

## Frequently Asked Questions: EPA Greenhouse Gas Provisions for Clean Alternative Fuel Conversions of Light-Duty Vehicles and Medium-Duty Passenger Vehicles

**T**his information is intended to assist conversion manufacturers in understanding the greenhouse gas regulations. It is not a substitute for compliance with EPA greenhouse gas requirements in 40 CFR parts 85, 86, and 600. Heavy-duty vehicle greenhouse gas requirements will be described in a separate information sheet.

**What are the current and proposed EPA greenhouse gas (GHG) regulations?**

2012 Light-Duty Rule - GHG requirements for Original Equipment Manufacturers (OEMs) and conversion manufacturers started in the 2012 model year (MY) and apply to light-duty vehicles, trucks up to 8500 GVW, and medium-duty passenger vehicles (passenger vehicles from 8500 to 10,000 GVW). The rules apply to conversion manufacturers modifying 2012 and later MY OEM vehicles.

2014 Heavy-Duty Rule - GHG requirements for OEMs and conversion manufacturers begin with the 2014 MY and apply to both chassis tested vehicles over 8500 but less than 14,000 GVW (class 2b and 3 heavy-duty vehicles), and engine-dynamometer tested heavy-duty engines which the engine manufacturer could reasonably expect to be used for motive power in class 4-8 heavy-duty vehicles, as well as class 4-8 heavy-duty vocational vehicles and commercial tractors.

2017 Light-Duty Proposed Rule – A proposed rule for light-duty vehicles for 2017 and later MYs was published in December 2011. The final rule is expected to be published in 2012.

## What are light-duty GHG emissions?

GHG exhaust emissions include carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O). Compliance with GHG requirements is based on measurement of carbon related exhaust emissions, or CREE. The specific components of CREE exhaust gases are fuel dependent and are presented in the equations in 40 CFR part 600.113-12. Using a CNG fuel as an example, CREE is the summation of CH<sub>4</sub>, non-methane hydrocarbon (NMHC), carbon monoxide (CO), and CO<sub>2</sub>, where CH<sub>4</sub>, NMHC, and CO are converted to CO<sub>2</sub> equivalents.

The light-duty GHG regulations include individual standards for CH<sub>4</sub> and N<sub>2</sub>O.

OEMs may also qualify for credits by reducing air-conditioning system leakage of GHG hydrofluorocarbons and by improving air conditioning system efficiency. These credits are then used in determining overall compliance with fleet average CO<sub>2</sub> standards.

## Do the Small Business status and Conditional Exemption status described in Part 86, subpart S regulations also apply to conversion manufacturers?

Yes. The exemption categories described in 40 CFR part 86.1801(j) and (k) also apply to conversion manufacturers.

Small Business Administration Exemption - If you employ less than 1000 employees worldwide and are engaged in manufacturing you are exempt from GHG requirements. Note that the Small Business Administration regulation requires the aggregation of employees of related affiliate companies to determine qualification for this exemption. You do not need EPA approval to qualify as Small Business Administration Exempt.

Conditional Exemption - If you employ over 1000 employees worldwide and your average U.S. based sales for the three most recent consecutive model years are less than 5000 units you may qualify as Conditionally Exempt from GHG requirements. Similar to OEMs, conversion manufacturers need advance EPA approval to qualify as Conditionally Exempt.

Not Exempt - If you do not qualify as Small Business Administration Exempt or Conditionally Exempt, you must meet the GHG requirements described in Q5 below and presented in 40 CFR part 85.525(a)(2)(i).

## Describe the requirements to demonstrate GHG compliance for the different exemption status categories?

Small Business Administration Exemption - If you are Small Business Administration Exempt, you have no GHG compliance or reporting requirements.

Conditional Exemption – If EPA approved, you are not required to meet the OEM’s in-use CO<sub>2</sub> standard described in 40 CFR part 85.525(a)(2)(i), but you are required to meet the standards for CH<sub>4</sub> and N<sub>2</sub>O of 0.030 g/mi and 0.010 g/mi, respectively. If you cannot meet these standards you may exercise any of the options described in paragraphs A, B, C in Q8 below, or use the back-to-back methodology which is proposed to be added to 40 CFR part 85.525(a)(2)(i) as paragraph D in the Light-Duty 2017 GHG rule and discussed in Q9 below.

Not Exempt - If you are not exempt you must meet the in-use exhaust emission CO<sub>2</sub> standard and the CH<sub>4</sub> and N<sub>2</sub>O standards. You may exercise any of the compliance options described in Q8 to meet the standards, or conduct back-to-back testing described in Q9.

## What are the light-duty OEM GHG exhaust emission compliance requirements?

CH<sub>4</sub> and N<sub>2</sub>O standards (applicable to conditionally exempt and not exempt manufacturers): Manufacturers are required to meet standards for CH<sub>4</sub> and N<sub>2</sub>O of 0.030 g/mi and 0.010 g/mi, respectively.<sup>1</sup> Compliance with the standards is based only on FTP test results. Standards apply at the EPA defined full useful life, meaning that deterioration factors (DFs) need to be applied to low mileage test results. If there is no CH<sub>4</sub> DF available, manufacturers may use an NMOG DF to demonstrate compliance with the CH<sub>4</sub> standard.

Manufacturers may currently comply with the N<sub>2</sub>O standard by making a compliance statement in their certification applications. This provision exists through the 2014 MY (proposed to be extended through the 2016 MY).

Fleet average CO<sub>2</sub> standards (not applicable to conversion manufacturers): Manufacturers are required to meet fleet average CO<sub>2</sub> standards using the vehicle specific CREE measured emissions. The fleet average CO<sub>2</sub> standards are based on vehicle “footprint” size (an area in square feet determined from the product of vehicle specific track width and wheel base) and the corresponding footprint size CO<sub>2</sub> target values. Each manufacturer’s fleet average CO<sub>2</sub> standard will be unique due to differences in vehicle footprint size and a manufacturer’s product sales mix. The manufacturer’s vehicle CREE fleet average emission results are used to demonstrate compliance to the standard. CREE is the sum of a vehicle subconfiguration 55% weighted FTP test result with a corresponding 45% Hwy test result. The FTP and Hwy CREE emissions are reported at the EPA defined full useful life, meaning deterioration factors need to be applied to low mileage test results. EPA GHG regulations define CO<sub>2</sub> emissions as having zero deterioration over the EPA defined full useful life.

The fuel specific CREE calculation methodology is presented in 40 CFR part 600.113-12. Note that CREE calculations adjust the carbon containing exhaust constituents by multiplying the specific carbon pollutant in g/mi by the ratio of the molecular weight of CO<sub>2</sub> to the molecular weight of the other corresponding carbon pollutants. This methodology assumes that the carbon containing exhaust emissions are completely converted to carbon dioxide, or carbon dioxide equivalent in the atmosphere.

<sup>1</sup> 40 CFR part 86.1818-12(f)(1).

Given the direct (inverse) relationship between GHG emissions and fuel economy, the reported CREE test results are derived from manufacturer test data that is submitted to comply with Corporate Average Fuel Economy (CAFE) standards. Compliance with CO<sub>2</sub> standards is based on a fleet averaging program. Manufacturers may take advantage of averaging, banking, and trading of GHG credits to assist in complying with model year specific fleet average CO<sub>2</sub> standards.

EPA rules allow light-duty manufacturers the option of including CH<sub>4</sub> and N<sub>2</sub>O emissions in the CREE calculation in lieu of meeting the CH<sub>4</sub> and N<sub>2</sub>O standards. This compliance method entails meeting an “optional” CREE standard, commonly referred to as OCREE. Again using CNG as an example, OCREE GHG emissions are the summation of CH<sub>4</sub>, NMHC, CO, CO<sub>2</sub> and N<sub>2</sub>O. In the OCREE calculations, NMHC and CO are adjusted by the same multiplicative factors (ratios of molecular weights) used in the CREE calculation, but CH<sub>4</sub> and N<sub>2</sub>O are multiplied by 25 and 298, respectively, to account for the increased global warming potential of CH<sub>4</sub> and N<sub>2</sub>O relative to CO<sub>2</sub>. OCREE vehicle subconfiguration results are also based on a 55% FTP plus 45% Hwy weighting of full useful life emission results. For the 2012 through 2014 model years, manufacturers may enter a value of 0.010 g/mi for N<sub>2</sub>O in the OCREE calculations in lieu of entering a measured value for N<sub>2</sub>O (proposed to be extended through the 2016 model year). No DF is applied to the 0.010 g/mi N<sub>2</sub>O emission value used to calculate OCREE emissions.

Manufacturer compliance with fleet average CO<sub>2</sub> standards is demonstrated through an end of model year report submitted to EPA.

In-use CO<sub>2</sub> standards (applicable to not exempt manufacturers):

Manufacturers are required to meet in-use CO<sub>2</sub> standards, where compliance is demonstrated by meeting a standard equal to the vehicle subconfiguration or model type CREE result (or the OCREE result if the optional compliance method is selected) multiplied by 1.1. Unlike conventional emission standards, CO<sub>2</sub> in-use standards are derived from certification test results generated at the time manufacturer test groups are certified.

**How do GHG requirements differ between OEMs and conversion manufacturers?**

Clean alternative fuel conversion manufacturers differ from OEMs in a number of ways and therefore the GHG compliance requirements that exist for conversion manufacturers also differ from the requirements for OEMs. Conversion manufacturers:

1. Do not comply with a fleet average CO<sub>2</sub> standard<sup>2</sup>
2. Do not have the options to earn, bank, average, or trade credits
3. Do not submit pre or final model year GHG compliance reports
4. Do not participate in any special credit programs available to the OEMs, such as A/C leakage or A/C efficiency credits, early credits, fleet average credits, or off cycle credits.<sup>3</sup>

<sup>2</sup> 40 CFR part 85.525(a)

<sup>3</sup> Response to Comments for Final Rulemaking for Clean Alternative Fuel Vehicle and Engine Conversions. EPA publication EPA-420-R-11-002 p57

## Where are the light-duty GHG standards for conversion manufacturers described?

The GHG standards for conversion manufacturers are described in 40 CFR part 85.525, as amended. The April 8, 2011 fuel conversion regulations were amended as part of the Heavy-Duty GHG rule (76 Fed. Reg. 57106, Sep. 15, 2011).

## What GHG provisions apply to conversion manufacturers who are not exempt from GHG requirements?

As provided in greater detail in 40 CFR part 85.525(a)(2)(i), conversion manufacturer compliance with GHG emission standards may require compliance with the OEM in-use CO<sub>2</sub> exhaust standard for the vehicle “subconfiguration” that is identical to the fuel conversion emission data vehicle. If the subconfiguration-derived in-use CO<sub>2</sub> standard is not available to the conversion manufacturer, for example because the vehicle was not tested by the OEM for fuel economy, then the fuel converted vehicle must comply with the OEM “model type” in-use CO<sub>2</sub> standard.

*Subconfiguration*, as defined in 40 CFR part 600.002-93 means a unique combination within a vehicle configuration of equivalent test weight, road-load horsepower, and any other operational characteristics or parameters which the Administrator determines may significantly affect fuel economy within a vehicle configuration. The terms *vehicle configuration*, *equivalent test weight*, and *road-load horsepower* are further defined in 40 CFR part 600.002-93.

*Model type*, as defined in 40 CFR part 600.002-93 means a unique combination of car line, basic engine, and transmission class. The terms *car line*, *basic engine*, and *transmission class* are further defined in 40 CFR part 600.003-93.

40 CFR part 85.525(a)(2)(i) also provides that converters comply with standards for CH<sub>4</sub> of 0.030 g/mi, and for N<sub>2</sub>O of 0.010 g/mi. Standards apply at full useful life, or 120K miles. Until the 2015 MY, OEMs and conversion manufacturers may use a statement of compliance in lieu of measuring and reporting N<sub>2</sub>O results.<sup>4</sup>

40 CFR part 85.525(a)(2)(i), paragraphs A-C, describe three options in lieu of meeting the standards presented in Q5 above.

Paragraph A – If the OEM complied with the fleet averaging option for CH<sub>4</sub> and N<sub>2</sub>O using the OCREE methodology, the conversion manufacturer may demonstrate compliance with standards by using the OCREE methodology in lieu of meeting the standalone standards for CH<sub>4</sub> and N<sub>2</sub>O. The fuel conversion OCREE test result must be less or equal to the OEM OCREE test result.

Paragraph B - If the OEM used an “alternative” higher standard for CH<sub>4</sub> and/or N<sub>2</sub>O, the conversion manufacturer can demonstrate compliance by meeting the OEM alternative higher standard. For example, an OEM could select a CH<sub>4</sub> standard of 0.060 g/mi. The conversion manufacturer would then be able to demonstrate compliance against this 0.060 g/mi standard.

<sup>4</sup> 40 CFR part 86.1829(b)(1)(iii)

Paragraph C - Some types of converted vehicles will emit less CO<sub>2</sub> than the OEM vehicle. This option converts the difference between the manufacturer's "in-use CO<sub>2</sub> exhaust emission standard" and the measured CO<sub>2</sub> value for the converted configuration into equivalents of CH<sub>4</sub> and/or N<sub>2</sub>O g/mi emissions. These equivalents are then used to reduce the CH<sub>4</sub> and/or N<sub>2</sub>O emissions from the fuel converted vehicle and thereby show compliance to the CH<sub>4</sub> and/or N<sub>2</sub>O standards. This option is also available to conversion manufacturers using an OEM's alternative higher standard. For GHG purposes, the method assumes 25 g/mi of CO<sub>2</sub> is equivalent to 1 g/mi of CH<sub>4</sub>, and 298 g/mi of CO<sub>2</sub> is equivalent to 1 g/mi of N<sub>2</sub>O.

Example of compliance with CH<sub>4</sub> Standard: Assume an OEM's in-use CO<sub>2</sub> exhaust emission standard equals 400 g/mi CO<sub>2</sub>. Assume the corresponding fuel conversion test vehicle produces the following CO<sub>2</sub> and CH<sub>4</sub> emission results:

$$\begin{aligned} \text{CO}_2 &= 325 \text{ g/mi} \\ \text{CH}_4 &= 0.070 \text{ g/mi} \end{aligned}$$

Using the difference in CO<sub>2</sub> test results and equating 25 g/mi CO<sub>2</sub> to 1 g/mi CH<sub>4</sub>:

$$\begin{aligned} 400 - 325 &= 75 \text{ g/mi CO}_2 \\ (75 \text{ g/mi CO}_2) / (25 \text{ g/mi CO}_2) &\text{ yields a } 3.000 \text{ g/mi CH}_4 \text{ "equivalent"} \end{aligned}$$

Reducing the fuel conversion CH<sub>4</sub> test results by the GHG equivalent:

$$0.070 \text{ g/mi CH}_4 - 3.000 \text{ g/mi CH}_4 = \text{a negative CH}_4 \text{ result}$$

In this example, the negative adjusted fuel conversion CH<sub>4</sub> result would be reported as 0.000 g/mi CH<sub>4</sub>, thus complying with the CH<sub>4</sub> standard of 0.030 g/mi.

## What if the OEM in-use standard is not available when the conversion manufacturer needs it?

The OEM in-use CO<sub>2</sub> standard based on subconfiguration or model type may not be available at the time the conversion manufacturer needs it. The OEM in-use CO<sub>2</sub> standards will typically not be available until April of the calendar year following the end of the model year. For example, 2012 OEM in-use CO<sub>2</sub> values will become available in April of 2013.

EPA has proposed in the 2017 GHG rulemaking to add a fourth option (Paragraph D) to 40 CFR part 85.525(a)(2)(i) (76 Fed. Reg. 74854, Dec. 1, 2011). This option is called the back-to-back compliance testing option. GHG emissions would be measured before and after the fuel conversion. Because CO<sub>2</sub> emissions may be lower when the vehicle is operating on the alternative fuel, it may be possible to demonstrate that higher CH<sub>4</sub> emissions when operating on CNG, for example, are more than offset with lower CO<sub>2</sub> emissions. The calculation methodology used in the back-to-back testing is proposed to be the optional CREE reporting method (OCREE).

## How do the light-duty GHG regulations impact OBD compliance for conversion manufacturers?

There are no OBD GHG compliance requirements for OEMs or conversion manufacturers.

## Where will the OEM in-use CO<sub>2</sub> standards be published?

EPA is working to make these data available on an EPA website.

## What are the Verify Data System GHG entry requirements?

Small Business Administration Exemption Data Entry - In addition to the other emission test results, enter the FTP CH<sub>4</sub> test result in the Verify Test Information dataset. Enter a CREE or OCREE value of 0.0

Do not enter standards or DFs for CH<sub>4</sub>, N<sub>2</sub>O, CREE or OCREE in the Verify Test Group dataset.

No pass/fail determinations will be displayed as part of the Test Group Information dataset for CH<sub>4</sub>, N<sub>2</sub>O, CREE or OCREE because no standards were entered for these GHG emissions.

Conditional Exemption Data Entry - In addition to the other emission test results, enter the FTP CH<sub>4</sub> test result in the Verify Test Information dataset. Enter a CREE or OCREE value of 0.0

Do not enter CO<sub>2</sub> in-use standards or DFs for CREE or OCREE in the Verify Test Group dataset. Do not enter an N<sub>2</sub>O standard if meeting the standard is based on a compliance statement. Enter the CH<sub>4</sub> standard only if the fuel conversion CH<sub>4</sub> test result passes the 0.030 g/mi standard or the higher OEM alternative CH<sub>4</sub> standard.

A "Pass" determination will be displayed in the Certification Summary Information (CSI) report if the CH<sub>4</sub> result meets the CH<sub>4</sub> standard, or the higher OEM alternative CH<sub>4</sub> standard. No pass/fail determination will be displayed for N<sub>2</sub>O, CREE, or OCREE because no standards were entered for these GHG emissions.

If the back-to-back testing option was exercised to show compliance with the CH<sub>4</sub> standard, the comparisons of the before and after fuel conversion tests are based on the OCREE calculation methodology. These comparisons should be reported in Manufacturer Test Comments so they will appear on the Verify CSI report. EPA will examine these results to determine that GHG emissions have not been increased.

## Not Exempt Data Entry -

### A) Compliance is demonstrated against the OEM standards

Enter in the Verify Test Information dataset the fuel conversion test results for CREE or OCREE, and CH<sub>4</sub>. Conversion manufacturers will need to apply DFs to their emission results using EPA assigned DFs if necessary. A “Pass” determination will be displayed in the Certification Summary Information (CSI) report if the CH<sub>4</sub> result meets the CH<sub>4</sub> standard, or the higher OEM alternative CH<sub>4</sub> standard. Even though CREE or OCREE standards and test results were entered, Verify will not return a pass/fail determination. EPA will examine the OEM CREE or OCREE standards and fuel conversion CREE or OCREE test results to confirm that GHG emissions have not been increased.

If the OEM reports an in-use CO<sub>2</sub> standard based on CREE methodology, enter in the Verify Test Group dataset the OEM in-use CO<sub>2</sub> CREE standard (based on subconfiguration or model type) as the fuel conversion test vehicle CREE standard. Enter the CH<sub>4</sub> standard if the conversion CH<sub>4</sub> result will meet the CH<sub>4</sub> standard or the optional OEM higher CH<sub>4</sub> standard. Do not enter an N<sub>2</sub>O standard if meeting the standard is based on a compliance statement.

If the OEM reports an in-use CO<sub>2</sub> standard based on OCREE methodology, enter the OEM in-use CO<sub>2</sub> OCREE standard (based on subconfiguration or model type) as the fuel conversion test vehicle OCREE standard. Do not enter CH<sub>4</sub> or N<sub>2</sub>O standards because the OEM chose to use the OCREE compliance option.

If the fuel conversion CH<sub>4</sub> test result does not meet the CH<sub>4</sub> standard or the optional higher OEM CH<sub>4</sub> standard, and the OEM has reported a CREE in-use CO<sub>2</sub> standard, do not enter a CH<sub>4</sub> standard. In this case, compliance with the CH<sub>4</sub> standard may be determined using the CO<sub>2</sub> equivalence approach described in Paragraph C in Q6 above. Demonstrating that the CH<sub>4</sub> result passes the CH<sub>4</sub> standard using the approach in Paragraph C should be shown in Manufacturer Test Comments so that the test results will appear on the CSI document. EPA will examine the results to determine that the CH<sub>4</sub> standard, or the higher OEM alternative CH<sub>4</sub> standard has been met.

### B) Compliance is demonstrated using the back-to-back testing option

Enter in the Verify Test Information dataset the CH<sub>4</sub> and OCREE alternative fuel test results. Enter the pre-conversion OCREE results, for example based on testing with gasoline, in Manufacturer Test Comments so they appear on the CSI document. DFs need not be applied to the pre and post conversion OCREE test results.

Do not enter standards or DFs for CH<sub>4</sub>, CREE, or OCREE in the Verify Test Group dataset. Do not enter an N<sub>2</sub>O standard if meeting the standard is based on a compliance statement.

A compliance demonstration using the back-to-back testing option is based on showing that the GHG emissions from the converted test vehicle have not been increased.



**Are there other unique Verify data entries, or questions to be ignored, given the programmatic differences between conventional certification (40 CFR part 86 regulations) and fuel conversion regulations (40 CFR part 85 regulations)?**

Yes. In the Certificate Request module, do not respond by answering Yes or No to the question “Has the Greenhouse Gas Pre-Model year report been submitted to EPA for this model year and does it meet all the requirements of 40 CFR 600.514 or 40 CFR 1037.104? This question is only applicable for OEMs.

**How will GHG reporting be handled for conversion manufacturers submitting notifications under the Intermediate Age Vehicle program?**

EPA data forms and Excel spreadsheets are being revised to accept reporting of GHG emissions, but at present EPA will assess compliance by examining the test results submitted to support the IAV notification.