UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL VEHICLE AND FUEL EMISSIONS LABORATORY
2565 PLYMOUTH ROAD
ANN ARBOR, MICHIGAN 48105-2498

OFFICE OF
AIR AND RADIATION

July 21, 2005 CCD-05-12 (LDV/LDT/MDPV/HDV/HDE/LD-AFC)

Dear Manufacturer:

Subject: Clean-Fuel Vehicle Standards

This letter provides guidance on determining the equivalency of vehicle and engine emission standards in Code of Federal Regulations (CFR) Part 86 standards and Part 88 standards for Clean-Fuel Vehicles. The determinations that follow may be used effective with the issue date of this guidance letter.

Background

The EPA Clean-Fuel Fleet Program (CFFP) was established by the requirements under Part C – Clean-Fuel Vehicles, Sections 241-246 of the1990 Clean Air Act (CAA) Amendments. The purpose of the CFFP was to reduce emissions in metropolitan areas not meeting Federal air quality standards through the use of clean alternative fuels.[1] The CAA prescribed exhaust emission standards for light-duty vehicles, light-duty trucks, and heavy-duty vehicles between 8,501 lbs and 26,000 lbs GVWR.[2]

In response to the Clean-Fuel Vehicle (CFV) requirements of the CAA Amendments, EPA published regulations in 40 CFR Part 88, Subpart A, Emission Standards for Clean-Fuel Vehicles, and Subpart C, Clean-Fuel Fleet Program. Following the requirements in Sections 242, 243, and 245 of the CAA Amendments, EPA published standards for three vehicle classes: light-duty vehicles (LDVs), light-duty trucks (LDTs) up to 8,500 lbs GVWR, and heavy-duty vehicles (HDVs) between 8,501 lbs and 26,000 lbs GVW. A CFV light-duty vehicle or light-duty truck can be classified as a transitionally low emissions vehicle (TLEV), low-emission vehicle (LEV), ultra low-emission vehicle (ULEV), or a zero emission vehicle (ZEV). Heavy-duty vehicles or engines used in heavy-duty vehicles are classified as low-emission vehicle (LEV), ultra low-emission vehicle (ULEV), inherently low-emission vehicle (ILEV) or a zero emission vehicle (ZEV).

Subsequent to publishing its CFV regulations, EPA has promulgated new emission standards that are generally more stringent than or equivalent to the CFV emission

---

[1] Section 241(2) of the 1990 CAA Amendments lists the following fuel types as clean alternative fuels: any fuel mixture with gasoline or other fuel containing 85% or more (by volume) methanol, ethanol, or other alcohol, reformulated gasoline, diesel, natural gas, liquefied petroleum gas, hydrogen, and electricity.
[2] Section 241(7) defines a clean-fuel vehicle as "…. a vehicle in a class or category of vehicles which has been certified to meet for any model year the clean-fuel vehicle standards applicable under this part for that model year to clean-fuel vehicles in that class or category."

standards for light-duty vehicles, light-duty trucks, and heavy-duty engines. These new EPA regulations added a new medium-duty vehicle passenger class, and also created a new chassis test procedure for heavy-duty vehicles.

Vehicle and engine manufacturers continue to receive requests from fleet customers who desire to purchase vehicles compliant with CFV standards.[3] Manufacturers have requested EPA guidance on how to continue to demonstrate to fleet customers that current standards are equivalent to or more stringent than CFV standards.

The CFV emission standards for vehicles and engines are presented in 40 CFR Part 88 Subpart A, sections 88.104-94 for vehicles and in 88.105-94 for heavy-duty engines. Current federal vehicle and engine certification emission standards are published in 40 CFR Part 86. Specifically, light-duty vehicle, light-duty truck, and medium-duty passenger vehicle standards are presented in 86.1811-04 and complete heavy-duty vehicle emission standards are presented in 86.1816-05 and 86.1816-08. Otto cycle standards for the 2005-2007 model year heavy-duty engines and vehicles are presented in 86.005-10 and in 86-008-10 for 2008 and later model years. Diesel cycle emission standards for 2004-2006 model year heavy-duty engines and vehicles are presented in 86.004-11 and in 86.007-11 for 2007 and later model years.

Determination

To determine equivalency, current certification emission standards for Tier 2 vehicles (LDVs, LDTs, and MDPVs), heavy-duty vehicles, heavy duty Otto cycle engines, and heavy-duty diesel engines were compared to CFV vehicle and engine emission standards using the methodology outlined in the Attachment. The results of this analysis are summarized as follows:

Tier 2 LDVs, LDT1-4s, and MDPVs certified to the following Tier 2 bin standards are equivalent to or more stringent than CFV LEV emission standards:

LDV Bins 1-7 and Bin 9
LDT1 Bins 1-7 and Bin 9
LDT2 Bins 1-9
LDT3 Bin 1-10
LDT4 Bin 1-10
MDPV Bin 1-11[4]

Tier 2 LDVs, LDT1-4s, and MDPVs certified to the following bin standards are equivalent to or more stringent than CFV ULEV emission standards:

LDV Bins 1-3
LDT1 Bins 1-3
LDT2 Bins 1-4

[3] Correspondence addressed to EPA from the Engine Manufacturers Association dated December 8, 2004.
[4] There are no CFV emission standards that correspond to the Tier 2 MDPV class but MDPVs meeting Tier 2 Bins 1-11 are all equal to or more stringent than LDT4 CFV LEV standards.

LDT1 Bins 1-3
LDT2 Bins 1-4
LDT3 Bins 1-4
LDT4 Bins 1-4
MDPV Bins 1-4[5]

The following determinations are made for 2005 and later model year Otto cycle heavy-duty vehicles:

8,501-10,000 GVWR Otto-cycle heavy-duty vehicle chassis standards are more stringent than the CFV Otto cycle heavy-duty engine LEV emission standard.

10,001-14,000 GVWR Otto-cycle heavy-duty vehicle chassis standards are more stringent than the CFV Otto cycle heavy-duty engine LEV emission standard.

The following determinations are made for 2005 and later model year heavy-duty Otto cycle engines and diesel engines:

Current emission standards for heavy-duty engine Otto cycle engines and diesel engines are more stringent than CFV LEV heavy-duty Otto cycle engines, or heavy-duty diesel engine emission standards.

Compliance with EPA Standards and Program Requirements
Manufacturers may assure fleet managers that vehicles and engines certified under current emission standards which EPA has determined to be as or more stringent than corresponding CFV emission standards meet CFV emission standards. (See the Determination section above for determining which current standards qualify)

Section 40 CFR 86.1817-05(a)(1) prohibits heavy-duty vehicles and engines labeled for use in clean-fuel vehicles from participating in EPA's NOx averaging, banking, and trading (ABT) program. Similarly, 40 CFR 86.004-15(a)(1) also prohibits CFV-labeled engines in heavy-duty engine families from participating in NMHC plus NOx, and particulate ABT. Engines that are not labeled CFV-compliant are eligible to participate in Part 86 ABT programs.

This guidance document shows which Part 86 emission standards are equivalent to or more stringent than CFV emission standards. This document does not change any of the requirements of the CFFP in Part 88. Manufacturers certifying under Part 88 CFFP emission standards are not exempt from complying with all other CFFP requirements.

Questions concerning CFV standards and CFFP requirements for vehicles up to 14,000 GVWR vehicles may be directed to Martin Reineman, 734-214-4430, or reineman.martin@epa.gov. Questions on CFV engine standards and CFFP requirements may be directed to Jason Gumbs, 202-343-9271, or gumbs.jason@epa.gov.

[5] There are no CFV standards that correspond to the Tier 2 MDPV class but MDPVs meeting Tier 2 Bins 1-4 are all equal to or more stringent than LDT4 CFV ULEV emission standards.

Sincerely,

Merrylin Zaw-Mon, Director
Certification and Compliance Division
Office of Transportation and Air Quality

Attachment

Attachment to CCD-05-12

Analysis of CFV Emission Standards

There are four issues which must be addressed in order to determine the equivalency of CFV standards and the federal certification emission standards: determining CFV-equivalent standards for the newly-added MDPV class, equating grams per brake horsepower-hour standards and grams per mile standards, converting NMHC to NMOG, and determining equivalency for a combined NMHC+NOx CFV standard when current federal standards are expressed as separate NMHC and NOx standards.

1. How to address the newly-added vehicle class of Medium-Duty Passenger Vehicle (MDPV).

The newly-added class of Medium-Duty Passenger Vehicles (MDPVs) did not exist at the time of the CFV regulations. These vehicles include heavy-duty vehicles weighing less than 10,000 pounds GVWR designed primarily for carrying passengers. These vehicles would have been considered as heavy-duty vehicles under the CFV provisions. However, they would not have been tested in the same way - MDPVs are chassis-tested, whereas heavy-duty vehicles were engine-tested. The issue that arises from this is that the engine testing-based emission standards are expressed in different units than chassis testing-based standards, as discussed below.

2. Converting g/bhp-hr into g/mi.

The CFV standards for heavy-duty vehicles (which, at the time were tested on engine dynamometers) are expressed in units of g/bhp-hr. The CFV standards for light-duty vehicles (tested on chassis dynamometers) are expressed in grams per mile. Since the time of these standards, some heavy-duty vehicles are now required to be tested on chassis dynamometers. Also, the new class of MDPVs has g/mi standards, whereas under the CFV program, they would have had g/bhp-hr standards. To determine if CFV emission standards for these vehicles are equivalent to or more stringent than the federal certification emission standards in effect today the g/bhp-hr standards must be converted into g/mi.

For engine standards in the 8,501–10,000 GVWR range (such as MDPVs), the g/bhp-hr units are converted to g/mi units by multiplying them by the factor 1.096. For engine standards in the 10,001–14,000 GVWR range, convert g/bhp-hr units to g/mi units by the factor 1.150. The CFV g/bhp-hr engine emission standards for vehicles between 8,500 and 14,000 GVWR were converted to g/mi units by using EPA-derived conversion factors contained in EPA Report No. EPA420-R-00-010.[1] The 1.096 and 1.150 conversion factors referenced in this guidance letter are used solely for the purpose of equating Part 86 chassis test and Part 88 engine test standards for vehicles in the 8,501-14,000 GVW range. Accurate assessment of emissions from a unique vehicle/engine configuration can only be accomplished by conducting dual emissions measurements using both chassis test and engine test procedures and protocols.

[1]This report is available on-line at www.epa.gov/otaq/regs/hd-hwy/2000frm/r00010.pdf

3. Converting NMHC into NMOG.
Current Tier 2 vehicle emission standards for hydrocarbons are presented as non-methane organic gas (NMOG); whereas CFV engine emission hydrocarbon standards are based on non-methane hydrocarbons (NMHC). NMOG may be converted to NMHC by use of the equation:

NMOG emissions = NMHC*1.04

The 1.04 factor was published as part of EPA's Tier 2 regulations.

4. Combined emission standards.
The CFV standards for heavy-duty vehicles include a combined NMHC+NOx standard expressed in g/bhp-hr. To compare to today's standards, not only must the measurement units be converted, but the NMHC standard must be converted to NMOG. Also, because the Tier 2 standards do not include a combined standard, it is necessary to add the chassis-based NMOG standard and the chassis-based NOx standard, after using the appropriate g/mi to g/bhp-hr conversion factor.

For example, to compare the 2005-2007 model year heavy-duty vehicle chassis-based standards for NMOG (0.28 g/mi) and NOx (0.9 g/mi) to the corresponding CFV engine based emission standard for the sum of NMHC + NOx (3.8 g/bhp-hr), the following conversions were performed:

Converting 0.28 g/mi NMOG to NMHC:
0.280 g/mi NMOG/1.04 = 0.27 g/mi NMHC

Summing the 0.27 g/mi NMHC and 0.9 NOx heavy-duty vehicle chassis standards:
0.27 g/mi NMHC + 0.9 g/mi NOx = 1.17 g/mi (NMHC + NOx)

Converting the 3.8 g/bhp-hr CFV engine based standard to g/mi units:
3.8 g/bhp-hr (NMHC + NOx)*1.096 = 4.16 g/mi (NMHC + NOx)

Comparing the current heavy-duty vehicle chassis standard to the CFV engine standard:
1.17 g/mi < 4.16 g/mi