification testing summary)
- EPA does not consider emissions data to be CBI
- For GHG, EPA intends to publish as much non-CBI information for each manufacturer after the end of the model year as possible



## Future Guidance

- EPA will issue guidance on future subjects when and if necessary.
- Please use the index cards to submit questions



## For More Information:

- A copy of this presentation will be available at [www.epa.gov/otaq/climate/regulations.htm](http://www.epa.gov/otaq/climate/regulations.htm)
- See GHG rulemaking documents at [www.epa.gov/otaq/climate/regulations.htm](http://www.epa.gov/otaq/climate/regulations.htm)
- See Federal Register at 76 FR 57106, September 15, 2011
- See Code of Federal Regulations, 40 CFR Part 1037 and Part 86
- Contact your EPA team member