Response to Comments: Fuel Economy Labeling of Motor Vehicles

United States Environmental Protection Agency

Office of Transportation and Air Quality
EPA420-R-06-016
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Assessment and Standards Division
and
Certification and Innovative Strategies Division

Office of Transportation and Air Quality
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List of Commenting Organizations and Abbreviations

The abbreviations and annotations in this list are used throughout this document to refer to various organizations that submitted written and/or oral comments on the proposed rulemaking. We also received comments from more than 2,800 members of the public.

Comments Submitted During the Comment Period

Organization	Abbreviation	Docket Document Number
Alliance of Automobile Manufacturers	AAM	EPA-HQ-OAR-2005-0169-0110 EPA-HQ-OAR-2005-0169-0110.1
American Automobile Association	AAA	EPA-HQ-OAR-2005-0169-0105 EPA-HQ-OAR-2005-0169-0105.1
American Council for an Energy-Efficient Economy	ACEEE	EPA-HQ-OAR-2005-0169-0119 EPA-HQ-OAR-2005-0169-0119.1 EPA-HQ-OAR-2005-0169-0119.2
American Honda Motor Co., Inc.	Honda	EPA-HQ-OAR-2005-0169-0115 EPA-HQ-OAR-2005-0169-0115.1
Association of International Automobile Manufacturers	AIAM	EPA-HQ-OAR-2005-0169-0110 EPA-HQ-OAR-2005-0169-0110.1
Bluewater Network	Bluewater	EPA-HQ-OAR-2005-0169-0100
Consumers Union	CU	EPA-HQ-OAR-2005-0169-0137
DaimlerChrysler	DCX	EPA-HQ-OAR-2005-0169-0121 EPA-HQ-OAR-2005-0169-0121.1
Delphi LLC	Delphi	EPA-HQ-OAR-2005-0169-0116 EPA-HQ-OAR-2005-0169-0116.1
Environmental Defense	ED	EPA-HQ-OAR-2005-0169-0124 EPA-HQ-OAR-2005-0169-0124.1 EPA-HQ-OAR-2005-0169-0138
Ferrari S.p.A.	Ferrari	EPA-HQ-OAR-2005-0169-0112.1
Fuji Heavy Industries USA, Inc. (Subaru of America)	Subaru	EPA-HQ-OAR-2005-0169-0114 EPA-HQ-OAR-2005-0169-0114.1 EPA-HQ-OAR-2005-0169-0114.2
General Motors Corporation	GM	EPA-HQ-OAR-2005-0169-0106 EPA-HQ-OAR-2005-0169-0106.1
Mitsubishi Motors	Mitsubishi	EPA-HQ-OAR-2005-0169-0125 EPA-HQ-OAR-2005-0169-0125.1
Montana Coalition for Health, Environmental & Economic Rights	Montana CHEER	EPA-HQ-OAR-2005-0169-0072

Organization	Abbreviation	Docket Document Number
National Automobile Dealers Association	NADA	EPA-HQ-OAR-2005-0169-0131 EPA-HQ-OAR-2005-0169-0131.1 EPA-HQ-OAR-2005-0169-0131.2 EPA-HQ-OAR-2005-0169-0131.3 EPA-HQ-OAR-2005-0169-0131.4
National Renewable Energy Laboratory	NREL	EPA-HQ-OAR-2005-0169-0108 EPA-HQ-OAR-2005-0169-0108.1
Natural Resources Canada, Transportation Energy Use Division	NRC-TEUD	EPA-HQ-OAR-2005-0169-0109 EPA-HQ-OAR-2005-0169-0109.1
Natural Resources Defense Council	NRDC	EPA-HQ-OAR-2005-0169-0117 EPA-HQ-OAR-2005-0169-0117.1 EPA-HQ-OAR-2005-0169-0135 EPA-HQ-OAR-2005-0169-0128 EPA-HQ-OAR-2005-0169-0128.1
New York State Department of Environmental Conservation	NYDEC	EPA-HQ-OAR-2005-0169-0078 EPA-HQ-OAR-2005-0169-0078.1
Nissan Motor Company Limited	Nissan	EPA-HQ-OAR-2005-0169-0113 EPA-HQ-OAR-2005-0169-0113.1
PPG Industries	PPG	EPA-HQ-OAR-2005-0169-0130
Public Citizen	PC	EPA-HQ-OAR-2005-0169-0123.1 EPA-HQ-OAR-2005-0169-0128 EPA-HQ-OAR-2005-0169-0128.1
Toyota Motor Corporation	Toyota	EPA-HQ-OAR-2005-0169-0118 EPA-HQ-OAR-2005-0169-0118.1 EPA-HQ-OAR-2005-0169-0136
Union of Concerned Scientists	UCS	EPA-HQ-OAR-2005-0169-0127 EPA-HQ-OAR-2005-0169-0127.1 EPA-HQ-OAR-2005-0169-0128 EPA-HQ-OAR-2005-0169-0128.1
Volkswagen of America, Inc.	VW	EPA-HQ-OAR-2005-0169-0120

Comments Submitted after the Close of the Comment Period

Organization	Abbreviation	Docket Document Number
American Honda Motor Co., Inc.	Honda	EPA-HQ-OAR-2005-0169-0143
Ford Motor Company	Ford	EPA-HQ-OAR-2005-0169-0141
Alliance of Automobile Manufacturers	AAM	EPA-HQ-OAR-2005-0169-0142 EPA-HQ-OAR-2005-0169-0142.1 EPA-HQ-OAR-2005-0169-0142.2
Selle DorTse LLC		EPA-HQ-OAR-2005-0169-0140
Bluewater Network – compendium of emails from J. Wilson et al.	Bluewater	EPA-HQ-OAR-2005-0169-0139

Public Hearing Testimony

Mantill Williams, Director of Public Affairs
American Automobile Association (AAA)

Ed Tonkin, Chairman of the Regulatory Affairs Committee
Andy Koblenz, Vice President and General Counsel
National Automobile Dealers Association (NADA)

Giedrius Ambrozaitis,
Alliance of Automobile Manufacturers

David Raney, Senior Manager of Environmental and Energy Affairs
John German
American Honda Motor Company

Dr. John DeCicco
Environmental Defense

Dr. Russell Long, Founder
Bluewater Network
Vice President, Friends of the Earth U.S.

Introduction

On February 1, 2006, we published a Notice of Proposed Rulemaking (NPRM) that proposed changes to the testing and calculation procedures for fuel economy estimates that are posted on the window stickers of all new cars and light trucks sold in the United States. In addition to proposing a new calculation methodology that would bring the estimates closer to the real-world experience of consumers, we proposed revisions to the design and content of the label, as well as to some of the information that appears on it.

We held a public hearing on the NPRM in Romulus, Michigan on March 3, 2006. At that hearing, oral comments on the NPRM were received and recorded. A written comment period remained open until April 3, 2006. A complete list of organizations that provided comments on the NPRM is shown in the following table, along with abbreviations for these organizations that are used throughout this document. In addition to the organizations shown in the following table, we received comments from many individual stakeholders. All comments and hearing testimony have been placed in the docket for this rulemaking. Publicly available docket materials are available either electronically through www.regulations.gov or in hard copy at the Air and Radiation Docket, EPA/DC, EPA West, Room B102, 1301 Constitution Ave., NW, Washington, DC. See Docket ID No. EPA-HQ-OAR-2005-0169. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Air and Radiation Docket is (202) 566-1742.

This Response to Comments contains a detailed summary of all comments we received on the NPRM as well as our analysis of each comment and our response. In many cases this document also summarizes what we proposed in the NPRM, but we can not repeat the same level of detail that was presented in the NPRM. For that reason we refer readers to the NPRM for detailed descriptions of what we proposed. The reader should also refer to the final rulemaking notice in the Federal Register and to the Final Technical Support Document.

Chapter 1: General Issues

1.1 General Comments Supporting Proposal

What commenters said:

We received general support from many stakeholders, including automotive dealers, states, automotive manufacturers, environmental organizations, consumer groups, and individual consumers. Supporting comments often noted the growing dissatisfaction with the frequent gap between the EPA label values and real-world experience. All agreed that consumers deserve the most useful, accurate, and up-to-date information in order to make educated purchasing decisions. Auto companies tended to support the general improvements and the conclusion that the new procedures will result in more accurate fuel economy information, but they expressed some reservations regarding specific details of the program. We address the specific comments from the auto industry later in this document. Comments of this general nature came from Toyota, DaimlerChrysler, GM, Mitsubishi, Nissan, NADA, NYDEC, AAA, PC, AAM/AIAM, PPG, NRDC, UCS, many citizens, and multiple anonymous commenters.

Bluewater Network stated that the evidence demonstrates "conclusively that there are staggering inconsistencies between the mileage motorists are actually achieving, and the values on the labels." They commend EPA "for advancing a strong proposal to attempt to rectify this problem." Despite their support, they note several areas which they believe must be strengthened.

AAA commissioned a study by the Automobile Club of Southern California's Automotive Research Center. This study tested a number of the most popular vehicles on the US06 test. They also collected in-use fuel economy data from more than 40 of these vehicles. They argue that their results both confirm the shortcomings of the existing fuel economy labeling tests and indicate that EPA "…is on the right track with its proposal…"

Several comments implicitly support our proposal by virtue of commenting negatively on the current label's reflection of reality. For example, one commenter suggested that "EPA allows automobile manufacturers to mislead and defraud unsuspecting consumers by placing faulty mileage estimates on automobile stickers." Another stated that "EPA has been hoodwinking american [sic] consumers for years…"

Our response:

We agree with and appreciate the general comments of support. The NPRM outlined in detail the deficiencies of the current methods and the resulting gap between the current fuel economy estimates and what consumers are achieving in real-world driving. We continue to believe that the case for action is strong, and that the proposal advanced a technically sound approach for dramatically improving the accuracy of the

EPA fuel economy estimates. After consideration of all the comments, we are finalizing a new program that in many respects matches the basic framework of the proposed program. However, we are also addressing numerous public comments in the final program, as discussed throughout this document.

1.2 General Comments Opposing Proposal

What commenters said:

Only one comment specifically suggested taking no action at all. His concern is that the new methods will discourage consumers from considering hybrid vehicles. He suggests no action or simply reducing the current labels by a flat 15 percent for all vehicles. Environmental Defense urged EPA to proceed with caution, citing conflicting sources of information regarding the magnitude of the discrepancy between the EPA label values and real-world values.

Our response:

As noted above under Section 1.1, we continue to believe that the case for taking action is strong, and consequently we are finalizing a program essentially identical to the proposed approach. We do not agree with comments that suggest a flat one-size-fits-all adjustment factor. Our analysis in the NPRM clearly showed a large amount of vehicle-to-vehicle variation over the US06, SC03, and Cold FTP tests. These findings call into question the appropriateness of the continued use of "one-size-fits-all" adjustment factors. These additional emission test cycles incorporate several critical factors that are present in real-world driving, and that can have a significant impact on fuel economy. Use of these test cycles will result in fuel economy estimates that are essentially tailored to each vehicle's response to the impacts of each test cycle (higher speeds, more aggressive driving, air conditioning, and cold temperatures).

We do not believe that the new approach will discourage consumers from purchasing or considering hybrid vehicles. While it is true that many vehicles that get high fuel economy, including hybrids, will see a greater reduction in the label values than lower mpg vehicles, we do not believe that this will discourage consumers from considering those high-mpg vehicles. High mpg vehicles will be more sensitive to changes in driving conditions for two reasons. One, because they use relatively little fuel in the first place, any increase in fuel consumption will be relatively larger in percentage. Two, because of the non-linearity of fuel economy (distance per unit of fuel volume, e.g. miles per gallon) with respect to fuel consumption (unit of fuel volume per distance, e.g. gallons per 100 miles), a fixed increase in fuel consumption (e.g., due to air conditioning) will lower the fuel economy of a high mpg vehicle much more than it will lower the fuel economy of a low mpg vehicle. For example, the fuel consumption increase associated with a 35 mpg rating that actually achieves 30 mpg in the real-world is the same as a 15 mpg rating that actually achieves 14 mpg. In addition, we have no interest in perpetuating label values that bear little relationship to reality. Even with the adjusted label values, hybrid vehicles will remain among the most fuel-efficient vehicles available in the marketplace. Hybrids may well be the most significant powertrain technology innovation driven to market commercialization primarily because of its fuel economy potential. In addition, the nature of hybrid technology (the addition of a battery as a second source of on-board power, sophisticated control systems, sometimes a smaller engine) suggests that fuel economy will likely be more sensitive to certain conditions such as high acceleration and deceleration rates, cold ambient temperatures, etc. Finally, by industry standards, hybrids are a relatively young technology, and there is every reason to believe that as the technology matures, hybrid vehicle fuel economy will become much more robust over a broader range of driver behavior and climate conditions.

1.3 Estimates Are Based on Controlled, Repeatable Tests

What we proposed:

The methodology we proposed was based on the use of controlled, repeatable tests conducted in emission and fuel economy testing facilities that conform to EPA's stringent regulations on test procedures.

What commenters said:

Several supporting comments further expressed agreement with EPA's assessment in the NPRM that it is essential that the fuel economy estimates be based on controlled, repeatable laboratory tests that provide manufacturers with a level playing field. Some of these commenters also agreed that the auto manufacturers should remain the primary parties responsible for performing the fuel economy testing and calculation of the mpg estimates.

Our response:

It is essential that our fuel economy estimates continue to be derived from controlled, repeatable, laboratory tests. We noted in the NPRM that these laboratory tests provide a level playing field for all vehicles, which is essential for comparing the fuel economy of one vehicle to another. EPA and manufacturers test over 1,250 vehicle models annually and every test is run under identical conditions and under a precise driver's trace, which assures that the result will be the same for an individual vehicle model no matter when and where the laboratory test is performed. Finally, EPA must preserve the ability to confirm the values achieved by the manufacturers' testing, and this can only be achieved with a highly repeatable test or set of tests.

However, the EPA fuel economy test methods need to reflect real world conditions as well as being a repeatable test. While some organizations have issued their own fuel economy numbers based on on-road driving, their approach introduces a wide number of variables – different drivers, driving patterns, weather conditions, temperatures, etc. – that make repeatability, and therefore vehicle-to-vehicle comparisons, impossible. The new fuel economy test methods are more representative of real-world conditions than the current fuel economy tests, yet we retain in this final rule our practice of relying on controlled, repeatable, laboratory tests.

1.4 There is No Perfect Test

What we proposed:

We emphasized in the NPRM that it is impossible to design a “perfect” fuel economy test that will provide accurate real-world fuel economy estimates for every consumer.

What commenters said:

Some comments expressed agreement with the principle that there is no perfect test that can accurately predict the fuel economy for every driver under all circumstances, and that there will inevitably be times when a driver’s actual fuel economy will be higher or lower due to differences in vehicle use, driving styles, and conditions. For example, AAA noted that because people’s driving habits vary significantly, there is no single test that will yield 100% accuracy.

Our response:

We agree with the comments, and will continue to stress this fundamental point. It is important to emphasize that fuel economy varies from driver to driver for a wide variety of reasons, such as different driving styles, climates, traffic patterns, use of accessories, loads, weather, number of passengers, and vehicle maintenance. Even different drivers of the same vehicle will experience different fuel economy as these and other factors vary. Therefore, it is impossible to design a “perfect” fuel economy test that will provide accurate fuel economy estimates for every consumer. With any estimate, there will always be consumers that get better or worse actual fuel economy. The EPA estimates are meant to be a general guideline for consumers, particularly to compare the relative fuel economy of one vehicle to another. Nevertheless, we do believe that the new fuel economy test methods will do a better job of giving consumers a more accurate estimate of the fuel economy they can achieve in the real-world.

1.5 CAFE Program

What we proposed:

We noted in the NPRM that the proposal would not impact the test procedures, driving cycles, measurement techniques, or the calculation methods used to determine fuel economy values for CAFE compliance calculations.

What commenters said:

A number of commenters addressed the connection between the CAFE program and the fuel economy label estimates. NADA stressed that it is important that EPA's action not have an impact on CAFE. A number of others expressed disagreement with this opinion, however. The NYDEC recommended that the CAFE test methods be updated to match the proposed revised methodology. Their fear, in particular, is that "EPA's efforts to inform the public about fuel economy will be thwarted by the use of different standards for the vehicle labels than those used for [CAFE]…" In agreement, M. R. King put it this way: "If the window fuel economy sticker is not accurate, why should the CAFE calculation continue to be inaccurate?" If the CAFE test methods remain fixed, NYDEC requests that the CAFE value assigned to the vehicle be put on the label.

Bluewater Network notes that they have observed "a great deal of confusion" over the several different sets of fuel economy values published by EPA and NHTSA (CAFE values, EPA "adjusted" values, and EPA "unadjusted" values). For this reason, they suggest that EPA end any public dissemination of the unadjusted EPA values, including in the EPA Trends Report. They find "no compelling justification or public good" that results from these values, and absent a legal mandate to make these values public, they urge us to not make them publicly available.

Our response:

Our final rule does not alter the FTP and HFET driving cycles, the measurement techniques or the calculation methods used to determine CAFE. EPCA requires that CAFE for passenger automobiles be determined from the EPA test procedures in place as of 1975 (or procedures that give comparable results), which are the city and highway tests of today, with a few small adjustments for minor procedural changes that have occurred since 1975. The new method for calculating fuel economy label estimates fall under regulations that are separate from the CAFE regulations.

EPCA requires that CAFE for passenger automobiles be determined from the EPA test procedures in place as of 1975 (or procedures that give comparable results), which are the city and highway tests of today, with a few small adjustments for minor procedural changes that have occurred since 1975.[1] Today's final rule will not impact the CAFE calculations.[2]

EPA notes the comment by Bluewater Network regarding the release of unadjusted fuel economy values and will focus future EPA Fuel Economy Trends reports on information that is useful to consumers.

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[1] See 49 U.S.C. 32904(c).
[2] See 49 U.S.C. 32904(c).

1.6 Should Label Estimate Cover 50th or 75th Percentile?

What we proposed:

We proposed to continue to set the city and highway mpg estimates at the average, or mean, level, consistent with analytical approaches of the past. However, we expressed our understanding that many drivers expect to achieve or exceed the fuel economy indicated by these average mpg estimates. By continuing to set the estimates at the average level, by definition, the average driver will achieve of exceed the fuel economy label values fifty percent of the time. We invited comment on whether the city and highway estimates should be set a level that is lower than average – for example, to ensure that the average driver will achieve or exceed the label value 75 percent of the time.

What commenters said:

AAM/AIAM supported EPA's position in the NPRM, which retains the existing practice of setting the city and highway fuel economy label estimates at the average, or mean, level. AAM/AIAM note that an alternative, such as that suggested above, would amount to applying an arbitrary discount to the mean value produced from 5-cycle testing, in addition to the proposed 11% downward adjustment for non-dynamometer effects, and would add no value to the label as a useful tool for comparative purposes. The also believe that consumers understand that fuel economy label values represent the average fuel economy experienced by drivers. Rather than arbitrarily setting a level that is lower than average to ensure more driver coverage, AAM/AIAM suggest that a more prudent approach would be to validate the accuracy of the current 5-cycle approach through analysis of real-world fuel economy data. NYDEC and PC concurred with the view of AAM/AIAM, noting that the average is more consistent with how consumers understand the label values, and that using an alternative would result in label values that are inaccurate by a greater degree for a higher percentage of consumers. NADA commented that the goal should be to present label numbers that are a "hypothetical average." Natural Resources Canada suggests reducing the weighting given to high speed and aggressive driving, or shifting the estimates to a percentile whereby more than 50 percent of drivers would not achieve the label value.

Our response:

We received no comments opposing the proposed approach or supporting an alternative approach to the one that was proposed. We agree with the commenters and continue to believe that the labels should express consumer's average fuel economy experience, thus we are finalizing the city and highway estimates as average values as proposed.

1.7 Public Availability of Fuel Economy Test Data

What we proposed:

We did not propose anything specific with respect to making fuel economy test data publicly available. However, we have historically made fuel economy data available in several ways. Fuel economy information for all cars and light trucks has always been published in the statutorily required Fuel Economy Guide available at automobile dealerships. We have also historically published the Fuel Economy Trends report, which presents an annually analysis of fuel economy data. And we have always made public the raw fuel economy test data, and have posted data going back to 1978 on our web site.

What commenters said:

ACEEE commented that EPA should continue to make fuel economy information available with a high degree of transparency.

Our response:

We plan to continue to make fuel economy data available to the public in the most useful ways possible.

1.8 Overall Purpose of Fuel Economy Estimates

What we proposed:

The EPA fuel economy estimates have appeared on the window stickers of all new cars and light trucks since the late 1970's and are well-recognized by consumers. In the NPRM we noted that these estimates essentially serve two purposes: (1) to provide consumers with a basis on which to compare the fuel economy of different vehicles, and (2) to provide consumers with a reasonable estimate of the fuel economy they can expect to achieve. While the EPA fuel economy estimates have generally been a useful tool for comparing the relative fuel economy of different vehicles, it is also important that they reflect the fuel economy that consumers can reasonably expect to achieve in the real world. Consumers need to be provided with accurate, easily understandable, and relevant information regarding the fuel economy of new vehicles.

What commenters said:

Natural Resources Canada took some issue with our use of the label estimates to represent driving that by definition results in poor fuel economy. In particular, they focus on the representation of aggressive and fast driving through the inclusion of the US06 driving cycle. A more appropriate use of the label, from their perspective, is to act as a benchmark that drivers can reasonably expect to achieve through fuel-efficient driving techniques. They agree that making adjustments to the label estimates to account for items that the driver has limited control over (e.g., climate and fuel factors) is appropriate, "…but making adjustments to the label value to correct for poor driving behavior may not fairly represent the fuel economy that a driver could (and in our view should) attain." In their view a significant part of narrowing the gap between the label estimates and actual in-use fuel economy should be the education of consumers to promote better driving behavior. Our approach, they suggest, diminishes the label's ability to promote good driving behavior.

UCS comments that the primary goal of the fuel economy ratings should be to "provide consumers with a reliable basis for comparing the fuel economy and costs of individual vehicles." A secondary goal, they state, is to ensure that policymakers and the public have a reliable means for measuring the average fuel economy performance of the fleet as a whole.

Our response:

We continue to believe that the fuel economy labels serve two key purposes: (1) to provide consumers with a basis on which to compare the fuel economy of different vehicles, and (2) to provide consumers with a reasonable estimate of the fuel economy they can expect to achieve. Natural Resources Canada's point is really about a philosophical choice between two ways of representing fuel economy. We have always determined that the labels should represent typical U.S. driving habits and conditions, without making judgments as to whether driving behavior is poor and inefficient or conservative and efficient. We do not believe that we are necessarily correcting for "poor driving behavior," rather, we see it as representing real-world driving behavior. Representing fuel economy levels that could be achieved with good driving techniques under good conditions would not solve the current problem (in fact, it would enhance it) of a large disconnect between label values and real-world fuel economy. We have to represent the typical driver and typical conditions, and at the same time ensure that vehicle owners receive useful information regarding what they can do to improve fuel economy.

1.9 Small Volume Manufacturers

What we proposed:

We did not propose any specific provisions for small volume manufacturers, as our analysis indicated that none were necessary. We proposed features designed to provide adequate lead time and to minimize test burden that equally apply to both large and small volume manufacturers.

What commenters said:

Ferrari, while in general support of our proposal, expressed concern about additional testing burden needed to run all five test cycles on each model. They suggest to adopt a manufacturer-specific correlation factor in lieu of performing the US06, SC03 and Cold FTP tests, or to use the "worst case" fuel economy data to represent untested configurations.

Our response:

Our proposal does not require manufacturers to run all five test cycles on each model. First, until 2011, all manufacturers will be able to employ the mpg line method, which only continues to rely on the same FTP and HFET tests as today. Second, for 2011 and later models, full five-cycle model type testing will only be required when the criteria set forth in the final rule are exceeded. Based on these criteria, we project that only four percent of test groups will need to perform Cold FTP and SFTP tests and only 13 percent will need to perform US06 tests. However, EPA's regulations allowing data substitution (worst case fuel economy data substituted for untested configurations) and for analytically derived data (where the fuel economy from an untested configuration can be mathematically determined by using the data from a similar tested vehicle that is more fuel efficient.) These provisions should address Ferrari's concerns about test burden.

1.10 Typographical Errors and Regulatory References

What commenters said:

Some commenters found what they believe to be errors or inconsistencies in the regulatory text. Mitsubishi alerted us to the following issues:

- In 600.010-08(b)(1) the text should read "The manufacturer shall generate city and HFET fuel economy data…" rather than "The manufacturer shall generate city and FTP fuel economy data…"
- The equation for Running FC in 600.114-08(a) should be the following, where the denominator of the second term in the second parenthetical term is $Bag3_{20}FE$, not $Bag2_{20}FE$ as it was in the NPRM:

$$Running\,FC =$$

$$0.70\times\left[\frac{0.48}{Bag2_{75}\,FE}+\frac{0.41}{Bag3_{75}\,FE}+\frac{0.11}{US06\,City\,FE}\right]+0.30\times\left[\frac{0.5}{Bag2_{20}\,FE}+\frac{0.5}{Bag3_{20}\,FE}\right]$$

$$+0.133\times\frac{21.5}{19.9}\times\left[\frac{1}{SC03\,FE}-\left(\frac{0.61}{Bag3_{75}\,FE}+\frac{0.39}{Bag2_{75}\,FE}\right)\right]$$

- In 600.115-08(b) the equation for Derived 5-Cycle Highway Fuel Economy should read “HFET FE” where the NPRM read “FTP FE”:

$$Derived\ 5-cycle\ Highway\ Fuel\ Economy = \frac{1}{\left(\{Highway\ Intercept\} + \frac{\{Highway\ Slope\}}{HFET\ FE}\right)}$$

- Section 600.116-08(a)(1) references 600.114-08(b) for the 5-cycle city fuel economy equation. Mitsubishi believe that the referenced section actually related to the 5-cycle highway fuel economy equation, and that the appropriate reference is 600.114-08(a).
- Section 600.116-08(a)(3)(B)(1) references 600.114-08(c), a section that does not exist. Mitsubishi believes that the appropriate reference is 600.114-08(b).

NREL commented that the air conditioning equation as expressed in the Draft TSD on pages 67 and 75 is incorrect, and that the correct form of the equation appears on pages 101 and 113. They believe that the correct form of the equation is the following:

$$A/C\,FC = \frac{1}{SC03\,FE} - \left(\frac{0.61}{Bag\,3\,FE_{75}} + \frac{0.39}{Bag\,2\,FE_{75}}\right)$$

NREL commented that the coefficient for Ambient Temperature in the equation on page 71 should be 0.084, not 0.84.

Mitsubishi encountered ambiguity in some of the regulatory references in 600.116-08. They note that there are two references to 600.010-08 as a method for calculating 5-cycle city fuel economy and 5-cycle highway fuel economy. However, their confusion stems from the fact that 600.010-08 does not define the 5-cycle equations, but merely the calculations for each specific cycle in the equations. They suggest that it may be more appropriate to reference 600.114-08, where the 5-cycle equations are defined. Mitsubishi recommends that EPA explain these references more clearly, or change the references to the appropriate section.

The comments from AAM/AIAM included a long list of incorrect, obsolete, or non-existent regulatory references which should be changed. They also offer a number of suggests for correction or clarification of regulatory language.

Our response:

We appreciate the level of detail with which these commenters reviewed the proposed regulatory text. Many of their comments and suggestions are valid, and we have incorporated their suggestions as appropriate. Readers of the final regulations will find that these and other errors and typographical mistakes have been corrected.

1.11 Miscellaneous Regulatory Comments

What commenters said:

AAM/AIAM recommended that a number of definitions be added to the definitions list in 40 CFR 600.002-08. They proposed adding definitions of US06-City and US06-Highway to Part 600 rather than modifying Part 86, as was done in the proposal. Their proposed definitions are as follows:

- *Two-bag FTP* means the FTP for HEVs as described in section 86.1811-04(n).

- *US06-City* means the combined periods of the US06 Test that occur before and after the US06-Highway period.

- *US06-Highway* means the period of the US06 Test that begins at the end of the deceleration which is scheduled to occur at 128 seconds of the driving schedule and terminates at the end of the deceleration which is scheduled to occur at 493 seconds of the driving schedule.

- *Five-cycle* means the FTP, HFET, US06, SC03 and cold temperature FTP tests as described in Subpart B and C of this Part.

- *Alcohol* means a mixture containing at least 85 percent by volume denaturized ethanol, or because of requirements relating to cold start, safety, or vehicle functions, a mixture containing at least 70 percent by volume denaturized ethanol.

- *Alcohol dual fuel automobile* means an automobile:
    - Which is designed to operate on alcohol and on gasoline; and
    - Which provides equal or greater energy efficiency as calculated in accordance with section 600.510(g)(1) while operating on alcohol as it does while operating on gasoline; and
    - (iii)Which, in the case of passenger automobiles, meets or exceeds the minimum driving range established by the Department of Transportation in 49 CFR part 538.

- *Certification vehicle* means a vehicle that is selected under section 86.1828-01 of this chapter and used to determine compliance under section 86.1848-01 of this chapter for issuance of an original certificate of conformity.

Our response:

We agree with AAM/AIAM that the majority of these definitions add clarity to the regulations, and with one exception we have incorporated them into the final regulatory text. We are not finalizing a definition for “Two-bag FTP” because it is not a term that is used in the final regulations.

1.12 Daytime Running Lights

What we proposed:

We did not propose anything specific with respect to daytime running lights.

What commenters said:

An anonymous commenter suggested that EPA “repeal” the manufacturer guidance letter CD-94-02, which allows manufacturers to disable daytime running lights (DRLs) while determining fuel economy. Their reasons for this were several: (1) DRLs can impact fuel economy; (2) an impact of up to 0.25 mpg equates to millions of barrels simply to support DRLs; (3) increased refueling events exposes consumers to toxic chemicals and fire injury potential; (4) safety advantages of DRLs are unproven; and (5) manufacturers have made it increasingly difficult to disable DRLs.

Our response:

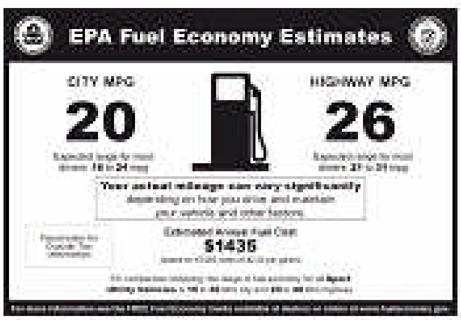
We believe that DRLs have generally evolved to minimize power usage, especially relative to those that were in use when the guidance memo was issued. Nevertheless, allowing them to be disabled is inconsistent with the intent of the new fuel economy estimates to better reflect the conditions that vehicles experience in actual real-world use. Thus, we intend to reevaluate the provisions of the guidance memo in the future, in consultation with NHTSA.

Chapter 2: Label Format and Content

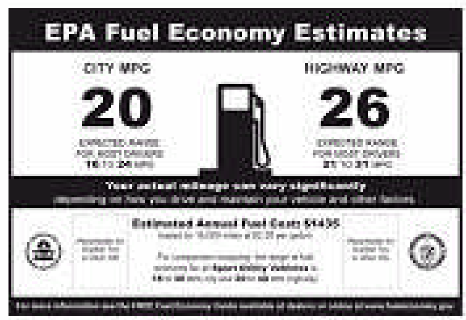
2.1 General Label Preferences

What we proposed:

We proposed to revise the design and informational content of the fuel economy window sticker to convey fuel economy information more clearly to consumers. The proposal included four label options under consideration.[3] While Alternatives 1 and 2 preserve some of the "look and feel" of the current label, Alternatives 3 and 4 depart from the traditional label design, presenting the same information graphically. Alternative 4 is similar to Alternative 3, but illustrates the comparable class information graphically. The four alternatives are shown below:

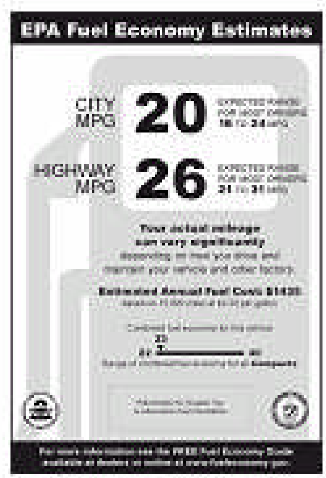


Alternative 1



Alternative 3

Alternative 2



Alternative 4

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[3] Note that the NPRM contained four alternatives, printed in the Appendix to the proposed regulations on pages 5510-5513, labeled Alternative 1, 2, 3, and 4. These same labels were posted on EPA's website, but in a slightly different order and with different nomenclature (Label A, B, C, and D). In the following discussion we refer to the labels printed in the NPRM and use that nomenclature.

What commenters said:

Nearly all of the commenters (almost 3000 in total) preferred Alternative 4, attributing their choice to the graphic expressing the vehicle's fuel economy relative to other vehicles in its class. Alternative 4 contained the only within-class comparison graphic, which many likened to the Energy Star graphic comparing energy use of appliances. One commenter stated that Alternative 4 "best clarifies the relative fuel economy against competitors in the same vehicle class." Another noted that Alternative 4 "looks sufficiently different from the current sticker to make it easy for consumers to notice the change." [NYDEC, AAA, F. Schmitt, Bluewater Network, B. Kotlier, multiple anonymous]

However, many automobile manufacturers expressed that the "portrait" orientation of Alternatives 2 and 4 (the current label format is "landscape") would pose significant implementation issues. [AAM/AIAM, GM] Subaru supported the industry position, adding that the shadow figure of a full-size gray gas pump (a "watermark") would conflict with the Subaru logo watermark currently displayed on their labels.

NADA noted that each of the proposed label formats offered pluses and minuses for dealership sales personnel who frequently address consumers' concerns at the point-of-sale. They stated that an "informal, non-statistical" survey of some dealers suggested "overwhelming support" for Alternative 1 and a consensus against Alternatives 3 and 4. This preference was attributed to Alternative 1's similarity to the current label, which they saw as an advantage to the public, noting that it offers a "cleaner, simpler, and more straight-forward approach" than the current label or the other proposed alternatives. Alternatives 3 and 4 were viewed by the surveyed dealers as "…too radical a departure from the time-honored label currently in use." They added that the final label should be as simple as possible.

Natural Resources Canada supported the layouts of Alternatives 3 and 4 and mentioned that Alternative 3 may be more familiar to consumers because it retains a landscape orientation and does not diverge dramatically from the current format. They preferred the contemporary design of Alternative 4, because although it may require the consumer to look carefully at first, it clearly highlights the fact that information has been updated and improvements have been made.

Two anonymous commenters expressed a preference for Alternative 1. While one failed to explain why, the other suggested that the similarity to the current label would make it easier for consumers to locate it on the window sticker. This commenter also stated that Alternative 1 showed the annual fuel cost estimate more prominently than the other labels. [Anonymous#1, Anonymous#3]

ACEEE advised EPA that consumers may not fully benefit from the label largely because labels are not optimized for consumers. Consequently ACEEE recommended that EPA hire "one or more outside specialists in visual communication or quantitative information to design from scratch a label for EPA's consideration that will maximize comprehension, motivation, and message effectiveness."

Bluewater Network commented that they strongly support the approach taken in Alternative 4 "because it provides a great deal of valuable consumer information very clearly."

Our response:

Clearly, no one label design can address every comment, but with the exception of NADA, the groups generally agreed that a new appearance is desirable. We acknowledge NADA's concern that the new label should not be a "radical departure" from the current design and recognize that dealers are highly involved in answering public questions about the label. Although the new label will present the facts differently, it will retain most of the content. Much of the new information will be self-explanatory, such as the web link to www.fueleconomy.gov, or the added basis for the estimated annual fuel costs (price per gallon and miles per year.) However, the public did not share NADA's "overwhelming [dealer] support" for a more "time-honored," conservative label design; while the pictorial representation of the comparable fuel economy is the most transformed feature that dealers may need to explain, commenters indicated that the new graphic is a highly desirable improvement over the textual version. The label design we are adopting does retain some familiar design aspects, specifically the location of the city and highway estimates on either side of the fuel pump graphic. We believe that we can address NADA's concerns about consumer comprehension by jointly-sponsoring an outreach campaign with car dealers that could include explanatory materials, such as a brochure that dealers could distribute to customers. We also plan to conduct outreach and education targeted at the general public to raise consumer awareness of the new label and its contents.

We acknowledge the ACEEE suggestion that EPA utilize outside experts to help design the label. The old fuel economy label, portions of which were developed in the 1970's, was designed by EPA engineers and not by graphic designers. Based on a limited amount of market research for the new label, we discovered that prospective buyers did not understand much of the information on the label other than the large city and highway numbers, and that we lacked the expertise to develop a label format that would be more user-friendly. Therefore, we contracted a professional graphic design firm before the proposal, to help us both create and market-test new designs, resulting in the four proposed alternatives. We also enlisted their assistance after the proposal in order to market-test alternatives based on comments received. This contractor then incorporated suggestions from public comments and the focus groups into the final label design recommendations for EPA's consideration. Comments and suggestions from the focus groups are located in the Focus Group Report and the Docket.[4] The final label design is shown below:

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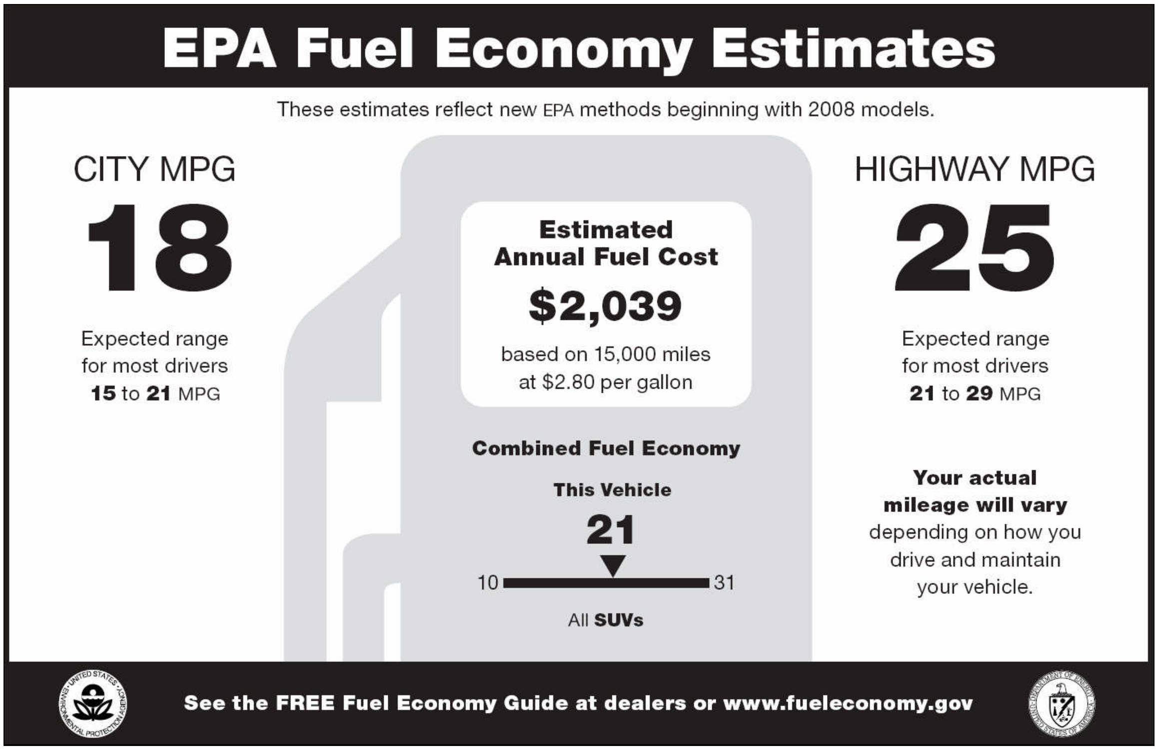
[4] Each of these can be found in the public docket, which is available at www.regulations.gov. Search under EPA Docket ID No. EPA-HQ-OAR-2005-0169.



2.2 Label Format Effective Date

What we proposed:

The NPRM proposed changes to the methodology for calculating label values and changes to the design and content of the label, beginning with 2008 models.

What commenters said:

AAM/AIAM noted that when new fuel economy labels become effective (the 2008 model year), the auto companies will be simultaneously be implementing the new safety rating label requirements finalized by the National Highway Traffic Safety Administration (NHTSA) on September 12, 2006.[5]

AAM/AIAM also argued that lead time for changing the format is inadequate because the few months between EPA's finalization of the rule and the potential start of 2008 model year production in January of 2007 is not enough time to work with suppliers on creating new labels. Consequently, they requested that any changes to the look, font, orientation, content, or language be made voluntary for the 2008 model year. They specifically noted that they are not proposing to delay the presentation of

[5] See 71 FR 53572 (Sept. 12, 2006).

the new label values, only that changes to the appearance be voluntary for the 2008 model year. They further recommended that EPA allow manufacturers to maintain the old label format, provided that text is added in the variable text field (under the fuel pump, above the Estimated Annual Cost) that states “New 2008 Method.”

Subaru commented that manufacturers frequently purchase pre-printed Monroney pricing labels in bulk, thus making it likely that some will already have label stock for the 2008 model year vehicles long before EPA’s rule is finalized.

The industry’s view was that if a final rule were published by September 2006, modifications to the look, font, orientation, content, or language on the label could be implemented on vehicles manufactured on or after September 1, 2007. They indicated that if the fuel economy label effective dates are aligned with the statutorily-mandated timing of the safety label requirements, they require only one round of significant modification to their overall pricing labels. General Motors reiterated this position in their comments, citing their staggered model production throughout the calendar year and the difficulty in applying labels to early 2008 vehicles with the first build event scheduled for January of 2007.

NADA suggested that the final rule clarify that manufacturers are free to provide dealers with replacement labels for installation on undelivered vehicles initially labeled under the old rules. Providing this flexibility, they argue, will reduce consumer confusion.

Our response:

We believe that the new fuel economy estimates should ideally be accompanied by a new fuel economy label design that clearly announces this fact to the public. Recognizing that a typical dealer's lot may contain vehicles from multiple model years (e.g. 2007 and 2008) for the first or second calendar years of implementation, consumers would be able to readily distinguish the new estimates by the new look of the label, and thus more likely to understand that the fuel economy of 2007 models will be different from that of 2008 models. We also realize that the timing of this final rule will cause some significant practical difficulties for those manufacturers introducing 2008 models early in the calendar year 2007. Manufacturers remarked that the new NHTSA safety ratings are statutorily required on vehicles manufactured on or after September 1, 2007, and that harmonizing the new fuel economy label effective with that same date would ease some of their implementation burden. In general, the traditional "start" of the new model year has been October of the previous calendar year (e.g., model year 2008 would begin in October of calendar year 2007). However, as manufacturers have indicated, staggered production schedules throughout the calendar year have become widespread across the industry. We now understand that some manufacturers have very early model year 2008 (e.g., January/ February, 2007) launches planned for several vehicle models. We are therefore finalizing a requirement that aligns mandatory use of the new label format with the NHTSA label date. This will give manufacturers needed lead time to phase in the new labels without multiple changes to the vehicle pricing (Monroney) sticker. All 2008 models manufactured on or after September 1, 2007 will have the new label format. We agree with NADA's comment that manufacturers should be allowed to use the new label design as soon as possible, and we strongly encourage manufacturers to apply them on a voluntary basis to 2008 models for sale before that date. Those 2008 models using the current fuel economy label design will be required to include, at a minimum, the following information on the label:

1. The city and highway estimates, based on the new calculation methods contained in this final rule.
2. A statement in bold print that says "These estimates reflect new EPA methods beginning with 2008 models.".

2.3 Label Content Issues

2.3.1 Fuel Economy of Comparable Vehicles

What we proposed:

The EPCA statute requires that the label include the fuel economy of comparable vehicles: This provision was intended to help car shoppers compare the fuel economy of similar vehicles. EPA's current regulations require that the label include the following statement: “For comparison shopping, all [vehicles/trucks] classified as [insert category as determined in §600.315] have been issued mileage ratings ranging from ___ to ___ mpg city and ___ to ___ mpg highway.” Based on pre-proposal focus group research, it appeared that car buyers disregarded this statement since we learned in small print and contained lengthy text. Many perceived it as “fine print,” and thus less important. We showed the pre-proposal focus groups label samples with less text for comparable fuel economy, and they generally preferred these versions. A few participants suggested that a pictorial representation may be even more clear. In our proposal, three of the four sample labels contained a revised statement to lessen the “fine print” look, and the fourth was a graphical representation similar in concept to DOE’s EnergyGuide label on which we requested comment. This graphic based the fuel economy comparison on combined city/highway fuel economy instead of separate city and highway comparisons, as demonstrated in the old label and the proposed alternatives 1 through 3.

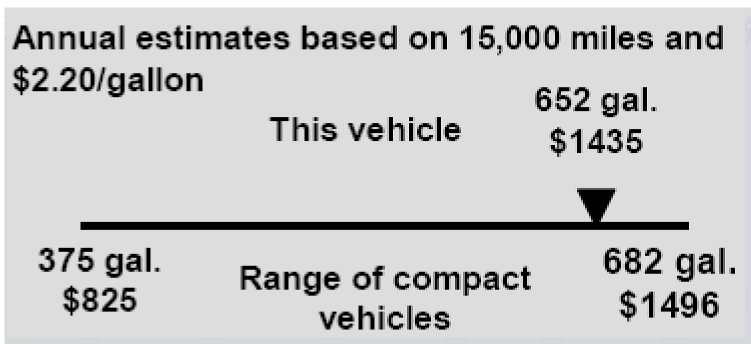
What commenters said:

We received many comments on this issue with suggestions and alternatives provided below.

AAM/AIAM noted that EPA’s current class definitions are quite broad, and as a result “the range in fuel economy in any one class is generally very large, and the class leaders are typically lower volume specialty vehicles.” They remarked that a Toyota Prius and a Rolls-Royce Phantom are both classified as mid-size vehicles, yet they are clearly not in the same market segment. Citing this wide variation, AAM/AIAM suggested retaining the current label language on the fuel economy of comparable vehicles. They requested that if EPA were to receive comments on this issue specifying a substantial preference for a graphical approach, they “would like to work with the agency…on the correct look, feel, and format of a graphic that ensures our competitive concerns are addressed.”

NADA commented that an informal and non-statistical survey of dealers on their Regulatory Affairs Committee found that the graphical presentation of comparable class fuel economy “…failed to offer advantages…” over the text used in EPA’s proposed Alternative 1 label. However, they held that the label should continue to contain this information in some form.

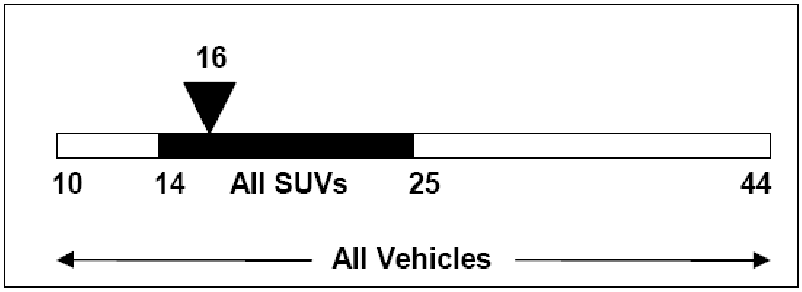
Toyota submitted a label concept that included the following recommendation for a graphic combining both the annual estimated fuel cost and the fuel economy range of comparable vehicles.

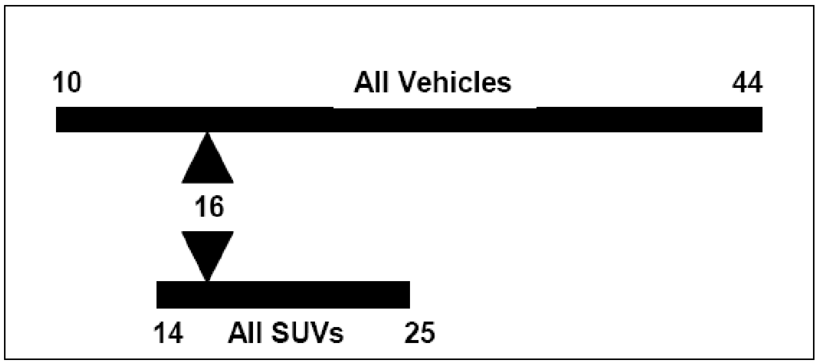


Public Citizen suggested that customers will less likely dismiss a pictorial representation because it may more effectively convey information. They also remarked that non-English speakers may understand the graphic more easily. In addition to graphically comparing the combined fuel economy, they recommended that this approach be used for both city and highway fuel economy estimates. For implementation, they suggested that EPA conduct focus groups to determine the best format for a graphical comparison of comparable class fuel economy.

Bluewater Network noted that “the bar graph is also consistent with the EnergyGuide Label, and highly comprehensible to consumers.”

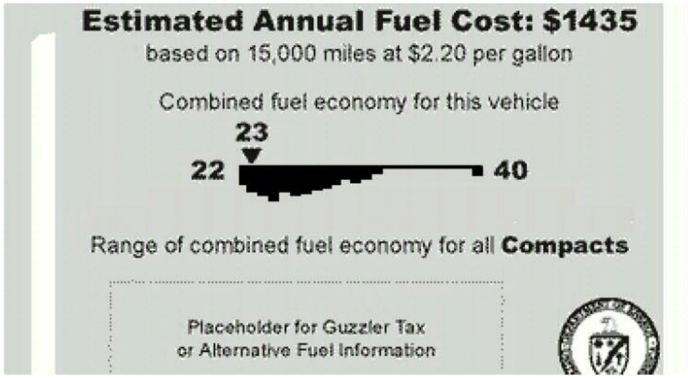
UCS argued that with the recent proliferation of vehicle designs and the “fading class distinctions” exemplified by crossover vehicles, consumers have increased shopping across classes and should be presented with information comparing vehicles on the dealer lot to the full range of vehicles on the market. They proposed the two following alternative comparable class graphics for the label including comparisons to the whole fleet and to the specific class.





Placed on the Alternative 4 label and similar to that of the EnergyGuide program, commenters generally understood the graphical element and preferred it over the current text. Many commenters preferred Alternative 4 because the visual was more powerful and comprehensible. [A. Benenson, AAA, R. Appel]. Natural Resources Canada stated that a graphical representation should be on the final label design. An anonymous commenter suggested that since this graphic presented useful information and was the label's only reference to combined fuel economy, it should be displayed in a font size "nearly as large as the City and Highway numbers." This commenter also noted that while the within-class range is useful, it would be even more useful to see the average combined fuel economy for that class of vehicles.

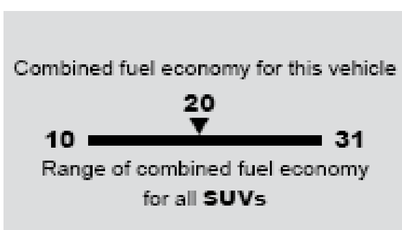
One commenter remarked that the graphical depiction of comparable class fuel economy is "statistically lacking" because it does not convey information about how many vehicles are in the relevant vehicle class and how their fuel economy values are distributed between the minimum and maximum. Since one of the endpoints of the range (e.g., the maximum fuel economy in the class) could be an outlier and the bulk of the vehicles in the class might be clustered nearer the minimum value, this commenter suggested making the graphic a small histogram and provided an example of this concept. As illustrated in the following graphic, a car could be at the midpoint between 22 and 40 mpg, suggesting that it achieves average or median fuel economy in the class. The histogram, however, would more accurately indicate that a midpoint value would actually indicate a higher combined fuel economy than most vehicles in the class. [D. Fitz-Randolph]



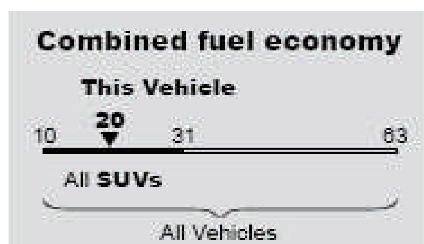
Our response:

While public commenters preferred a graphic representation of comparable fuel economy, manufacturers were concerned about competitive fairness. We examined this element further with post-proposal focus groups, which highly supported the graphic. Although many noted that including the combined fuel economy was important, since most drivers do not drive exclusively in the city or highway style, others remarked that while the information would be useful to some, it would be of no use to them because they did not shop within a specific class of vehicle. We thought the UCS comment to show the fuel economy range of all vehicles had merit, and we tested the following versions of this graphic with the focus groups:

Version 1: Within-Class Range of Vehicles



Version 2: Added Range of All Vehicles



The focus groups slightly preferred Version 1 because of its simplicity, many participants noting that they already knew which class of vehicles they would be considering. Others preferring Version 2 mentioned that it could influence some people to reconsider vehicles with higher fuel economy. Although some participants thought the added fuel economy range in Version 2 was useful, many thought it was too much information or were confused by what it represents.[6]

We are requiring a graphic for comparable fuel economy and the scale showing the range of fuel economy for vehicles in the comparable class because it was well-

[6] The comparable classes that EPA designates are related to how the comparable fuel economy is presented on the label. Section 2.6 contains a separate discussion of comparable classes.

received by the public commenters and focus groups. People responded favorably to its likeness to the widely-used EnergyGuide graphic. We recognize manufacturers' concern that showing comparable fuel economy information may be misleading in some cases, since the class ranges are often broad and sometimes defined by lower sales volume vehicles. However, this issue is derived more from how to create class distinctions, rather than how to present the information. Some focus group participants noted that if a certain class of vehicles had a particularly wide fuel economy range, a car shopper could solicit the informational sources provided on the label (Fuel Economy Guide or web site) to determine if the more fuel efficient models in that class would meet their vehicle needs. We agree with this observation and are retaining a simpler graphic similar to that in Alternative 4, because the label information is more clear and concise.

2.3.2 Estimated Annual Fuel Cost

What we proposed:

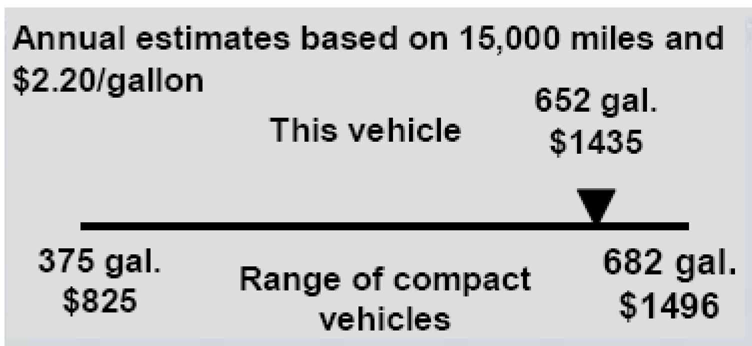
The EPCA statute requires that estimated annual fuel cost be reported on the label. Currently, the EPA requires only the dollar amount in the cost estimate, but allows manufacturers to voluntarily include the per-gallon fuel cost and annual miles driven, items that derive annual fuel cost. However, since manufacturers typically do not include this optional information, most labels contain only the annual cost. We proposed to require also the per-gallon fuel cost and annual miles driven on the label in the following statement: "Estimated Annual Fuel Costs = $XXXX (based on XX,XXX miles at $X.XX per gallon)." We also sought comments on whether the text should include the combined fuel economy number as part of the derived Estimated Annual Fuel Cost.

What commenters said:

While opinions on the presentation of estimated annual fuel cost differed, no one opposed including per-gallon fuel cost and annual mileage, the bases for the estimate. Some commenters suggested showing a range of estimated fuel costs based on either a five-year projection of fuel costs or an analysis of fuel volatility. [Bluewater Network, A. Benenson, anonymous] Bluewater Network suggested a font size for this element at least as large as the mpg values and also urged EPA to present a fuel cost range from 100% city driving to 100% highway driving, because it is useful to those who drive exclusively in the city or on the highway. A. Benenson stated that EPA should revise the per-gallon fuel cost at least annually, and MT-CHEER noted that the label should use the most realistic fuel economy number, whether it is the combined, city, or highway figure to estimate the annual cost. AAA and NADA generally supported these notions, and an anonymous commenter stated that annual fuel cost is "one of the most important pieces of information for the consumer." Another anonymous commenter noted that the label lacked a fuel consumption metric, and suggested displaying the estimated annual fuel cost more prominently, since it is a useful proxy for fuel consumption.

Public Citizen and UCS commented that because the combined fuel economy number is important in determining the estimated annual fuel cost, it should be included in the explanation, since it makes the calculation less transparent to consumers. They suggested, however, that EPA conduct a focus group study to examine consumer response.

AAM/AIAM and Subaru supported including both miles per year and dollars per gallon of fuel on the label, because this information may be valuable to fuel-economy-conscious consumers. They recommended that EPA continue to update the fuel cost annually and not more often because frequent changes may be problematic, confusing, and costly. Toyota submitted the following label concept which combines both the annual estimated fuel cost and the fuel consumption range of comparable vehicles.



Our response:

Focus group participants and public commenters expressed interest in fuel cost information, remarking that the added bases for this calculation (cost-per-gallon and miles-per-year) substantially improved the label. We agree that we should enlarge the fuel cost font. We tested various sizes with focus groups; most focus group participants preferred seeing the fuel cost information more prominently on the label. However, the fuel cost value will not be as large as the city and highway estimates in the final label, because we believe that it is confusing to display three large numbers of the same size. There is now a smaller fourth number for the combined fuel economy shown on the comparable class fuel economy graphic that competes for space on the label. The final font size for fuel cost and combined fuel economy is the same, and the city and highway numbers are slightly larger.

We appreciated Bluewater's suggestion that adding a range of fuel cost based on 100% city driving or 100% highway driving may be useful to those who drive predominantly in urban or rural areas. We tested the following graphics with the focus groups:

Option 1: Proposed fuel cost info | *Option 2: With added city and highway fuel cost*

Estimated
Annual Fuel Cost
$2100
based on 15,000 miles
at $2.80 per gallon

Estimated
Annual Fuel Cost
Combined: **$2100**
City $2333
Highway $1680
based on 15,000 miles
at $2.80 per gallon

The focus groups had mixed reactions to these options, but slightly preferred Option 1 because it was simpler and provided all of the vital information. Others thought that the combined estimate would be more accurate, since they did not drive exclusively in either city or highway conditions. Alternatively, those that preferred seeing the added city/highway fuel costs did so because they did drive under one condition more often than another; others simply preferred having more information.

We are finalizing Option 1 based on positive response from both public commenters and focus groups. While the option to include separate city and highway annual fuel costs may provide additional useful information for some consumers, others may disregard it altogether because of its complexity. Furthermore, there is enough information provided on the simpler graphic that a person could determine their own customized fuel cost estimate by modifying one or more parameters (e.g. mpg, dollars-per-gallon, or miles-per-year).

2.3.3 Combined Fuel Economy Calculation

What we proposed:

We proposed that the combined fuel economy used in the comparable class graphic to calculate the estimated annual fuel costs be the weighted average of 43% city mpg and 57% highway mpg, instead of the current 55% city mpg and 45% highway mpg. This change is consistent with the ratio used to determine combined 5-cycle fuel economy for the fleet. This 43/57 ratio is based on national driving patterns indicating average mileage driven (not time spent) in "city" versus "highway" conditions.

What commenters said:

Bluewater Network noted that the proposed 43/57 city/highway split for determining combined fuel economy was not accounting for the amount of time spent in city or highway conditions. They suggested that EPA use a 50/50 city/highway split because it more closely aligns with how many customers consider their driving patterns (in terms of time spent versus miles driven).

Alliance/AIAM agreed that while the proposed 43/57 split may be statistically valid on a miles-driven basis, it does not account for time spent during the trip. They believed that people relate their driving habits most closely to the current 55/45 split, and that the current division may be preferable, but also recommended that EPA collect more data including the effects of modern-day congestion.

Our response:

The two public comments submitted on this topic suggested that most people intuitively consider how much time they spend driving in either city or highway-type conditions, rather than the percent of miles driven, and moreover, that most people think of their driving as 50% city and 50% highway, or something close to that. We are inclined to agree with this, since the label is designed for the general public's use. We also note that the combined fuel economy used for corporate average fuel economy (CAFE) and the Gas Guzzler tax remains 55% city/45% highway, according to EPCA and IRS statutory requirements. Thus, in order to maintain continuity, we are maintaining the weights for combined fuel economy at the current 55% city and 45% highway weights.

2.3.4 Range of Expected Fuel Economy

What we proposed:

Although not statutorily required, the current label provides a single statement explaining why actual fuel economy will vary from the EPA estimates and an expected range of fuel economy for that vehicle, determined by +/- 15 percent of the city and highway estimates. Providing the range of expected city and highway fuel economy on the label helps consumers predict their fuel economy across a wider spectrum of driving conditions. The current label presents a few reasons why mileage will vary and includes the range of expected city and highway fuel economy. Earlier focus group research showed that consumers were not easily associating the ranges given with city and highway numbers with the vehicle. Some thought that this information was associated with the city number, since it was located directly below it. We proposed to split this statement into two separate elements: 1) the general statement that fuel economy will vary, and 2) the numerical range of expected city and highway fuel economy. In order to help consumers determine their realistic fuel economy, we proposed to place the range of expected fuel economy closer to (underneath or on the side of, depending on the label) the actual city and highway estimates. We also proposed to increase the range to +/- 17 percent, representing a 10^{th} to 90^{th} percentile of expected in-use fuel economy.

What commenters said:

AAM/AIAM noted that this information is not statutorily required by EPCA and stated their belief that it adds little value. They recommended removing this information from the label, “thus making the look of the label less cluttered and making the remaining information more bold, concise, and noticeable.” They also suggested that the expected fuel economy range be provided in EPA’s Fuel Economy Guide and on the fuel economy web site, www.fueleconomy.gov.

Our response:

We agree with the industry comment that since the current label’s presentation of expected fuel economy is difficult to comprehend, it is not useful to car buyers in that form. However, we maintain that it is important to inform consumers that fuel economy will vary and to provide a reasonable range given this variability. Focus group participants more favorably received the shortened disclaimer language and its new location. The groups recognized that fuel economy would vary based on the driver and driving conditions. Some stated that since the estimated values can easily be mistaken for reality, it is necessary to include the expected range as a disclaimer. Others commented that this information may be particularly useful for younger, first-time car buyers, who may not be aware of how fuel economy can vary. We acknowledge these comments and are finalizing this requirement as proposed.

2.3.5 “Your Mileage Will Vary” Statement

What we proposed:

We proposed to separate the range of expected fuel economy and the statement that actual fuel economy will vary from the EPA estimates, in order to emphasize to consumers that the mpg values are estimates only and that drivers may experience different fuel economy depending on many factors. Since many focus group participants did not notice the current label’s text, which includes reasons why mileage will vary, we proposed to reword and reformat it to convey the message more effectively. The proposed text was “Your actual mileage can vary significantly depending on how you drive and maintain your vehicle and other factors.”

What commenters said:

NADA commented that this “disclaimer/qualifier” is an “all-important” item and should continue to be on the label.

Bluewater Network suggested replacing the proposed language with the following, in order to educate consumers about maintenance and driving habits that affect fuel economy: “For best mileage performance, please keep tires fully inflated, conduct regular tune-ups, use cruise control, avoid rapid acceleration and high speeds, and reduce air conditioning, defrosting, or heating when possible.” They also recommended that EPA delete the “actual fuel mileage may vary” or relegate it to a footnote.

Toyota suggested adding detail to the “Your mileage will vary” statement by listing items a driver typically can and cannot control. Their proposed language was the following:

> **Your actual mileage can vary significantly:**
> Some factors are beyond your control
> traffic, geography and climate
> Some you can control:
> Speeding, aggressive driving or not
> maintaining your vehicle well

Our response:

Most commenters recognized the importance of the disclaimer statement but took issue with how much detail should be provided in this statement. We tested alternative wordings with the focus groups to see if additional explanation, as suggested by Bluewater Network and Toyota, would be necessary and the general consensus was that fewer words were better. Nearly all of the groups independently suggested the same revision to the disclaimer statement, which was a combination of a simple statement and a web link. Since all groups were able to list multiple reasons why fuel economy varies, including weather, driving habits, and maintenance, we considered that it may not be necessary to provide detailed reasons on the label. Many advised that including too much detail would be "preaching to the choir," and suggested a web link for young first-time buyers who may not know these details, since younger drivers may be more inclined to use the internet. We are finalizing a shorter disclaimer statement: "Your actual mileage will vary depending on how you drive and maintain your vehicle." However, we are not adding the web site to the statement, because the final label includes this link in the bottom border, directly beneath this text.

2.3.6 Graphical Updates and Government Logos

What we proposed:

We proposed to update the appearance of the label. In the sample labels, we included a more contemporary fuel pump design. Since many focus group participants were unaware that the EPA issues the fuel economy estimates, rather than auto manufacturers or dealers, we proposed label designs with more prominent EPA and DOE logos to clarify that the mpg values originate from government testing. We also proposed adding a link to the EPA-DOE Fuel Economy Guide website (www.fueleconomy.gov) to provide additional information for interested consumers.

What commenters said:

Public Citizen supported making the government logos more prominent to indicate that EPA and DOE are responsible for the fuel economy labels and testing.

AAM/AIAM agreed with enhancing the EPA and DOE logos and label heading.

Subaru initially objected to the gray gas pump watermark in the background of two of the proposed labels because it would cover the Subaru brand logo artwork that currently appears on their Monroney label, but agreed with the more prominent display of the government logos. In a subsequent comment, Subaru informed EPA that it was implementing a new design and was no longer concerned with the fuel pump graphic.

Our response:

We are requiring the enhanced EPA and DOE logos on the label and the "EPA" designation in the label title because commenters and focus group participants clearly indicated that the government seals add credibility to the label.

2.3.7 Environmental Information on Fuel Economy Labels

What we proposed:

Historically, EPA used the Green Vehicle Guide web site (www.epa.gov/greenvehicles) to rate vehicle fuel economy and emissions information on a 0 to 10 scale. Some suggested adding similar information to the label to convey more completely a vehicle's environmental performance and to provide a graphical vehicle to vehicle comparison. Prior to the proposal, we showed examples of fuel economy labels that included environmental ratings (for Air Pollution and Greenhouse Gas) to focus group participants and asked for their impressions. Although there was confusion arising from the newness of the information, they generally agreed that the ratings could be useful in the future. We requested comment in the NPRM on a possible voluntary environmental labeling program.

What commenters said:

AAM/AIAM stated that they "…support making available to the consumer, data on vehicle emissions and fuel economy but do not support ratings or rankings of vehicles that must ultimately be based on subjective methodologies." They continued, "…we believe that fuel economy and exhaust emissions data should be reported separately to the consumers." They argued that the label should report exhaust emissions data to the consumer on the vehicle's certification standard and not a subjective "1 to 10" or other type of scale, because skeptics can raise numerous questions on how the factors are weighted. They suggested that EPA make factual information available to the public to ensure that each individual can make informed decisions, although they also noted from the focus groups that additional information dilutes the meaning of the overall information. They recommended that we exclude this information on the label, but publish it on the web site for those interested.

While NADA commented that “no environmental descriptor is necessary,” Public Citizen suggested that EPA require this information and that it would “greatly enhance consumers’ ability to purchase a vehicle that meets their environmental demands.”

UCS commented that EPA should execute its authority under U.S.C. Section 32908(b)(1)(F) to require environmental information on fuel economy labels. UCS preferred numerical and graphical representations of the vehicle’s greenhouse gas and smog scores like those set forth in the NPRM, noting that these scores should compare vehicles with all new vehicles, instead of those within a certain class. UCS also suggested that EPA include an official “seal of approval” on the label for the most environmentally benign vehicles.

ACEEE agreed that the label should include greenhouse gas and smog ratings, since space is available. They cited their 2005 report, “Environmental Performance Labels for Vehicles: Findings of Research with Consumers and Stakeholders,” as a potential source for different forms of presenting this information. They further suggest that the time is ripe for adding this information to the label because of the label redesign process that our proposal put in motion.

Environmental Defense did not support a voluntary environmental label with EPA's greenhouse gas rating from 0-10, which they criticized as "too coarse". They commented that we should instead educate consumers on the relation of fuel economy and the environment and emphasize that individuals can reduce impact on the environment by choosing a vehicle with high fuel economy.

An anonymous commenter suggested that EPA include “CO/mile” (but undoubtedly meaning CO_2 emissions per mile) to raise awareness about the vehicle’s impact on global warming.

Our response:

While some environmental groups wanted to add other environmental information to the label, automobile manufacturers and NADA were reluctant, since they were concerned with the subjective nature of the 0 - 10 scale. Focus group participants repeatedly indicated that a simpler label conveyed the fuel economy message better. At this point in time, we believe it is premature to add environmental or GHG score information to the label. Since there was no clear consensus from the public comments and several commenters raised concerns about the scales for these scores, we believe the issue needs further evaluation.

However, to fully consider the suggestions from environmental groups, we tested the following brief statement linking fuel economy and the environment with the focus groups: "Buying a vehicle with better fuel economy helps protect the environment and reduces dependence on oil." Reaction to this statement was strongly divided; some declared that the statement was "preachy," obvious, and unnecessary, while others stated that it was important and reflected EPA's mission. Because public comments and focus group reactions were strongly divided, and because we would like the label to be as simple and uncluttered as possible, we are not requiring other environmental information on the label at this time. We agree with automakers that the EPA Green Vehicle Guide and Fuel Economy web sites are better places to publish information on environmental impacts from vehicle ownership, since there is more space for elaboration. Thus, we are not currently addressing a voluntary environmental labeling effort, but may choose to do so in the future.

2.3.8 Vehicle Descriptor Information

What we proposed:

Consistent with the current regulations, we proposed that fuel economy labels within the "Monroney" price sticker not contain vehicle descriptor information, but those affixed separately must include it.

What commenters said:

AAM/AIAM agreed with the deletion of fuel metering, catalyst usage, and California systems from the vehicle description requirements in 40 CFR 600.307-08(c). They additionally suggested that we delete “(iv) Number of engine cylinders or rotors” as a separate line item subsection and include it instead in the category of “additional engine information, if necessary." Thus, they suggested changing paragraph (v) from its proposed reading (“Additional engine description, if necessary to distinguish otherwise identical model types, as approved by the Administrator; and”) to the following: “Additional engine description (for example, number of cylinders or rotors or number of valves), if necessary to distinguish otherwise identical model types, in accordance with good engineering judgment; and...."

NADA suggested that EPA reconsider whether to require all of the vehicle-specific description information in the proposed section 600.307-08(c) and noted that EPA has considerable statutory authority in this regard.

Several commenters recommended that the label continue to contain the vehicle descriptor information on the label, because they thought the proposed labels omitted information such as the vehicle model, engine and transmission type, etc.

Our response:

Our goal for vehicle descriptor information is to provide consumers enough detail to distinguish between visually identical models on a dealer's lot that may have different fuel economy because of differences in engine design, (such as number of cylinders, rotors, etc.). We agree with the manufacturers' suggestion and are revising the regulation accordingly. We also recognize that EPA has considerable statutory authority regarding vehicle descriptor information, and would like to finalize the minimum text required for consumers to match the vehicle and its fuel economy. This information would appear only on those fuel economy labels that are physically separate from the price stickers, an infrequent occurrence, based on an informal survey of car makers.

We are also finalizing details for the location, font size and other design information. To assist manufacturers, we are including an example label that contains the vehicle description information.

2.3.9 Website Reference

What we proposed:

We proposed to require that the label include a web link to the jointly sponsored EPA-DOE website, fueleconomy.gov, which contains information on vehicle fuel economy matters and includes downloadable versions of the Fuel Economy Guides, 1985 to present.

What commenters said:

NADA commented that the label should refer prospective purchasers to the www.fueleconomy.gov website and the DOE/EPA Fuel Economy Guide for more information, noting that those purchasers who consider fuel economy an important factor in their choice will likely use these tools to compare options before arriving at the dealer. Public Citizen likewise supported placing the website reference on the new label. UCS commented that "the prominent inclusion of [the website address] on the label is essential."

Our response:

We agree with the commenters that the web link is an important addition to the label. The pre-proposal and post-proposal focus groups confirmed that the web link was useful and important information, and thus we are finalizing it on the label.

2.3.10 Transition Language

What we proposed:

We requested comments on the need for a temporary transitional statement on the label to indicate that that the fuel economy estimates were based on new methods. We also requested comments on how long it should appear on the label.

What commenters said:

Several commented that for a period of time after the new labels are introduced, the label should include a statement explaining that fuel economy estimates are based on new methods. For example, A. Benenson suggested the following:

> *“Starting with 2008 model year vehicles, EPA has improved the way it estimates vehicle mileage. Because of this change, the mpg estimates on this label more accurately reflect the mileage drivers will actually obtain.”*

The Alliance/AIAM agreed that a brief statement would be a positive addition to the label and suggested "New 2008 Methods."

Our response:

We agree that a transitional statement is needed, although A. Benenson’s statement may be too wordy and the auto makers’ statement too brief. We tested the following text with the post-proposal focus groups: "These estimates reflect new EPA methods beginning with 2008 models." The groups understood the sentence but felt that it left the reader to ask, "What are the new methods?" They then concluded that they might find the answer at the web site provided or in the Fuel Economy Guide. Since this is the goal of the website reference, we are finalizing the statement tested with the focus groups. It will be centered near the top of the label.

When asked how long the transitional statement should appear on the label, focus group response varied widely. Some suggested the expected duration of a consumer’s vehicle purchase cycle and others recommended one year, indicating that this information would become "stale" after a while. We are requiring this transitional statement on all fuel economy labels for the 2008 and 2009 model years, because dealer lots may contain vehicles with both label designs. When 2010 models are offered, however, all models on dealer lots will have the new label design, and the text will not be necessary anymore.

2.3.11 City and Highway Numbers

What we proposed:

We proposed to retain the large "city" and "highway" numbers as the most prominent information on the label. The numbers on the four alternate labels were all the same size, and were slightly larger than the old label.

What commenters said:

An anonymous commenter, citing a memory that after the 1972 oil embargo the city estimate had a larger font than the highway estimate, desired to see this again, believing that the city estimate is a more accurate estimate of overall fuel economy.

Our response:

The commenter is correct that in the early stages of fuel economy labeling, an EPA regulation eliminated the highway estimate from the label, because many consumers complained that the highway number was unrealistically high When EPA revised the label in 1984, it reinstated the highway estimate with a 22% downward adjustment to reflect real world driving more accurately. The new calculations we are finalizing today reflect changes in driving behavior and technology since 1984, and better predict today's on-road city and highway fuel economy. Although no single estimate can ever capture a person's complete real world experience, we believe that consumers will be more likely to achieve the new estimates. While we are continuing to provide consumers with the range of city and highway fuel economy they can expect to achieve on the road, we are also introducing a combined fuel economy estimate on the label. Finally, when we showed pre-proposal focus groups a label having a single range instead of separate city and highway estimates, they strongly preferred to see both numbers, because this format was familiar, and the new presentation confusing. Therefore, we are requiring both the city and highway estimates.

2.4 Label Size and Orientation Issues

What we proposed:

Of the four proposed labels, two were positioned vertically ("portrait"), and two horizontally (landscape). The vertical format was 4.5 inches wide and 7 inches tall, while the horizontal format (currently used) was 7 inches wide and 4.5 inches tall.

What commenters said:

Several manufacturers commented that the portrait format would require a complete redesign of the "Monroney" price sticker label. AAM/AIAM noted that changing the orientation would require "significant and costly modifications" to manufacturers' fuel economy labeling and vehicle pricing systems, and recommended that we retain the current landscape format. GM stated that they recently redesigned their Monroney pricing sticker to include the newly required NHTSA safety ratings, with a horizontal fuel economy label, and that changes would be costly. Subaru suggested letting the manufacturers choose between portrait or landscape versions.

The general public preferred the appearance of Alternative 4, positioned vertically, but specifically favored its graphic of comparable fuel economy.

Our response:

We agree that the new estimates should be represented by a more contemporary label. We acknowledge industry cost concerns about redesigning pre-existing price stickers and recognize the challenges posed by simultaneously incorporating two new labels onto the price sticker - the NHTSA crash rating label and the fuel economy label. Although public commenters preferred the vertical orientation, the primary reasons provided were more relevant to the design elements (particularly the gray "watermark" fuel pump design with information it its "window" and the bar graphic showing comparable fuel economy) rather than the label orientation itself. Therefore, in order to address both the consumers' needs and the automakers' concerns, we are finalizing a horizontal label orientation and requiring those elements of the vertical format that were appealing to the public, such as the new fuel pump graphic, the bar graph of comparable fuel economy, clearly indicated fuel cost information, expected fuel economy ranges located close to the city and highway numbers, a disclaimer statement that is set apart, a web link, and a transitional statement announcing the new estimates.

We do not agree with Subaru that we should let manufacturers choose their orientation, because customers we believe it is important for consumers to recognize a constant label design.

2.5 Implementation Outreach

What we proposed:

In the preamble to the proposal, we discussed the need for an extensive outreach campaign to ensure that the public understands that the estimates and label design are new.

What commenters said:

AAM/AIAM urged EPA to plan several media announcements in early 2007 to inform consumers about the changes to the estimates and the label design.

Toyota recommended that EPA aggressively promote the new fuel economy label to assure that customers comprehend the changes in fuel economy numbers, during the label transition process. Toyota specifically suggested that EPA increase public awareness of the transition through the Fuel Economy Guide, the fuel economy website, and other methods, such as a pamphlet explaining the label transition.

Our response:

We concur and will work with the automotive industry and other interested parties to inform the public on changes to the fuel economy label and estimates.

2.6 Comparable Class Designations

What we proposed:

We proposed to add SUVs and Minivans to the pre-existing list of comparable classes, and to expand the "Small Pickup Truck" class weight limit of 4500 lbs to 6000 lbs.

We did not propose a class definition for "crossover" vehicle types, but requested comments on how to classify vehicle designs that do not clearly fall into a single category, based on the EPA definitions. We proposed to retain our current policy of allowing manufacturers to recommend,, subject to EPA approval, which class they believe best fits a "crossover" vehicle.

What commenters said:

AAM/AIAM supported adding minivans and SUVs to the list of comparable classes, suggesting that the proposed definition of minivan be modified to read: "minivan means a light truck which...," instead of "minivan means an automobile which...," to align with the definition of light truck given in 40 CFR Section 600.315-08(a)(2)(iv).   They also recommended that we clarify the distinction between minivans and SUVs by adding a rear sliding door to the minivan definition. They agreed with the proposed increase in weight delineation for the small pickup truck class from 4500 pounds GVWR to 6000 pounds GVWR. For "crossover" vehicles, they agreed that EPA should continue to determine the most suitable class on a case-by-case basis. They commented that although they did not recommend changing any of the other comparable class designations, they were concerned about the graphic presentation of the range of fuel economy for comparable vehicles, as discussed previously in Section 2.3.1.

UCS commented that the addition of SUVs and minivans to the vehicle class list was "good in principle," but that since the definitions of the two are similar, it is likely that many vehicles will fit both definitions.

UCS commented that class distinctions have been blurring in recent years, and that any prescribed definition could quickly become obsolete. They further noted that

EPA should present information on the label to accommodate consumers, who are increasingly shopping across a number of classes, such as minivan, SUV, large car, etc. They proposed a comparable class fuel economy graphic that gave the range of fuel economy for all vehicles and the range of the given class.

Our response:

We agree with auto manufacturers and UCS that we should clarify minivan and SUV definitions, and are adopting the suggestions from AAM/AIAM.

We also agree that we should retain our current policy to determine a class for "crossover" vehicles on a case-by-case basis. So-called “crossover” vehicles are those that meet the definition of more than one vehicle class, and thus are difficult to categorize. EPA currently uses discretion to assign these vehicles to a class on a case-by-case basis. For example, we attempt to determine which class assignment makes sense from a consumer perspective (e.g., is it more likely to be considered by consumers looking for a minivan or for an SUV) and what marketing segment is being targeted by the manufacturer. We did not propose to change how we are addressing the recent proliferation of “crossover” vehicles, but we requested comments on whether we should create a separate “crossover” class. Some public comments supported the creation of this class, but did not suggest how to define it. Auto companies were opposed to it, citing the difficulties in creating a meaningful class definition. Lacking such a definition that would clearly distinguish between a “crossover” vehicle and other vehicle classes, we are not creating a separate class for crossover vehicles. It should also be noted that the EPA-defined vehicle classes are used only to provide consumer information about fuel economy and serve no other regulatory purpose (i.e., they are not used to determine CAFE compliance, and they are not used for the purpose of determining compliance with EPA emission standards.)

In portraying the range of fuel economy for comparable vehicles on the label, several commenters noted that the comparable class structure does not adequately provide consumers with meaningful fuel economy comparisons, and that class distinctions have been blurring in recent years. Commenters noted that many consumers shop across classes. These commenters did not suggest any specific revisions to the class structure to address these concerns; rather, their suggestions relate to the presentation of the comparable class information on the label, which is addressed in Section III. Additionally, manufacturers expressed concern that the wide fuel economy ranges of some classes are not necessarily representative of vehicles that consumers would normally compare (the example they cite is the midsize class, which contains the Toyota Prius and the Rolls Royce Phantom). Auto manufactures further noted that the highest sales vehicles are typically near the midpoint of the range, and that vehicles at either end of the range (low and high fuel economy) are typically vehicles with low sales volume or “niche” vehicles. They suggest that consumers usually shop within subsets of the defined vehicle classes, and not across the entire class. To address these concerns, manufacturers recommended against using a graphical representation of the comparable class fuel economy, and that EPA should continue to use the text that is used today. However, they did not suggest any specific changes to the class structure to address these concerns.

We believe that with the changes we are finalizing today, the comparable class structure generally represents the distinctions between vehicle types offered in the fleet today. Absent suggestions during the public comment period for new comparable vehicle classifications, we are finalizing the comparable class structure largely as proposed, with minor changes as discussed above. We welcome interested parties to continue working with EPA in the future on how to ensure that the comparable classes are kept current with the dynamic vehicle fleet. If it becomes necessary in the future to further modify the comparable class structure, EPA would do so through a rulemaking.

2.7 Labeling Requirements for Dual Fueled Vehicles

What we proposed:

Currently, manufacturers may voluntarily include the alternative fuel's estimated fuel economy and annual cost on the label, but are not required to do so. The EPCA statute currently requires that the label should:

> "(A) indicate the fuel economy of the automobile when operated on gasoline or diesel fuel;
> (B) clearly identify the automobile as a dual fueled automobile;
> (C) clearly identify the fuels on which the automobile may be operated; and
> (D) contain a statement informing the consumer that the additional information required by subsection (c)(2) of this section is published and distributed by the Secretary of Energy." Ref. 49 U.S.C. 32908 (c)(3)."

The current labeling requirements for dual fueled vehicles are consistent with these EPCA requirements. We neither proposed changes to these requirements, nor sought comment on the topic.

What commenters said:

EPA received a late public comment from several environmental and consumer groups urging EPA to require manufacturers to include for E85 vehicles the fuel economy and estimated annual fuel costs of both gasoline and ethanol. With increased marketing and availability of these vehicles, the late comment suggested that the label be required to not only display separate gasoline and ethanol fuel economy and annual cost estimates, but also to provide EPA smog and greenhouse gas scores and the ratio of ethanol to gasoline (which is not always 85:1) on the label. The additions would inform customers that, when operating an E85 vehicle with E85 fuel, their fuel economy will be decreased, not a condition that most consumers expect from vehicles touted as "environmentally friendly". They also noted that these additions would educate customers that although E85 fuel economy may be lower than that of gasoline, the alcohol-based fuel reduces greenhouse gas emissions.

Our response:

We believe that a mandatory requirement for manufacturers to display E85 fuel economy information on the label in addition to gasoline deserves a more carefully considered approach. Before requiring the inclusion of E85 fuel economy for FFVs, we must consider many issues pertaining to the design and placement of this information, such as: 1) how to clearly present E85 mpg relative to gasoline; 2) how to educate consumers that E85 helps reduce greenhouse gases; 3) how to best convey estimated annual fuel costs of E85 (given the varying cost of E85 prices nationwide), and 4) how to graphically depict comparable class fuel economy for E85 in addition to gasoline.

Since we did not request comments on this topic, we are not finalizing requirements today that differ from the current regulations. However, we agree that it is important to provide consumers with complete fuel economy information on alternatively fueled vehicles, particularly in light of the rising sale of flex-fueled vehicles and a developing E85 fuel infrastructure. We agree that it is important for consumers to understand that fuel economy on E85 is typically 20-30 percent lower than on gasoline, because E-85 has a lower energy density.[7] Consumers can view the gasoline and E85 estimates of all FFVs in the Fuel Economy Guide and on the www.fueleconomy.gov web site.

We strongly encourage manufacturers to voluntarily include the E85 (or other alternative fuel) mpg and estimated annual fuel costs on the label. The final label design includes a placeholder for such information. In the near future, we plan to work with interested stakeholders to determine how best to present E85 fuel economy information on the label.

[7] Based on fuel economies of gasoline and E85 reported in the Model Year 2006 Fuel Economy Guide, p. 18.

Chapter 3: Implementation Issues

3.1 In-Use Validation of 5-Cycle Coefficients

What we proposed:

In the proposal, we expressed an interest in ensuring that the new methods continue to reflect real-world fuel economy into the future, and we encouraged stakeholders to submit data that would inform future analysis and potential changes to the methodology. While we did not propose a specific program for validation of the 5-cycle formulae, the NPRM clearly expressed that we would be receptive to new and additional data. We noted that the 5-cycle formulae are derived from extensive data on real-world driving conditions, such as driving activity, temperatures, air conditioner operation, trip length, and other factors. We requested comment on the formulae and on the underlying data on which they are based. We encouraged stakeholders to submit data that might inform the 5-cycle analyses, and we expressed our desire to ensure that the 5-cycle approach continues in future years to reflect updated conditions impacting real-world fuel economy. Therefore, in the NPRM we encouraged stakeholders to submit data so that EPA may evaluate the need for changes to this approach over time.

What commenters said:

AAM/AIAM expressed support for the 2008 mpg-based approach, calling it "…a good compromise between urgency and use of available data…" However, they believe that "EPA has an obligation to validate the proposed five-cycle equations against available in-use data to ensure the continual integrity of the labeling program." They raise a number of concerns with the 5-cycle approach that they believe warrant additional validation. For example, they believe that the equations may be appropriate for predicting aggregate fleet-wide fuel economy, but that they may break down when applied to individual vehicles. They also cite technical reasons for questioning the accuracy, particularly with respect to the inherent variability of the US06 cycle and how that might carry through to the label values given the high weighting of the US06 in the highway equation. They further note that the cycles used in the 5-cycle approach were designed as worst-case emission test cycles, and that the 5-cycle approach assumptions that these "extreme" cycles can be used to accurately predict fuel economy performance over a wide range of operation may be incorrect, especially for new technologies such as hybrid vehicles and cylinder deactivation. (These specific criticisms are addressed in Section 5 of this Response to Comments Document.) AAM/AIMA makes it clear that they are not asking for new driving cycles, but rather for adjustments to equations and coefficients if warranted by investigation of in-use data. They believe that EPA must take a leadership role in this effort, and further urge EPA to "…place a milestone date in the rule (approximately August of 2009) before which the agency would review all available data and determine if the available data raise questions or concerns about the effectiveness of the labeling program." If this question is answered in the affirmative, AAM/AIAM requests that EPA initiate a supplementary rulemaking to propose and finalize changes.

Honda likewise expressed support for the mpg-based methodology, noting that "it addresses an immediate need for responding to customer concerns…" They expressed a preference that the equations be validated, but mitigating this concern is the fact that any errors in the methodology would be applied equally to all vehicles.

DaimlerChrysler and other automobile companies commented that the new regulation must allow for future review and adjustments based on assessments of real-world fuel economy data. They asked that EPA affirm a commitment to adjusting the formulae if data suggests that that the resulting fuel economy values do not reflect real-world experience. They noted the importance of this with respect to assuring that new technologies receive accurate label values.

Toyota echoed these comments, stating that "Toyota believes that the formulas promulgated in the NPRM need to be validated…," expressing their support for an in-use fuel economy data collection program. Honda similarly encouraged EPA to support a testing program of in-use vehicles to validate the 5-cycle equations. Nissan commented that they could support surveys of in-use vehicles for fuel economy purposes, but that EPA-mandated testing of in-use vehicles by manufacturers would be overly burdensome.

Toyota expressed an opinion that periodic updating of the fuel economy coefficients for the 5-cycle equations should be done every 3-4 years. Specifically, they suggest that the equations should be updated when an innovative technology to improve fuel economy has been introduced.

Bluewater Network stressed that allowing 20 years to transpire between adjustments to the fuel economy procedure is unacceptable. They asked that EPA put in place a system to "(1) monitor accuracy of test results across all manufacturers and models and (2) to make adjustments as necessary to reflect changed technology, driving conditions, driving habits, speeds, temperatures, etc." They suggest three ways to monitor accuracy: requiring manufacturers to submit onboard computer data, instituting a consumer data collection program, and monitoring fuel economy testing done by other institutions.

Public Citizen argues for a thorough study of real-world driving behavior and fuel economy test procedures that ultimately reflect the findings of such a study. They argue, for example, that the US06 and SC03 tests may no longer be accurate because they were developed from driving surveys conducted in 1992, and driving has changed since then (e.g., driving has become more aggressive). They state that "it is critical that EPA's testing procedures reflect current real-world driving conditions." They argue that a study is needed both in the short term to feed into new label estimates, and periodically thereafter, to ensure that the label estimates continue to reflect real-world driving conditions.

NRDC likewise commented that "…this nation's overall fuel economy program efforts…would critically benefit from a statistically robust collection of in-use fuel-economy data," urging the auto companies and EPA to commit to a public/private partnership to ensure that such a program is implemented quickly. They suggest that the current situation is largely due to the lack of an ongoing mechanism to collect and evaluate fuel economy data. They also ask that EPA commit to modifying the methodology if in-use data demonstrates that a change is needed. They argue that an ongoing program of data collection is necessary to "…ensure consumers are receiving accurate information in the future, to prevent "gaming" of the system by manufacturers, and to adequately support the nation's overall fuel economy program." NRDC is also concerned about some criticisms that have been raised regarding the statistical validity and accuracy of the proposed 5-cycle methodology, particularly with respect to hybrid vehicles, and they suggest that the proposal would benefit greatly from the collection of more data from hybrid vehicles. Section 3 of the Technical Support Document (TSD) contains an analysis of the accuracy and validity of the 5-cycle methodology for hybrid vehicles.

UCS states that the proposed 5-cycle methodology is "a promising interim solution," but that EPA needs to take the next step and begin a comprehensive study of real-world driving patterns and fuel economy. They further state that EPA should develop new test cycles based on the results of the in-use data collection. They argue that by testing vehicles under the same conditions in which they are likely to be used, the need for vehicle-specific adjustment factors can be eliminated. Further, they suggest that new test cycles will fairly reflect the potential fuel savings of various existing and emerging technologies, which may not be true of the proposed 5-cycle methodology. They specify that a study of in-use driving patterns and fuel economy would involve collecting data on fuel consumption, speed on a second-by-second basis, trip start and end times, air conditioner and defroster usage, ambient and engine temperatures, additional use of accessories, and other factors relevant to fuel economy.

UCS commented that in addition to updating the mpg-based equations periodically, which will ensure that the mpg-based adjustments reflect evolution in the relationship between 5-cycle and FTP/HFET results, EPA should update the weightings of the various cycles within the 5-cycle equations as data becomes available.

NADA commented that EPA should implement the first phase of the program, but "…reserve the potential implementation of the second phase until appropriate validation testing suggests it makes sense to do so."

AAA expressed no opposition to further research, and in fact said that it should not be precluded, but concluded that the increasingly-important emphasis on gas prices and fuel-efficiency mandates that EPA "…get this program up and running quickly." Bluewater Network similarly stated that there should be no further delay in issuing a final rule.

PPG recommended that EPA consider Federal laboratories such as the National Renewable Energy Laboratory (NREL) as a qualified source of data, and factor any appropriate data from such agencies into the new mileage ratings.

Finally, several commenters suggested that EPA conduct an evaluation of the 5-cycle method prior to model year 2011, when the 5-cycle method becomes required.

Our response:

In the proposal, we expressed an interest in ensuring that the new methods continue to reflect real-world fuel economy into the future, and we encouraged stakeholders to submit data that would inform future analysis and potential changes to the methodology. We remain open to reviewing any valid test data that would show that any of the 5-cycle assumptions were inappropriate for a specific vehicle and considering modifications to the 5-cycle formulae to account for these differences. We believe it is critical to ensure that the fuel economy methods are periodically evaluated. We are committed to evaluating the 5-cycle method every several years (e.g., five years) to ensure that it appropriately accounts for advancements in vehicle technology, changes in driving patterns, and any new data collected on in-use fuel economy. We welcome stakeholders to submit any such future data for use in our periodic evaluation of the fuel economy test methods.

We are also committed to offering technical guidance to any stakeholder interested in undertaking an in-use testing and data-collection program. By seeking our technical input up front, stakeholders can better ensure that the data is collected in a way that is ultimately best-suited to evaluate potential changes to the methodology. It is important to note that collection of in-use fuel economy data alone is interesting, but can only be used to indicate whether the 5-cycle estimates are too high or too low; it does not inform how the 5-cycle methodology could be improved. The 5-cycle approach is based on emission test results over the five test cycles and on the weighting of a number of factors based on their average impact across all U.S. driving. Data on in-use fuel economy alone, without complementary driving behavior and activity data, does not provide any insight on what changes may be appropriate to the 5-cycle weighting factors.

If appropriate data is submitted before the end of 2008, we would plan to review it in a timely manner. If such data suggests that changes to the 5-cycle approach are necessary, we would plan to issue a separate rulemaking to address changes to the methodology, providing adequate lead time to the industry to comply.

3.2 Periodic Review and Updating of the mpg-Based Curves

What we proposed:

We proposed to update the mpg-based curves periodically, using all of the available five-cycle fuel economy estimates for the previous three or more model years. The proposal stated that we would publish the equations for the mpg-based approach by January 1 of the calendar year prior to the model year to which the equations would first apply (e.g., for model year 2010 fuel economy calculations, the equations would be made available before January 1, 2009). We also indicated in the proposal that updating would take place periodically, but no more than on an annual basis.

What commenters said:

While expressing general support for periodic and timely updates, AAM/AIAM describes concerns with lead time and with the frequency of such updates. AAM/AIAM commented that making the equations available on January 1 of the model year prior to the model year for which they first apply provides insufficient lead time for manufacturers. They note that the start of production for some vehicles can be as early as January 2 of the calendar year prior, thus giving manufacturers a new labeling equation after product designs are locked down, leaving manufacturers unable to respond to the new equations. Consequently, they advocate making the new equations available no later than January 1 of the model year two years prior to the model year to which the equations would first apply. AAM/AIAM agrees that EPA should have the flexibility to update the mpg-based equations periodically (especially if validation data identifies a specific need), but they believe that doing so on an annual basis would be costly and time-prohibitive. They recommend that EPA update the mpg-based equations "only when such an update is warranted based on statistical significance, rather than at specified intervals."

Our response:

We plan to update the mpg-based curves periodically using all of the available 5-cycle fuel economy estimates for the previous three or more model years. We proposed that these revised mpg-based equations would be issued through the publication of an EPA guidance document which would be released by January 1 of the calendar year prior to the model year to which the equations first apply. We suggested in the proposal that this meant, for example, that mpg equations for the 2012 model year would be published prior to January 1 of 2011. However, we now recognize that the model year for many manufacturers can begin almost a full year before the start of the identically-named calendar year (i.e., the 2012 model year can begin on January 2, 2011). Manufacturers commented that issuing guidance applicable to a given model year potentially mere days or weeks from the start of that model year for some vehicle lines did not provide adequate lead time. We agree with manufacturers that more lead time is needed than what we proposed. However, we do not believe a full year before the earliest model year introduction date is necessary. We believe a period of 6 months prior to the first possible model year provides sufficient lead time, and also gives EPA ample time to issue new mpg-lines based on more current data. We are thus finalizing regulations that require EPA to issue guidance regarding revisions to the equations by no later than July 1 of the calendar year prior to the earliest start of the model year that starts in the following calendar year. In other words, for new equations to be applicable to the 2010 model year (which can begin as early as January 2, 2009), EPA must issue guidance prior to July 1, 2008.

3.3 Use of Bag Data Factors in the 5-Cycle Equations

What we proposed:

In the Draft Technical Support Document, we derived the mpg-based equations from a fuel economy database that consisted of both bag-specific fuel economy measurements and estimated bag measurement data. Those vehicles with bag fuel economy data were used to develop relationships between bag and whole cycle fuel economy, and from these relationships the bag data was then estimated for those vehicles lacking complete bag fuel economy data. We also estimated the relationship between US06-City and US06-Highway fuel economy and overall US06 fuel economy based on test data from 80 vehicles.

What commenters said:

AAM/AIAM proposed that manufacturers be allowed to use these same factors for the initial 5-cycle regression equation when using the 5-cycle approach. They suggested that this would “aid in the adoption of the five-cycle equation” and “promote process simplicity going forward.” They noted that both EPA and manufacturer data systems are not currently capable of incorporating bag data, and that use of these factors would provide some lead time for getting these systems updated and modified. They suggested that manufacturers not be precluded from submitting bag data, but that if they do such data should be posted to the EPA website that provides supplementary information to the Test Car List. They propose new regulatory language that would implement these factors.

Our response:

We do not believe that it is necessary to allow the use of these bag data factors for early use of the 5-cycle equation. The 5-cycle method is optional in the first several years of the new program (model years 2008-2010). EPA will be prepared to receive bag data in these instances. Manufacturers will have the necessary bag data to incorporate into the 5-cycle test, regardless of whether the data systems are completely ready to accept such data. We do not believe it is appropriate or reasonable to allow manufacturers to estimate bag data using these factors, as it would lessen the accuracy of the 5-cycle result for a given vehicle. Moreover, manufacturers would possess the bag data results. Therefore, we are requiring that manufacturers use actual bag fuel economy data in their 5-cycle fuel economy calculations, and that they submit that information to EPA.

3.4 Flexibility to Apply the mpg-Based Adjustments at the Model Type Level

What we proposed:

Section 600.115-08 of the proposed regulations would apply the mpg-based adjustments at each test result level supporting the fuel economy label instead of at the model type level. These values then feed into section 600.207, which determines the fuel economy values for each vehicle configuration, which ultimately feed into section 600.210 to calculate the label value.

What commenters said:

AAM/AIAM noted that current regulations apply an adjustment factor at the model type level (sections 600.209a and 600.207b), not at the test result level, and that manufacturer and EPA data systems are not configured to apply an adjustment factor at the test result level. According to AAM/AIAM, many manufacturers do not have separate data systems for fuel economy labeling and CAFE, and unless EPA allows flexibility to apply the adjustments at the model type level, this change would impact manufacturer's CAFE databases. They propose specific language for section 600.210 that would accomplish the desired result.

Our response:

We agree with AAM/AIAM that allowing flexibility in applying an adjustment factor at the model type level instead of the test result level will be less costly to implement and we are modifying the regulatory text to reflect this. The city and highway test results obtained from certification and fuel economy test vehicles shall first undergo the vehicle configuration and model type calculations for FTP and HFET-based fuel economy (sections 600.206-08 and 600.208-08), and then the resulting FTP-based and HFET-based model type fuel economy values shall undergo the derived 5-cycle calculations. This change is consistent with the placement of the current fuel economy label downward adjustments (-10% city and -22% highway), which are performed after the model type fuel economy is determined.

As a result, Section 86.600.115-08 has been removed, and the remaining sections in Subpart B renumbered accordingly, and the appropriate derived 5-cycle calculations and associated text has been added to section 86. 600.210-08. The final label values will not be impacted in any significant way, except for possible minor rounding differences.

3.5 Criteria for Additional 20°F / SFTP Testing

What we proposed:

Each year, manufacturers must demonstrate compliance with federal emission standards by performing tests over all five test procedures. The vehicles on which these tests are performed are known as "emission data vehicles", which are selected to represent the "worst-case" emitting vehicle in a group of vehicles, known as a "test group", which share common engine and emission control designs.[8] EPA issues certificates of emission conformity for each test group of vehicles in each model year. Thus, for each test group, there exists a set of official certification test data from all five test cycles - FTP, HFET, US06, SC03 and Cold FTP. The fuel economy measured from these official certification tests can be inserted into the 5-cycle city and highway formulae to determine city and highway fuel economy values. Since FTP and HFET testing is included in the official certification data, the mpg-based city and highway fuel economy values can also be determined. Thus, for each emission data vehicle, the 5-cycle city and highway fuel economy values then can be compared to the mpg-based city and highway fuel economy values. We believe that it is reasonable to allow continued use of the mpg-based line when the available 5-cycle fuel economy data (from emissions certification) indicates that the mpg-based fuel economy determined from the official FTP and HFET tests performed for the test group are similar enough to the 5-cycle fuel economy determined from the official FTP, HFET, US06, SC03 and Cold FTP tests for that same test group. In that case, the manufacturer can use the mpg-based method for all model types covered under the EPA certificate of conformity that is represented by the 5-cycle data submitted to represent those vehicles. The manufacturer will not need to conduct 5-cycle testing for fuel economy labeling for these model types.

What commenters said:

AAM/AIAM expressed concerns that EPA's proposed rule does not sufficiently address certain common and uncommon certification vehicle test processes that would present challenges in determining whether or not the criteria for additional testing are applicable. They provide the following examples:

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[8] The "emission data vehicle" is the test vehicle chosen to represent a "test group" for emission certification purposes. A "test group" is made up of vehicles that share common combustion cycle, engine type, fuel type, fuel metering system, catalyst construction and precious metal content, engine displacement, number and arrangement of cylinders, and emission standards. The emission data vehicle is required to be the vehicle within the test group that is expected to be worst-case for exhaust emissions. In general the criteria that cause the emission data vehicle to be worst-case for emissions will also cause it to be worst-case for fuel economy (e.g., it will be the heaviest vehicle in the test group, with an automatic transmission, four-wheel drive, etc.). In general, the FTP, HFET, US06 and SC03 are performed on the emission data vehicle to demonstrate that the test group complies with the federal emission standards. The Cold FTP is performed on the worst-case vehicle within a durability group, which represents a larger group of vehicles, including those covered in the test group.

- When a model type is certified under multiple test groups (e.g., a model type certified under both Federal and California test groups);
- When the five cycles are not conducted on the same vehicle sub-configuration (e.g., SC03 tested at ALVW and US06 tested at LVW);
- When the EDV conducts multiple tests for any of the five cycles (e.g., manufacture-conducted testing and agency confirmatory testing);
- When the test group is dual-certified (at heavier and lighter test weights).

AAM/AIAM provides proposed language to be added to section 600.116-08 which they believe would add consistency and fairness to the process. They propose that the regulations specify that:

- In general, manufacturers should evaluate data generated in the same vehicle sub-configuration to determine if the criteria for additional testing are met.
- EPA will provide guidance by the end of 2008 on how manufacturers should evaluate if the criteria are met when multiple test data exist, when multiple sets of 5-cycle data exist, and when model types are certified under multiple test groups.
- Once a model type is approved as not requiring additional 20F/SFTP testing, then the manufacturer may proceed with the labeling of products of evaluation of meeting the criteria will not be revisited.
- A requirement to conduct additional 20°F/SFTP testing for 2011 and later model year products is only to be based on the test group's 2011 and later model year five-cycle test data. For example, if a 2010 MY product is carried over to the 2011 MY, and the 2010 MY product used the mpg Approach to calculate the label, then the 2011 MY product should be allowed to use carryover label values.
- If the criterion to conduct additional 20°F/SFTP testing is not met based on manufacturer-conducted testing, but data from subsequent agency-confirmatory testing result in the criteria being met, then manufacturers shall be allowed to use the mpg-based equations for calculating label values for all model types in the same test group as the certification vehicle except for the model type represented by the certification vehicle's configuration. That model type would then be required to use the five-cycle equations to calculate the label values and would be allowed to use appropriate agency-confirmatory test data to calculate the label values. On principle, AAM/AIAM believes that evaluations to determine if the criteria for additional testing are met should be based on five-cycle test results conducted on the same test vehicle at the same test facility. AAM/AIAM is concerned that if agency-confirmatory test data suddenly resulted in a requirement for additional testing, manufacturers could not reasonably complete all additional five-cycle tests required for affected models in that test group and produce fuel economy labels before production.

Our response:

We agree that whenever possible manufacturers should evaluate data generated by the same vehicle configuration or sub-configuration. Although we acknowledge the manufacturer’s point that this may not always be possible, we believe that in most cases the official EPA test data should suffice, without adjustment or substitution. The manufacturers noted several situations where the results for the five test procedures might not meet the ideal in terms of comparability (e.g., tests done on different sub-configurations with differing test weights). It may be appropriate in some of these situations to allow the manufacturers to make adjustments to fuel economy test results in order to achieve results that are comparable across the five tests. For example, if four tests are conducted with a test weight of 4500 lbs and one is tested at 4750 lbs, we expect that an appropriate method could be identified that would enable the manufacturer to adjust the test result at the heavier test weight to represent a lower test weight. To address this situation, a provision has been added to the regulations allowing the Administrator to approve adjustments or substitutions to the official certification test data. We intend to issue guidance that will address a range of reasonable adjustments and substitutions of fuel economy data, and that will maintain a level playing field across the industry.

3.6 Analytically Derived Fuel Economy

What we proposed:

Currently, the US06, SC03 and cold FTP tests are only performed on a sub-set of new vehicle configurations. In contrast, for fuel economy purposes, FTP and HFET tests are performed on many more vehicle configurations. In order to minimize the number of additional US06, SC03 and cold FTP tests resulting from this proposal, we proposed that manufacturers be allowed to estimate the fuel economy over these three tests for vehicle configurations that are not normally tested for emission compliance purposes using the fuel economy measurements that are normally available. This is currently done on a more limited basis for both the FTP and HFET, and is referred to as analytically derived fuel economy (ADFE).

What commenters said:

AAM/AIAM support the use of ADFE, but expressed concern that no definitive timetable was established to ensure that a method will be approved by the EPA before 5-cycle testing is required for some labels beginning in the 2011 MY. They suggest that the regulations should state clearly that EPA will provide guidance by the end of the 2008 calendar year on how to estimate five-cycle fuel economy for configurations not normally tested over all five cycles. They also request that the regulations provide sufficient flexibility to allow EPA to consider other proposals for determining analytically-derived estimates that may be offered by manufacturers. As an example, they note a possible method using the ratio of “five-cycle city fuel economy” to “FTP fuel economy” of the certification vehicle, applying that quotient to the FTP fuel economy of the FEDV in the same test group to estimate five-cycle city fuel economy of the FEDV. A similar approach could also be used to estimate highway fuel economy. They also note that EPA may want to consider other more sophisticated methods to estimate individual US06, SC03 and 20°F fuel economy results analogous to currently approved methods to estimate FTP and HFET fuel economy.

Our response:

When a vehicle is required to generate data from all five test cycles, there are multiple ways for the manufacturer to accomplish this. One way would be to perform the three additional tests – the US06, SC03, and cold FTP tests (the FTP and HFET would be performed under current and future requirements). The other way is to estimate fuel economy values over the US06, SC03 and cold FTP tests analytically (i.e., analytically derived fuel economy, or ADFE) from testing of a similar vehicle over these three cycles. Under this method, manufacturers will be allowed to estimate the effect of differences in inertia test weight, road load horsepower, and N/V ratio (the ratio of engine revolutions to vehicle speed when the vehicle is in its highest gear) on fuel economy, and use these estimates to calculate predicted fuel economy over the three new fuel economy test cycles. A procedure to estimate the effect of these three vehicle parameters on FTP and HFET fuel economy has already been developed.[9] We plan to work with manufacturers to appropriately analytically derive fuel economy for the US06, SC03 and cold FTP tests. We will implement these estimation procedures using agency guidance, as is currently done for FTP and HFET fuel economy.

3.7 Consumer Education Issues

What we proposed:

While we did not propose anything specific with respect to consumer education, our effort in redesigning the label is to improve how we communicate fuel economy information to consumers.

What commenters said:

AIAM/AAMA and Subaru suggested that EPA plan several media announcements in early 2007 to inform consumers that new changes have been made to the method for estimating the fuel economy values that will appear on the window stickers of 2008 MY vehicles, including any early introduction vehicles that may be available soon.

Toyota supports and recommends an EPA initiative to improve consumer education on fuel economy improvements that can be achieved through better vehicle maintenance and driving techniques which promote fuel conservation. NADA opined that it will continue to be necessary to remind vehicle buyers that variations in climate, traffic, driving styles, accessory use, loads, tire pressure, weather, vehicle age, vehicle modifications, maintenance, and other factors, the fuel economy actually achieved in-use may be higher or lower than the EPA label values.

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[9] U.S. EPA Memorandum "Updated Analytically Derived Fuel Economy (ADFE) Policy for 2005 MY and Later," CCD-04-06 (LDVLDT), March 11, 2004. Available in the public docket for review.

Our response:

We are always looking for new and better ways to communicate fuel economy information to consumers, and our redesigned label and the www.fueleconomy.gov website accomplish much in this regard. We are planning to conduct additional public outreach when the rule is released, and we are working with stakeholders on how to best communicate the change in fuel economy label values to consumers. Part of this outreach will include educating consumers that they can have a great deal of impact on the fuel economy they achieve.

3.8 Government-Industry Working Groups

What we proposed:

We did not propose anything specific with respect to a government-industry working group.

What commenters said:

General Motors recommended that EPA convene a working group to address a number of specific details that they believe require further discussion and analysis before full implementation can be achieved. GM volunteered to lead and help coordinate such an effort.

Our response:

As always, we will work with industry representatives and other stakeholders as needed to achieve the smoothest possible implementation of the new program. We appreciate GM's offer to assist in this effort.

3.9 When City Fuel Economy is Greater Than Highway Fuel Economy

What we proposed:

Consistent with the language of current regulations, we proposed that if the city value exceeds the highway value for a model type, the city value will be set equal to the highway value. In cases where special vehicle design features may result in city values that exceed highway values, we proposed that the manufacturer may request EPA approval to waive this requirement. Our proposal would require that such a request be accompanied by on-road fuel economy data which demonstrates that the fuel economy during city-type driving is higher than fuel economy during highway-type driving.

What commenters said:

AAM/AIAM stated that they fail to see the necessity for the proposed provisions which would require on-road fuel economy data to demonstrate that city fuel economy exceeds highway fuel economy. They argue that if a vehicle is designed to optimize city fuel economy and that is reflected in the testing results, there should be no reason why additional on-road testing is necessary. They comment that "…imposing an additional, unspecified on-road testing requirement would amount to a significant burden on manufacturers that would add cost, complexity, and time burdens which could impede the development of vehicles with attributes desirable to millions of commuters who live and drive in congested urban areas." They consequently recommend that paragraphs (c) and (d)(2) of the proposed regulations in section 600.210-08 be deleted.

Our response:

We agree with the comment from manufacturers, and the final rule thus deletes the paragraphs in 600.210-08. Hybrid vehicles in particular are more likely to achieve better city fuel economy than highway fuel economy, and in the context of this technology we no longer believe that the existing requirements are needed or reasonable.

3.10 Technology-Specific, Model-Specific, or Manufacturer-Specific Adjustment Factors

What we proposed:

We proposed a methodology that would apply similarly to all vehicles, without any adjustment factors based on specific technologies, models, or manufacturers. We did not specifically propose a methodology for making adjustments to fuel economy results based on vehicle technology, vehicle models, or on the manufacturer.

What commenters said:

Because they observed that "a small number of vehicles appear to have real-world gas mileage that falls significantly below the proposed new mileage values," Bluewater Network suggests that EPA consider finalizing regulations that allow separate adjustments for individual vehicle models which have test data that differs markedly from real-world values. One approach they suggest would be allowing EPA to make these adjustments based on real-world results reported by consumers and "reputable sources conducting independent testing" although they acknowledge the potential difficulty with determining a protocol for deciding if a vehicle's real-world performance is far enough from the label value to warrant an adjustment. A second approach they suggest is to allow manufacturers to collect and submit onboard computer data that could be used to make adjustments for individual vehicle models. However, they recognize the potential for "gaming" of the system using such data, and urge EPA to use caution if such an approach is considered.

Bluewater Network commented that they believe plug-in hybrids will be commercially available in the future and EPA should consider how this emerging technology should be addressed with respect to fuel economy labeling and testing.

Honda suggested that EPA allow manufacturers to collect real-world fuel economy data which could then feed back directly into fuel economy estimates. Under their concept, the manufacturer would gather in-use fuel economy data from actual customer vehicles during the first 6 to 12 months of production, and then label future production using the average of the in-use data.

Volkswagen expressed concerns that the proposed procedures may unfairly penalize diesel vehicles. They believe that a high percentage of their diesel vehicle customers come closer to achieving today's current labels than is suggested by the proposed methodology, and that additional factors that reduce the label estimate may represent an unnecessary penalty for diesel technology. They acknowledge that little data exists to support or refute this concern and that they intend to collect some and present it to EPA.

AAM/AIAM commented that EPA's proposed changes to the fuel economy label accounts for many variables that can affect fuel economy, but that expanding the program to account for technology differences would introduce significant complexity and not be consistent with the intent of the Fuel Economy Guide as a convenient consumer tool. They point out that validation of the technology adjustment factors would be necessary to ensure their integrity, and that such validation could only be accomplished after extensive field experience was demonstrated. They point to EPA's 1984 final rule on labeling, in which EPA explicitly rejected the technology-specific approach to adjustment factors.[10] A rationale for rejecting technology-specific factors at that time, and one that AAM/AIAM suggests is even more relevant today, is that "…such factors could become outdated so fast as to provide no better (and in some cases, worse) estimates of expected in-use fuel economy." AAM/AIAM points out that "…hybrid technology is progressing so rapidly and there are so many different types of hybrid systems that hybrid-specific factors would be difficult to determine and would quickly become outdated." They recommend that EPA should not consider adopting technology-specific weighting factors at this time. Toyota also expressed opposition to technology-specific solutions.

UCS recommends that EPA not consider calculation procedures or adjustments that are specific to certain technologies, or to vehicles deemed to be used by certain groups of drivers, unless definitive data can demonstrate no other way to reliably provide fuel economy estimates. Any specific procedures could undermine the impartiality of the fuel economy testing, and should be avoidable by developing new

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[10] See 49 FR 13834 (April 6, 1984).

cycles that accurately reflect the range of in-use driving conditions experienced by most drivers. UCS solidified their argument by noting that "The best chance for EPA's fuel economy ratings to remain the gold standard of objectivity is to ensure that all vehicles are tested under an appropriately wide set of identical conditions."

Our response:

We are not finalizing a methodology by which in-use data can feed back into adjusting the fuel economy estimates. At this time, we do not believe that it is possible to determine a method for this that is fair, equitable, and that retains a level playing field across manufacturers. Allowing this would open up the serious potential for unfair practices – manufacturers could selectively choose the specific vehicles for which in-use data is collected, thereby giving them an opportunity to boost fuel economy results where they believe the in-use data to be an advantage, but simultaneously ignore those vehicles that might actually be performing below the label values in real-world use. Additionally, adjusting the results of individual vehicles or technologies undermines the credibility of the fuel economy estimates because vehicles would no longer be tested in an identical and repeatable way. Rather, we would encourage manufacturers that collect in-use data to share it with EPA such that the data could contribute to our periodic evaluation of the 5-cycle method.

Our analyses in the Technical Support Document do not indicate an issue with respect to diesel vehicles. However, we always remain open to hearing from manufacturers with specific concerns, and we encourage manufacturers with such concerns to collect and evaluate appropriate data and bring it to our attention.

Commercial hybrids available today ultimately obtain all propulsion energy from liquid fuel stored in the fuel tank, while a plug-in hybrid uses a combination of liquid fuel and supplemental energy from the electric grid stored in the battery (i.e., overnight charge). Properly accounting for this supplemental electric energy is the central issue in assessing the performance of plug-in hybrids. Therefore, plug-in hybrids will require a more comprehensive assessment in order to determine the proper test procedures for fuel economy and emissions. Since plug-in hybrid technology is rapidly advancing, we will work with key stakeholders in the next few years to assess the appropriateness of the 5-cycle methodology in capturing the fuel economy impact of the plug-in technology.

We agree strongly with those commenters urging against technology-specific adjustment factors. We are especially concerned that such an approach would create an uneven playing field across vehicles. We are aware that technologies are rapidly developing, and we intend to ensure, as part of our ongoing evaluation of the fuel economy test methods, that new and developing technologies are represented appropriately.

3.11 Use of Fuel Economy Estimates in Advertising

What we proposed:

We did not propose anything specific with respect to the use of fuel economy estimates in advertising.

What commenters said:

An anonymous commenter "is appalled" that auto manufactures are allowed to advertise using solely their highway fuel economy estimates, while the city values are relegated to the fine print.

Our response:

Use of the fuel economy estimates in advertising is governed by the Federal Trade Commission (FTC). In the mid-1970's the Federal Trade Commission (FTC) "took note of the dramatic increase in the number of fuel economy claims then being made and of the proliferation of test procedures then being used as the basis for such claims."[11] They responded by promulgating regulations in 16 CFR Part 259 entitled "Guide Concerning Fuel Economy Advertising for New Vehicles" ("Fuel Guide"). The Fuel Guide, adopted in 1975 and subsequently revised twice, provides guidance to automobile manufacturers to prevent deceptive advertising and to facilitate the use of fuel economy information in advertising. The Fuel Guide advises vehicle manufacturers and dealers how to disclose the established fuel economy of a vehicle, as determined by the Environmental Protection Agency's rules pursuant to the Automobile Information Disclosure Act (15 U.S.C. 2996), in advertisements that make representations regarding the fuel economy of a new vehicle. The disclosure is tied to the claim made in the advertisement. If both city and highway fuel economy claims are made, both city and highway EPA figures should be disclosed. A claim regarding either city or highway fuel economy should be accompanied by the corresponding EPA figure. A general fuel economy claim would trigger disclosure of the EPA city figure, although the advertiser would be free to state the highway figure as well. The authority for the Fuel Guide is tied to the Federal Trade Commission Act (15 U.S.C. 41-58) which, briefly stated, makes it illegal for one to engage in "unfair methods of competition in or affecting commerce and unfair or deceptive acts or practices in or affecting commerce."

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[11] See 40 FR 42003 (Sept. 10, 1975).

Chapter 4: Other Related Proposals

4.1 Voluntary Fuel Economy Labeling for Vehicles Exceeding 8500 Pounds Gross Vehicle Weight Rating

What we proposed:

In the NPRM, we sought comment on a voluntary labeling program for vehicles above 8,500 pounds gross vehicle weight rating (GVWR), and how such a program might be implemented. Over the past several years there has been a growing market for these heavier vehicles, which fall into a number of utility classes, such as SUVs, pickups, and vans (including heavier versions of such models as Hummer, Ford Excursion, Chevy Silverado and Dodge Ram). We believe that consumers would be interested in using fuel economy estimates for these vehicles when comparison shopping. The rising fuel prices of recent times certainly have increased consumer awareness of the costs associated with owning a vehicle. When our proposal was published we did not have the authority under the relevant statutes to require labeling of these vehicles.

What commenters said:

NYDEC expressed support for calling for manufacturers to place fuel economy window stickers on vehicles over 8,500 pounds GVWR, citing the fact that a large number of these vehicles are frequently used as passenger vehicles for personal transportation. Public Citizen argued that "EPA has clear authority to test and label vehicles above 8,500 lbs. and should do so," providing a lengthy legal argument supporting their contention. UCS agreed, summarizing the Public Citizen legal analysis in their comments. UCS stated that EPA should develop a mandatory fuel economy labeling program for these vehicles, noting that these vehicles typically consume more fuel than other consumer-oriented vehicles and without a label consumers have no idea what to expect from them. UCS also recommended that EPA work with DOE to gather "Your mpg" data from real world users of these vehicles and include this information on the www.fueleconomy.gov website. Bluewater Network commented that, while it was unclear to them whether EPCA allows EPA to require labeling of these vehicles, it does not appear that EPA is precluded from requiring that fuel economy information for these vehicles be provided in other forums. Bluewater suggested that EPA require manufacturers to publish fuel economy values for these vehicles in vehicle user manuals and other sales materials. They also suggested that EPA make the same information available in EPA's Green Vehicle Guide, on EPA's website, and in other relevant publications, to the extent that EPCA allows.

AAM/AIAM argued that EPA's request for voluntary labeling is understandable, but it may not provide information that is of significant value. They noted that tests currently performed for these vehicles can vary dramatically from the tests performed for light duty regulated vehicles. For example, current regulations require that many of these vehicles be tested using significantly different procedures from light duty test procedures that generate the fuel economy label values (e.g., some are engine-certified). They also noted that highway tests are not required for all fuel types, even in California where most of these vehicles are chassis-certified. As a result, AAM/AIAM suggested that labeling of these heavier vehicles will not produce information that is comparable to the labels on light duty vehicles, and may in fact create more confusion and misunderstanding than additional value in the marketplace.

Ford submitted a comment after the close of the comment period that responded in detail to the legal analysis presented by Public Citizen. Ford's analysis was subsequently supported by comments from the Alliance of Automobile Manufacturers. Ford detailed why they believe that Public Citizen's assertion that EPA has the authority to require fuel economy labeling for vehicles over 8,500 lbs GVWR is faulty. Ford concludes that Public Citizen's "expansive" reading EPCA is inconsistent with the statutory language and principles of statutory construction. Further, they note that at a minimum, "it must be acknowledged that [EPCA] does not explicitly authorize EPA to issue rules expanding the scope of labeling, in contrast to the authority granted to NHTSA…with respect to the CAFE program," and that "At most, EPA should allow NHTSA to determine the scope of the CAFE program under its authority, and follow suit in its administration of the labeling program." Finally, they conclude that "EPA should not seek to require fuel economy labeling on any vehicles not required to comply with CAFE standards, because doing so would ignore Congress' clearly-stated intent to avoid having the labeling program drive additional testing requirements, thereby overburdening manufacturers."

NADA did not object to EPA's suggestions that manufacturers voluntarily post fuel economy information on vehicles over 8,500 pounds GVWR.

Our response:

We are finalizing in this rule a fuel economy labeling program for Medium-Duty Passenger Vehicles (MDPVs), a subset of vehicles between 8,500 and 10,000 lbs GVWR. MDPVs were first defined in the regulation that put in place the "Tier 2" emission standards.[12] This recently-defined class of vehicles includes SUVs and passenger vans between 8,500 and 10,000 lbs GVWR, but excludes large pick-up trucks. The specific regulatory definition was designed to capture in the light-duty vehicle emissions program those vehicles that are designed predominantly for passenger use.[13]

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[12] See 65 FR 6698 (Feb. 10, 2000).

[13] This is the regulatory definition of Medium-Duty Passenger Vehicle, found in 40 CFR 86.1803-01:

Medium-duty passenger vehicle (MDPV) means any heavy-duty vehicle (as defined in this subpart) with a gross vehicle weight rating (GVWR) of less than 10,000 pounds that is designed primarily for the transportation of persons. The MDPV definition does not include any vehicle which:

(1) Is an "incomplete truck" as defined in this subpart; or

(2) Has a seating capacity of more than 12 persons; or

(3) Is designed for more than 9 persons in seating rearward of the driver's seat; or

(4) Is equipped with an open cargo area (for example, a pick-up truck box or bed) of 72.0 inches

Under the Energy Policy and Conservation Act (EPCA), EPA is required to establish regulations that require a manufacturer to attach a label to each "automobile" manufactured in a model year.[14] "Automobile" is defined as a vehicle not more than 6,000 lbs GVWR, and those vehicles between 6,000 and 10,000 lbs GVWR that DOT determines are appropriate for inclusion in the CAFE program.[15] "Automobile" for the purposes of labeling also includes vehicles at no more than 8,500 lbs GVWR whether or not DOT has included those vehicles in the CAFE program.[16] EPA has no authority to require labels on vehicles that are not automobiles, therefore EPA has no authority to require labeling of either vehicles above 10,000 lbs GVWR, or vehicles between 8,500 and 10,000 lbs GVWR that are not included by DOT in the CAFE program.

Since the time of EPA's proposal, DOT has included some vehicles above 8,500 lbs GVWR and below 10,000 lbs in its CAFE program, beginning in model year 2011.[17] Since these vehicles now meet the definition of automobile, EPA is authorized to include these vehicles in labeling program.

MDPVs are currently subject to emission standards that apply on the existing Federal Test Procedure, and many also undergo emission testing on the current Highway Fuel Economy Test due to requirements in California. Beginning with the 2011 model year, manufacturers will be routinely testing MDPVs over the FTP and the HFET tests in order to comply with the CAFE program. However, MDPVs are not today subject to all of the additional emission tests we are utilizing for the 5-cycle method.[18] Specifically, MDPVs are not subject to the 1996 Supplemental Federal Test Procedure (SFTP) regulations.[19] The SFTP regulations include the US06 and SC03 test procedures, both of which are necessary elements of the 5-cycle fuel economy methodology. These two test cycles represent high speed and aggressive driving (US06), and impacts of air conditioner operation (SC03). We do not believe it is appropriate to require SFTP testing for MDPVs for fuel economy purposes alone, but we are not prepared at this time to establish SFTP standards for MDPVs. In the Tier 2 regulations, we acknowledged that MDPVs were not covered by SFTP requirements, and we specifically noted that SFTP emission standards would be addressed in a future regulation.[20] We believe that the appropriate time to consider 5-cycle fuel economy testing for MDPVs is during or after development of appropriate SFTP emission standards for MDPVs. We plan to address SFTP emission standards for MDPVs in the

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in interior length or more. A covered box not readily accessible from the passenger compartment will be considered an open cargo area for purposes of this definition.

[14] See 49 U.S.C. 32908(b).
[15] See 49 U.S.C. 32901(a)(3).
[16] See 49 U.S.C. 32908(a).
[17] See 71 F.R. 17565, (April 6, 2006).
[18] MDPVs are currently required under the Tier 2 program to meet a carbon monoxide standard on the cold FTP test; compliance with this standard is being phased in over the 2008 and 2009 model years.
[19] See 61 FR 54852 (Oct. 22, 1996).
[20] See 65 FR 6789 (Feb. 10, 2000)

near future. At that time, we will also assess the appropriateness of 5-cycle fuel economy testing for MDPVs. However, we are finalizing a program that requires MDPVs to use the mpg-based adjustments to calculate fuel economy estimates. The mpg-based approach does not require testing beyond what will be required to meet the CAFE program in model year 2011. Manufacturers will simply take their FTP and HFET test results (conducted for the CAFE program) and apply them to the mpg-based equation to determine their fuel economy label values.

4.2 Electronic Distribution of Dealer-Supplied Fuel Economy Booklet

What we proposed:

A statutory provision in EPCA authorizes EPA to prescribe regulations that require car dealers to provide to consumers a copy of the annual Fuel Economy Guide.[21] Historically, DOE has printed and sent copies of the Guide to dealers, at government expense, although this is not an EPCA requirement. In recent model years, dealers have been allowed, on a trial basis, to provide the Guide electronically. Dealers can have an on-site computer for customers, or they can provide the Guide on a CD or diskette, or they can print a paper copy for the customer. This has been working well, and DOE agrees with our proposal to codify these options effective with the 2008 model year.

What commenters said:

NADA stated at the public hearing and in their written comments that EPA’s existing approach appeared to be working very well, and that they support EPA’s proposal. Public Citizen opposed allowing dealers the option of electronically providing the Fuel Economy Guide to customers. Their primary opposition is (1) that some people are disinclined to use computers, and (2) that EPA presented no evidence that the trial program was in fact successful. In an oral testimony given at the public hearing, NADA supported EPA’s proposal, stating that the approach “seemed to be working very well.”

Our response:

We are finalizing our proposal to allow the electronic distribution of the Fuel Economy Guide by dealerships. We proposed adding language to the regulations that allows dealers to fulfill their requirement to provide customers with copies of the Fuel Economy Guide booklet by using an on-site computer. This method has been used on a trial basis in recent years. The National Automobile Dealer Association (NADA) commented that this proposal should be finalized, because it is a more efficient, effective way of providing customers with this information. EPA's regulations do not relieve dealerships of the responsibility to make the Guide “available to prospective

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[21] See 49 U.S.C. 32908(c)(3).

buyers."[22] We agree with Public Citizen that there are people who may be disinclined to use a computer. However, we would expect dealers who opt to provide the guide electronically would also provide assistance as needed to those car shoppers in accessing and viewing the Guide. The electronic version of the Guide is an easy-to-use PDF file, which can be viewed a page at a time, exactly the same way a paper copy is viewed.

4.3 Consideration of Fuel Consumption vs. Fuel Economy as a Metric

What we proposed:

EPCA defines fuel economy as "...the average number of miles traveled by an automobile for each gallon of gasoline (or equivalent amount of other fuel) used, as determined by the Administrator under section 32904 (c) of this title."[23] Thus, EPA's fuel economy information program has always expressed fuel efficiency in miles per gallon. It is a metric that Americans have come to know and understand. Notwithstanding this requirement, a few auto manufacturers have suggested that it may be more meaningful to express fuel efficiency in terms of consumption (e.g., gallons per 100 miles) rather than in terms of economy (miles per gallon). A fuel-consumption metric is currently used in Canada and in Europe. Fuel consumption numbers speak directly to the amount of fuel used, to which a consumer can relate in terms of cost when filling up. Because a few stakeholders have expressed interest in a fuel-consumption metric, we requested comments on the gallons-per-mile fuel consumption metric, and how it could be best used and presented publicly, such as whether it should be included in the Fuel Economy Guide.

What commenters said:

Public Citizen noted that, while there is some merit to a fuel consumption metric, consumers are comfortable today with the miles-per-gallon metric. Any change, they argue, should be carefully deliberated and should involve a massive public outreach campaign to educate consumers. They also suggest that the estimated annual fuel cost provides information derived from a consumption basis.

Toyota believes that fuel consumption is a more meaningful measurement than miles-per-gallon for expressing fuel efficiency, although they recognize EPA's statutory limitations. They note that the miles-per-gallon metric is fundamentally non-linear in relation to issues of consumer interest, such as cost of fuel or gallons of fuel used, and they suggest that anecdotal evidence shows that the non-linear aspects of miles-per-gallon can itself lead to consumer confusion. They conclude that "…this is a matter on which the EPA is obligated to educate the public as fuel consumption, not fuel economy, is a direct reflection of the environmental impact of vehicles in use."

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[22] See 49 U.S.C. 32908 (c)(3).
[23] See 49 U.S.C. 32901(a)(10).

NADA noted no opposition to including fuel consumption information on the www.fueleconomy.gov website or in the annual DOE/EPA Fuel Economy Guide.

An anonymous commenter expressed disappointment that none of the EPA's proposed label designs prominently lists fuel consumption as opposed to fuel economy. They note that only the consumption metric truly allows for simple comparisons of fuel savings between different vehicles.

Our response:

The final rule will continue the past practice of expressing the City and Highway estimates in fuel economy units of miles per gallon, rather than as fuel consumption units. We are statutorily required to report miles per gallon on the label by EPCA, which defines fuel economy as "...the average number of miles traveled by an automobile for each gallon of gasoline (or equivalent amount of other fuel) used, as determined by the Administrator under section 32904 (c) of this title."[24] We have always expressed fuel efficiency in miles per gallon, and it is a metric that Americans have come to know and understand.

Our experience is that consumers are very familiar with the miles-per-gallon estimates given on the label. Given that we are obligated statutorily to report fuel economy in terms of miles per gallon, we cannot change the metric on the fuel economy label, and we believe it would be far too confusing to report a fuel consumption metric in addition to the miles per gallon estimates. We are concerned that consumers would not understand a different fuel-efficiency metric and, without a long-term, comprehensive public awareness campaign, it would be very confusing to the public. We also understand that some manufacturers plan to pursue some public outreach and education in regards to using the fuel consumption metric.

However, the labels do provide an easy way to compare the relative fuel consumption – and therefore, fuel and dollar savings – of different vehicles. The estimated annual fuel cost information on the label is based on a fuel consumption metric: it is simply the dollar equivalent of the number of gallons consumed over 15,000 miles. Thus we believe the inclusion of the estimated annual fuel cost on the label is already a valuable metric for consumers, which relates directly to fuel consumption. Moreover, we believe it would take a long-term educational process for consumers to begin to relate to the fuel consumption metric of gallons per mile.

[24] See 49 U.S.C. 32901(a)(10).

4.4 Web-based Driver-Specific Fuel Economy Calculator

What we proposed:

We requested feedback from stakeholders regarding what additional information could be made available either in the annual Fuel Economy Guide or the www.fueleconomy.gov web site. We acknowledged that overall space on the label is limited, but that we would like to be able to make more information available to consumers who are interested in a greater depth of detail. The web site and the Fuel Economy Guide are logical places to include additional detail that does not lend itself to presentation on the label. We requested specific comment on including a fuel economy calculator on the web site that would enable consumers to calculate an estimated fuel economy that is tailored to their specific driving conditions and behavior. Such a fuel economy calculator could be designed that would allow the user to input their specific driving conditions, such as the amount of time spent with air conditioning on, what climate they live in, how much driving is done under higher speed/aggressive driving conditions, etc. These inputs could go into an algorithm that would estimate the fuel economy for a specific vehicle under the conditions input by the user.

What commenters said:

Public Citizen is supportive of the addition of a fuel economy calculator to allow consumers to obtain a fuel economy estimate tailored to their specific driving conditions and styles. However, they emphasize that EPA must be careful to ensure that such a calculator produces accurate estimates. They suggest that such a calculator, if or when it is finalized, be referenced on the fuel economy label. Although UCS agrees that such a tool could provide users with valuable insight into the effects of many factors on fuel economy, they recommend that EPA wait to establish such a calculator until additional data is gathered after the final rule is issued.

Subaru expressed general support for such a calculator, noting that it “could prove to be an educational tool to consumers.” Natural Resources Canada also expressed support, recommending that such a calculator be designed to suggest an optimum target fuel economy and areas where a driver could, through changes in behavior or technique, improve fuel economy. AAM/AIAM agreed that a more detailed calculator on the EPA fuel economy website could prove to be useful to consumers. They suggested that the calculator include driving types, temperatures, and accessory loads.

Our response:

Based on the analyses that now underlie the new fuel economy estimates, we believe at this time that we could construct a web-based calculator as described in the proposal. We agree with those who commented that such a calculator could be a useful and educational tool for consumers. For example, a user could input their vehicle information, their passenger load, their air conditioner use, and other factors, and receive as outputs a variety of information regarding the impact of various factors on their fuel economy and fuel economy estimates that are specific to their situation. We agree with commenters that it is important to ensure the accuracy of such a tool, since the algorithms required to complete these calculations are non-trivial. We plan to consider further how to best design and implement a calculator tool, and we may seek additional input from interested stakeholders.

Chapter 5: City and Highway Fuel Economy Estimates and Methodology

5.1 The Proposed Formulae are Complex

What we proposed:

We proposed new methods for calculating fuel economy that are in fact more complex than the previous methods. However, the proposed methods will also better predict the fuel economy that customers will achieve in real-world use.

What commenters said:

Natural Resources Canada, which fields consumer complaints and questions about fuel economy, expressed concern that the proposed formulae will be too complex to communicate to consumers. They suggest that “A new system for estimating vehicle fuel economy would be simpler and more meaningful to consumers if it did not factor in extreme driver behavior and if the final equations were streamlined to remove any of the non-significant coefficients or factors.”

Our response:

We do not believe that most consumers will be interested in or concerned about the actual mathematical equations used to combine the fuel economy measurements made over the various dynamometer test cycles in city and highway fuel economy labels. The focus groups indicated to us a general aversion on the part of consumers to complex and detailed information, except in a very few cases (and in those cases, the information is available via the website that will be included on the new label). We believe that it will be sufficient for most consumers to understand that EPA included actual fuel economy measurements while the vehicle was driven at high speeds and rates of acceleration, at colder temperatures and with the air conditioning turned on. One of the most difficult tasks we currently face is explaining to consumers how we historically estimated onroad fuel economy by testing vehicles at a maximum speed of 60 mph only at 75°F with the air conditioning off.

We also believe that consumers are sufficiently intelligent to understand that engineering equations can sometimes appear complex, even if the principles involved can be explained rather simply. The alternative is to simplify the equation and lose accuracy for the subjective advantage of being able to show a simple equation in the regulations or an article explaining our new label procedure. We do not believe that this is a necessary or appropriate trade-off.

5.2 Validation of the 5-cycle Formulae for Individual Vehicles

What we proposed:

We did not propose a specific method for validating the accuracy of the 5-cycle formulae on an individual vehicle basis.

What commenters said:

Honda commented that: "the individual (understood to mean 5-cycle) label adjustments are based primarily upon analyses of driving behavior alone. … By ignoring the effect of changes in driving behavior and conditions on the in-use fuel consumption of individual vehicles, the Proposal implicitly assumes that all vehicles have the same relationship between fuel consumption and real world driving conditions. However, the proposal makes no attempt to validate this assumption, either analytically or with in-use fuel economy data."

UCS states that "Because the 5-cycle methodology begins to test for a number of important factors, it is appropriate for use as an interim solution while new test cycles are being developed." They argue that because the 5-cycle approach is based on models (MOBILE and MOVES) that are designed to consider the entire vehicle fleet, the methodology may improve the average fuel economy ratings for the fleet without leading to corresponding improvements in the accuracy of individual vehicle ratings. They suggest the possibility that the 5-cycle approach is delivering the correct results by virtue of errors canceling one another out. For example, the relative importance of cold starts could be exaggerated, but be balanced out by an underestimation of air conditioner impacts. Consequently, they recommend that EPA strengthen the methodology through validation with in-use data.

Our response:

In addressing the comments by Honda and UCS, it is useful to first summarize certain key aspects of EPA's general approach to developing the fuel economy label, as well as describing the basis for the 5-cycle formulae and how it compares to the current labeling formula and the mpg adjustment approach.

The fuel economy label on any vehicle model has two basic functions - to provide information on the city and highway fuel economy that can be expected from that individual model, and to allow for a comparison between different models. Meeting these goals has to take into account that there is a very wide variety of different in-use driving conditions - speed, acceleration rates, deceleration rates, fluctuations in speed and accelerations/decelerations, vehicle operating conditions such as AC use that increase the load on the engine, ambient conditions like temperature and wind speed, road conditions like grading, vehicle conditions like tire pressure and wear, and so on. All of these factors can affect the fuel economy of a vehicle. In addition, this wide variety of driving patterns reflects the wide variety among drivers and how and where

they drive their vehicles. Since a single fuel economy label needs to provide useful information to a wide variety of persons nationwide, EPA's general approach has been to provide label values that predict in-use fuel economy for the vehicle assuming that it will be driven in a way that is generally representative of average nationwide patterns. This recognizes that a single label value cannot be developed that identifies for each person the fuel economy they would experience based on that individual's unique driving patterns. The use of a common benchmark of representative in-use driving patterns, however, provides information that is still quite useful for each person in gauging the likely fuel economy they can expect for themselves, as well as providing a consistent basis for comparison of expected fuel economy between different vehicles.
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Fuel economy label values are derived using fuel economy data obtained by testing a vehicle over a limited number of prescribed driving conditions in the laboratory, and then making projections of the vehicle's fuel economy when it is operated in-use under a wide variety of conditions including those not tested in the laboratory. The current label formula combines data on fuel economy from testing over the driving conditions found on the FTP and the HFET, and then adjusts these results by a set percentage. The FTP represents a subset of city driving conditions – relatively low speed, mild acceleration and deceleration rates, about 75F ambient temperature, accessories like the AC are off, and the engine is first started up after a long time sitting at the same 75F temperature. The FTP fuel economy value is then adjusted by a set percentage to then predict city fuel economy over the wide variety of conditions found in in-use city driving, including the many types of driving conditions that are not included in the FTP – higher speeds, more aggressive acceleration and deceleration, AC use, and the myriad other variations in in-use driving conditions.

Under the current label formula, if two vehicles have the same fuel economy result on the FTP they have the same label value for city fuel economy. If their FTP fuel economy data differs – for example, one is a set percentage lower than the other - then they will have different labeled values for city fuel economy which will continue to show the same relative difference as the vehicles showed on the FTP. This is based on two assumptions. The first is that a vehicle with a certain fuel economy during specified laboratory driving conditions will continue to have the same fuel economy during in-use driving conditions that are basically the same as those under the test. The common adjustment factor reflects a second assumption - that every vehicle will react the same way to the wide variety of in-use driving conditions that are not included in the tests, and for which we therefore do not have vehicle specific data. In effect, the current label formula predicts that if a vehicle were driven under conditions that are representative of the wide variation in in-use driving conditions, it's in-use city fuel economy would always be a set percentage below the value it shows when tested on the FTP driving conditions.

The impetus behind this rulemaking was the large amount of in-use data from a number of sources indicating that the current formula does not do a satisfactory job of meeting the two informational goals described above. In developing an updated approach to address these concerns, a significant amount of information on in-use driving conditions is now available to better characterize the variety of in-use driving conditions. There are also several additional laboratory tests available that allow for collection of fuel economy test data from individual vehicles over a wider variety of driving conditions.

In developing the 5-cycle formulae, EPA uses much of the same basic framework described above: (1) the formula is designed to predict fuel economy over representative in-use driving conditions, using a common benchmark for labeling different vehicles, (2) the formula assumes that if a vehicles achieves a certain fuel economy during testing under a certain kind of driving, then the vehicle will continue to achieve that fuel economy value under similar in-use driving conditions, and (3) where we do not have data to allow projection of individual vehicle fuel economy test data to similar in-use driving conditions, then a common, generic adjustment factor is used to account for all conditions not generally represented by the laboratory tests.

For example, there are five tests that are now available to provide fuel economy values for an individual vehicle. As a group, they reflect a much wider variety of driving conditions. They cover several distinct kinds of driving patterns (based on factors such as average speed and power - Bag 3 FTP, Bag 2 FTP, HFET, USO6 City, US06 Hwy), different temperature conditions (75F, 20F, 95F), different accessory loads (AC use on, AC use off) and different amounts of time sitting between engine start (soak time - 10 min., 12 hour). There is also a large amount of information on in-use driving conditions to use in deriving a characterization of representative in-use driving conditions.

For example, fuel economy during in-use driving is made up of two parts – the fuel used during warm-up of the engine when that engine is started (start fuel use), and the fuel used after the engine is warmed up (running fuel use). For each of these, EPA developed a comprehensive picture of average conditions. For example, for running fuel use EPA developed a description of average U.S. driving from the Draft MOVES2004 motor vehicle emissions model. EPA determined that about 41% of in-use city driving is under driving conditions that are similar to the driving conditions of Bag 3 of the FTP, 48% of in-use driving is similar to the driving conditions of Bag 2 of the FTP, and 11% is similar to the more aggressive driving conditions in the USO6City. EPA also evaluated temperature conditions during which in-use driving occurs, and determined that the average temperature in which driving occurs is approximately 58.7F, and on average the air conditioner compressor is engaged and putting load on the engine approximately 15.2 percent of the time. EPA then developed a formula that properly weights the varied kinds of test driving conditions by their relative contribution to this benchmark of average in-use driving. In some cases this required additional analysis. For example, the tests are driven at 75F and 20F, but not at 58.7F. Using engineering analysis and test data on how fuel economy changes as temperature changes, EPA developed a relationship for the change in fuel use related to starting the engine as temperature increases from 20F to 75F. This relationship, along with an individual vehicle’s test data at 20F and 75F, is used to predict the fuel economy at 58.7F.

The 5-cycle formulae therefore reflects EPA's use of a common benchmark for labeling - average in-use driving conditions nationwide – and the assumption that a vehicle's fuel economy during a certain kind of driving in the lab reflects the vehicle's fuel economy during similar in-use driving conditions. For example the running use formula assigns a rating to Bag 3 of the FTP that is consistent with the fact that the driving on Bag 3 is similar to 41% of the average city driving. The formula is based on the assumption that the fuel economy a vehicle achieves during Bag 3 of the FTP is a good predictor of the fuel economy it will receive during the 41% of average in-use city driving that is similar to the driving during Bag 3. The formula also incorporates the fuel economy test data at 20F and 75F to numerically provide the proper discount to reflect that average city driving is at 58.7F. For conditions that are represented by the test driving, EPA assumes that in-use driving will show the same variation in fuel economy that the test driving does – different vehicles that have different fuel economy during the test driving will show the same variation in fuel economy when driving in-use over similar conditions. This is reflected in the weightings used in the 5-cyle formulae.

The 5-cycle formula also uses a generic adjustment factor to account for the variety of conditions that occur during in-use driving that are not fairly represented by the driving conditions under which individual vehicles are tested, such as variations in wind speed, road conditions, tire pressure, and the like. For these conditions EPA does not have test data for individual vehicles and assumes that all vehicles will show the same effect notwithstanding differences in design between different vehicles. This is reflected in the generic adjustment factor.

There are therefore two basic differences between the current label formula and the 5-cycle formula. The range of in-use conditions over which EPA is able to use test data to identify differences in fuel economy between different vehicles is a broader range of driving conditions for the 5 cycle than the current label, and the range of in-use conditions over which EPA assumes all vehicles react the same way is a narrower set of conditions over the 5-cycle than the current label.

Honda commented that: "the individual [5-cycle] label adjustments are based primarily upon analyses of driving behavior alone. … By ignoring the effect of changes in driving behavior and conditions on the in-use fuel consumption of individual vehicles, the Proposal implicitly assumes that all vehicles have the same relationship between fuel consumption and real world driving conditions. However, the proposal makes no attempt to valid ate this assumption, either analytically or with in-use fuel economy data."

This is not an accurate description of the 5-cycle formula. It is based upon analysis of in-use driving behavior, but not primarily on that alone. An analysis of driving behavior is a central element, but just one element. The analysis of in-use driving patterns is critical because it allows EPA to accurately characterize average driving conditions across the US, and use this as a benchmark. It also allows EPA to accurately identify which parts of this average in-use driving are represented by the various kinds of driving conditions in the laboratory tests, and properly weigh the test driving so it accurately reflects the contribution that that kind of driving makes to the benchmark of average in-use driving. Having done that, the 5-cycle then applies the vehicle specific fuel economy data generated in the test driving, weighing it properly to reflect the contribution of that driving to overall, representative in-use driving. Thus the analysis of average in-use driving behavior is a central element of the formula, but it is not used alone or in isolation, but instead is combined with individual vehicle specific fuel economy data generated during testing.

The 5-cycle formula does not "ignore[e] the effect of changes in driving behavior and conditions on the in-use fuel consumption of individual vehicles." It does the opposite. The 5-cycle formula uses a broader range of driving conditions under which individual vehicles are tested, which then identifies whether and how much a change in driving conditions changes fuel consumption for the individual vehicle. The formula then assigns that change in fuel economy to similar in-use driving conditions. It does this over a broader range of driving conditions than the current label formula, because the driving tests cover a broader range of driving conditions. The generic adjustment used in the 5-cycle formula does ignore differences between individual vehicles, and assumes that all vehicles will react the same way to the changes in in-use driving conditions covered by the generic adjustment factor. This applies to the conditions not fairly represented by the test driving conducted on individual vehicles. However this assumption covers a much narrower range of driving conditions for the 5-cycle formula than for the current label.

The 5-cycle formula does not "implicitly assum[e] that all vehicles have the same relationship between fuel consumption and real world driving conditions." As described above, for the broad range of driving conditions covered by the test driving conditions, it identifies an individual vehicle's fuel consumption. This identifies differences between vehicles over these driving conditions. These differences in fuel economy are then properly weighted to reflect their occurrence during in-use driving. It is only for the generic adjustment that the 5-cycle formula assumes all vehicles have the same relationship between fuel consumption and real world driving conditions. However for the 5-cycle formula this is a narrower range of in-use driving conditions than the current label formula.

Honda objects that EPA did not validate this implicit "assumption", either analytically or with in-use fuel economy data for individual vehicles, before making the 5-cycle formulae mandatory. As noted above, EPA does not make the assumptions Honda suggests, except for the generic adjustment factor. The technical basis for the generic adjustment factor is explained in Section III.A.5 of the Final TSD. Honda does not appear to object to the technical basis for the generic adjustment, however. Its call for validation is aimed at the parts of the 5-cycle formula that use vehicle specific test data, and not the generic adjustment which is not vehicle specific. For the vehicle specific parts of the formulae, as discussed above, EPA did not make the assumptions that Honda states, and in fact made distinctly different assumptions.

Honda does not appear to object to several of the basic elements of EPA's approach. For example, Honda does not appear to object to the assumption that the fuel economy an individual vehicle demonstrates when tested under certain driving conditions also fairly represents the fuel economy the vehicle will show during similar in-use driving conditions. While in-use fuel economy data for individual vehicles arguably would be relevant to validate this assumption, it is clearly a reasonable engineering judgment to make and in any case there is no apparent dispute on this issue.

Honda does not appear to raise significant objections to the concept of using average in-use driving conditions as the benchmark for fuel economy labeling. That is, the fuel economy label should be based on a projection of the fuel economy of the vehicle over a driving pattern that fairly represents average US driving conditions.[25] While Honda states there is a need to validate the 5-cycle formula for in-use fuel economy for individual vehicles, such in-use fuel economy validation would not be relevant to characterizing this average US driving pattern. The average driving pattern is not intended to be vehicle specific; it is an average that is then used as the benchmark for labeling. The weightings of the formula are likewise not vehicle specific, but are intended to reflect the correlation between the kind of driving during testing and the amount of such driving in the average US driving. In use fuel economy data would not inform you about the validity of this average driving pattern, because it is a driving pattern, not a fuel economy value. It is true that information on in-use driving of individual vehicles would provide additional data about in-use driving patterns, irrespective of the in-use fuel economy. However absent a broad range of in-use data over a variety of models, manufacturers, and driving conditions, it would not be a useful way to identify whether the average driving pattern needs to be revised. Again, that is because this benchmark and the related weightings in the formula are not vehicle specific but are intended to be an average covering a wide range of in-use conditions.

The vehicle specific part of the 5-cycle formula is the fuel economy data derived for an individual vehicle over the kinds of driving covered by the various tests. In-use fuel economy validation from individual vehicles is not needed to validate the laboratory results themselves, and as discussed above it is not needed to validate the assumption that the individual test data for the vehicle represents the fuel economy it will achieve when driving under conditions in-use that are similar to those during testing.

Arguably Honda is referring to EPA's invitation for comment on whether certain vehicle technologies are generally driven in a way that is distinctly different from the average, e.g. unusually low incidence of aggressive driving, A/C usage, etc. See 71 FR 5442 (col2-3). For example, Honda suggests using the 5-cycle formula only until a manufacturer collects enough fuel economy data on an individual model from in-use drivers of that model, and then substituting this manufacturer derived fuel economy value for the 5-cycle value. As discussed in the preamble of the proposal, in this situation in-use data would be used to show that a different average benchmark (with

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[25] Honda does object to various details of the benchmark average driving pattern developed by EPA, and those objections are responded to elsewhere.

correlated changes to the weightings in the 5-cycle formula) should appropriately be used for a specific kind of technology. That is a different issue, however, than the need for in-use validation before using the 5-cycle formula for it's stated purpose – to predict in-use fuel economy over a broad national average of driving conditions, based on fuel economy test data for an individual vehicle gathered over a broad but necessarily limited variety of driving conditions. The fact that in-use fuel economy data might be necessary and useful in deciding whether to provide an exception to the benchmark average driving pattern for certain vehicles or a certain kind of technology does not indicate that such in-use data is needed or useful in validating the average in-use driving pattern itself. As noted above, it generally is not.

As will be discussed further below, the proposed 5-cycle formulae are based in part on some assumptions about how vehicles respond to conditions that are not tested directly by the five dynamometer tests. E.g., the effect on fuel economy of ambient temperatures between the 20F and 75F is subject to an engineering analysis and certain test data to establish the relationship between fuel economy at the average US driving temperature, 58.7F, and fuel economy measured at 20F and 75F. Likewise, EPA makes certain assumptions about the AC compressor load during driving patterns not included in the test driving. However, these assumptions are much less extensive than those involved in either the current label formula or the proposed mpg adjustment formula. All the assumptions regarding how fuel economy varies under conditions "in between" the various tests were supported by the results of dynamometer testing or engineering analysis. Honda has provided no data to indicate that any particular assumption was inappropriate for any specific vehicle. EPA remains open to reviewing any valid test data which would show that any of its assumptions were inappropriate for a specific vehicle and considering modifications to the 5-cycle formulae to account for these differences. But the need to perform these analyses is not a basis for delaying use of the 5-cycle formulae. EPA's analyses are supported in the record, as noted, and EPA believes the 5-cycle formula presents significantly less risk of error in labeling than the much more extensive assumptions that made and not supported in the current label formula.

For the reasons noted above, EPA does not believe that it needs in-use validation data from individual vehicles prior to making the 5-cycle formula mandatory. In large part this is based on the extensive technical analyses underlying the 5-cycle formula, the validity of the representative in-use driving pattern used as a benchmark, and the increased ability to use individual vehicle test data to represent the vehicle's in-use fuel economy. In addition, this is based on the view that the 5 cycle formulae would still be a better choice for fuel economy labeling that the mpg adjusted formula or the current label formula.

It is inconsistent to reject the 5-cycle formula because it has not been validated through data on in-use fuel economy for individual vehicles, but to accept the mpg adjusted formula or the current label formula. The mpg adjusted formula is basically a streamlined way to predict the 5-cycle formula result for an individual vehicle. For the large majority of vehicles, the mpg adjustment formula does a good job of accurately predicting the 5-cycle formula value for that vehicle. If the 5-cycle formula is inappropriate because of various problems and the lack of in-use validation, then the mpg adjustment is inappropriate for the same reasons because the mpg adjustment formula is just a shorthand way to develop the 5-cycle formula result. There are vehicles where the mpg adjustment formula does not do a very good job of accurately predicting their 5-cycle formula results. For this subset of vehicles, the mpg adjustment basically assigns them the average 5-cycle fuel economy derived from the large majority of vehicles where the mpg adjustment does a good job of predicting the 5-cycle value. For these cars, any basic defect of the 5-cycle formula would also apply to the mpg adjusted value. If there is not a valid technical basis to use the 5-cycle formula then logically there is not a valid technical basis to use the mpg adjustment formula. EPA believes, however, that there is a valid basis to use the 5 cycle-formula, hence a valid basis to use the mpg adjustment formulae as well, especially for the large majority of vehicles where there is a close correlation between the 5 cycle result the and the mpg adjustment result.

It also would be inconsistent to delay the 5-cycle formulae pending further in-use validation, while continuing to use the current label formula. The current label has not been validated for individual in-use vehicles, and in general in-use data shows that the current label formula generally overestimates fuel economy and masks differences in fuel economy between individual vehicles. This is because it generates vehicle specific fuel economy data over a narrow range of laboratory driving conditions, and it uses a generic factor, that does not discriminate between individual vehicles, to cover all other driving conditions. The 5-cycle formula generates vehicle specific fuel economy data over a wider range of test driving conditions, and relies on a generic adjustment factor to cover a narrower range of the remaining driving conditions. The comparison of 5-cycle results to the current label, as reflected in the mpg adjustment formula, indicates that the 5 cycle formula does a better job than the current label formula of predicting in-use fuel economy and identifying fuel economy differences between different vehicles.

The real solution to the issue raised by Honda and explicitly suggested by UCS – greater accuracy in predicting individual vehicle fuel economy - is not to delay use of the 5-cycle formula but to expand the extent of individual vehicle fuel economy testing in the laboratory (i.e., more driving patterns, intermediate colder and hotter temperatures, intermediate soak times, etc.), assuming the increase in accuracy was worth the increased testing. Honda and the other vehicle manufacturers have argued strongly against this approach. Absent such an increase in fuel economy testing of individual vehicles, for the reasons discussed above EPA believes there is not a valid technical basis to delay the use of the 5-cycle formulae pending validation by in-use fuel economy testing of individual vehicles, with reliance on either the mpg adjustment or the current label formula in the meantime.

5.3 Some Formulae Coefficients are Counter-Intuitive

What we proposed:

We proposed weightings of the various cycles or bags that were based on extensive analyses of in-use driving data and vehicle test data.

What commenters said:

Honda commented that the overall contributions of several of the cycles or bags in the 5-cycle formulae do not make engineering sense, as some of the contributions are negative. In terms of fuel consumption (as opposed to fuel economy), Honda consolidated the various terms of the 5-cycle formulae in order to identify the overall weight given to each cycle or bag. The results are shown in Table 5-1.

Table 5-1: Proposed Coefficients for the 5-Cycle Fuel Economy

	City	Highway
FTP – Bag 1	25.7%	1.5%
FTP – Bag 2	28.0%	-2.0%
FTP – Bag 3	-5.8%	-4.6%
HFET		21.3%
US06 – City Bag	7.7%	
US06 – Highway Bag		79.9%
SC03	14.4%	5.0%
Cold FTP – Bag 1	8.1%	0.5%
Cold FTP – Bag 2	15.0%	
Cold FTP – Bag 3	6.9%	-0.5%

Honda presents five concerns related to the figures in this table.

1) The negative coefficients for Bag 3 of the FTP in both formulae, and the negative coefficient for Bag 2 of the FTP in the highway formula. These negative coefficients mean that if a manufacturer increases a vehicle's fuel economy during this type of driving, the vehicle's 5-cycle fuel economy will actually decrease, not increase.

2) The weighting for SC03 in the city formula is 14.4% but the driving conditions represented by this cycle only represent 3% of all driving.

3) The total weighting for cold FTP in the city formula is over 30%, but the driving conditions represented by this cycle only represent 2% of all driving.

4) In total, the extreme cycles represent over half of the weighting of the city formula, while only representing 5% of all driving.

5) For the highway driving, the extreme cycles account for over 85% of the highway label value.

Our response:

We conducted our own analysis to determine the overall weightings of the various bags and cycle in the two 5-cycle formulae and confirmed the reasonableness of the figures shown in Table 5-1. Thus, we agree with Honda that, from a purely mathematical perspective, the figures in Table 5-1 indicate how the fuel consumptions measured over the various bags and cycles contribute to the overall estimate of fuel consumption during either city or highway driving and thus, to the 5-cycle city and highway fuel economy label values.

Regarding Honda's concern about negative bag coefficients, we believe that this concern is purely theoretical, and does not represent a real problem with the 5-cycle formulae. For example, we recalculated the overall coefficients for the various bags and cycles using a very large average trip length (i.e., 10,000 miles) which effectively removes any contribution from the cold start towards city or highway fuel economy. The results are shown in Table 5-2.

Table 5-2: Proposed Coefficients for the 5-Cycle Fuel Economy with Infinite Trip Length

	City	Highway
FTP – Bag 1	0%	0%
FTP – Bag 2	27%	-2%
FTP – Bag 3	17%	-3%
HFET		17%
US06 – City Bag	10%	
US06 – Highway Bag		81%
SC03	16%	7%
Cold FTP – Bag 1	0%	0%
Cold FTP – Bag 2	16%	
Cold FTP – Bag 3	14%	0%

As can be seen, the negative coefficient for Bag 3 of the FTP in the city formula changes to a relatively large positive 17% with the removal of cold start fuel use. Thus, the -5.8% coefficient in the proposed 5-cycle city formula is clearly due to the presence of cold starts in city driving (i.e., short trips). The method for estimating cold start fuel consumption is via the difference between fuel consumption over Bags 1 and 3 of either the FTP or cold FTP. The driving pattern during both bags is exactly the same. The only difference is that Bag 1 begins with a cold start and Bag 3 begins with a hot start. Thus, the difference in fuel consumption over the two bags is clearly due to the presence of the cold start in Bag 1. This difference has been used in emission modeling, such as that performed in the EPA MOBILE models for thirty years and is well established.

Honda did not suggest excluding the impact of cold starts from the 5-cycle formulae. Nor do we believe that they meant to imply that the impact of cold starts should not be included. Still, this indicates that their concern about the negative coefficient is theoretical, and not practical. For example, there are a number of ways to improve fuel economy over Bag 3 of the FTP, such as reducing vehicle weight or aerodynamic drag, or modifying gear ratios, etc. However, in the vast majority of these cases, fuel economy over Bag 1 will improve as well, since it involves exactly the same type of driving. As seen in Table 5-2, the coefficient for Bag 1 vastly exceeds that of Bag 3. Thus, even if the change in Bag 1 fuel consumption was somewhat smaller than that of Bag 3, 5-cycle city fuel economy would improve. In addition, since Bag 2 of the FTP and the SC03 test consist of very similar, low speed driving, the vehicular changes described above would likely improve fuel consumption over these other bags and cycles as well, further improving 5-cycle city fuel economy.

Honda did not provide any examples of technologies or techniques which could improve fuel consumption over Bag 3, but which would not improve fuel consumption over any of the other bags and cycles. Thus, we do not believe that the existence of a negative effective coefficient for an individual cycle or bag is necessarily a problem in the 5-cycle formulae.

The negative coefficients for Bags 2 and 3 in the 5-cycle highway formulae are primarily due to the inclusion of the effect of air conditioning in the formulae. The effect of air conditioning is estimated via the difference in fuel consumption over the SC03 test and a mix of Bags 2 and 3 of the FTP. Again, it seems extremely unlikely that a manufacturer could improve fuel consumption over Bags 2 and 3 of the FTP without also improving fuel consumption over SC03, since the driving patterns are quite similar. Thus, again, we believe that Honda's concern in this case is more theoretical than practical.

Regarding the effective coefficient of 14% for SC03, Honda states that the driving conditions represented by this test only occur 3% of the time on the road. Honda did not explain or provide data to support the basis for this percentage. However, it is likely that the 3% represents the percentage of onroad driving which occurs at 95 degrees Fahrenheit or higher. If so, this characterization is very biased, because it assumes that if driving occurs at a temperature below 95 degrees Fahrenheit, it is adequately represented by the other bags or cycles. This is clearly not the case. Drivers use their air conditioning systems at temperatures below 95 degrees Fahrenheit. None of the other bags or cycles involves operation of the air conditioning system. Thus, to completely exclude driving at lower ambient temperatures when the air conditioning is operational when assessing the applicability of the SC03 test to onroad driving is technically unjustifiable.

The contributions of fuel consumption over SC03 in the 5-cycle formulae explicitly consider the variation in use of air conditioning over the range of ambient conditions, the cycling of the compressor at various ambient conditions and the effect of air conditioning on fuel consumption as a function of vehicle speed. Honda neither challenged any of these analyses, nor provided suggestions for their improvement. Overall, these analyses (which are described in the TSD) indicate that the air conditioning compressor is engaged about 15% of the time on the road. Since the SC03 cycle essentially consists of city driving, it is not surprising that the weighting of the SC03 test in the 5-cycle city formula is very close to this figure. In addition, the SCO3 results are combined with other results to approximate the effect of the air conditioner compressor on fuel economy irrespective of ambient temperature, and this impact is then weighted to reflect that the compressor is on during approximately 15% of VMT. Thus, the actual percent of VMT represented by the SCO3 driving cycle is not directly relevant, as the test data is used to isolate the impact of the compressor load irrespective of driving cycle.

Starting with the cold CO test, we agree with Honda that only 2% of national VMT occurs below 20°F. However, to cite this statistic as the only indication of the relevance of the cold FTP test is misleading. This implies that the standard FTP at 75°F is a better representation of the remaining 98% of driving, particularly cold starts. As indicated in Figure 1 of Honda's comments, this is not the case. The FTP at 75°F is not a better indicator of fuel economy at temperatures just slightly above 20°F than the cold CO test. A temperature of 50°F is roughly halfway between the nominal temperatures of the two FTP tests. Figure 1 indicates that roughly 30-35% of national VMT occurs at temperatures which fall closer to the 20°F test than to the 75°F test. Thus, when examined in greater depth, the 20°F cold FTP is not as "extreme" as it appears at first blush, especially given the fact that the weighting factor for the various bags of the cold FTP in the 5-cycle formulae are between 0.24 and 0.30.

This is even more true for the SC03 and US06 tests. Honda points out that the SC03 test is performed at 95°F, when again only 2% of national VMT occurs at this temperature or greater. However, the SC03 test is an air conditioning test, not simply an FTP at 95°F. Our analysis indicates that the air conditioning system is turned on 23.9% of the time in-use (Section III.A.3. of the Final TSD). As discussed there, the National Energy Research Laboratory estimates even higher use, 29%. An FTP performed at 75°F with the air conditioning off is not a better indicator of the incremental fuel use associated with air conditioning than the SC03 test, even if the temperature is below 95°F. Thus, the percentage of driving occurring with the air conditioning on is much more relevant to the benefit of the SC03 test than the percentage of driving occurring at or above the temperature of the SC03 test.

Drivers rarely use their air conditioning below 70 F. Thus, the amount of driving below 70 F is irrelevant to the representativeness of the SC03 test. When the air conditioning system is turned off, it has no effect on fuel economy and our analysis accounts for the fact that it has no effect on fuel economy. The issue is how to best estimate the impact of air conditioning on fuel consumption. The 5-cycle formulae isolates the impact of air conditioning at 95°F by comparing the fuel consumption over the SC03 test to that over a combination of Bags 2 and 3 of the FTP designed to match the driving cycle of the SC03 test. The 5-cycle formulae then weights this incremental fuel consumption by 1) the percentage of driving occurring with the air conditioning turned on, 2) the percentage of time that the air conditioning compressor is on relative to that occurring during the SC03 test, 3) the relative load of the compressor on the engine at the temperature at which the driving is occurring, and 4) the speed of city and highway driving relative to that of the SC03 test. Each adjustment accounts for differences between the specific conditions occurring during the SC03 test and those existing on the road. The alternative is to assume that the impact of air conditioning is proportional to fuel use over the FTP, a test where the air conditioning is not operating. Honda presents no data to indicate that this alternative is a better estimate of the impact of air conditioning. Available data of fuel consumption over the SC03 and FTP tests indicates that the impact of air conditioning is not proportional to fuel use over the FTP (see Figure III-11 of the Draft TSD). Thus, Honda's statement that only 2% of in-use driving occurs above 95°F does not address the major issue, that of air conditioning and its effect on onroad fuel economy.

In response to Honda's comment that the vehicle in the SC03 test has been sitting for 10 minutes in the sun prior to the test, we do not believe that this is extreme. Prior to driving, vehicles can be parked under a roof, but often they are parked in the open. Our in-use data on vehicle starts indicates that only 1% of all starts in-use occur after a vehicle soak of 10 minutes or less. Thus, when vehicles are parked outside in sunny conditions, their inside temperature is likely much higher than that in the SC03, even when the ambient temperature is below 95°F. While the test is relatively short, 10 minutes or 3.5 miles, this is exactly our estimate of the average trip length during "city" driving. Thus, with respect to both its vehicle soak time and its length, the SC03 cycle is not "extreme".

Honda's comments about the "extreme" cycles representing half to 85% of the contributions to the 5-cycle formulae extend the same thinking to the US06 cycle. Few if any specific vehicles are driven exactly like any of the bags or cycles. Thus, they are all extreme in this sense. As examined in Section III of the TSD, the US06 cycle is also extreme in the sense that only a small percentage of onroad driving tends to fall outside of its speed-acceleration envelope. But like the contributions of the SC03 and cold FTP tests, the issue with the US06 contribution is which bag or cycle best represents onroad driving, not whether one or the other bag or cycle exactly matches it. Honda neither presented any new onroad driving activity data, nor suggested any way to improve the analyses which determined the relative contributions of the various bags or cycles to describe onroad driving. As described in Appendix A of the TSD, recent California chase car data indicates that 20% of city driving time and 41% of highway driving time fell outside of the speed-acceleration envelope of the FTP and HFET cycles. This does not imply that the US06 cycle can only represent these percentages of city and highway driving. It just means that these percentages of driving in California are not represented by even one second of driving on either the FTP or HFET cycles. The weighting of driving at the edges of the FTP/HFET speed-acceleration "envelope" may be much lower than those found on the road. The VSP-based cycle analysis of city driving indicated that the US06 contribution was much lower than the 20% figure based on the FTP/HFET speed-acceleration envelope. In contrast, the VSP-based cycle analysis of highway driving indicated that the US06 contribution was much higher than the 41% figure based on the FTP/HFET speed-acceleration envelope. Both types of analysis show that the contributions of the various bags and cycles, including those referred to as extreme by Honda, appear to be appropriate at this time.

5.4 Start Fuel Use May Not Be Accurate on Per Vehicle Basis

What we proposed:

In the proposal we assessed the sensitivity of the 5-cycle equations to several factors and alternative assumptions. We evaluated the effect of soak time and ambient temperature on start fuel use using test results from 50 degree F testing required by California. Based on this data, we concluded that it was unlikely that uncertainty in the effect of ambient temperature on start fuel use would significantly affect city 5-cycle fuel economy. We also concluded that it would have no effect on 5-cycle highway fuel economy, due to the extremely low contribution of start fuel use in highway driving. Hybrids would likely show the greatest variability in this area, due to the greater number of technological factors that could be affected, but even for these vehicles we found that the 5-cycle fuel economy for the vehicle reflecting the greatest difference in temperature sensitivity was only changed 1%.

What commenters said:

UCS commented that the comparison of start fuel use at 50 degrees and 20 degrees Fahrenheit presented in the Draft Technical Support Document should not be interpreted too broadly. They suggest that the model may correctly predict the average start fuel use for the nine vehicles, it is not clear that each individual vehicle's start fuel use is accurately reflected. They point to the data for hybrid vehicles, which indicates that the appropriate weighting for the 20 degree start fuel use may vary by a factor of two between different vehicle models. They suggest that it will be important to validate the approach for individual vehicles, rather than on the basis of a group average.

Our response:

UCS' comment about the possibility that the correct weighting factors for 20°F and 75°F operation might differ between individual vehicles was addressed with the previous comment by Honda. As discussed there, the current label procedure, as well as the mpg-based equations, not only assumes the same rate of change of start fuel use with temperature, but the same overall degree of change between 20°F and 75°F. Both the degree of change occurring between 20°F and 75°F and the rate at which this change occurs are important. The 5-cycle formulae utilize actual vehicle test data to obtain the degree of change between 20°F and 75°F, while assuming that the rate of change between 20°F and 75°F matches that of the vehicles which have been actually tested at intermediate temperatures, as well as at 20°F and 75°F. The other two approaches assume both factors (degree of change between 20F and 75F, and rate of change between those temperatures), and assume all vehicles react to changes in temperature in the same way in both regards. The 5-cycle approach is clearly superior in this regard.

5.5 Relative Accuracy of the mpg-Based Equations Versus the 5-cycle Formulae for Individual Vehicles

What we proposed:

We proposed the use of the mpg-based equations for model years 2008 through 2010, then implementation of the vehicle-specific 5-cycle method starting with the 2011 model year.

What commenters said:

Honda commented: "We believe EPA has done a credible analysis based upon air quality modeling methodologies to create an equation that incorporates new, more aggressive driving conditions to predict aggregate fuel economy for the fleet in actual use. Reducing the equation as EPA has done into the mpg-based equation works because this is not attempting to make the results vehicle specific. However, little in-use data exists to validate the coefficients in the 5-mode equation for use in predicting vehicle specific results. Thus, Honda supports the 2008 mpg-based approach but we do have some concerns with applying the formula to individual vehicles in 2011."

Our response:

These two statements reflect a basic misunderstanding about the relationship between the three approaches to developing fuel economy label values discussed in the NPRM: 1) the current label formulae, 2) the mpg-based equations, and 3) the 5-cycle formulae. All three approaches produce vehicle specific fuel economy label values. The foundation of all three approaches is a set of measured fuel economy values based on the testing of the vehicle being labeled. Thus, all three approaches are "vehicle specific." All three approaches also include "fleet average" adjustments to the "vehicle specific" fuel economy measurements. The difference between the three approaches is in the degree of vehicle specificity, not a fundamental difference where two of the approaches are appropriately fleet average and the third (5-cycle) is vehicle specific.

Honda appears to be looking only at the portion of the various fuel economy label formulae beyond the current FTP and HFET testing. Viewed in this way, the current label formulae apply generic city and highway percentage adjustments to all measured FTP and HFET fuel economy values. While slightly more elegant in its mathematics, the mpg-based equations do essentially the same thing, as the effective percentage adjustment applied to the FTP and HFET fuel economy values varies only slightly except for roughly three hybrid vehicles with extremely high city fuel economy.[26]

The 5-cycle formulae, in contrast, introduce measured fuel economy values from other test cycles. Because of this, Honda appears to perceive these fuel economy values as "vehicle-specific adjustments" to the FTP and HFET fuel economy values. However, these additional three tests are no more vehicle-specific in concept than those measured over the FTP and HFET tests. Thus, the distinction being drawn by Honda is more related to history (how are the current "vehicle specific" fuel economy labels changing) than based on fundamental engineering or technical considerations. Going back further historically, the original fuel economy label values were based solely on the FTP. The use of the HFET for highway label values was introduced at a later date. This modification was in fact a vehicle specific adjustment to the original, FTP-based label values. (Fuel economy measured over the HFET is obviously vehicle specific.)

Viewed much more simply, the current label procedures utilize vehicle specific data on the fuel economy of vehicles driven under relatively mild city and highway driving conditions at 75°F. The driving cycles for these tests were developed from fleet-average driving surveys which consisted of much less data than was used to develop the driving cycles contained in the US06 and SC03 tests. The FTP and HFET tests have never been justified on a vehicle specific basis in the way that Honda seems to be implying needs to be done for the three additional tests.

However, no effort was made in the past to determine if the FTP and HFET were the "best" indicators of city and highway fuel economy, respectively. The FTP and HFET were simply two reasonable driving cycles with average speeds in the range desired and were believed to provide reasonable estimates of onroad fuel economy. Obviously, in 1984, it was shown that these cycles significantly over-estimated onroad fuel economy and required adjustment. This was done in a fleet-average manner. However, neither EPA nor any other organization concluded that there were no vehicle specific factors which contributed to the shortfall indicated by the data. In fact, as described above, the impact of high speed, aggressive driving, air conditioning and cold temperature on fuel economy, while being correlated to a vehicle's fuel economy over the FTP or HFET, has a vehicle specific component which can often be traced to its specific design (e.g., power to weight ratio, body style, etc.).

Also, while the FTP fuel economy can appear to be a single fuel economy value, it is really the result of weighting of three fuel economy values, one for each test "bag." The weightings of these bags, particularly Bags 1 and 3, were based on the same type

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[26] It is important to note that this does not indicate that the mpg adjustment approach and the current label approach use similar methodologies or similar types of assumptions, as they do not. The mpg approach is basically a way to estimate an individual vehicle's 5-cycle result, thus it is a surrogate for the 5-cycle approach, and not a different approach relying on different assumptions or data. It turns out that for the large majority of cars the 5-cyce results do tend to cluster in ways that are similar to using a common adjustment factor

of “fleet-average” data (i.e., the in-use distribution of vehicle soak times prior to engine start-up) that were used in developing the weighting factors in the 5-cycle formulae. The 43% weighting of Bag 1 and 57% weighting of Bag 3 have never been validated on a vehicle-specific basis, as Honda is saying is required for the 5-cycle formulae. The driving cycles which comprise the FTP and HFET tests were based on much less onroad vehicle driving activity data than those used to develop the weighting factors for the 5-cycle formulae. Even the weighting factors for Bag 1/3 and Bag 2 of the FTP used in the current label formulae have never been “validated” on a vehicle specific basis. Thus, Honda’s perception that the current fuel economy label formulae do not need to be validated, but the 5-cycle formulae require such validation, is clearly arbitrary and not based on any real technical distinction.

The same is true for the assumed trip lengths for city and highway driving. The city fuel economy label is based on the FTP’s length of 7.5 miles (with respect to cold starts), while the highway fuel economy label is based on an infinite trip length (i.e., zero cold starts). Likewise, the FTP and HFET are both performed at a nominal 75°F. These factors have also never been validated on a vehicle-specific basis.

In fact, all of these factors implicit in today’s fuel economy labels and the proposed 5-cycle labels would differ slightly for individual vehicles. The volume of fuel needed to start and warm up the engine as a function of soak time and ambient temperature varies between vehicles. If all vehicles were thoroughly tested across the wide range of situations encountered in-use and the results condensed so that a cold start at 75°F was averaged with a hot start at 75°F, the fraction of cold starts would differ. This can be easily shown using the data on start fuel use presented in the TSD. The issue is not that the appropriate weighting factor would be exactly the same for each individual vehicle design, but that the weighting factors do not vary too widely. If this were the case, the solution, again, would be to measure fuel economy under more conditions. The solution would not be to return to generic, fleet-average adjustments.

It should also be noted that Honda did not provide any data supporting the ability of the FTP and HFET to accurately reflect any additional fuel consumption related to other driving patterns, air conditioning and defroster use, and cold temperature, including the effect of heating the passenger compartment. Nor did they provide any data to indicate that the US06, SC03 or cold FTP tests reflected fuel economy impacts not indicative of those occurring in-use. In fact, even a simplistic analysis of engine and vehicle design and their effect on fuel economy would demonstrate that specific vehicles are going to respond differently to the factors not covered by the FTP and HFET tests. Honda itself argues that vehicles respond differently to such factors. Thus, their own arguments, when appropriately applied to the currently label procedures and the proposed mpg-based equations, highlight the limitations in these two approaches relative to the proposed 5-cycle formulae.

The 5-cycle formulae assume that the US06, SC03 and cold FTP tests, in addition to the FTP and HFET, contain vehicle specific information with respect to onroad fuel economy. Honda makes a number of specific arguments which attempt to challenge this position which we address below. However, overall, Honda provides no vehicle activity or fuel economy data which demonstrate that the US06, SC03, and cold FTP tests do not provide information which is relevant to estimating a vehicle's onroad fuel economy. It is clear that vehicles are often driven faster and more aggressively than the FTP and HFET and at temperatures below 75°F, and drivers often use their air conditioning. The NPRM also provide substantial fuel economy data that the impact of these factors have a differential effect on specific vehicle's fuel economy. Thus, broadly speaking, Honda did not provide any justification for not utilizing this information while still trusting the information provided by the FTP and HFET tests. Therefore, we find this distinction being made by Honda incorrect and reject their suggestion that the coefficients in the 5-cycle formulae need a level of justification not required by the current label procedure and mpg-based equations.

5.6 mpg-based or "Generic" Adjustments to FTP and HFET

What we proposed:

The mpg-based method that we proposed bears some similarity to the current method, in that the method makes adjustments to FTP and HFET test results. However, the mpg-based adjustments we proposed are not flat percentage amounts, but differ based on the fuel economy achieved on the FTP and HFET tests.

What commenters said:

Honda strongly supports the application of mpg-based adjustments to the FTP and HFET fuel economy measurements. In support of this, they state that "if there is some error in the methodology, it is applied equally to all products."

Our response:

We appreciate Honda's support for the first phase of our proposed changes to the fuel economy label calculation procedures. However, we disagree that the error in the mpg-based equations, if they exist, are equivalent for all vehicle models. A very simple example demonstrates this. While relatively few vehicles are sold without air conditioning today, this was more frequent in the past. Manufacturers would often sell the same vehicle model with and without air conditioning. These two vehicle configurations would achieve essentially identical fuel economy over the FTP and HFET tests, since the air conditioning was never operative and the weight of the air conditioning system itself is quite small compared to that of the vehicle and might not even move the vehicle up to a higher inertia weight class. However, their onroad fuel economy would clearly differ, due to the one vehicle's air conditioning use. Both the current label procedure and the mpg-based adjustments would indicate that both vehicles would achieve the same onroad fuel economy. This would be obviously incorrect. The onroad shortfall for the vehicle equipped with air conditioning would be greater than that for the vehicle without air conditioning. Thus, applying a generic adjustment to FTP and HFET fuel economy does not automatically minimize the difference between onroad and label fuel economy.

In fact, this comment by Honda directly conflicts with a later comment. Later in their comments Honda states that: "By ignoring the effect of changes in driving behavior and conditions on the in-use fuel consumption of individual vehicles, the Proposal implicitly assumes that all vehicles have the same relationship between fuel consumption and real world driving conditions." The proposed 5-cycle formulae does this to some degree, in that some of its weighting factors are based in part on interpolations of how fuel economy changes between values measured over two tests, such as the cold FTP and FTP, or SC03 and the FTP. However, the generic adjustments recommended by Honda assume that the fuel economy of all vehicles respond in the same way to any conditions not included in the FTP and HFET tests. Ample data was presented in the Draft Technical Support Document which proved this not to be the case for colder temperatures, air conditioning use and high speed and aggressive driving.

Honda appears to be willing to accept the vehicle specific fuel consumption information which is generated by the FTP and HFET tests, but not any other tests. This is again odd, since the driving cycles of both tests have never been representative of any driving studies, even the studies upon which they were based. For example, all accelerations and decelerations which were found to occur in-use which exceeded 3.3 mph per second were reduced to this value, due to problems with operating a vehicle under these conditions on the older twin-roll dynamometers. These equipment driven limitations in the FTP and HFET cycles have continued to this date. Yet Honda makes no mention of this problem.

This comment by Honda overlaps significantly with a number of their other comments. Because of this, we will present additional analyses below which also bear on the comment being addressed here. However, we believe that even this cursory evaluation shows that Honda did not present any information to justify accepting the vehicle specific nature of the FTP and HFET tests, while rejecting all additional vehicle specific information. Nor did they supply any data to support their assertions in this area.

5.7 The Three New Test Cycles are Extreme

What we proposed:

We proposed that three test procedures currently used for emissions compliance purposes be incorporated into the fuel economy estimate calculations. These test procedures are the US06, SC03, and Cold FTP. These procedures allow the fuel economy methodology to account for vehicle-specific responses to conditions that are not represented by the current tests, such as high speed driving, rapid accelerations and decelerations, the use of air conditioning, and cold temperatures.

What commenters said:

Honda states that the conditions addressed by the three tests are “worst-case”, or in other words, rarely occur in-use. Honda states, for example, that only 2% of national vehicle miles traveled (VMT) occurs when the temperature is 20°F or less.

Our response:

Starting with the cold CO test, we agree with Honda that only 2% of national VMT occurs below 20°F. However, to cite this statistic as the only indication of the relevance of the cold FTP test is misleading. This implies that the standard FTP at 75°F is a better representation of the remaining 98% of driving, particularly cold starts. As indicated in Figure 1 of Honda’s comments, this is not the case. The FTP at 75°F is not a better indicator of fuel economy at temperatures just slightly above 20°F than the cold CO test. A temperature of 50°F is roughly halfway between the nominal temperatures of the two FTP tests. Figure 1 indicates that roughly 30-35% of national VMT occurs at temperatures which fall closer to the 20°F test than to the 75°F test. Thus, when examined in greater depth, the 20°F cold FTP is not as “extreme” as it appears at first blush, especially given the fact that the weighting factor for the various bags of the cold FTP in the 5-cycle formulae are between 0.24 and 0.30.

This is even more true for the SC03 and US06 tests. Honda points out that the SC03 test is performed at 95°F, when again only 2% of national VMT occurs at this temperature or greater. However, the SC03 test is an air conditioning test, not simply an FTP at 95°F. Our analysis indicates that the air conditioning system is turned on 23.9% of the time in-use (Section III.A.3. of the Final TSD). As discussed there, the National Energy Research Laboratory estimates even higher use, 29%. An FTP performed at 75°F with the air conditioning off is not a better indicator of the incremental fuel use associated with air conditioning than the SC03 test, even if the temperature is below 95°F. Thus, the percentage of driving occurring with the air conditioning on is much more relevant to the benefit of the SC03 test than the percentage of driving occurring at or above the temperature of the SC03 test.

Drivers rarely use their air conditioning below 70 F. Thus, the amount of driving below 70 F is irrelevant to the representativeness of the SC03 test. When the air conditioning system is turned off, it has no effect on fuel economy and our analysis accounts for the fact that it has no effect on fuel economy. The issue is how to best estimate the impact of air conditioning on fuel consumption. The 5-cycle formulae isolates the impact of air conditioning at 95°F by comparing the fuel consumption over the SC03 test to that over a combination of Bags 2 and 3 of the FTP designed to match the driving cycle of the SC03 test. The 5-cycle formulae then weights this incremental fuel consumption by 1) the percentage of driving occurring with the air conditioning turned on, 2) the percentage of time that the air conditioning compressor is on relative to that occurring during the SC03 test, 3) the relative load of the compressor on the engine at the temperature at which the driving is occurring, and 4) the speed of city and highway driving relative to that of the SC03 test. Each adjustment accounts for differences between the specific conditions occurring during the SC03 test and those existing on the road. The alternative is to assume that the impact of air conditioning is proportional to fuel use over the FTP, a test where the air conditioning is not operating. Honda presents no data to indicate that this alternative is a better estimate of the impact of air conditioning. Available data of fuel consumption over the SC03 and FTP tests indicates that the impact of air conditioning is not proportional to fuel use over the FTP (see Figure III-11 of the Draft TSD). Thus, Honda's statement that only 2% of in-use driving occurs above 95°F does not address the major issue, that of air conditioning and its effect on onroad fuel economy.

In response to Honda's comment that the vehicle in the SC03 test has been sitting for 10 minutes in the sun prior to the test, we do not believe that this is extreme. Prior to driving, vehicles can be parked under a roof, but often they are parked in the open. Our in-use data on vehicle starts indicates that only 1% of all starts in-use occur after a vehicle soak of 10 minutes or less. Thus, when vehicles are parked outside in sunny conditions, their inside temperature is likely much higher than that in the SC03, even when the ambient temperature is below 95°F. While the test is relatively short, 10 minutes or 3.5 miles, this is exactly our estimate of the average trip length during "city" driving. Thus, with respect to both its vehicle soak time and its length, the SC03 cycle is not "extreme".

Finally, Honda characterizes the US06 test as representing the 99.5 percentile of onroad speed and acceleration conditions. Honda did not provide data to support this statement. The US06 cycle was constructed primarily from segments of the REP05 cycle, which represented 28% of onroad driving in 3 U.S. cities in early 1990's.[27] (One hill of the US06 cycle came from a high speed, high load cycle developed by CARB that was analogous to the REP05 cycle.) Thus, the US06 cycle represents less than 28% of the urban driving monitored in these three cities at that time. However, conditions have changed dramatically since the early 1990's in at least two important ways. One, freeway speed limits have increased from 55 mph to 70 mph or even higher. Two, the power to weight ratio of vehicles has increased dramatically over the past 15 years. For example, between 1975 and 1990, the horsepower to weight ratio of new cars ranged from 0.0320-0.0402 hp/lb. In contrast, between 1990 and 2005, the horsepower to weight ratio of new cars ranged from 0.0402-0.0525 hp/lb, an increase of 20-30%.[28] Thus, it is inappropriate to judge any driving cycle, but especially one focused on high speeds, using onroad driving activity data developed 15 years ago.

One indication of how representative the US06 cycle is for today's highway driving is the comparison of its vehicle-specific power (VSP) frequency distribution to

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[27] U.S. Environmental Protection Agency. Regulatory Impact Analysis (Final Rule) – Federal Test Procedure Revisions. U.S. EPA, August 15, 1996.
Website: http://www.epa.gov/otaq/regs/ld-hwy/ftp-rev/sftp-ria.pdf

[28] "Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2005", Appendix E, U.S. EPA, EPA420-R-05-001, July 2005.

estimates of onroad highway driving. Of particular interest are those VSP bins with the highest power levels and highest fuel consumption rates. Table 5-3 presents the VSP frequency distribution for the five highest power bins for highway driving as represented in the 5-cycle highway fuel economy formula (79% US06 highway bag plus 21% HFET), as well as the VSP frequencies from three independent estimates of current highway driving onroad. All three sources of onroad driving, the EPA Draft MOVES2004 model, EPA testing conducted in Kansas City, and California ARB sponsored chase car studies conducted in California, are described in the TSD.

Table 5-3: Comparison of Driving Activity in High Speed, High Power Modes

	Frequency of Driving in VSP Bins During Highway Driving			
VSP Bin	5-Cycle (79% US06 Highway)	MOVES	Kansas City (non-hybrids)	California Chase Car *
26	1.7%	4.7%	1.0%	0%*
36	10.9%	10.1%	15.7%	12.5%
37	12.8%	9.8%	6.5%	12.3%
38	8.1%	8.0%	4.5%	10.6%
39	12.3%	10.7%	11.2%	13.8%
Total	45.8%	43.3%	38.9%	49.2%

* Estimated from speed-acceleration frequency distributions. Value of 0% for bin 26 is likely an artifact of the processing of driving activity between 40 mph and 50 mph into city and highway driving, which is assumed to have a speed cut-point of 45 mph.

As can be seen, the frequency of driving in any particular high power VSP bin can vary by a few percent. Overall, the total amount of driving in the five highest power VSP bins in the 5-cycle highway formula varies from the onroad estimates by -3.4% to + 6.9%. Thus, with a 79% contribution to highway driving, the US06 highway bag cannot be described as extreme with respect to several estimates of current onroad highway driving. In contrast, while not shown in the table, only 8.1% of the HFET cycle falls into these five high power VSP bins. Thus, the HFET cycle by itself is clearly not a good indicator of current highway driving. However, if one had to choose between the HFET cycle and US06 highway bag as being an “extreme” description of highway driving, from the point of view of fuel consumption, one would have to conclude that the HFET was the more extreme cycle of the two, being extremely mild in its required engine power levels.

5.8 Weighting of New Cycles

What we proposed:

We proposed weightings of the 5-cycle test data that were based on extensive analyses of real-world and laboratory test data.

What commenters said:

Honda states that: “The proposed 5-cycle coefficients assign most of the weight of a given type of in-use operation to the extreme cycles.”

Our response:

Except for the representation of most of highway driving by the highway bag of the US06 test, Honda’s statement is clearly incorrect. The effective weighting factor for air conditioning use is only 0.144 in city driving and 0.050 in highway driving. These factors are clearly well below 50% of vehicle operation. The factors for the various bags of the cold FTP are between 0.24 and 0.30, again well below 50%. As discussed above, we also disagree with Honda’s claim that these cycles are “extreme.”

5.9 Interpolation of Fuel Economy Using Five Cycles

What we proposed:

Where made possible by available data, the 5-cycle method uses interpolation to determine the fuel economy at intermediate conditions not represented directly by test data. We found this to be more accurate and preferable to using extrapolation techniques.

What commenters said:

Honda states that “these extreme cycles cannot represent the broadband and midpoints of driving and fuel economy performance. Thus, the 5-mode proposal implicitly assumes that interpolation of fuel consumption can properly represent all conditions on all vehicles. This assumption is valid only if there is a smooth relationship between fuel consumption and driving conditions without non-linear steps and if all vehicles have the same fuel consumption response to changes in driving condition. Again, these assumptions have not been validated.” Further on, Honda states that: “The proposed 5-cycle coefficients assign most of the weight of a given type of in-use operation to the extreme cycles. [This previous statement is addressed immediately above.] This is not necessarily representative of the entire range of the real world driving conditions and the characteristics of the middle ground between the various conditions represented in the 5-cycle equation.” Honda also states that the discontinuities present in a number of newer fuel efficient technologies may cause the proposed 5-cycle formulae to under value their efficiency (i.e., penalize them relative to their benefit in the real world).

Our response:

In this comment, Honda is basically arguing that the US06, SC03 and cold FTP tests are so extreme that any interpolations based on them is fraught with error. In fact, as discussed above, Honda is basically arguing that extrapolating fuel economy effects from only the FTP and HFET fuel economy values is better than interpolating fuel economy effects using all five cycles.

It is common knowledge that interpolation is generally more accurate than extrapolation due to the availability of additional data. Extrapolation is based on pure speculation of the effect of the parameter being extrapolated. Interpolation at minimum bounds the effect, since the effect under intermediate conditions will fall between the two conditions tested. Thus, Honda is taking a very extreme position with this comment. They are arguing that the three new tests are so extreme (i.e., their conditions rarely occur in-use) that knowledge of fuel economy under these conditions provides little value.

In addition, Honda states that the effect of driving patterns, air conditioning and colder temperatures on the fuel economy of modern vehicles is extremely non-linear and even discontinuous in nature. Therefore, they imply that knowledge and use of fuel economy data over the three new test cycles will actually misrepresent fuel economy over conditions intermediate between these tests and the FTP and HFET tests.

We have already shown above that the three new tests are not as extreme as Honda asserts. In addition, the concept of interpolation is much less applicable to the US06 and HFET tests, than for the SC03, cold FTP and FTP tests. For example, the US06 driving cycle itself contains a wide range of driving, ranging from idle to over 80 mph, high rates of acceleration and deceleration, as well as relatively steady state cruising. On average, the US06 highway and HFET driving patterns are quite different. However, over 50% of the time spent driving in the two cycles occurs in VSP bins where both cycles have significant operation (i.e., bins 0, 33, 35, and 36). Thus, it is not the case where fuel consumption is being averaged at idle and wide open throttle. Both cycles represent a range of highway driving. The HFET represents relatively low speed highway driving coupled with very low rates of acceleration and deceleration. The US06 highway bag represents higher speed driving coupled with some more severe accelerations and decelerations. Weighted together in the 5-cycle highway formula, their combined driving pattern matches the best available description of onroad driving patterns contained in the EPA's Draft MOVES2004 model, fairly well. Thus, the 5-cycle formula for highway fuel economy does not interpolate between the HFET and US06 driving patterns as much as it combines them. The concept of interpolation is much more applicable to the use of the SC03 and cold FTP data in the proposed 5-cycle formulae.

First, Honda did not provide any data to support the fact that fuel economy effects developed from the US06, SC03 and cold FTP tests were not indicative of changes in fuel economy which would occur at more intermediate conditions. Honda claims that discontinuities in fuel economy effects occur with modern vehicles, but again provides no data to support this contention. Therefore, we have to consider Honda's concerns as hypothetical at this point. Still, we consider the possibility for such a hypothetical situation to exist below.

In contrast, in many cases where EPA interpolated between the conditions represented by two of the five dynamometer tests (e.g., ambient temperature, air conditioning), test data at intermediate levels of the parameter of interest (e.g., cold start fuel use at 50°F) were used directly to develop the linear or curvilinear shape of the curve depicting the effect of the parameter on fuel consumption. These data at the intermediate temperatures indicated that vehicles generally responded to lower temperatures in a similar manner (i.e., start fuel use increased), though there was some variability between individual vehicle's response. Some of this difference may have been due to the normal variability in fuel economy measurement. However, some of the difference in vehicles' response to colder temperatures is likely due to differences in design. It is helpful to look at an example.

In developing the weighting factor for start fuel use, we used the results of FTP testing 580 vehicles at a variety of ambient temperatures (Section III.A.1 of the TSD). We further evaluated this database and found 295 vehicles which were tested at the same three ambient temperatures, 15-35 F, 42-60 F, and 68-80 F. To this database, we added the 13 Honda and Toyota vehicles described in Section III.A.1 of the TSD, which were tested over the FTP at 20°F, 50°F, and 75°F. We determined the start fuel use for the cold start of the FTP at each of these temperatures for each vehicle. The average start fuel use for the three temperature ranges was:

15-35 F	0.0735 gallons
42-60 F	0.0457 gallons
68-80 F	0.0246 gallons

The issue here is how to best estimate the start fuel use at the intermediate temperature range. Is it better to apply a fleet-wide adjustment to the start fuel use at 68-80 F, or to interpolate between the start fuel use estimates for both the high and low temperature ranges?

The first approach is that used by the current fuel economy label procedure. This is basically to determine the average impact of temperature on start fuel use and apply this to every vehicle. This can be done in either of two ways: additive and multiplicative. We will evaluate both ways here. The additive approach indicates that the start fuel use at the intermediate range is 0.0211 gallons higher than that at 68-80 F. The multiplicative approach indicates that the start fuel use at the intermediate range is 1.856 times higher than that at 68-80 F.

The second approach is that used in the 5-cycle formula. This approach estimates the start fuel use for the intermediate temperature range on the start fuel use in the lowest and highest temperature ranges. This approach indicates that the start fuel use at the intermediate range is 43.1% of the way from the start fuel at 68-80 F to that at 15-35 F.

On average, all three approaches work. Any errors made in predicting the start fuel use for individual vehicles always balance out. The issue is which approach provides the best estimate for each vehicle individually. We assess this by calculating the coefficient of variation of the error between the estimated start fuel use at the intermediate temperature and that actually measured. The additive version of the fleet-wide approach produced a coefficient of variation of 34%, while the multiplicative version of this approach produced a coefficient of variation of 37%. The interpolation approach produced a coefficient of variation of 24%, well below that of either fleet-wide approach. The interpolation approach, which is that imbedded in the 5-cycle formulae, clearly produces the smallest error in predicting start fuel use at intermediate temperatures.

We repeated this analysis for the 13 Toyota and Honda late model vehicles. The results were the same. The additive and multiplicative extrapolation approaches produced coefficients of variation of 20% and 19%, respectively. Interpolation produced a coefficient of variation of 9%. It is interesting to note that, while this group of vehicles was small, it consisted of a wide variety of vehicle types and included four hybrids. Honda appears most concerned about the application of the 5-cycle formulae to advanced technology vehicles. Yet when applied to exactly such a group, the interpolation approach embedded in the 5-cycle formulae performed well and much better than the approach taken in the current label formulae and the mpg-based equations.

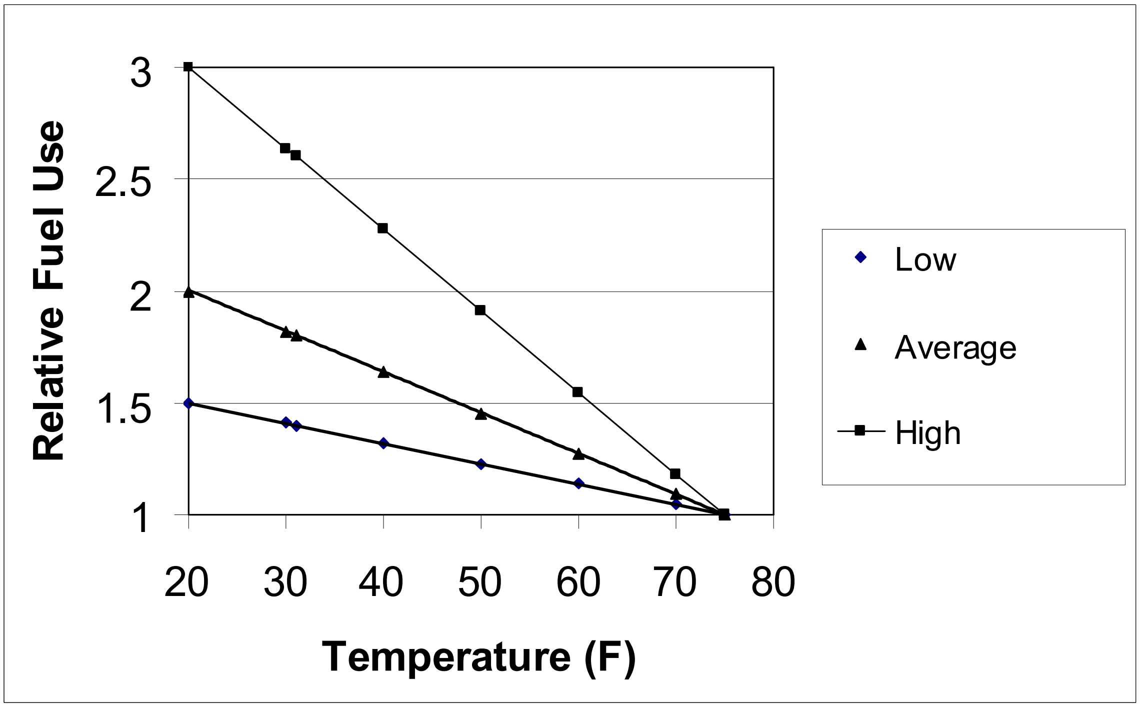
Thus, it is clear, at least for the effect of ambient temperature on cold start fuel use, that interpolation is far superior to extrapolation. Given that start fuel use is by far the dominant effect of the cold FTP on 5-cycle fuel economy, this example essentially addresses the main issue related to the use of the cold FTP in the 5-cycle formulae. If Honda concern was valid, the “extremely” low temperatures of the lowest temperature range would have produced misleading predictions of start fuel use for the intermediate temperature range. That this did not occur indicates that Honda’s concern is invalid, at least for this the effect of ambient temperature on start fuel use.

We believe that it is useful to illustrate in a more conceptual manner the circumstances which must come together in order for Honda’s concerns to become reality. All three label procedures, current, mpg-based and 5-cycle, incorporate the effect of a variety of operational and environmental conditions on fuel economy. However, they do so in different ways. We will focus our discussion on the current and 5-cycle procedures. The mpg-based procedure basically represents the average effect of the 5-cycle procedure adjusted for a vehicle’s fuel economy over the FTP and HFET. Thus, conceptually, it differs only slightly from the current procedure with respect to the issue being addressed here.

Figure 5-1 illustrates the change in relative start fuel consumption with a drop in ambient temperature from 75°F to 20°F for three vehicles; one with a relatively low response to temperature, one with an average response and one with a high response.

For simplicity, we assumed that start fuel use varies linearly with temperature in each case. We will address the issue of non-linearity below.

Figure 5-1. Effect of Ambient Temperature on Cold Start Fuel Use

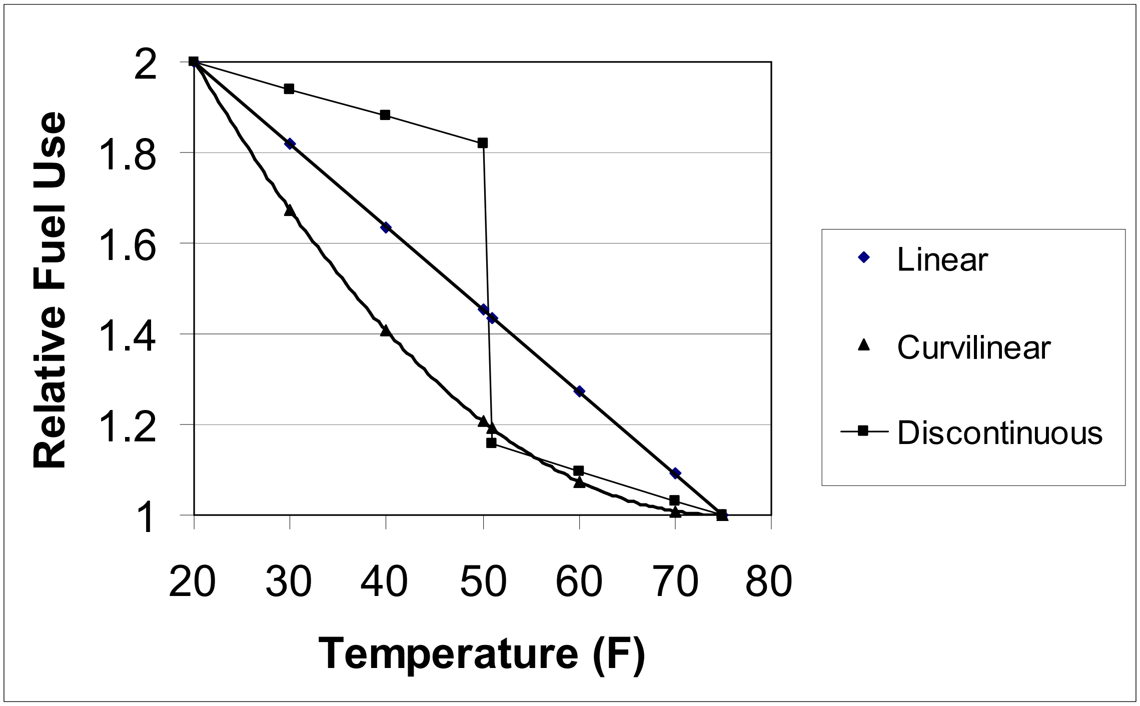


The current label procedures are based on dynamometer testing at 75°F. Thus, only start fuel use at 75°F is known for a specific vehicle. As mentioned above, the 10% adjustment factor for city driving implicitly assumes that all vehicles' cold start fuel use changes with temperature to the same degree. No other projection can be made, since no other information is available. We know from available test data at both 20°F and 50°F that this is not the case. The start fuel use of individual vehicles responds differently to temperature. Thus, the current label procedure is clearly in error when it assumes that this response is identical for all vehicles.

The 5-cycle formulae base their estimates of start fuel use on testing at both 20°F and 75°F. Therefore, it does not need to assume this effect. This effect is based directly on the fuel economy measured over both the FTP and cold FTP tests. Honda does not appear to be acknowledging this direct use of test data in the 5-cycle formulae.

The weighting factors for start fuel use in the 5-cycle formulae are based on an assumed shape of the curve of start fuel use in between 20°F and 75°F. Figure 5-1 shows this effect to be linear. However, in reality it can be linear, curvilinear, or even discontinuous, as pointed out by Honda. Figure 5-2 shows the change in relative start fuel use versus temperature for three vehicles which all show the same total effect of moving from 75°F to 20°F. One vehicle's response is linear, another's is curvilinear (increasing slowly at first and then accelerating as the temperature approached 20°F), while the third vehicle's is linear with a discontinuity at 50°F. The last vehicle's discontinuity might be due to the shut-off of some fuel saving technology, like engine shut off when the vehicle is stopped.

Figure 5-2. Possible Shape of Start Fuel Use Versus Temperature



In-use, vehicles are operated over a range of ambient temperatures. From a driving perspective, the average ambient temperature is just under 60 F (see Section III.A.4 of the TSD). Driving is more frequent at this temperature that it is at higher or lower temperatures. Average start fuel use in-use is then the start fuel use at any specific temperature weighted by the frequency of starts at that temperature. If vehicles were tested over small intervals of ambient temperature, for example every 5 F, the differences in the three vehicles' start fuel use responses shown in Figure 2 would be fully reflected in the predicted average fuel consumption. However, since vehicles are only tested at 20°F and 75°F, the weighting of these two test results needed to produce the average start fuel use with respect to ambient temperature would differ to some degree.

For example, the weighting of start fuel use at 20°F for the vehicle with the curvilinear response would be lower than that for the vehicle with the linear response. This would be the case, because the vehicle with the curvilinear response would have lower fuel consumption at every temperature in between 20°F and 75°F and would necessarily have a lower start fuel use than the vehicle with the linear response. (We are ignoring what happens below 20°F and above 75°F in this example, which is relevant in the real world.)

There is no way to reflect this difference in the current label procedures. The two vehicles' start fuel use at 75°F is reflected in their FTP tests and incorporated into the label values. However, the increase in start fuel use at lower ambient temperatures is based on the fleet-average vehicle and comprises a portion of the 10% and 22% generic adjustment factors. Thus, as discussed above with respect to the vehicles depicted in Figure 1, the current label procedure assumes that all vehicles have the same relationship between start fuel use versus temperature.

The 5-cycle procedure includes the ability to reflect differences in vehicles' start fuel use at both 20°F and 75°F. However, it, like the current label procedures, cannot reflect differences in the shape of the curve in between these two temperatures. Thus, the 5-cycle procedure is better than the current procedure in one respect, but still not ideal. Additional testing at intermediate temperatures would be required to further improve the accuracy of the label value. However, Honda and other manufacturers clearly recommend against this, and currently EPA believes it is unnecessary.

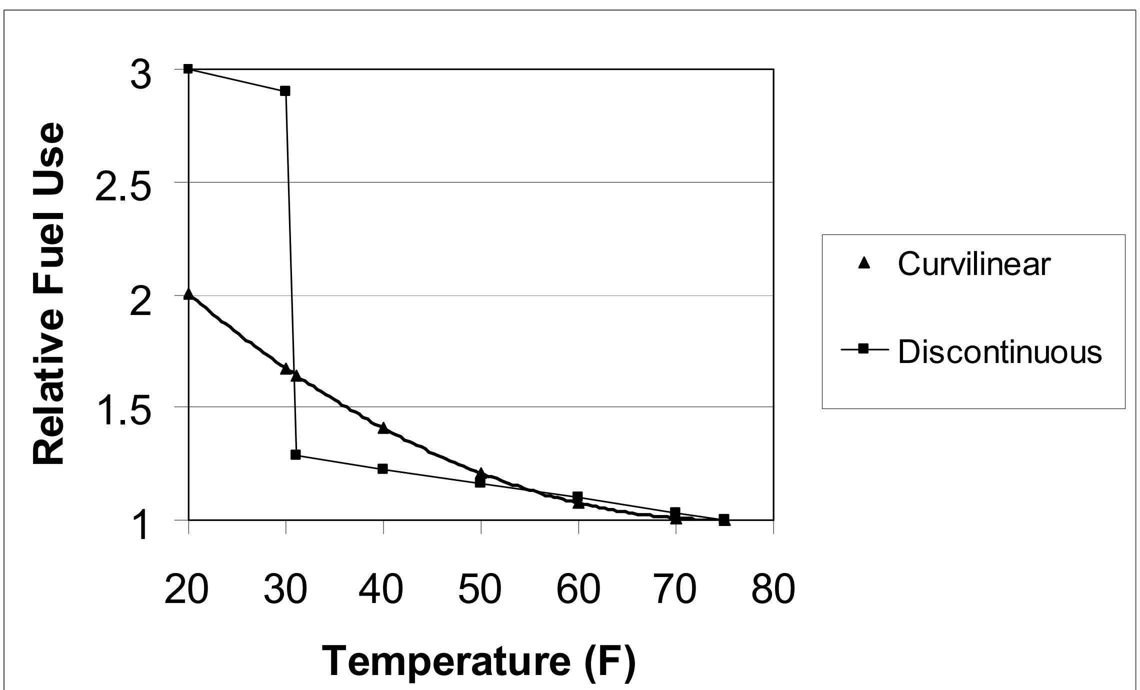
The mpg-based procedure converts the individual vehicle responses estimated by the 5-cycle formulae to their fleet-wide averages as a function of FTP or HFET fuel economy. If the effect of ambient temperature on start fuel use in relative terms changes with vehicles' FTP fuel economy, then the mpg-based procedure will reflect this. However, if the differences in vehicles' response to temperature are due to other factors, then the mpg-based procedure reduces basically to the current label procedure with a different adjustment factor. In fact, the mpg-based equations create a city fuel economy label by reducing FTP fuel economy by 20-28%; the adjustment to HFET fuel economy is 29-30%. Thus, the mpg-based equations reflect a portion of the difference in individual vehicle responses to various factors which affect city fuel economy. However, regarding factors which affect highway fuel economy, the mpg-based equation is nearly identical to the current label procedure with a higher downward adjustment.

It is impossible to theoretically predict how the average start fuel use for the vehicle with the discontinuous response to ambient temperature would compare to that for the other vehicles. Its average start fuel use, and thus, its weighting of start fuel use at 20°F, could be higher or lower depending on where the discontinuity occurs (e.g., 30 F or 60 F) and the degree that fuel consumption changes at the discontinuity. None of the three label procedures is capable of accurately accounting for such discontinuous effects of ambient and operation conditions on fuel economy. Aside from testing vehicles over a much wider and comprehensive set of ambient and operating conditions, the only issue is how to use the available test results to best estimate onroad fuel consumption. Again, we can use the example of the effect of ambient temperature on start fuel use to evaluate which of the three procedures best uses the available information to predict onroad fuel economy.

As shown in Figures 5-1 and 5-2, vehicles can vary in their total response to a change in temperature from 20°F to 75°F, as well as in the rate of change in this response as temperature moves from one end to the other. The 5-cycle formulae clearly can account for the total difference in this response between the dynamometer tests which are conducted. Thus, the only potential inaccuracy in the formulae is due to differences in the shape of the curves between the two endpoints. With the current label procedure, neither the degree of the change in fuel consumption between 20°F and 75°F, nor the shape of the curve is known. Thus, all vehicles are assumed to have the same relative change in fuel consumption at every ambient temperature other than 75°F. The only way that the 5-cycle formulae could produce a worse estimate of onroad fuel economy would be if vehicles' response to ambient temperature between, for example, 40 F and 75°F was inconsistent with their response at 20°F. Even in this situation, the degree of error would need to be relatively large to be worse than the current label procedure, since the latter completely misses all differences in vehicles' response to any relevant factor.

While this is theoretically possible, it requires that the change in start fuel use at 20°F differ so substantially from that at intermediate temperatures that vehicles with higher increases in fuel consumption at 20°F have lower increases at, for example, 45 F, and vice versa. In other words, the types of curves shown in Figures 5-1 and 5-2 have to criss-cross. It is highly unlikely that differing degrees of curvature in a vehicle's response could produce this result. The most likely situation would involve a severe discontinuity in a vehicle's response. Figure 5-3 shows this situation.

Figure 5-3. Potential Source of Error in the 5-Cycle Weighting Factors



As shown in Figure 5-3, the vehicle with the curvilinear response has a lower increase in start fuel use at 20°F relative to 75°F than the vehicle with the discontinuous response. However, over most the temperature range shown, the vehicle with the discontinuous response has the lower increase in start fuel use. Thus, the onroad fuel consumption of the vehicle with the discontinuous response is likely to be the lower of the two vehicles. However, a weighting of the start fuel use at 20°F and 75°F would indicate the opposite. In order for the use of the 20°F measurement to cause this problem, the discontinuity indicated in Figure 3 must be both large and occur close to 20°F.

This is the situation about which Honda appears to be concerned. While theoretically possible, we have no fuel economy data which indicate such a severe discontinuity exists with any currently marketed vehicle or any future technology. Honda submitted no data to support the existence of such severe discontinuities. Honda also submitted no data indicating that such discontinuities would occur in a way that the vehicle would be in high fuel consumption mode frequently over the SC03, US06 or cold FTP tests, but less frequently in-use compared to the weighting of these tests in the 5-cycle formulae. As presented above, the existing data clearly support the superiority of the interpolation approach followed in the 5-cycle formulae.

Practically, such a large discontinuity only occurs when a piece of equipment or a technology turns off or on. Examples would be engine shut off at vehicle idle or mild driving and cylinder deactivation at low engine loads. Such technologies are currently applied in only a very limited number of models. A practical example related to colder temperatures could involve use of the heater and its effect on the engine shut-off strategy for hybrids. Most hybrids save fuel by shutting the engine off when the vehicle is idling. However, many current hybrid systems disable this engine shut-off when the heater is turned on, as the heat comes from the engine. Thus, the savings related to engine shut-off disappear in the range of ambient temperatures when people tend to turn on their vehicle heater. If people tend to turn on their heater just above 20°F, then the situation indicated in Figure 3 could occur. However, people tend to turn on their heater well above this temperature. The weighting factor for the cold FTP with respect to start fuel use is 24%, while that for running fuel use is 30%. In the case of the heater affecting engine shut-off, as long as the heater was turned on 24-30% of the time in-use, even if this caused a large discontinuity in fuel use, the 5-cycle formulae would provide a reasonable estimate of onroad fuel consumption. Roughly 35% of all driving occurs below 50°F, while about 21% occurs below 40 F. Nearly all people will have their heater turned on at 40 F. Many, if not most drivers will turn on their heater at 50°F. Thus, in this case, the weighting factor for the fuel consumption over the cold FTP appears quite appropriate with respect to the impact of heater use on engine shut-off and fuel consumption.

In contrast, we have ample evidence that vehicles vary in their fuel economy response to ambient temperature. The 5-cycle formulae allow these differences to be incorporated into the label values. The current formulae do not. The mpg-based equations only allow them to be incorporated to the extent that the differences are a function of FTP or HFET fuel economy. Other differences in the response to temperature are lost with the mpg-based equations. The only advantage of the current or mpg-based equations would be to avoid the hypothetical situations where the incorporation of the three new tests over-estimates significantly the impact of these conditions on onroad fuel economy value.

It is interesting to note that the mpg-based equations have the same potential for error as the 5-cycle formulae should the hypothetical technologies which reflect severe discontinuities become the predominant technology in the new vehicle fleet. In this situation, 5-cycle fuel economy values of most of the vehicle fleet would reflect the problem asserted by Honda. The mpg-based regression of these 5-cycle fuel economy values would fully reflect the effect of the 5-cycle weighting of the three new tests.

In addition to interpolating start fuel use between 20°F and 75°F, Honda also cites concerns about interpolating between: 1) the low highway speeds and power levels of the HFET and the high highway speeds and power levels of theUS06 highway bag and 2) the 75°F non-air conditioning operation of the FTP and the 95°F air conditioning operation of the SC03 test. As we have already discussed, the 5-cycle formulae does not interpolate between fuel economy over the HFET and the highway bag of US06, as much as it combines them. Some in-use highway operation occurs like that of the HFET and some occurs like that of the US06 highway bag. Both cycles include a range of vehicle speeds and power levels. Together, there are no large gaps in vehicle operation in terms of VSP, unlike that in between the cold and standard FTP. Thus, Honda's concern about interpolating in between the HFET and US06 fuel economy values is unfounded.

Regarding air conditioning use, there are at least a couple of ways in which the weighting factors in the 5-cycle formulae were developed utilizing interpolation. We estimated the percentage of time that the compressor is engaged at temperatures and humidities both above and below those existing during the SC03 test. We also estimated the change in load which the compressor places on the engine at temperatures other than 95°F. Individual vehicles might respond differently to these "off-cycle" conditions. Had we used fuel economy data over these intermediate conditions for various vehicles, we might have developed somewhat different weighting factors for the effect of air conditioning use in the 5-cycle formulae. However, as stated a number of times already, the alternative is to simply apply the same factor to all vehicles' fuel economy based on its fuel economy over the FTP and HFET. This is highly uncertain and clearly wrong in several instances. One, vehicles without air conditioning would receive the same adjustment as those with air conditioning. Second, larger vehicles with optional rear passenger air conditioning would receive the same adjustment with or without the option. Under the 5-cycle approach, the vehicle with the larger or second compressor would achieve a lower fuel economy over SC03 and a lower 5-cycle fuel economy.

In Section 5 of their comments, Honda also cites data referenced in the Draft TSD that indicates that the engagement of the air conditioning compressor over SC03 varied between vehicles. Honda states that these data show that the assumption about air conditioning compressor engagement based on fleet wide averages do not apply to individual vehicles. We reevaluated the data cited by Honda and it appears that Honda misunderstands how the weighting factors of the proposed 5-cycle formula work in practice for a specific set of vehicles. This same is true for the current label procedure.

Honda cites data from six vehicles on the percentage of time that the air conditioning compressor is disengaged during the SC03 test. Honda states that these percentages range from 3% to 37%. The implication is that a single value cannot represent both 3% and 37% and therefore, the weighting factor in the proposed 5-cycle formulae must be wrong. First, the 5-cycle formulae do not assume any compressor on time for a specific vehicle operated over SC03. This percentage is implicit in the SC03 test itself. The vehicle is operated over the SC03 test, the air conditioning compressor is engaged to cool the cabin as would be the case onroad under the ambient conditions of the test and this compressor engagement increases fuel consumption in the same way. The fundamental impact of running the air conditioning system is determined by the test, not by some assumed formulae.

The 5-cycle formulae do assume that the impact of air conditioning under more moderate conditions is a specific fraction of the impact over a short trip at 95°F. If a vehicle shows a relatively high impact of air conditioning over SC03, then the proposal assumes that this vehicle will also show a relatively high impact at more moderate conditions. The same assumption is made regarding a vehicle showing a relatively low impact of air conditioning over SC03. The data cited by Honda actually confirms the reasonableness of this assumption.

Table 5-4 shows the percentage of time that the air conditioning compressor is engaged during the SC03 test.[29] We show the percentage of time that the compressor is engaged, rather than disengaged, since air conditioning increases fuel use when the compressor is engaged, not when it is disengaged. Three test conditions are shown. The first is the official test temperature of 95°F with the required solar load. The second set of runs was performed at 75°F, again with solar load. The third set of runs was performed at 75°F without any solar load, but with the heater turned all the way up to simulate the effect of solar load on compressor engagement.

Table 5-4. Air Conditioning Compressor Engagement over SC03 (% of time)

	95°F	75°F With Solar Load	75°F With Heater On
Escort	63	40	44
Mustang	93	53	71
Town Car	97	66	95
Bronco	97	76	95
Windstar	97	68	98
Corolla	97	68	100

[29] SAE Nam paper on A/C load

As indicated by Honda, the percentage of time which the compressor was engaged varied between the vehicles. However, the primary issue with respect to the weighting factors for air conditioning use in the proposed 5-cycle formulae is the correlation between compressor engagement over the SC03 test and that at other, usually less severe conditions. We performed a regression between the percentage of time which the compressor was engaged over SC03 and that at 75°F with solar load. The adjusted r-square was 0.760. The p-value for the factor relating the two compressor usages was 0.022, indicating a very strong statistically significance. The same type of regression was performed between compressor engagement over SC03 and that at 75°F with the heater turned on and the results showed an even stronger correlation (adjusted r-square of 0.827 and a p-value of 0.008. These strong correlations indicate that the degree of compressor usage over SC03 is a very good indicator of compressor usage at lower temperatures. Since this is the precise assumption made in developing the weighting factor for the impact of air conditioning on fuel economy in the 5-cycle formulae, these data are a strong confirmation of the proposal and do not refute the formulae, as asserted by Honda.

While these data confirm the proposed 5-cycle formulae, they do refute the assumption inherent in the current label formulae. The current label procedure utilizes no vehicle-specific information regarding compressor engagement or the impact of air conditioning on onroad fuel economy. The impact of air conditioning on onroad fuel economy is assumed to be the same for all vehicles and is implicitly included in the generic 10% and 22% adjustment factors applied to the FTP and HFET fuel economy measurements. The test program producing the above data did not report fuel economy, so we cannot evaluate the impact of air conditioning use on a vehicle specific basis for these vehicles. However, we know from the certification database presented in the NPRM that there is some variability in vehicles' fuel economy response to air conditioning. The data in Table 5-4 confirm this difference by indicating that the compressors of some vehicles run all the time over SC03, while others run much less. Thus, the implicit assumption in the current label procedures that the impact of air conditioning is a constant percentage for all vehicles is challenged by the data from this test program.

In summary, Honda suggests that we ignore significant amounts of valid fuel economy obtained with the three new tests in order to avoid a purely hypothetical situation where the use of these data might produce a less realistic estimate of onroad fuel economy than the current procedure or the mpg-based equations. In doing so, Honda ignores the fact that the current label procedure (and the proposed mpg-based procedure) involves more extensive assumptions about the response of various vehicles' fuel economy to ambient and operational conditions than the proposed 5-cycle formulae. A generic adjustment to FTP and HFET fuel economy produces a fuel economy label which is just as vehicle specific as the 5-cycle formulae. Assuming that all ambient and operational conditions which differ from the FTP and HFET have the same effect on each vehicle's fuel economy does not automatically minimize error. In fact, as will be shown below for start fuel use at colder temperatures, a generic adjustment produces a much larger error than using fuel economy values measured over the FTP and cold FTP tests. This should be no surprise. Additional testing provides additional information which allows more accurate fuel economy estimates to be developed. In fact, if cost was not an issue, even more testing covering an even wider set of driving patterns and ambient conditions would be beneficial.

Put a slightly different way, Honda has pointed out a number of uncertainties associated with the proposed 5-cycle formulae which we agree are present. What they fail to acknowledge is that the same type of evaluation of the current label procedure and the proposed mpg-based equations would reach the same conclusion, only more so. Thus, we conclude that Honda's comment that the proposed 5-cycle formulae assume that all vehicles have the same relationship between fuel consumption and real world driving conditions is false. In contrast, it is actually true for the current label procedure which we propose to replace with the 5-cycle fuel economy formulae.

5.10 Misuse of Emission Factor Models

What we proposed:

We proposed weighting factors in the 5-cycle formulae that were developed using fleet-average driving activity and fuel consumption data. The basis for some of these weighting factors was data that are currently used in our MOBILE and MOVES emission factor models.

What commenters said:

Honda goes through the development of the 5-cycle formulae as described in detail in the Draft TSD and identifies 15-20 areas where EPA used fleet-average activity or fuel consumption data to develop the weighting factors in the formulae. One example is the change in a vehicle's fuel consumption as the ambient temperature decreases from 75°F to 20°F. Honda believes that EPA should validate that the weighting factors developed in each of these areas applies to individual vehicles, as well as to the fleet-average vehicle. Honda's concerns are increased by the belief that modern computer controls allow significant non-linearity to be introduced into vehicle operation. While historically, the fuel consumption of conventional vehicles might have increased gradually as ambient temperature decreased, the fuel consumption of modern vehicles might change suddenly at some specific temperature. A weighting of fuel consumption at 20°F and 75°F based on fleet average data reflecting the gradual change might not be appropriate for a specific vehicle exhibiting the sudden dramatic change. Most importantly, Honda believes that without such validation, the 5-cycle formulae as proposed might produce a worse estimate of onroad fuel economy than the current label procedures.

Our response:

We do not take issue with Honda's comment that the weighting factors in the 5-cycle formulae were developed using fleet-average driving activity and fuel consumption data. Nor do we claim to have validated these factors on an individual vehicle basis. In fact, we presented some data in the Draft TSD which indicates that a set of 5-cycle formulae "tuned" to an individual vehicle would likely differ to some degree (e.g., the comparison of appropriate weighting factors for start fuel use at 20°F for hybrids versus conventional vehicles in Section III.A of the TSD). However, we disagree with Honda that these two facts make the proposed 5-cycle formulae somehow inappropriate or unjustified. In order to demonstrate this, we address each of Honda's concerns below.

Regarding Honda's concern that fleet-averages were used to develop the weighting factors, this approach is the same as that used to develop the current fuel economy labels. For example, the city fuel economy value is 90% of the fuel economy value measured over the FTP. The 90% factor was based on the difference between onroad fuel economy estimated for a large number of in-use vehicles (i.e., the fleet) and the average of these vehicles' FTP fuel economy values. This factor should have been larger for some vehicles and smaller for others. However, the only way to know this for certain for individual vehicles is to measure the onroad fuel economy of each vehicle and compare it to its FTP fuel economy. However, once the onroad fuel economy is available, there is no need for an adjustment factor, one could just use the onroad fuel economy value and skip measuring fuel economy over the FTP. Of course, the major problem with this approach is that onroad fuel economy values would only be available after a considerable number of vehicles of the particular model have been sold and operated for some time. It is also difficult to obtain a fully representative sample. Thus, the 90% factor represents an acceptable adjustment factor on average.

The FTP itself includes at least two aspects which were based on fleet average estimates. First, the driving cycle was based on the average speeds of individual vehicles which were driven over a particular road route in Los Angeles circa 1970. Different vehicles of various power-to-weight ratios and other design criteria were likely driven over this road route differently. Also, vehicles are obviously driven on many other types of road routes during "city" driving. The relationship between each vehicle's average onroad fuel economy and its fuel economy over LA road route #4 will vary. Yet, all vehicles' city fuel economy label values are based on their fuel economy over this single road route. The same is true for the highway fuel economy label.

The other aspect of the FTP which is based on fleet average estimates is the 57% weighting of fuel consumption following a hot start (i.e., 10 minute soak) and the 43% weighting of fuel consumption following a cold start (i.e., 12 hour soak). Vehicles are started in-use after a wide range of soak times. Even if every vehicle model was found to have the same distribution of pre-start soak times in-use, the relative weight of hot start fuel use and cold start fuel use which produced each vehicle's average start fuel use in-use would likely vary. The current FTP weighting factors of 43% and 57%

represent factors which were determined to be reasonable on average in the early 1970's.

Neither of these two aspects of the FTP have these been validated on an individual vehicle basis in the way Honda asserts must be done in order for the 5-cycle formulae to be valid. Numerous studies have shown a statistical correlation between FTP fuel economy and "city" fuel economy and between HFET fuel economy and "highway" fuel economy. However, as will be discussed below regarding fuel economy data obtained from Strategic Visions, there is a high degree of correlation between the fuel economy values measured over all five of the driving cycles. Thus, the fact that past studies showed a good correlation between FTP fuel economy and onroad city fuel economy means very little. A similar analysis would have indicated a good correlation between SC03 FTP fuel economy and onroad city fuel economy, even though air conditioning is used much less than half of the time in-use. The same would be true for a correlation between US06 fuel economy and onroad highway fuel economy. As the Honda analysis indicates, even fuel economy over HFET is a good predictor of city fuel economy. No study has been performed which shows or "validates" that the FTP and HFET are the appropriate tests on an individual vehicle basis.

The driving patterns contained in the FTP and HFET, as well as the cold/hot start weighting factors are examples of the use of fleet-average data and relationships explicitly included in the current label procedure. However, essentially every relationship which we used to develop the 5-cycle formulae, and which Honda criticizes, is implicitly included in the current label procedure, as well. (Because the mpg-based equations apply the differences between the 5-cycle label values and FTP or HFET fuel economy values, the mpg-based equations involve these same relationships, as well.) For example Honda criticizes EPA's development of the weighting factor for the highway bag of US06 in the 5-cycle highway fuel economy formula. However, the current highway label procedure assumes that the effect of driving patterns which differ from the HFET is the same for all vehicles. This factor is not explicitly identified. It is simply a portion of the overall 22% downward adjustment applied to HFET fuel economy. However, it is assumed to be identical for all vehicles. Honda's own comments state that they believe that the fuel economy of individual vehicles will respond to different driving patterns differently. The assumption that all vehicles respond identically has never been validated on an individual basis. If such an attempt were made, it would likely fail. The differential relationship between fuel economy over the HFET and US06 highway bag is also evidence of this difference.

As stated above, unless vehicles are tested over all possible modes of operation and ambient conditions occurring in-use, some judgment must be applied to, in a sense, estimate fuel economy over the untested conditions. We believe that it is much better to perform this estimation via interpolation between actual fuel economy measurements, as opposed to extrapolating from a single fuel economy measurement, such as the FTP or HFET. The proposed 5-cycle formulae involve the actual measurement of fuel economy over ten individual sets of operation and conditions. The current label procedure involves three measurements. The fuel economy effect of the assessed range of operation and ambient conditions included in these ten distinct measurements is determined for each vehicle directly from the testing of that vehicle. These measurements involve no assumptions. The current label procedures, as well as the proposed mpg-based equations, do not involve the direct measure of fuel economy at the extra seven sets of operation and conditions. These approaches must "assume" these fuel economy effects. All approaches have to estimate fuel economy for operation and conditions not tested. However, with the proposed 5-cycle formulae, these assumptions are usually bracketed by real test data. With the current and mpg-based procedures, there are not extra data points which provide such bracketing. Estimation of fuel economy during all operation and conditions not included in the FTP or HFET are assumed based on fleet-wide relationships of the type criticized by Honda. Thus, we must reject Honda's repeated assertions that the 5-cycle formulae are inherently deficient because these relationships have not been "validated" for individual vehicles. Honda has simply failed to understand the greater role of these same relationships in the current and mpg-based procedures.

Honda has also inconsistently applied its own criticism of the use of fleet-wide fuel economy relationships by assuming that fleet-wide adjustments to FTP and HFET fuel economy, as is done with the current and mpg-based procedures, is inherently accurate, while criticizing the use of such relationships under more restricted conditions in the development of the weighting factors for the 5-cycle formulae.

5.11 Derivation of Vehicle-Specific 5-Cycle Method

5.11.1 Start Fuel Use

5.11.1.1 Start Fuel

What we proposed:

We proposed that start fuel consumption for a vehicle be determined by calculating the difference between its FTP Bag 1 (cold start) fuel consumption and its FTP Bag 3 (hot start) fuel consumption.

What commenters said:

UCS commented that the proposed methodology is reasonable in principle, but it is valid only if the vehicle is fully warmed up by the end of Bag 1 of the FTP. If the vehicle is not fully warmed up until Bag 2, then the start fuel use would be the difference in fuel use between Bags 1 and 2 combined and that of Bags 3 and 4 combined, with a 4-bag FTP. By only considering the difference between Bags 1 and 3, they argue, the proposed methodology may omit some start fuel use that occurs in Bag 2, thus underestimating the start fuel consumption and overestimating the running fuel consumption during Bag 2. As a potential indicator that this might be the case, UCS points to the data in Table III.A-22 in the Draft TSD, where in many cases the Bag 4 fuel economy is higher than the Bag 2 fuel economy, especially at 20 degrees F. They further note that no data points to hybrids as being unique in this regard, and thus it is possible, they postulate, that conventional vehicles may also not be warmed up by the end of Bag 1. They suggest that a modest test program on a dynamometer could determine whether vehicles are warmed up after Bag 1, Bag 2, or not until later, and 75 and 20 degrees F.

They further argue that different vehicles must be tested in similar and consistent ways in order to ensure fairness. Start fuel for hybrids, tested on the 4-bag FTP and where the vehicle is “allowed” to warm up through Bags 1 and 2, might produce results inconsistent with a conventional vehicle tested on a 3-bag FTP, where the vehicle is assumed to warm up by the end of Bag 1.

Our response:

As described in the Draft TSD, testing at 75°F has assumed that vehicles are fully warmed up after Bag 1 for over 20 years. As also discussed in the Draft TSD, it is less clear that this is true at 20°F. If the vehicle is not fully warmed up after Bag 1 at either temperature, its cold start fuel use will be under-estimated, as pointed out by UCS. However, the vehicle’s warmed up fuel use, which is taken in part from Bag 2, will be over-estimated. Thus, the net impact on estimated fuel use would be less than that indicated just by the under-estimation of start fuel use.

Throughout this rule, we have made it a premise to avoid adding to the current tests which are performed. There have been exceptions to this premise, such as requiring diesels to be tested at 20°F. However, this change is the extension of a testing requirement already applicable to nearly all vehicles to a few vehicles which had been granted an exception. We have also proposed some changes to the test procedures, such as splitting the US06 test in to two bags and requiring the heater to be turned on during the cold FTP test. However, these changes would not extend the test and would have little long term impact on test costs.

In contrast, requiring all vehicles to be tested over a 4-bag FTP would increase the cost of every FTP both in terms of dynamometer and personnel time. This would particularly be true for cold FTP testing. The increase in accuracy of the fuel economy label due to this change is unknown, but likely to be small. Table III.A-21 in the Draft TSD presents the result of a DOE test program performed at several temperatures. It found fuel economy over Bag 1 to be 26% lower at 20°F than at 75°F, while this difference was only 8% for both Bags 2 and 3. Roughly 2% out of these differences was likely due to difference in summer and winter fuel. Thus, even if all of the remaining difference in Bag 2 and 3 fuel economy was due to further warm up, this 6% difference would only represent one-fourth of that found in Bag 1. Some of this remaining 6% difference is likely due to factors normally associated with colder temperatures, such as increased friction in the drivetrain. Thus, the three-bag FTP could be capturing more than 80% of the cold start fuel use and part of the remainder would be captured through an increase in running fuel use.

We believe that this is adequate for the purpose of fuel economy labeling. It is certainly better than the current procedure where we assume that every vehicle has the same percentage increase in start fuel use at colder temperatures relative to its start fuel use at 75°F. To the decrease that a small amount of start fuel use is missed by the current cold FTP test procedure, this is captured in a generic way through the non-dynamometer factor.

5.11.1.2 Trip Length

5.11.1.2.1 City/Highway VMT Split of 43/57 Percent

What we proposed:

The combined fuel economy using the current label formulae is a 55/45 harmonic weighting of the current city and highway fuel economy labels. For the proposed 5-cycle formulae and related analyses, we used a 43/57 harmonic weighting of the 5-cycle city and highway fuel economies to represent combined overall fuel economy. This city/highway split for the 5-cycle fuel economies was based on:

1) The assumption that driving generally less than 45 mph is city driving and that above 45 mph is highway driving, and

2) The description of onroad driving patterns contained in MOVES.

Note that there are two separable issues here: one relating to the 5-cycle equations and related background analyses that have little direct impact on the label, and the other relating to those items on the label that are directly influenced by the city/highway split and highly visible to consumers (e.g., the average annual fuel cost and combined fuel economy). It may in fact be reasonable to use different weightings in these two different cases. This section addresses the weightings used in the 5-cycle analyses; Section 2.0 addresses the use of the combined fuel economy on the label itself.

What commenters said:

AAM/AIAM notes that the proposed change in the EPA city/highway split, from 55/45 to 43/57, suggests that today's drivers are more frequently traveling at speeds greater than 45 miles per hour, or at least more frequently than twenty years ago when the adjustment factors were first developed. They point out that the proposed change assumes that drivers commuting on the road would get there more quickly today than they would have were they to drive the same route twenty years ago. AAM/AIAM finds that this is statistically valid on a miles-driven basis, but they believe that their analysis reveals that EPA's proposed change does not take into account modern-day congestion. As a result, they point out that the methodology produces counter-intuitive predictions, such as most drivers are driving at highway speeds 57% of the time as EPA reports in their NPRM. They believe that the current 55/45 split aligns more closely with the way many customers think of their driving patterns – a 50/50 split – than the proposed split, which hints at a precision that departs from many drivers. Being unconvinced that a change is needed, AAM/AIAM recommends that EPA pursue further data collection and validation, which include the effects of modern-day congestion.

Our response:

The split of U.S. driving into city and highway fractions was based on an analysis of estimates of U.S. driving as a whole contained in the Draft MOVES2004 emissions model. This split is inherently subjective, as it can involve both the immediate driving pattern of the vehicle, as well as the overall driving pattern of the trip. Various drivers are highly likely to use different definitions and would estimate different driving splits even if they were to drive exactly the same route at the same time of day. The city/highway split of 43/57 was developed using the approximate boundary of 45 mph, applied to a segment of driving, and not on a second-by-second basis. This worked well for the various driving cycles used in MOVES2004 to represent onroad driving activity. However, in real life, many trips would contain driving segments in both the city and highway categories which would be difficult to separate in a quantitative way.

As described in Section III.E of the TSD pertaining to the comparisons of fuel economy label values to onroad fuel economy estimates, it is most accurate to compare combined fuel economy in both cases. This avoids the need to split driving in to city or highway categories. The most important factor in this case is that the city and highway driving be re-combined in the same as it was originally split. As outlined in Section III.F of the TSD, we evaluated alternative definitions of city and highway driving which in turn changed the split of VMT between the two categories. None of these alternatives appeared to carry any advantages, particularly in terms of being able to be simulated by the various dynamometer cycles. We have no new data or insight which would change this conclusion.

Regarding the impact of congestion on the split between city and highway driving, we believe that AAM/AIAM is confusing the impact of congestion on driving time and mileage. Congestion increases the length of a trip in terms of time, but does not necessarily change its mileage. Thus, congestion by itself would not be expected to increase the city fraction of VMT. The 43/57 split is based on VMT, not time. It is possible that congestion would shift some driving which was formerly at highway speeds to that which is now considered to be city driving. This would tend to increase city fraction of all driving.

The other trend which has been occurring for the last 30 years is urban and suburban sprawl. This tends to increase trip length, as confirmed by the National Personal Travel Survey results. Urban beltways and other new freeways have allowed relatively efficient additional travel to occur with city driving at either ends. At the same time, some of these freeways become congested at rush hour and convert to city driving. This congestion likely increases city driving less than might be thought, again due to the difference between time and mileage. It takes a long time to move a mile on a congested freeway. Even those people who spend most of their time in what seems like a parking lot likely achieve most of their mileage at a much higher speed.

The final factor affecting the comparison of the current 55/45 and the proposed 43/57 city/highway split is the fact that they were based on different definitions of city and highway driving, as outlined in Section III.A.2 of the TSD. The 55/45 split was consistent with the urban/rural split of VMT as estimated by FHWA in the late 1970's and early 1980's. As indicated by the characterization of driving patterns in MOVES2004 and supported by common sense, more highway driving occurs on freeways in urban areas than low speed driving occurs in rural areas. Thus, breaking down city and highway driving by vehicle speed is likely to yield a lower fraction of city driving than a breakdown based on urban driving. This is likely the biggest factor yielding the change in the city/highway split.

5.11.1.2.2 Highway Trip Length

What we proposed:

We proposed a highway trip length of 60 miles.

What commenters said:

Mitsubishi expressed concern over the use of the denominator of "60" in the following equation, found in proposed 600.114-08(b). They commented that EPA did not clearly explain why the number is used, and how it was derived, arguing that it appeared to be arbitrarily chosen. UCS likewise expressed some concerns with EPA's assumptions regarding trip length in the 5-cycle equations and how they may impact the calculated fuel economy, especially given EPA's language that the trip length of 60 miles was "somewhat arbitrary." They agree with EPA's assessment that once highway trip length is over 30-40 miles the denominator in the equation makes little difference, but they argue that it has not been clearly established that the average in-use highway trip is indeed greater than 30 miles.

$$StartFC\left(gallons\ per\ mile\right) = 0.330 \times \left(\frac{\left(0.76 \times StartFuel_{75} + 0.24 \times StartFuel_{20}\right)}{\mathbf{60}} \right)$$

More importantly, UCS argues, is the fact that highway trip length has an indirect impact on city fuel economy because EPA has fixed the city/highway mileage ratio and the average trip length, thus making city trip length a de facto function of highway trip length. They recommend that EPA focus on determining more accurately the length of the average city trip, then allowing the highway trip length to be determined as a function of the city trip length, if necessary.

Our response:

EPA's derivation of the trip lengths for all driving, city driving and highway driving is explained in great detail in Section III.A.1 of the TSD. Many vehicle trips in real life involve a mix of city and highway driving. There is no single method for assigning these trips to either type of driving. Thus, it is impossible to determine a precise estimate of trip lengths for either city or highway driving. One can estimate the length of the average vehicle trip from studies of vehicle operation. In the TSD, we estimate this length to currently be 7.68 miles. The estimates of city and highway VMT coupled with the trip lengths for city and highway driving must be consistent with this overall trip length of 7.68 miles.

The city/highway split of VMT in the U.S. of 43/57 comes from our analysis of the characterization of driving contained in the MOVES2004 model and our definition of city and highway driving. This estimate is independent of any assumptions regarding trip length. Given an estimate of either city or highway trip length, the other trip length is determined by the other information. Table 5-5 shows how the two trip lengths interact.

Table 5-5. Relationship Between City and Highway Trip Length (miles)*

City	Highway	City	Highway
3.0	-48.7	5	12.8
3.5	60 **	6	9.7
4.0	24.3	7	8.3
4.5	16.2	7.7	7.7

* Figures based on more precise city/highway VMT split of 42.5/57.5.
** Rounded, per proposed 5-cycle formulae.

As can be seen, relatively small changes in city trip length produce large changes in highway trip length. Highway trip length becomes infinite for a city trip length of 3.27 miles, so city trips cannot be shorter than this length. Also, highway and city trip length become equivalent for a city trip length of 7.7 miles. Since it is counter-intuitive that city trip would be longer than highway trips, city trips cannot be longer than this length.

Regardless of the specific city and highway trip lengths, the excess fuel use associated with engine starts will be accounted for in either the city or highway fuel economy estimate. The only issue is where to concentrate the start fuel use. The current procedure concentrates all measured start fuel use in city driving. The HFET is a hot start test. Assigning a finite 60 mile trip length to highway driving decreased 5-cycle highway fuel economy by 0.5%. Because of the interaction between city and highway trip length, this increased city fuel economy by 0.4%. Decreasing the highway trip length from 60 to 20 miles would decrease 5-cycle highway fuel economy by 0.9%, while increasing city fuel economy by 1%. This change would tend to bring the city and highway fuel economy label values closer together (by roughly 2%). A change of this magnitude would only affect the actual label values of a very small fraction of vehicles given that labels are rounded to whole mpg figures.

Changing the highway trip length to a lower value than 60 miles would be no less arbitrary than the original 60 mile estimate. Many drivers commute 60 miles to work, so this distance fits many drivers' situation. It is also long enough that any "city" driving at the beginning and end of the trip is likely to be relatively short. Drivers also often assess their fuel economy on even longer trips. Thus, an estimate made using a 60 mile trip length is still very applicable to an all day highway trip, for example. At the same, many drivers commute 20 miles to work and might appreciate a shorter trip length than 60 miles. One number will not be preferred by all drivers or interested parties. At this time, we believe that a wider difference between city and highway fuel economy highlights the difference in driving patterns and provides useful information to the consumer. Thus, we do not choose to change the trip length for highway driving to a lower figure.

As described above, there is an inter-relationship between the trip length for city, highway and all driving. As described in Section III.A.1 of the Draft Technical Support Document, the average trip length for city driving was estimated to be 3.5 miles. This estimate was based on two estimates of trip length. One source was a set of instrumented vehicle studies conducted in the early 1990's in support of EPA's Supplemental FTP rulemakings. The other source was the National Household Travel Survey (NHTS), which shows a national average trip length of 9.8 miles.

The results of the instrumented vehicle studies are shown in Table 5-6 below. This is the same information that was presented in Table III.A-7 of the Technical Support Document for the NPRM. The estimate of average trip length used in MOBILE6.2 is based on the average trip lengths found in Baltimore and Spokane, which is believed to be the most unbiased methodology of those used in the various cities.

Table 5-6. Estimates of In-Use Average Trip Length

Location	Average Trip Length (miles)	
	Instrumented Vehicle Studies	Chase Car Studies
Baltimore – Exeter	4.0	Not Available
Baltimore – Rossville	5.9	Not Available
Baltimore – Combined	4.9	7.5
Spokane	3.6	5.8
Atlanta	6.0	Not Available
Los Angeles	Not Available	7.8
MOBILE6.2	4.49	Not Applicable

As pointed out in the Draft TSD, there is a fundamental inconsistency between the MOBILE6.2 trip length of 4.49 miles and the NHTS trip length of 9.8 miles. The MOBILE6.2 estimate should be considered to apply to urban driving, while the NHTS estimate represents a nationwide average. Still, given that urban driving represents over half of all U.S. driving, the MOBILE6.2 trip length results in more urban trips than the NHTS estimate implies to occur nationwide.

In the NPRM, we removed this inconsistency by reducing the NHTS trip length to 7.7 miles based on a presumption that a survey of this nature misses trips which are of a very short duration, or counts a sequence of trips that are interrupted by very short engine off times as single trips.

Since the time of the NPRM, EPA obtained more recent data on the operation of vehicles in Atlanta from Georgia Tech. Georgia Tech has been instrumenting vehicles in the Atlanta area for some time and gathering operational data. As with the previous instrumented vehicle studies, this type of study captures all vehicle trips no matter how short. The major difference between this more recent work and the previous studies is the amount of data being collected. To date, Georgia Tech has collected data on over 620,000 vehicle trips. In contrast, the previous instrumented vehicle studies involved about a week's worth of operation for less than a hundred vehicles per city. Thus, the recent data represents almost two orders of magnitude more data than was evaluated in the instrumented vehicle studies described in Table 5-6 above.

The average number of trips per day found for these 620,000 trips was 4.62. Unfortunately, the analysis of the number of miles traveled per trip is still underway and will not be available until later this year. Nationally, vehicles travel about 34 miles per day. Urban vehicles might drive somewhat less than rural vehicles. However, given that Atlanta is a sprawling metropolis, its driving is probably close to the national average in terms of miles traveled per day. Assuming this, the average trip length in Atlanta is about 7.4 miles. This is 24% greater than the average trip length of 6.0 miles found in the early 1990's. The series of NHTS have also found a general increase in trip length nationally of about 1.0 mile between 1990 and 2001.

5.11.1.3 Formula for Start Fuel Use

What we proposed:

We proposed the following formula for start fuel use, using 3.59 and 3.91 as the distances for the first and second bags of the FTP, respectively.

$$Start\ Fuel_x\ for\ vehicles\ tested\ over\ a\ 4-bag\ FTP =$$

$$\frac{7.5}{\left(\frac{3.59}{Bag1\,FE_x}+\frac{3.91}{Bag2\,FE_x}\right)}-\frac{7.5}{\left(\frac{3.59}{Bag3\,FE_x}+\frac{3.91}{Bag4\,FE_x}\right)}$$

What commenters said:

Mitsubishi noted that 40 CFR 86.144-90 describes the distance of the first bag/phase of the FTP as 3.598 miles, and the distance of the second bag/phase as 3.902 miles. They point out that the proposed equation in 600.114-08(a) uses figures slightly inconsistent with these values. Mitsubishi recommends that EPA use the published distances in 86.144-90, rather than the proposed values.

Our response:

The regulations in 40 CFR 86.144-90 do in fact describe the distances as Mitsubishi notes, but this is only in the context of an example calculation. For the actual calculations from a given test, the manufacturer is required to use the measured driving distance of the appropriate phase as calculated from the measured roll or shaft revolutions. This may or may not be equal to the distances shown in the example calculations in 40 CFR 86.144-90. In order to be consistent with other terms in the 5-cycle formulae, we will use the figures from 40 CFR 86.144-90, but we will round off these figures to one decimal place (i.e., 3.6 and 3.9 miles).

5.11.2 Running Fuel Use

5.11.2.2 Representative Mix of Dynamometer Driving Cycles

What we proposed:

The Draft MOVES2004 emissions model describes on-road driving differently than previous EPA emission inventory models. While starting with whole driving cycles, it goes further by breaking down vehicle operation on a second by second basis into 17 categories or bins. One bin (Bin 0) contains significant decelerations. Another bin (Bin 1) contains idling operation. The other 15 bins contain brief or modest decelerations, cruising operation and accelerations. The 15 bins are broken down into three sets of bins by vehicle speed: Bins 11-16 contain operation at 1-25 mph, Bins 21-26 contain operation at 25-50 mph, Bins 33-36 contain operation at 51 mph or faster. These three sets of bins are further sub-divided according to the power required of the engine divided by vehicle mass. This ratio is termed vehicle specific power, or VSP, and has the units of kilowatt per megagram (kW/Mg).

The VSP distributions for the four complete dynamometer cycles plus individual bags of the FTP and US06 cycles are shown in Table III.A-15. As was the case for the Draft MOVES2004 inventory cycles, these VSP distributions represent a 50-50 mix of cars and light trucks.

Table 5-7. VSP Distributions for Dynamometer Cycles (% of time)

BinID	LA4	HFET	US06	US06 City	US06 Hwy	SC03	Bag 3	Bag 2
0	12.0%	3.5%	16.8%	32.6%	7.1%	10.5%	13.3%	11.2%
1	18.6%	0.7%	7.5%	14.3%	2.5%	19.7%	18.8%	18.5%
11	6.4%	0.0%	0.7%	1.3%	0.3%	3.7%	2.8%	8.5%
12	10.6%	0.1%	0.8%	1.7%	0.3%	9.2%	4.4%	14.3%
13	8.0%	0.3%	0.3%	0.9%	0.0%	5.0%	3.0%	10.9%
14	5.0%	0.1%	0.5%	1.3%	0.0%	2.4%	2.4%	6.5%
15	2.3%	0.5%	0.2%	0.4%	0.0%	2.0%	2.9%	1.9%
16	0.7%	0.1%	1.0%	2.2%	0.3%	2.1%	1.7%	0.2%
17	0.1%	0.0%	0.8%	2.2%	0.0%	0.0%	0.4%	0.0%
18	0.0%	0.0%	0.5%	1.3%	0.0%	0.0%	0.0%	0.0%
19	0.0%	0.0%	1.7%	3.5%	0.5%	0.0%	0.0%	0.0%
21	4.4%	4.1%	1.4%	3.3%	0.3%	7.7%	4.6%	4.3%
22	10.9%	3.6%	0.7%	1.5%	0.1%	9.6%	7.3%	13.0%
23	9.5%	12.4%	0.8%	1.7%	0.1%	10.3%	12.4%	7.9%
24	2.9%	17.3%	0.1%	0.2%	0.0%	6.6%	4.5%	2.0%
25	1.5%	7.5%	0.4%	1.1%	0.0%	3.9%	2.7%	0.8%
26	0.7%	2.5%	0.2%	0.4%	0.0%	4.0%	2.0%	0.0%
27	0.2%	0.4%	0.7%	1.5%	0.1%	0.0%	0.6%	0.0%
28	0.3%	0.3%	1.2%	2.4%	0.4%	0.0%	0.9%	0.0%
29	0.2%	0.0%	4.5%	9.1%	1.6%	0.0%	0.6%	0.0%
33	1.6%	6.1%	7.8%	4.6%	9.9%	1.8%	4.3%	0.0%
35	2.6%	32.3%	14.1%	3.7%	20.7%	0.6%	7.1%	0.0%
36	1.1%	6.0%	8.6%	0.4%	13.8%	0.5%	2.9%	0.0%
37	0.1%	2.0%	10.3%	0.9%	16.2%	0.4%	0.3%	0.0%
38	0.2%	0.1%	6.6%	0.9%	10.2%	0.0%	0.5%	0.0%
39	0.0%	0.0%	12.0%	6.5%	15.5%	0.2%	0.0%	0.0%

What commenters said:

Honda criticizes the development of the 5-cycle weighting factors for high speed and aggressive driving because the highest VSP bins (bin numbers 19, 29, and 39 with 21 kw/Mg power or greater) start at a relatively modest level. About 18% of the US06 cycle falls into the highest power bins. Onroad driving follows a bell shaped curve. Operation is concentrated at the low end of each range of power levels, while US06 operation in this bin reaches as high as 50 kw/Mg. Honda argues that this causes an artificially high weighting for the US06 cycle. Honda also states that EPA misspoke when it stated that the US06 driving cycle was a concentrated version of the REP05 cycle. US06 contains some operation from California’s unified cycle, as well.

Natural Resources Canada take some issue with the fact that the US06 cycle contains speeds that are above those legally permitted in Canada or the U.S., and they question the high weighting factor of the US06 cycle in the highway fuel economy estimate and whether it is too high for a fair representation of the fuel economy performance of a vehicle. They don't argue with the methodology or the data sources used to arrive at the factor, which they note are robust and among the best available, but they are unable "…to justify [the maximum speed of the US06 cycle] to both industry and consumers as being suitable for use in a fuel economy test." They suggest one of two ways to resolve their concerns: (1) Ignore the fuel consumption associated seconds 290 through 350 of the US06 cycle (i.e., a portion of the cycle with vehicle speeds at roughly 80 mph) when calculating fuel economy; or (2) test a sample of vehicles with and without the speed excursion between 290 and 350 seconds of the cycle and evaluate the incremental fuel economy increase due to the 80 mph driving segment.

Our response:

As background to this discussion, it might be helpful to review the discussion of the concept of VSP and how it was used to derive the cycle weights in the 5-cycle formulae in Section III.A.2. of the Draft Technical Support Document.

First, Honda points out that 18% of operation during the US06 test falls into the three highest power bins. Three out of 26 bins is 12%. Given that US06 focuses on a specific type of driving (high speed, aggressive), it is not surprising that the distribution of driving across the VSP bins would not be equal. For example, as shown in Table III.A.-15 of the Draft Technical Support Document, 32% of the operation during HFET occurs in one VSP bin, bin 35.

Second, Honda states that the lower limit of the three highest power VSP bins, 21 mW/Mg, is modest. Yet the highest power level achieved over the HFET by a typical car or light truck (19 mW/Mg) does not even reach this level for one second. Only 3-3.5% of vehicle operation over the HFET is above 12 mW/Mg, the lower limit for VSP bins 16, 26 and 36. From their comments, Honda clearly prefers to base highway fuel economy solely on HFET testing plus a generic adjustment factor based on HFET fuel economy. Honda does not address the issue of accurately predicting fuel consumption at higher power levels using a test with such low power levels. Again, Honda is applying criteria selectively to the proposed 5-cycle formulae and failing to apply it to the current or mpg-based procedures.

Honda does not provide any data to support its claim that vehicle operation is concentrated at the lower end of each range of power levels. Honda's statement appears to assume that vehicle operation can be described by a single statistical distribution (i.e., driving activity is concentrated near the mean and diminishes in frequency as operation varies more from the mean). However, driving is not likely to occur randomly. Speed limits, particularly those affecting highway driving, are concentrated in a narrow range (i.e., 55-80 mph). Thus, driving activity might not diminish further from the mean. Two estimates of highway driving, that contained in Draft MOVES2004 and that based on California chase car data, indicate roughly equal amounts of driving in bins 36, 37, 38, and 39. Thus, it is doubtful that operation in these bins is concentrated at the low end of the range of VSP included in each bin. Operation in bin 39 could be an exception, since it is open-ended. Even with this bin, though, the power level at which the frequency of operation tends to tail off is unclear, as is the rate at which it tails off.

Nonetheless, Honda's overall point likely has some validity. EPA's 15 car study using a portable emission measurement unit (PEMS), which was described in the Draft Technical Support Document, compared fuel consumption measured during dynamometer tests to those measured onroad. In that study, the highest power VSP bin was 36 (i.e., bin 36 included all operation contained in VSP bins 36-39 as defined in the Draft Technical Support Document). We found that fuel consumption in bin 36 were 6% higher over US06 than onroad. This was due to a higher average power level in bin 36 over US06 than onroad. This was one of the reasons we expanded the number of high power bins beyond that used in the Draft MOVES2004 model. In particular, bins 16, 26 and 36 were each broken down into four VSP bins, limiting the amount of driving contained in the final, open-ended bin.

As shown in Table 5-3 above, the 5-cycle formula for highway fuel economy includes 12% of operation in bin 39, versus 37.5% for bins 36-39. It is unlikely that the difference between VSP bin 39 fuel consumption over US06 and onroad would be as high as 6%, given the more limited range of operation included in bin 39 compared to the bin 36 definition used in EPA's 15-car PEMS study. However, even if this were the case, a 6% over-estimation of fuel consumption for 12% of vehicle operation only results in a 0.7% overestimation of 5-cycle highway fuel consumption. This ignores the effect of the cold starts, air conditioning operation and operation at colder temperatures, which all work to lower this percentage. This is a very small potential source of error. The benefit of including US06 in the fuel economy label procedure is the direct measurement of fuel consumption in VSP bins 36-39 which are not addressed by the HFET and which represent 40% of highway driving in-use. The net benefit of the trade-off is very clear.

We performed an analysis of available second by second fuel economy data collected for 80 vehicles to directly address this issue further. As discussed in Section III.B. of the Draft TSD, 61 cars and 19 light trucks were tested over both the FTP and US06 tests and had their fuel consumption measured on a second by second basis. We grouped each second of each vehicle's operation over the warmed up portions of the FTP (Bags 2 and 3) and US06 tests into the 26 VSP bins and calculated the average fuel consumption for each vehicle in each VSP bin. We then weighted these VSP fuel consumption values by the frequency of vehicle operation over the HFET cycle and the US06 highway bag (as shown in Table 5.3 above) in order to estimate each vehicle's average fuel consumption over these test cycles. We repeated this weighting procedure for the MOVES estimate of onroad highway driving (see Table 5-3 above for the weighting factors for the high power VSP bins and Table III.A-12 of the Draft TSD for all of the weighting factors). On average, the fuel consumption for the 80 vehicles over the HFET, US06 highway and MOVES highway driving patterns were 3.049, 3.609 and 3.443 gallons per 100 miles, respectively.

The current label approach estimates onroad highway fuel consumption based on only fuel consumption over the HFET test. For these 80 vehicles, average fuel consumption over the MOVES highway driving pattern was 12.6% higher than that over the HFET. Per the current label approach, then, onroad highway fuel economy would be estimated by multiplying HFET fuel consumption by a factor of 1.126. We applied this factor to each vehicle's HFET fuel consumption and compared the result to our estimate of onroad highway fuel consumption per MOVES. On average, the HFET plus generic factor over-estimated onroad highway fuel consumption by 0.6%. However, more importantly, the standard deviation of the percentage differences was 3.2%. We could have completely eliminated the average difference by a slight change in the adjustment factor (i.e., 1.12 versus 1.126). However, the standard deviation would be unaffected. It is the standard deviation which indicates the ability of the approach to reflect differences in the fuel economy performance of individual vehicles.

We repeated this using the 5-cycle weighting of 79% US06 highway and 21% HFET fuel consumption. On average, the 5-cycle formula over-estimated onroad highway fuel consumption by 1.7% and the standard deviation of the percentage differences was 0.5%. The fact that the 5-cycle approach produced a greater difference on average is not important here, since the factor accounting for non-dynamometer effects (i.e., 0.89 in the NPRM) adjusts the final 5-cycle fuel economy values to match more robust estimates of onroad fuel economy, such as those made by FHWA. The key finding is that the combination of US06 highway and HFET fuel consumption is a much better predictor of each vehicle's fuel consumption over the MOVES description of highway driving than the HFET alone. This clearly refutes Honda's concern that the US06 test is too extreme to be a useful predictor of onroad fuel economy.

We agree with Honda that a portion of the US06 cycle came from what was then called the California ARB-02 cycle. As stated in EPA's technical report supporting the development of the US06 cycle:[30]

> *A third control approach involves a hybrid cycle that shares characteristics of both the air-fuel control approach and the representative cycle approach. The new cycle, US06, is 600 seconds in duration and is comprised of segments of CARB's ARB02 cycle and EPA's REP05 cycle. Similar to the air-fuel control method, this method targets specific high emission, non-FTP operation. And like the representative cycle, the US06 is based on actual segments of in-use driving.*

And

[30] "Final Technical Report on Aggressive Driving Behavior for the Revised Federal Test Procedure Notice of Proposed Rulemaking", EPA, January 31, 1995

The ARB02 cycle (figure 1-7) was developed by CARB based on data from their Los Angeles chase car study. The purpose of the cycle is to test vehicles over in-use operation outside the boundary of the LA4, including extreme in-use driving events.

Comparison of the REP05 and US06 cycles on a second by second basis indicates that hills 1 and 3 were taken from the ARB02 cycle, while the remainder of US06 was taken from the REP05 cycle. It appears that some splicing of portions of REP05 was performed to remove cruise events and focus on accelerations and decelerations. For example, hill 2 of US06 consists of seconds 3-52 and 364-393 of REP05, with one second added in between to provide time for a reasonable transition between the two segments.

Thus, all of the US06 cycle came from monitored vehicle operation via two representative cycles developed to represent high speed and aggressive driving not represented by the FTP. However, in order to develop a shorter test cycle which would be less costly to run which still required emission control over the most severe portions of the representative cycles, some of the less extreme operation outside of the FTP was excluded and the more extreme, though still representative, operation was retained.

With respect to the comment from Natural Resources Canada, we believe that various philosophies can be followed in developing consumer information in general and fuel economy label values in particular. We desire to provide consumers with as best an estimate of the fuel economy which they will achieve on the road given the way consumers actually drive. As can be attested by even brief trips on U.S. freeways, this often involves speeds exceeding the speed limit. Therefore, we do not believe that it is necessary to develop alternative label values or to assess the impact of removing driving which exceeds most speed limits from the estimate. In fact, the state of Texas recently increased their maximum speed limit to 80 mph in some parts of the state. Wyoming and other states have had speed limits above 70 mph for some time. Thus, this type of driving is not illegal everywhere.

It is useful to note that the HFET contains speeds as high as 60 mph. This cycle was developed when speed limits were no higher than 55 mph. A speed of 60 mph no longer seems excessive. However, at the time, it exceeded the allowable speed limit, because this was how people were found to drive. Therefore, we see no compelling need to change this approach at this time.

5.11.3 Effect of Air Conditioning on Fuel Economy

5.11.3.1 Approximating Excess Fuel Use Due to Air Conditioning

What we proposed:

We proposed to estimate the incremental fuel use due to the operation of the air conditioner as the difference in fuel use measured over the SC03 versus this combination of fuel use over Bags 2 and 3 of the standard FTP. This difference in fuel use between the two tests provides a direct estimate of the impact of air conditioning use for the conditions present during the SC03 test. The SC03 test is performed at 95°F and 40 percent relative humidity. The test only lasts 10 minutes and the vehicle is pre-heated with radiant lamps for 10 minutes prior to the test. Thus, the air conditioning compressor is generally engaged throughout the entire test. The speed of the vehicle during the SC03 test is relatively low, at an average speed of 21.5 mph. Of course, real-world vehicles operate at different speeds and ambient temperatures and the compressor may not be engaged 100 percent of the time, particularly during longer trips. All three of these factors can affect the impact of air conditioning on fuel economy. We therefore adjust the estimate of the impact of air conditioning on fuel use from the SC03 test in three ways to account for these three factors.

What commenters said:

UCS commented that while EPA's approach "appears reasonable," they question the potential impact of differences between the FTP and SC03 driving schedules. For example, they cite the acceleration rates of the SC03 cycle, which, while moderate, are beyond anything that occurs on the FTP. They also suggest that the possibility exists that that a car is not fully warmed up by Bag 2 of the FTP, whereas the SC03 is started with a fully warmed up engine. They recommend that EPA validate this approach by comparing the weighted FTP results of a representative sample of vehicles with the results of a set of modified SC03 tests conducted on the same vehicles. The "modified" SC03 tests would follow the SC03 driving schedule, but would be conducted with the air conditioning off and at the same environmental conditions as the FTP.

Honda also states that the effect of air conditioning is determined from the difference in fuel consumption over the SC03 test and a blend of Bags 2 and 3 of the FTP. Honda points out that the two driving cycles are different and do not necessarily yield the same fuel consumption absent air conditioning for all vehicles.

Honda presents a very general comment about the efficacy of testing which EPA performed to assess the impact of air conditioning over a number of test cycles.

Our response:

Honda is generally correct. The driving pattern in SC03 differs from that contained in the FTP. Our 39%/61% combination of Bags 2 and 3 of the FTP approximates the fuel consumption over SC03 at 75°F with the air conditioning turned off. However, the blend of Bags 2 and 3 which exactly matches SC03 without air conditioning is likely to vary somewhat across vehicles.

Again, however, this potential error in the proposed 5-cycle formulae does not occur in a vacuum. The alternative is the current label procedure, where air conditioning is assumed to affect all vehicles equally on a percentage basis; or the mpg-based equations, which assume that air conditioning affects vehicles in proportion to their fuel consumption over the FTP (which is actually quite similar to the current label procedure in this regard). Thus, it is not a matter of the 5-cycle formulae not being entirely accurate. It is a matter of which approach produces the best estimate.

We evaluated the potential for error in the various label approaches using data collected in support of the proposed rule.[31] In this test program, six vehicles were tested over a variety of cycles and temperatures with and without the air conditioning system turned on. In particular, vehicles were tested over a hot start FTP at 75°F without air conditioning, over a hot start FTP at 95°F with air conditioning, and over the SC03 cycle at 95°F with air conditioning. The testing at 95°F was not in an environmental chamber with solar load, etc. It was conducted in a standard dynamometer in a test cell heated to 95°F. Thus, the SC03 fuel economy values are not indicative of those which would occur over an official SC03 test. However, the consistency of testing methods for all the cycles actually helps isolate the impact of test cycle and is satisfactory for the purpose of this comparison.

The most direct measure of the impact of air conditioning is the difference in fuel consumption over a hot start FTP at 95°F with air conditioning and a hot start FTP at 75°F without air conditioning. This comparison avoids the concerns raised by Honda, since the driving cycles were exactly the same in both sets of measurements. Average fuel consumption over a hot start FTP at 95°F with the air conditioning on was 0.01267 gallons per mile higher than with the air conditioning turned off. Average fuel consumption over the hot start FTP at 75°F was 0.03867 gallons per mile. Thus, air conditioning use over a hot start FTP at 95°F increased fuel consumption by 32.7%.

We repeated this comparison using the 5-cycle approach. Air conditioning fuel use was determined by subtracting a 39/61% blend of fuel consumption over Bags 2 and 3 of the FTP from SC03 fuel consumption. Average fuel consumption due to air conditioning use was 0.01160 gallons per mile. Thus, air conditioning increased fuel consumption by 30.0%. Thus, the approach taken in the 5-cycle formulae underestimated fuel use due to air conditioning by 8%.

Of greater importance is the ability of the various fuel economy label approaches to predict the impact of air conditioning on a specific vehicle basis. The current label approach assumes that air conditioning has the same percentage effect on each

[31] Mitcham, A., Fernandez, A., & Bochenek, D. "Impacts of Ambient Temperature and Air Conditioning Usage on Fuel Economy" U.S. EPA, Office of Transportation & Air Quality, 2005.

vehicle. Thus, air conditioning use under this approach is assumed to be 32.7% of fuel consumption over the hot start FTP. The 5-cycle approach is exactly that described above. The mpg based approach uses the results of the 5-cycle formulae, but correlates the fuel use due to air conditioning against the hot start FTP. Doing so and performing a least squares regression produces an air conditioning fuel use of:

0.8581 + 0.0781 * hot start FTP fuel consumption.

As we have done above, we then determined the error in predicting each vehicle's air conditioning fuel use and calculated the coefficient of variation of the error.

The current label procedure produces the greatest error. The coefficient of variation was 48.9% for the six vehicles. The mpg-based procedure reduced this error by a factor of two, to 21.2%. However, the 5-cycle procedure reduced this latter error again by a factor of two, to 10.6%. Thus, it is very clear that the error introduced by using a blend of fuel consumption over Bags 2 and 3 as the basis for assessing air conditioning fuel use is minor compared to basing this fuel use on fleet-wide estimates. Thus, we find Honda's assertion incorrect. UCS' concern appears to be unwarranted.

With respect to Honda's criticism of our test program, Honda is correct that this testing did not simulate the flow of air through the engine compartment in a manner representative of onroad operation. However, the point of this testing was to simply confirm a very general principle that the air conditioning fuel use was primarily a function of time and not mileage. Honda did not present any data to indicate that a more representative simulation of air flow through the engine compartment would have changed this conclusion. Thus, we see no need to change this conclusion and its impact on the proposed 5-cycle formulae.

5.11.3.2 Available In-Use Data and Analysis

What we proposed:

The Draft MOVES2004 algorithm of compressor on fraction versus heat index was developed from the direct measurement of air conditioning operation of over 1000 trips by 20 vehicles in Phoenix, Arizona during the summer and fall of 1992. The algorithm considers both the frequency that the system is turned on by the driver and the frequency that the compressor is engaged once the system is turned on.

What commenters said:

Natural Resources Canada acknowledged that there is no better set of data than that gathered in Phoenix, Arizona in 1992 to describe the average performance characteristics of mobile air conditioning systems. However, they question whether the data and the resulting conclusions are valid given the advances in compressor and climate control system design in the last 14 years. To address this, they recommend that EPA repeat the Phoenix test program with newer vehicles in different U.S. cities to capture the effect of new technologies and climatic conditions on air conditioning use. Alternatively, they suggest that a sensitivity test could be performed using the existing 5-cycle test data, by varying the 13.3 percent air conditioning weighting factor between estimates of its possible extreme values and noting the impact on overall fuel economy. This would highlight the potential need (or lack thereof) for a new study.

NREL commented that the graph on page 69 of the Draft TSD reflects some unusual trends. In particular, they find it odd that at 100F, 85% of the vehicles have the air conditioning on, when personal experience suggests the percentage should be much higher. They also note the "dip" at about 85F.

Our response:

It would be beneficial to repeat the 1992 study of air conditioning use in Phoenix with late model year vehicles and in other locales. At the same time, the uncertainty introduced by reliance on this single study appears to be quite small on average. In Section III.A.3 of the Draft Technical Support Document, we described work by NREL which estimated air conditioning use using a method which is completely independent of that relied on by EPA. In the Draft Technical Support Document, we estimated that NREL's estimate for air conditioning use (switch turned on) for the U.S. as a whole was 24%. As described above, they have updated their analysis since that study we referenced. Their latest estimate is 29%. Based on the Phoenix study, we estimate that air conditioning is in use 23% of the time. While we believe our estimate is more sound, as it is based on actual measurements of air conditioning use, the NREL estimate can be used to estimate the potential error in this figure. Increasing our estimate of compressor on time of 13.3% by the ratio of 29/23 yields a new compressor on time of 16.8%. This decreases 5-cycle city and highway fuel economy by 0.8% and 0.4%, respectively. These are very small changes and would not even result in a change in the label figure in most cases, due to round off to the nearest mpg. Thus, uncertainty in the percentage of time that the air conditioning system is turned on does not appear to be a significant issue at this time.

Some newer climate control systems automatically turn on the air conditioning whenever cooling is desired and trim temperature using heat from the engine coolant system. Air conditioning use could be higher with such systems, as the driver might not even know that the air conditioning system was on. At the present time, such systems are more common in Europe than the U.S. Should they become more common in the U.S., their effect on air conditioning use could become an issue for the 5-cycle formulae.

Regarding NREL's comments about anomalies in the Phoenix data, they are correct. However, there are usually anomalies with real data. One would expect that essentially 100% of drivers would utilize their air conditioning at 100 F. However, if the drivers sampled happened to like driving with the windows down, or had just come out of a building which was over-cooled, they might have preferred the warm outdoor air to the air conditioning. Since the drivers were not asked why they used or did not use air conditioning for each trip, we will never know the answer.

Fortunately, whether 85% or 100% of drivers used air conditioning at 100 F had little impact on the overall projection of air conditioning use, given the high levels of use at slightly lower temperatures. As shown above, increasing air condition use by a relative 25% had little impact on 5-cycle fuel economy values. Therefore, the anomalies in the Phoenix data are not a major concern.

5.11.3.3 Driver Behavior

What we proposed:

We proposed that the SC03 test procedure be used, without modification, as an element of the 5-cycle test and calculation procedures.

What commenters said:

PPG supports changes that consider air conditioner use in the fuel economy label calculation, and they commented that EPA's current and proposed air conditioner fuel consumption test methodologies do not replicate actual consumer experiences. As an example, they note that vehicles in actual use are typically exposed to a solar load for substantially longer than the test requires. They further suggest that the proposed test protocol requiring that the air conditioner be operated at maximum cooling with high fan speed for the duration of the test is not representative. They suggest that this could drive temperatures lower than the consumer's comfort level, and that a more representative test would be to turn down the fan speed when a set comfort level was achieved. They suggest that the test would be more accurate if it replicated more realistic solar heating conditions by testing after extended heat soaks and by more accurately accounting for how consumers adjust their air conditioner settings.

Our response:

PPG's suggestion would amount to a revision to the SC03 emissions test procedure, which we did not propose to do. We do not necessarily agree or disagree with PPG's comments regarding solar load exposure and consumer behavior with respect to the fan speed settings, but we did not propose to amend the SC03 procedure, especially in ways that could potentially impact emission results or the cost of conducting the test. In particular, an extended heat soak could dramatically impact the costs for manufacturers. We did not intend for our proposal to reopen the SC03 test procedure and change it in any way; the emission standards for the SC03 were designed with the specific test procedure as it was designed, and changing the SC03 procedure would have far-reaching impacts. In addition, the impact of air conditioner usage on fuel economy is based on a difference in tests results, one test run with the air conditioner on and one run with the air conditioner off, with the result used as the estimate of the fuel economy impact of the air conditioner at the temperature of the SC03 test (95°F). The impact of temperature on air conditioning use is then used to determine the percentage of time that the air conditioning system is turned on in-use and the percentage of time that the compressor is actually engaged. The impact of temperature on compressor load is then factored in based on other information on the effect of temperature on load.

5.11.3.4 Accounting for Energy Reduction Technologies

What we proposed:

We did not propose any specific provisions to encourage or discourage energy reduction technologies.

What commenters said:

Delphi commented that because the compressor is "on" throughout the entire SC03 test, the test will not reflect any efforts by a vehicle manufacturer to improve the energy efficiency of their air conditioner systems at lower heat loads. Because average conditions in the U.S. are milder than those experienced during the SC03 test, they point out that "…accounting for the differential in A/C systems performance across these conditions is critical." Delphi claims that the most energy-efficient systems today may consume only 50 percent of the energy of the least efficient systems, and that "…this difference is not likely to be seen in the SC03 test" (emphasis is Delphi's). They believe that more accurate estimates of compressor usage are available and that there is a better way to establish the average energy used by today's A/C systems and future systems.

Delphi suggests that EPA update the "compressor on time" percentages, and refers to field data from 1987 model year vehicles with fixed-displacement cycling compressors and from 1997 model year vehicles with variable-displacement compressors. They also note that since the early 1990's, when the Phoenix data was collected, automatic climate control systems have become more prevalent, thus increasing compressor on-time. They present the following summary of their data, without additional detail:

Field Test	% Compressor On-Time (including defrost)
1987 Fixed Displacement, Manual and Semi-Automatic Systems	32%
1997 Variable Displacement, Manual Systems	45%
1997 Variable Displacement, Automatic Systems	70%

Additionally, Delphi proposes a series of correction factors that would be employed within the fuel economy calculation equations. These factors are intended to reflect the effect of air conditioning technology that may not show up in the SC03 test. They suggest factors that would adjust the fuel economy results for systems with variable-displacement systems, electronically controlled compressors, accurate control of evaporator temperatures, etc. They argue that these factors, while leading to more accurate fuel use estimates, will also provide manufacturers with the incentive to adopt some of these technologies.

NREL likewise noted some technologies that can reduce the fuel used by air conditioning systems but that would not be accounted for in the new fuel economy estimates. These technologies include those that reduce the thermal load in the cabin (e.g., solar reflective glass, insulation, ventilation), more efficient equipment (e.g., variable-displacement compressors), improved thermal comfort technologies (e.g., ventilated or climate control seats), and advanced control strategies (e.g., increased use of recirculation air). To resolve these issues, they recommend the following:

- Increase the soak period of the SC03 test or reduce the compressor-on percentage in the adjustment calculation for vehicles with load reduction technologies;
- Use a realistic temperature setpoint in the cabin for the test or adjust the compressor-on percentage for vehicles with load reduction technologies;
- Reduce the compressor-on percentage for vehicles with a control system that increases the use of recirculation air.

PPG also recommended that EPA consider modifying the proposal to consider the impact of technologies that lead to more efficient air conditioner systems, although their comments were focused on the potential impact of solar reflective window glazings on air conditioner fuel use.

Our response:

The current label procedure only addresses the impact of air conditioning use on fuel economy through the 10% and 22% generic adjustment factors which are applied to the FTP and HFET test results. Since these factors are the same for vehicles with and without air conditioning, the current procedure actually reduces the fuel economy label values due to air conditioning use for vehicles not even equipped with air conditioning. This is the status quo.

The proposed mpg-based equations actually continue this approach. While the fuel economy projections used to develop the mpg-based equations are based on the impact of air conditioning on individual vehicle’s fuel economy, the average adjustment is applied to vehicles with and without air conditioning.

The proposed 5-cycle formulae incorporate the impact of air conditioning on fuel economy through the SC03 test, with compressor usage and load adjusted for conditions outside those included in the SC03 test. The SC03 test, by virtue of its short duration and short time of heat load prior to the test, reflects the impact of some aspects of vehicles' climate control systems realistically, while not doing so with respects to other aspects. The adjustments in compressor usage for non-SC03 conditions were developed from data obtained from vehicles on the road in 1992. The adjustments in compressor load for non-SC03 conditions were based on air conditioning systems with fixed displacement compressors which cycle on and off frequently under less than maximum cooling conditions.

The comments summarized above point out a number of limitations with the proposed 5-cycle formulae in terms of granting credit to certain technologies whose benefits are either not reflected in the SC03 test or are only partially reflected. Delphi indicates that some efficient air conditioning systems in use currently could be as much as 50% more efficient than the systems modeled in the 5-cycle formulae. At the same time, Delphi points out that some climate control systems may actually run the compressor more than that indicated in the Phoenix study. This could increase the fuel economy impact of these systems relative to those modeled in the 5-cycle formulae.

Using the 5-cycle certification database for 615 vehicles, reducing the impact of air conditioning on fuel use (by reducing the effective compressor on percentage from the 13.3% estimated in the 5-cycle formulae to 6.7%) improved city and highway fuel economy by 1.6% and 0.7%, respectively. While significant, such an improvement would not change the actual label fuel economy for most vehicles due to the rounding of the label to one mpg. At the same, we desire to give credit to all technologies which affect onroad fuel economy to the fullest degree possible without significantly increasing the current test burden.

Both the current and proposed label procedure base the label values entirely on fuel economy measurements from dynamometer tests coupled with adjustments or weighting factors applicable to all vehicles. As described elsewhere in this document, we considered developing separate 5-cycle weighting factors for hybrid vehicles, but rejected that approach, in part due to the variation in what constitutes "hybrid" technology. The same concern applies here. The effect of each of the fuel-saving technologies mentioned in the comments would likely differ across vehicle lines and comprise more of a continuum in technology than discrete steps. Considerable effort would be needed to develop procedures to appropriately address such technologies. These efforts would necessarily delay the final rule implementing 5-cycle formulae without such adjustments for different air conditioning system technologies. Given the relatively small impact of these technologies on the label values, and the much larger impact of the 5-cycle approach as a whole, we do not believe it appropriate to delay the 5-cycle approach until procedures can be developed which account for differences in air conditioning systems. Nonetheless, we encourage those familiar with such systems to provide further information regarding their operation in-use and their impact on onroad fuel economy. We remain open to working with all affected parties in developing procedures which could allow the in-use efficiencies of such systems to be appropriately incorporated into the 5-cycle formulae.

5.11.3.5 Temperature Impact on Compressor Power

What we proposed:

Using data from the Phoenix program, we identified a relationship between compressor cycling and ambient temperature. Following this we used a simplified thermodynamic model to develop a correlation to reduce compressor torque as a function of ambient temperature.

What commenters said:

NREL commented that the impact of ambient temperature on compressor power may be double counted in our analysis. They note that on page 70 of the Draft TSD we identify the relationship between compressor cycling and ambient temperature. Following this we use a simplified thermodynamic model to develop a correlation to reduce compressor torque as a function of ambient temperature. NREL suggests that an actual air conditioning system "…will cycle the compressor to control the high side pressure and evaporator temperature while the simplified model adjusted the compressor power," and that using both may be inappropriately adjusting compressor power twice.

Additionally, NREL notes that, contrary to statements in the Draft TSD on page 71, there is available data from the SAE Alternate Refrigerant Cooperative Research Program regarding vehicle air conditioning system design and how engine speed and load affect its efficiency.

Honda mentions that EPA adjusted air conditioner load for ambient temperatures below 95°F, but did not do so for humidity or solar load or vehicle soak time in the sun prior to operation.

Our response:

We do not believe that we are performing any double counting when accounting for both the time which the compressor is not engaged and the reduced load on the engine at lower temperatures while the compressor is engaged. The study which estimated (in a simplified fashion) the compressor torque (and power) as a function of ambient temperature did so in a way which should be independent of cycling. The compressor model in the reference was designed to be combined with a cycling clutch model, which is briefly introduced in the paper, but not thoroughly developed. The activity cycling factors used in the AC factors in the present analysis were based on actual measurements of compressor use in Phoenix and should be independent.

With respect to Honda's comment, we stated in the Draft Technical Support Document that we did not adjust air conditioning compressor load for differences in humidity because we thought the effects were small. Honda provided no data to refute this. Thus, we are not adding any further adjustment at this time.

Regarding solar load and vehicle soak time in the sun prior to operation, it is not clear that this would affect compressor load. These factors will affect the amount of time that the compressor is engaged. This is already accounted for through the use of measured onroad compressor usage rates from the Phoenix study coupled with an assumption that the compressor is engaged 100% of the time over the SC03 cycle. The last assumption is due substantially to the solar load included in the SC03 test and the fact that the vehicle was under significant solar load for 10 minutes prior to start of the test.

Temperatures under the hood of a moving vehicle could be affected by solar load and, thus, affect compressor efficiency. EPA has no data which would allow the quantitative estimation of this effect. Honda also did not supply any data. We expect that the effect of varying solar load would be less than the effect of ambient temperature. Accounting for the variation in ambient temperature when the air conditioning is operating only reduced the effective compressor on time by 15%. Thus, ignoring the variation in solar load should be much smaller. Given that the overall impact of air conditioning is only 2% on city fuel economy and less on highway fuel economy, we expect this to have a negligible impact on 5-cycle fuel economy.

5.11.3.6 Estimates of National A/C and Defroster Use

What we proposed:

We used a study from NREL to determine estimates of national average air conditioning and air conditioning plus defroster use.

What commenters said:

NREL commented that our estimates of national average air conditioning and air conditioning plus defroster use (22.9% and 33.5%, respectively), which we derived from an NREL study, should actually be 28.1% for air conditioning and 32.6% for air conditioning plus defroster use after weighting by vehicle registrations. NREL also assumed a mix of 60% cars and 40% trucks, while our analysis used a mix of 65% and 35% cars and trucks, respectively.

NREL confirms our assumption that in their analysis, the relative fuel economy impact of air conditioning and defroster includes the impact of ambient temperature on load and on the operating frequency of the compressor.

NREL suggested that the 61F air temperature during defroster use (Draft TSD, page 73) seems high, noting their analysis assumed that the A/C would be used for dehumidification when the ambient temperature was between 35 and 55 F.

Our response:

We contacted NREL personnel to determine the source of the discrepancy regarding their estimate of national average air conditioning usage. We determined that they had since updated the analysis which they performed in 2002 and that the more recent analysis indicated higher air conditioning usage. Thus, NREL currently projects that drivers have the air conditioning system turned on 28.1% of the time, while our estimate is 23.8%, based on the Phoenix study. This difference is not surprising given the completely different methods used to derive these estimates. They are still quite similar in magnitude, though obviously not as close as indicated in the Draft Technical Support Document. We will continue to use our estimate in the developing the weighting factor in the 5-cycle formulae, due to the fact that it is based on actual vehicle testing, though this is admittedly limited in nature. NREL's estimate is based on a prediction of a driver's comfort level and has not been confirmed by any vehicle testing.

Regarding the use of a 61F air temperature assumed for defroster operation, it is not clear whether NREL thought this was our assumption, or, as was actually the case, our description of their assumption. This temperature is stated in their paper (actually as 16 C). We agree with NREL that this air temperature seems high given that they assumed that demister use would only occur when the ambient temperature was between 35 and 55 F. We attributed this to higher underhood temperatures, but could be wrong in this regard. It could have been a typographical error in the report or simply an error in their analysis. In either case, a lower temperature for demister use would decrease the compressor load slightly, which would decrease our estimate that demister use on average is equivalent to 1.3% of the excess fuel use per mile measured during SC03.

More importantly, correcting NREL's estimate of air conditioning use from 22.9% to 28.1% and total air conditioning plus demister use from 33.5% to 32.6% reduces demister use from 10.6% to 4.5%. This reduction is more than a factor of two and dwarfs the effect of a lower air temperature in demister load modeling and small changes to the assumed mix of cars and light trucks. Thus, the impact of demister use is likely less than 1% of the excess fuel use per mile measured during SC03. This strongly supports our decision in the Draft Technical Support Document to not include the impact of demister use in the 5-cycle formulae.

5.11.4 Effect of Cold Temperatures on Fuel Economy

What we proposed:

We proposed to model the effect of cold temperature on city fuel economy with a 50/50 weighting of fuel consumption over bags 2 and 3 of the cold FTP.

What commenters said:

Honda comments that EPA did not show that Bag 2 was representative of city driving at colder temperatures. They also stated that EPA did not perform any analysis to confirm its assumption that the effect of colder temperatures on running fuel use changed gradually and linearly.

Honda also points out that the excess fuel use at colder temperatures also includes a difference in driving pattern which may be confounding the results. EPA did not evaluate the impact of this difference in driving pattern for individual vehicles.

Honda further states that EPA did not validate its assumption that running fuel use during highway driving at 20°F was 4% higher than that at 75°F on an individual vehicle basis.

Our response:

There was a typographical error in some of the 5-cycle city fuel economy formulae indicating that city driving at colder temperatures was assumed to be equal to Bag 2 fuel consumption of the cold FTP. These equations should have indicated that a 50/50 weighting of fuel consumption over Bags 2 and 3 of the cold FTP. The text deriving this portion of the formula correctly indicated the latter understanding. This 50/50 weighting was the result of the same type of VSP modeling used to develop the cycle weighting factors at 75°F. It is also nearly identical to the relative weighting of the FTP itself. Thus, we see no issue with the representation of driving at colder temperature which would require modification to the 50/50 weighting.

Our response:

This assumption that the effect of colder temperatures on running fuel use changed gradually and linearly is used to develop the weighting factor for running fuel use at 20°F. Assuming a linear relationship between running fuel use and ambient temperature produced an average driving temperature of 58.7 F, which is 30% of the way from 75°F to 20°F.

We evaluated the potential impact of our assumption that running fuel use at highway speeds increases linearly with temperature between 75°F and 20°F. We analyzed the trend in hot LA4 fuel consumption for the 13 Toyota and Honda vehicles described in Section III.F.1 of the Draft Technical Support Document. Three of the four hybrids in this database were tested over a four-bag FTP. Thus, for these three vehicles, we used Bags 3 and 4 to represent a fully warmed up FTP, or hot LA4. This data shows that running fuel use at 50°F was 4.6% higher than at 75°F, while that at 20°F was 19.5% higher. Thus, for city driving, the relationship between temperature and running fuel use was non-linear, with the effect increasing gradually at first and then increasing as the temperature decreased further from 75°F. We fit a second order equation to this data. The result was that running fuel use at temperature "T" relative to that at 75°F was:

$$1 - 0.00035 * (T - 75°F) + 0.00006 * (T - 75°F)^2$$

Applying this relative running fuel use to each hour, month and county in the U.S., as described in the Draft Technical Support Document for start fuel use and air conditioning use, we found that relative running fuel use was on average across the U.S. 3.6% higher than that at 75°F. This increase of 3.6% is a relative 18% of the 19.5% effect of operating at 20°F for these 13 vehicles. Thus, it is possible that the 30% factor based on an assumed linear relationship over-estimates the impact of colder temperatures. Therefore, we will change the weighting factor in the 5-cycle formula for running fuel use at 20°F to 0.18 from 0.30. This increases 5-cycle city fuel economy by 0.8% for the 423 vehicles in our certification database, while 5-cycle highway fuel economy increases by 0.5%. Combined 5-cycle fuel economy increases by 0.7%. Because this change affects the relationship between combined fuel economy based on the FTP and HFET and that based on the 5-cycle formulae, it will tend to increase the factor which accounts for non-dynamometer effects.

Honda is correct in understanding that running fuel use during city driving at 75°F is based on a different composite driving cycle than that at 20°F. The reason for this is the fact that the US06 test is not performed at 20°F. Honda is also correct in pointing out that this difference of driving pattern is included in the description of excess running fuel use due to colder temperatures during city driving at the end of Section III.A.4 of the Draft Technical Support Document. However, approaching the inclusion of the effect of colder temperatures on running fuel use during city driving as a simple addition of an "excess" fuel use is not the best understanding of what was done. We presented this effect as an excess in order to be consistent with other aspects of the 5-cycle equation, like start fuel use and fuel use associated with air conditioning. It is more straightforward to understand the treatment of colder temperatures in this case as an averaging of running fuel use at warm temperatures (i.e., 75°F) and that at cold temperatures (i.e., 20°F). Running fuel use at 75°F is estimated using the best fuel economy data available, which includes the city bag of US06. Running fuel use at 20°F is estimated using the best available data, which only consists of Bags 2 and 3 of the cold FTP. If fuel economy over US06 was not available, then running fuel use at 75°F would also be based solely on Bags 2 and 3 of the standard FTP. It does not improve the accuracy of the estimate of running fuel use at 75°F to exclude the US06 city bag data. We could have developed a factor based on the FTP and cold FTP data which estimated the impact of cold temperature on city driving. This alternative approach was discussed in the Draft Technical Support Document and rejected in favor of the proposed approach. This alternative would have presumed that the change in running fuel use over the FTP at colder temperatures also applied to US06 city driving. While this assumption would not have been unreasonable, the proposed approach avoided this assumption. In its place, we simply have a simplified city driving cycle at colder temperatures. Given Honda's preference to base fuel economy labels on procedures which emphasize the FTP, this approach would presumably be preferential. Honda did not suggest an alternative approach within the 5-cycle construct. Thus, we see no need to change this aspect of the 5-cycle city fuel economy formula at this time.

Honda's comment that EPA did not validate its assumption that running fuel use during highway driving at 20°F was 4% higher than at 75°F on an individual basis seems to be a simple repetition of previous comments that EPA did not validate some aspect of the proposed 5-cycle formulae. The impact of the 4% assumption is essentially a 1.2% reduction in highway fuel economy for each and every vehicle. If this factor were not included in the 5-cycle highway formula, combined 5-cycle fuel economy would have been 0.6% higher. The comparison of combined 5-cycle fuel economy with onroad fuel economy estimates made by FHWA, as well as the sum of estimated non-dynamometer effects would have shown a 0.6% greater shortfall. Thus, the factor for non-dynamometer effects would increase by 0.6%. This would obviously reduce both the city and highway fuel economy of each and every vehicle by 0.6%. We have a data-driven method for accounting for colder temperatures on running fuel use during city driving. We believe it is preferable to estimate this effect for highway driving rather than account for it in the non-dynamometer factor which is applied to both city and highway fuel economy. We could attempt to develop separate non-dynamometer adjustment factors for city and highway fuel economy. However, the methodology to do so would involve a number of assumptions and uncertainties which would defeat much of the purpose for the separate factors.

In addition, the 4% assumption is very analogous to the approach taken in the current label procedures and the mpg-based equations. It does not rely on the US06, SC03, or cold FTP test results. To criticize this assumption seems to be inconsistent with the rest of Honda's comments.

5.11.5 Adjustment Factor for Non-Dynamometer Effects

What we proposed:

We proposed a downward adjustment to account for effects that are not reflected in the proposed 5-cycle approach. There are many factors that impact fuel economy, but are difficult to account for in the test cell on the dynamometer. These include roadway roughness, road grade (hills), wind, tire pressure, heavier loads, hills, snow/ice, effects of ethanol in gasoline, larger vehicle loads (e.g., trailers, cargo, multiple passengers), and others. Current data indicates that these impacts can lower fuel economy from 9 to 13 percent. We proposed an 11 percent downward adjustment to account for these non-dynamometer effects.

What commenters said:

ACEEE commented that EPA appears to have assumed – by using a single adjustment factor for both city and highway driving – that the non-dynamometer factors as a group affect city and highway driving equally. They contend that this may not be a valid assumption, especially given the large contribution of wind resistance to the proposed 11 percent adjustment, and the fact that the impact of wind resistance on fuel economy changes dramatically with vehicle speed.

Bluewater Network believes that the fuel economy results for both the mpg-based approach and the 5-cycle approach are overstated for hybrids. Consequently, they suggested that EPA add an additional non-dynamometer factor specifically for hybrid vehicle city fuel economy, citing a large real-world shortfall that they claim is not accounted for in the 5-cycle approach or the proposed non-dynamometer factor.

Honda argued EPA's estimates of the effects of ethanol in the fuel and low tire pressure seemed reasonable, but estimates for other factors were "problematic." They suggest that average wind speed data and the fuel economy impacts of wind speed seem far too high. They further argue that EPA made errors in comparing the average 5-cycle fuel economy values with fleetwide estimates of in-use fuel economy made by FHWA, and that the result of these errors leads to an overestimate of the impact of non-dynamometer effects. They conclude that the overall non-dynamometer effect should be 6 percent, not 11 percent as proposed.

Our response:

The comment by ACEEE reflects the common understanding that higher vehicle speeds produce greater aerodynamic drag and that this leads to an increased impact of wind on fuel economy. As discussed in the Draft Technical Support Document, this is true for a headwind, but not for wind coming from the side of the vehicle. For a given wind speed, the slower the vehicle is traveling, the greater the net angle that the vehicle is traveling through the air. Changes in this net angle of movement can have an enormous effect on total aerodynamic drag, as indicated by the analysis described in the Draft Technical Support Document. Thus, the effect of wind is not greater for highway driving than city driving.

More importantly, we do not have solid estimates of onroad fuel economy for city and highway driving separately. The uncertainties in splitting total onroad fuel economy into city and highway components are sufficiently large to counter any likely improvement in the accuracy of having separate non-dynamometer factors. Thus, we continue to believe that a single factor for non-dynamometer effects is appropriate.

It is possible that the proposed mpg-based equations overstate hybrid city fuel economy relative to that for conventional vehicles, at least as indicated by a comparison of mpg-based fuel economy to 5-cycle fuel economy. This is described in Section III.B of the Draft Technical Support Document and depicted in Figure III-17. Elsewhere, we address the comment that we develop separate mpg-based equations for hybrid vehicles and still conclude that a single equation for all vehicles is the most appropriate approach at this time. The required use of the 5-cycle formulae starting with the 2011 model year should make any deficiency in this regard a short term one.

Regarding Honda's comment, there were three steps in our determination of the 11% downward adjustment to account for factors not represented by the various dynamometer tests. First, we determined that the current label values over-estimate onroad fuel economy per FHWA (with some adjustments by EPA) by 3-4%. Second, we determined that the average combined 5-cycle fuel economy for the 414 conventional vehicles in our certification database was 3% higher than current label values on average. Third, we determined that changes to EPA test procedures occurring since the vast majority of the vehicles in the 2002 and 2003 in-use fleets were certified had increased average composite city-highway fuel economy by 3%. In total, then, the difference between the average composite 5-cycle fuel economy and FHWA estimates of onroad fuel economy was 9-11% on a comparable basis. We chose the upper end of this range for inclusion in the mpg-based and 5-cycle formulae.

Honda presented a number of reasons why changes to EPA test procedures occurring over the 2000-2004 model years did not increase composite fuel economy by 3%. Honda pointed out that two other changes occurred in addition to the one cited in the Draft Technical Support Document which basically compensated for the effect of removing the elimination of 10% road load adjustment to simulate air conditioning. Honda references several communications between EPA, NHTSA and industry on this issue.

Upon reevaluating this issue, EPA agrees with Honda's assessment that the net effect of test procedure changes occurring in this timeframe was roughly zero. Thus, when estimating the difference between the average composite 5-cycle fuel economy and FHWA estimates of onroad fuel economy, no adjustment should be made because of changes in test procedures occurring with the implementation of the Supplemental FTP standards in the 2000-2004 timeframe.

However, other factors affecting the estimate of the non-dynamometer factor also need to be updated. Specifically, more recent FHWA estimates of onroad fuel economy are available. Also, the effect of requiring the heater and/or defroster to be turned on during the cold FTP also needs to be incorporated into the analysis. Thus, a revised estimate of the non-dynamometer factor will be made in the Final TSD.

5.11.6 mpg Approach Equation Tolerances

What we proposed:

Section 600.116-08 of the proposed regulations would require additional 20°F/SFTP testing when the certification vehicle's city and highway five-cycle fuel economy are less than 0.96-times and 0.95-times the certification vehicle's city and highway mpg-based fuel economy, respectively. Because it is possible for the 5-cycle fuel economy values to meet either one of the city or highway criteria, but not the other, we proposed a methodology that accommodates the variety of possible outcomes. If the 5-cycle fuel economy values for a specific emission data vehicle are more than four percent below the mpg-based estimate for city fuel economy, all the vehicle configurations represented by that emission data vehicle would be required to use the 5-cycle approach for determining both city and highway fuel economy. This is because all five cycles play a significant role in the 5-cycle city fuel economy formula. In the case where the 5-cycle highway fuel economy values are more than five percent below the mpg-based estimate for highway fuel economy, but the 5-cycle city values are not more than four percent below the mpg-based city fuel economy estimate, we proposed that all vehicle configurations represented by that emission data vehicle would be allowed to use the mpg-based formulae to derive the city fuel economy label value. We proposed that the highway fuel economy value, however, would in this case be based on an alternative, simplified 5-cycle formula, which would be based only on test results from the FTP, HFET, and US06 tests. This is because the impacts of the Cold FTP and the SC03 tests on the 5-cycle highway formula are relatively small and can be included in the formula as simple estimations based on existing data.

What commenters said:

AAM/AIAM evaluated the 423-vehicle database used to generate the mpg-based equations and concluded that the proposed 0.95-times mpg-based highway fuel economy criterion would likely impose additional testing for over ten percent of vehicles. They suggest that this test burden would exceed the benchmark established in the CAP2000 rulemaking for requiring additional testing through a manufacturer confirmatory process. Their analysis of the data set also showed that the standard deviation of the five-cycle city data (about the mpg-based city curve) is 0.61 mpg, and the standard deviation of the 5-cycle highway data (about the mpg-based highway curve) is 1.14 mpg. They conclude from this that the variability of 5-cycle highway results was about 87% greater than that of 5-cycle city results, which they believe is reflective of the great variability seen in US06 data. They believe that a criterion of 0.93-times the mpg-based highway fuel economy would reflect this increased level of variability and consequently they request that EPA reconsider this factor.

Nissan noted that the proposed criterion for the City tolerance band is consistent with their experience, but they feel that the Highway tolerance band is "overly restrictive and does not accurately reflect the greater variability of the Highway result (principally from the greater variability of the US06 component)." They propose a factor of 0.93 x Highway mpg.

Toyota expressed support for the mpg-based formula with the applied "bandwidths," believing that it will help reduce the need for additional testing. They also expressed agreement with the proposed alternative highway fuel economy formula based on the FTP, HFET, and US06 tests, stating that it will also achieve 5-cycle goals and require less additional testing. However, Toyota also suggested an additional step, involving a "3-cycle" fuel economy analysis, before a vehicle line would be committed to the 5-cycle approach. This interim step would allow a manufacturer whose emission data vehicle falls outside the mpg-based tolerance limits to re-evaluate fuel economy with the Toyota 3-cycle formula. If the emission data vehicle's 3-cycle city or highway values fall within +/-1 mpg of the 5-cycle results, then the other vehicles within that test group would only have to run an additional US06, which would then be used in the Toyota 3-cycle equation to determine the label value. If the 3-cycle values fell outside a +/-1 mpg tolerance, then the full 5-cycle approach would be required.

UCS commented that the tolerance bands are too wide, and may fail to show significant differences between different models. They suggested comparing two vehicles, one which gets a highway rating of 30.4 mpg from both the 5-cycle test and the mpg-based adjustment, and the other which gets 28.1 mpg on the 5-cycle test but 29.5 mpg using the mpg-based adjustment. The label for each vehicle would be rounded to 30 mpg, although, UCS points out, the first vehicle gets 8 percent better fuel economy. They recommend that EPA tighten the tolerance band requirements to reduce the number of vehicles that are able to escape 5-cycle testing. They also suggest that EPA make data publicly available indicating which vehicles are contained in each test group to add transparency and opportunities to comment on their appropriateness. UCS also questioned the assumption that all the vehicle types within a test group can be adequately represented by the emission data vehicle and will return similar fuel economy test results. They believe that this assertion needs to be validated.

Toyota proposes that the tolerance levels for evaluating fuel economy estimates should be numerically expressed as +/-1 mpg, rather than a percentage-based tolerance level. They suggest that this is necessary in order to maintain consistency among the range of fuel economy data between high mpg and low mpg vehicles.

Our response:

The criteria for use of the mpg-based approach in model year 2011 and later (5-cycle city fuel economy above four percent and 5-cycle highway fuel economy above five percent) are based on the balance of three factors. First, we designed them to be sufficiently large so that typical test-to-test variability would not cause a test group to fail the criteria. This may be a greater concern for the highway fuel economy comparison, due to the dominance of the US06 fuel economy (which inherently has greater test-to-test variability than the other tests) in the 5-cycle formula. Second, we want to minimize the potential error in the fuel economy label. Label fuel economy values are rounded to the nearest whole mpg. Thus, we felt it important to keep the difference between the 5-cycle and mpg-based fuel economy values within roughly one mpg, if possible. In other words, if the difference between the two methods is less than 1 mpg, then the two methods would produce the same label value. If the difference is more than 1 mpg then we would expect the 5-cycle method to result in a different label value, and thus it is more important to trigger the requirement for additional testing. Third, we want to avoid requiring additional fuel economy testing that will have little to no impact on the label values.

The four percent tolerance band for city fuel economy is equivalent to roughly 0.6-0.7 mpg on average. Due to the contribution of a number of independent fuel economy measurements in the 5-cycle city formula, the effect of test to test variability should be much lower than four percent. Based on the 5-cycle test results of 615 recent model year vehicles, we estimate that about 96 percent of test groups would fall above the four percent tolerance line. Thus, we believe that this criterion adequately satisfies the three factors mentioned above.

The five percent tolerance band for highway fuel economy is equivalent to roughly 1.1 mpg on average. Thus, it is slightly higher than the typical error associated with rounding. However, due to the dominant contribution of the US06 fuel economy in the 5-cycle highway formula, and the fact that this test tends to have relatively high variability, we are concerned that test-to-test variability could be on the order of 3.0 percent in the 5-cycle highway formula. We estimate that about 87 percent of test groups would fall above the five percent tolerance line. Thus, again, we believe that this criterion adequately satisfies the three factors mentioned above.

Overall, allowing the continued use of the mpg-based approach in this way will reduce the number of additional SC03 and cold FTP tests by about 96 percent and reduce the number of additional US06 tests by about 87 percent. Moreover, this significant reduction in test burden is achieved with no significant impact on the fuel economy estimate.

We believe that Toyota's proposal adds unnecessary complexity with little likely gain. As we have noted, a large majority of vehicles are expected to pass both the city and highway criteria and thus be able to use the mpg-based adjustments. Our final rule offers a "3-cycle" option in the event that only the highway criteria is failed, with the end result that the burden of additional testing over five test procedures will be quite small.

Each year, manufacturers must demonstrate compliance with federal emission standards by performing tests over all five test procedures. The vehicles on which these tests are performed are known as "emission data vehicles", which are selected to represent the "worst-case" emitting vehicle in a group of vehicles, known as a "test group", which share common engine and emission control designs. We expect that these vehicles will also be the worst-case configuration for fuel economy, given that the parameters which contribute to higher emissions (e.g., transmission class, vehicle weight, presence of accessories) also generally contribute to lower fuel economy. We believe that it is reasonable to allow continued use of the mpg-based line when the available 5-cycle fuel economy data (from emissions certification) indicates that the mpg-based fuel economy determined from the official FTP and HFET tests performed for the test group are similar enough to the 5-cycle fuel economy determined from the official FTP, HFET, US06, SC03 and Cold FTP tests for that same test group. In that case, the manufacturer can use the mpg-based method for all model types covered under the EPA certificate of conformity that is represented by the 5-cycle data submitted to represent those vehicles. The manufacturer will not need to conduct 5-cycle testing for fuel economy labeling for these model types.

5.12 Onroad Fuel Economy Estimates by Other Organizations

What we proposed:

In the proposal, we compared onroad fuel economy estimates developed by several organizations to the current, mpg-based and 5-cycle fuel economy label values.

What commenters said:

Honda provided a number of comments on EPA's presentations of the onroad fuel economy estimates by outside organizations. Generally, Honda agreed with EPA's characterization of the relative strengths and weaknesses of the various estimates. Overall, Honda believes that none of the studies cited in the proposal comes close to being a robust source of onroad fuel economy data.

More specifically, Honda criticized the Consumer Report estimates due to their basis on unknown and apparently unrepresentative driving cycles and adjustments for differences in ambient temperature. Honda was especially critical of the temperature adjustment applied by Consumer Report to hybrid fuel economy. Honda also criticized EPA for comparing EPA label values to the Consumer Report estimates for the vehicle fleet as a whole and not on an individual vehicle basis.

Honda also criticized the unknown nature of the basis for the AAA estimates. Honda also criticized AAA's conclusion that the US06 test better characterized onroad fuel economy than the current label values.

With respect to the Oak Ridge National Laboratory "Yourmpg" database, Honda pointed out that their hybrids did not perform any worse than conventional vehicles.

Honda criticized EPA's use of onroad fuel economy estimates from the Department of Energy's FreedomCar program, most of the vehicles in this program are in commercial service. Honda cites the need for extensive maintenance of FreedomCar vehicles as evidence of extreme service.

Honda also criticized EPA's analyses of its fuel economy data collected recently in Kansas City, concerned that the presence of the PEMS equipment affected the fuel economy measurements. Honda also presented a number of concerns with the quality of the speed data. Honda also believed that comparisons should be performed in terms of fuel consumption instead of fuel economy, that relative performance between vehicle models is more important than absolute fuel economy comparisons.

Finally, Honda presented an analysis of onroad fuel economy estimates obtained from Strategic Vision. Honda also made a supplemental comment after the end of the comment period presenting additional analysis of the Strategic vision data.

In their comments at the hearing, AAA provided additional onroad and dynamometer fuel economy estimates. AAA borrowed 41 vehicles from their owners in Southern California, obtained their owners' estimate of onroad fuel economy, and then tested the vehicles using their own fuel economy test procedures, as well as over the FTP, HFET and US06 cycles. They compared the owners' fuel economy and their fuel economy estimates to the current label values and to US06 fuel economy levels. AAA found that the US06 fuel economy was a better estimate of onroad fuel economy than the current label value.

Our response:

Regarding Honda's criticism of various aspects of the various organizations' test procedures, we presented many of these elements in the NPRM and/or the Draft TSD. If sufficient estimates were available from test programs not having the weaknesses mentioned, it might be reasonable to avoid presentation of some or most of the estimates. However, because estimates lacking weaknesses are currently unavailable, we presented all of the estimates along with a complete description of their relative strengths and weaknesses. Since Honda believes that the Strategic Vision data are the best available, they presumably would prefer that these estimates be emphasized. However, as discussed below, we have discovered additional concerns with this database, as well. Thus, we believe that it is still most appropriate to present all of the organizations' estimates with appropriate caveats.

In response to Honda's specific criticisms of the Consumer Report estimates, we believe their criticism of generic temperature adjustments is exaggerated. As Honda noted, the Consumer Report estimates do not include any cold starts or air conditioning operation, the two conditions most affected by ambient temperature. Ambient temperature only weakly affects the fuel economy of warmed-up conventional vehicles, as discussed in the TSD. Hybrids could be more sensitive to temperature effects from changes in battery charging and discharging efficiency. Thus, Honda's criticism of Consumer Report's hybrid estimates could be correct in this area. However, this difference in the impact of ambient temperature on hybrid and conventional warmed up fuel economy argues for the 5-cycle approach, which Honda criticizes throughout their comments. Both the current and mpg-based label approaches can only apply the same adjustment factors to all vehicles, hybrid or conventional. If the effect of temperature differs for these two types of vehicles, or between individual vehicles, these label setting approaches cannot reflect these differences.

Regarding Honda's criticism of our analysis of the Consumer Report estimates, we added a comparison in the final TSD of the relative ability of all three label approaches to predict onroad fuel economy as estimated by Consumer Report.

Honda's criticism of AAA's test procedures is very similar to their criticism of the Consumer Report procedures. Our response is the same as described above. Honda's criticism of AAA's analysis of their new onroad and US06 data is similar to their criticism of our analysis of the Consumer Report data. Honda believed that an analysis of the ability of the various label approaches to match the onroad fuel economy estimates on an individual model basis is more important than an analysis of the match-up on average across all models. We will perform a more thorough analysis of this data in the Final TSD. While we will examine average fuel economy differences, we will also examine the ability of various label approaches to reflect the onroad fuel economy of individual vehicles.

Honda presented two criticisms of the FreedomCar data. First, the vehicles are primarily in commercial service. Second, no conventional vehicles are in the test program. Honda was concerned that many vehicles in commercial service are operated continuously, 6 days a week. They cited maintenance records that include catalyst and transmission replacement, indicating extremely aggressive driving.

Although commercial operation can differ from personal use, it provides an opportunity to obtain many hours of vehicle operation over a short period of time. The hybrid models cited by Honda have not been offered long enough for most vehicles in personal use to achieve greater than 100,000 miles. Thus, it is unclear whether the maintenance received by the FreedomCar vehicles is unusual or not, particularly for vehicles in a test program which likely receive more frequent and careful inspections than the average vehicle. From Honda's description, it would appear that there are factors affecting the FreedomCar Program's vehicles which increase fuel economy, as well as decrease fuel economy relative to the average vehicle. Continual operation means few cold starts. Phoenix certainly experiences little truly cold weather. Both of these factors reduce hybrid fuel economy more than conventional vehicles. Commercial operation might be more aggressive, but this is at best a subjective observation. Air conditioning use will be higher in Phoenix than on average across the U.S. However, 24-hour a day commercial operation means much more operation at night than the average vehicle, when temperatures and solar loading are lower. Thus, again, commercial operation in Phoenix might not be as extreme as it might look at first glance.

The inclusion of conventional vehicles in the program would have allowed a comparison of onroad fuel economy relative to label values for both conventional vehicles and hybrids and would have provided more information. However, this was not the focus of the DOE study. Overall, we do not believe that Honda has demonstrated that the FreedomCar data is unrepresentative to the degree that it should not be included in the discussion of available onroad fuel economy estimates relative to label values.

Honda's criticism of EPA's Kansas City data includes all of the weaknesses mentioned by EPA in the Draft TSD (e.g., few or no cold starts, little air conditioning operation, limited monitored operation per vehicle, etc.). In addition, Honda noted that the separate analysis of hybrid and conventional vehicle performance was inappropriate, due to the low r-squared value for the hybrid vehicles (-0.17). This value of r-squared is low because this study only included a few hybrids, all of which fell into a relatively narrow range of label fuel economy (48-56 mpg, with one vehicle at 64 mpg).

The low r-squared value indicates the relatively wide range of onroad fuel economy values achieved with vehicles with a narrow range of label fuel economy values.

Honda also criticized EPA for performing a regression of onroad fuel economy versus label fuel economy, believing that a regression of fuel consumption (inverse of fuel economy) would be technically preferable. We performed a regression of onroad fuel consumption per mile versus the inverse of the current fuel economy value for hybrid vehicles, as Honda suggested. First, we found that the intercept was not statistically significant (p-value of 0.684). Thus, we performed a new regression with an intercept of zero. We found an r-squared value of 0.18, which is not much different than that for the regression of fuel economy. The slope of the regression was 1.135, indicating that the hybrids consumed 13.5% more fuel than predicted by the inverse of their label values. More importantly, this slope had a p-value of 10^{-31}, indicating that it was extremely unlikely to be zero. The 95% confidence interval for the slope ranged from 1.09 to 1.18.

We repeated the analysis of fuel consumption per mile for conventional vehicles and found very different results. First, both the slope and the intercept were statistically significant at the 90% confidence level. (The slope was statistically significant at the 95% confidence interval, but the intercept was not.) The value of the intercept was 0.008 and the slope was 0.85. Thus, vehicles with relatively low label values (i.e., 20 mpg) performed well on the road, but conventional vehicles with higher label values (i.e., 35 mpg) showed a significant shortfall.

We then combined the conventional and hybrid data and performed a single regression, including an offset term for hybrids. (We did not evaluate the potential for a different slope for hybrids.) The offset term for hybrids was not statistically significant, indicating that hybrids were not found to perform differently than conventional vehicles during the Kansas City testing. At the same time, this testing did not include cold starts, which is the largest factor negatively affecting hybrid fuel economy relative to conventional vehicles.

Honda stated that EPA summarized the ORNL “Yourmpg” data well. Honda presented two criticisms of EPA’s analysis of this database. EPA found that hybrids had a greater discrepancy between label and onroad fuel economy than conventional vehicles. Honda believed that higher fuel economy vehicles, hybrid or conventional, would have a greater onroad shortfall. Two, EPA grouped all hybrids together in making this general observation. Honda found that this database indicates that not all hybrids show the same higher degree of onroad fuel economy shortfall. In particular, the onroad fuel economy shortfall for the Honda Civic and Insight models were not greater than those for conventional vehicles.

In response to Honda’s first comment on this database, we compared the onroad fuel economy shortfall for conventional vehicles with relatively high fuel economy (i.e., those which had a current combined label value of at least 33 mpg) to those for all conventional vehicles and hybrids. As discussed in more detail in Section II.A.1 of the

Final TSD, we performed this comparison on the expanded Yourmpg database as it existed on August 28, 2006. At this time, it consisted of roughly twice as many entries as it did when NPRM was published, (8180 versus 4092 fuel economy entries). Using the expanded database, we found that the onroad fuel economy shortfall for conventional vehicles, conventional vehicles with current label values of 33 mpg or greater, and hybrids were 1.4%, 2.3%, and 8.2%, respectively. Thus, conventional vehicles with relatively high label values appear to have a higher fuel economy shortfall. However, the increase is very small. Hybrids, on the other hand, showed a much greater shortfall. Therefore, we disagree with Honda that the greater shortfall observed for hybrids is due to their high label values.

With respect to the shortfall observed for individual hybrids, Table 5-8 shows the shortfall observed using the current database.

Table 5-8. Hybrid Fuel Economy in the Yourmpg Database

Vehicle Model	No. of Entries	Onroad Fuel Economy	Current Label Value *	Shortfall
Insight	30	66.0	65.0	2%
Civic	113	46.1	48.9	-6%
Prius	226	47.9	53.8	-11%
Silverado	2	15.2	17.5	-13%
Escape/Mariner	58	29.8	31.9	-6%
Accord	22	30.8	32.3	-4%
Lexus	45	25.1	29.4	-15%

As can be seen, there is a range of shortfalls observed for the individual hybrid models. However, there is also a wide range in the number of entries, so some care needs to be taken in comparing across models. The Insight does show a smaller shortfall than the other hybrids (actually a negative shortfall). However, there are only 30 fuel economy entries for Insights by 10 unique owners. All the other hybrids show a greater shortfall than the high fuel economy, conventional vehicles. The shortfall for the Accord hybrid exceeds that for the high fuel economy, conventional vehicles by only 2%, but with even less entries than the Insight. Finally, the Civic hybrid is on the lower end of the shortfall spectrum with many more entries. However, these 113 are by only 12 owners. The likelihood of significant differences in geographic location, driving styles, etc. for those making entries for each hybrid model is large. Thus, it is unclear whether these differences in shortfall are real or not. Even with all hybrids combined, there is concern that differences in driving style and location could affect the outcome.

AAA found that the US06 fuel economy indicated onroad fuel economy more accurately than the current label values. As previously mentioned, Honda disagreed with this finding and provided some additional regression analyses of the AAA data. We do not believe that the AAA analysis evaluates all the available alternatives for estimating onroad fuel economy. For example, it only examines two options: the current label values and the US06 fuel economy, from a sample size of only 17 vehicles. Still, it indicates the value of considering fuel economy occurring during aggressive and high speed driving in estimating onroad fuel economy. We believe that including both the city and highway portions of the US06 test in the 5-cycle formulae accomplish this task. We have added the new AAA data to our analysis of onroad fuel economy estimates in the Final TSD along with AAA fuel economy estimates developed prior to the NPRM.

Honda presented a number of correlations between the Strategic Vision data and label values based on the current, mpg-based and 5-cycle approaches. Specifically, Honda was able to match 95 vehicle models which were surveyed by Strategic Vision and were also present in EPA's 5-cycle certification database. First, Honda performed a regression of onroad city and highway fuel consumption from the Strategic Vision survey against the label values using the three approaches. All three approaches yielded good and similar correlation coefficients for both city and highway fuel economy. The 5-cycle label values performed best for city fuel economy and the current label values performed best for highway fuel economy. However, in all cases, the results were very similar. As discussed more below, the approximate nature of survey respondents' estimates of onroad fuel economy may prevent a more precise evaluation of the various label approaches.

Second, in their supplemental comments, Honda performed a regression of the inverse of the average fuel economy for each of the 95 models from the Strategic Vision survey versus the fuel consumption over each of the nine dynamometer cycles or bags. Honda used a backward, stepwise regression technique to identify the cycles or bags which were correlated with city or highway fuel economy at a 90% confidence level. The results are summarized in Table 5-9 below.

Table 5-9. Dynamometer Cycles Which Correlate with Strategic Vision Fuel Economy

City Fuel Economy		Highway Fuel Economy	
Significant correlation	Non-significant correlation	Significant correlation	Non-significant correlation
Bag 1, FTP	Bag 2, FTP	Bag 1, FTP	Bag 2, FTP
Bag 1, Cold FTP	Bag 3, FTP	Bag 1, Cold FTP	US06
HFET	US06	HFET	Bag 2, Cold FTP
SC03	Bag 2, Cold FTP	SC03	
	Bag 3, Cold FTP	Bag 3, FTP	
		Bag 3, Cold FTP	

As shown in the table, Honda found that Bag 1 from both the FTP and cold FTP tests, as well as the HFET and SC03 tests correlated with city fuel economy from the Strategic Vision survey values. The remaining five cycles and bags did not show statistically significant correlations once the other four bags and cycles were in the model. For highway fuel economy, the same four cycles and bags showed a statistically significant correlation, plus Bag 3 from both the FTP and cold FTP tests.

Some of these findings appear to be reasonable, while others are surprising. It is reasonable that bags that include a cold start should be good predictors of city fuel economy. The same is true for SC03 and the impact of air conditioning on city fuel economy. However, it is very surprising that the HFET test (basically 45-60 mph cruise-like driving) would be the best predictor of fuel consumption during relatively low speed, start-stop, city driving. Honda expressed the same surprise.

Regarding the regression results for highway driving, it is surprising that the two cold start bags would be important predictors of driving with presumably few cold starts. The inclusion of the two Bag 3's, the HFET and the SC03 tests is more reasonable. The exclusion of US06 is surprising, given the results of the MOVES driving pattern analysis presented in Chapter III.A.2 of the Draft TSD and the prevalence of onroad highway speeds above 60 mph.

The fact that this type of regression analysis produces both expected and unexpected findings is itself not surprising. In fact, such a regression analysis probably should not have been performed, as it violates an important premise of regression analysis. This premise is that the independent variables not be collinear. In this case, fuel consumption values for all of the various dynamometer cycles and bags are strongly correlated amongst themselves. Table 5-10 shows the correlation coefficients (r-squared values) between the fuel economy values over a number of the combinations of the various cycles and bags for the 95 vehicles that Honda used in their regressions.

Table 5-10. Correlation Between Fuel Consumption Values Over Dynamometer Cycles

Cycles	R-Squared Value	Cycles	R-Squared Value
Bag 2 FTP vs. Bag 3 FTP	0.974	Bag 3 FTP vs. HFET	0.971
Bag 2 FTP vs. HFET	0.912	Bag 3 FTP vs. US06	0.958
Bag 2 FTP vs. US06	0.893	Bag 3 FTP vs. SC03	0.945
Bag 2 FTP vs. SC03	0.943	Bag 2 Cold FTP vs. Bag 2 Cold FTP	0.966
Bag 2 FTP vs. Bag 2 Cold FTP	0.973	Bag 3 FTP vs. Bag 3 Cold FTP	0.983
Bag 2 FTP vs. Bag 3 cold FTP	0.953		

As can be seen in Table 5-10, all of the correlation coefficients are 0.89 or higher, indicating a very strong degree of collinearity between the various fuel consumption values. This is not surprising, since large vehicles will have relatively high fuel consumption rates over all the cycles and small vehicles will have relatively low fuel consumption rates over all the cycles. These high correlation coefficients indicate that one simply cannot regress onroad fuel economy estimates against fuel consumption values from dynamometer cycles. There is insufficient independence between the fuel consumption values over the various dynamometer cycles.

A much more sophisticated regression analysis will be necessary to evaluate how various dynamometer fuel economy values predict onroad fuel economy. First, it will be necessary to utilize high quality onroad fuel economy measurements, as opposed to survey responses. As described in Section II.A.3 of the Final TSD, there appears to be a significant bias in the Strategic Vision survey responses towards fuel economy values which are a multiple of 5. This indicates that a number of the survey responders (estimated to be about 13%) were rounding off their estimates to the nearest 5 mpg. This is insufficient detail for the type of regression performed by Honda. Second, it will probably be necessary to incorporate descriptions of the vehicle activity which led to specific onroad fuel economy measurements. The latter would allow the direct evaluation of cycles or bags which are aimed at specific operating conditions, like cold starts at various ambient temperatures and air conditioning. This would also avoid the problems with collinearity present when all the cycles and bags are included in the regression at the same time.

Chapter 6: Testing Provisions

6.1 General Test Procedure Issues

What we proposed:

We proposed the following changes to fuel economy test procedures: 1) collecting the US06 exhaust sample into two bags as opposed to the current one-bag sample; 2) requiring heater/defroster operation during the Cold Federal Test Procedure (FTP) testing (currently optional); 3) requiring Cold FTP testing for diesel vehicles; and 4) codifying requirements for four phase FTP testing of gasoline-electric hybrid vehicles rather than allowing this practice under special test procedures contained in 40 CFR §86.1840-01. As stated in the proposal, these changes were to take effect beginning with the 2008 model year.

What commenters said:

AAM/AIAM expressed general concerns with any changes that:

- "Are required for 2008 model year testing without sufficient lead-time;"
- "Could harm data accuracy and repeatability;"
- "Could impact stringency or misrepresent real-world conditions;" or
- "Could add significant cost and complexity without a value-added benefit."

Our response:

The general concerns expressed by AAM/AIAM apply to the entire set of test procedure changes set forth in the proposal. As such, our responses to specific comments on each individual test procedure change will indirectly address the general concerns and provide more detail. However, as background for the responses to specific comments, the following paragraphs summarize the specific test procedure changes, identify the associated general concerns, and provide a general response.

Upon analysis of AAM/AIAM's comments, we acknowledge the importance of allowing enough lead time to change 2008 model year testing. We are addressing this concern for all specific test procedure changes, except the Hybrid four-phase, four-bag FTP, by extending the applicable effective date until the 2011 model year. We are also finalizing alternative procedures for the 2008 through 2010 model year interim period for manufacturers choosing to use the 5-cycle approach. Therefore, the final rule addresses lead time concerns by providing additional lead time and alternative test procedures for the interim period, as proposed by AAM/AIAM.

AAM/AIAM commented that dividing the US06 exhaust sample into city and highway samples will affect data accuracy and test repeatability, although they did not provide data to support this claim. We performed a ten vehicle study examining the correlation and variability of the one-bag and two-bag US06 exhaust sampling approaches that demonstrated nearly identical fuel economy results and equivalent variability and measurement accuracy of criteria pollutants for the one-bag and two-bag US06.[32] While we continue to believe the two-bag US06 measurement proposed is a valid approach that will not lead to significant differences in emission results, we also believe that the alternative approaches suggested by the auto industry could yield technically valid results. We have therefore revised the proposal and are finalizing the requirements for the two-bag US06 measurement as outlined in Preamble Section IV.

AAM/AIAM commented that operating the heater/defroster device during the Cold FTP test may impact stringency or misrepresent real-world conditions. We proposed test protocols for climate control settings including specifying appropriate fan speed settings, timing of turning on the heater/defroster during the test, and accounting for various vehicle climate control designs (e.g., systems with automatic temperature adjustment). AAM/AIAM opposed some of the specific test protocols, arguing that a driver would not likely maintain the fan at maximum speed during an entire driving trip. AAM/AIAM stated that many electronic systems automatically control fan speed as the vehicle warms up, and further noted that some vehicles can not operate the defroster while the blower is off, which we proposed as a possible test protocol.

We agree with the comments from AAM/AIAM that the protocol could be modified to better simulate how a driver would typically operate the heater/defroster system in the real world, and we acknowledge the design challenges identified.

We disagree with the AAM/AIAM comment that operating the heater/defroster system will impact stringency. As demonstrated in EPA's docketed study (Docket No. EPA-HQ-OAR-2005-0169-0067, SwRI, "Fuel Economy Impacts of Interior Heater/Defroster Usage on Conventional and Hybrid Gasoline-Powered Vehicles" U.S. EPA, Office of Transportation and Air Quality, 2005.), the worst case scenario of activating the heater/defroster immediately upon start of test had an insignificant emission impact. In addition, we are waiting until 2 minutes into the test to turn on the heater/defroster, since, in reality, it is unlikely that passengers would blow cold air at maximum speed when first starting the vehicle. This further reduces any potential emissions impact, since nearly all catalyst systems should have achieved light off temperature at that point.

To address the AAM/AIAM comment that running the heater/defroster system as proposed may misrepresent real-world conditions, we are finalizing test protocol that allows fan speed to be reduced 505 seconds after the start of the test during the idle period between hill 5 and hill 6 of the FTP, which corresponds to the end of bag 1 and the start of bag 2. We are allowing manufacturers having unique climate control systems to use alternate heater/defroster test protocols, under the special test procedures contained in 40 CFR §86.1840-01, with prior agency approval.

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[32] Mitcham, A. & Fernandez, A., "Revising the US06 Test Procedure into a Two Sample Period Test" U.S. EPA, Office of Transportation and Air Quality, 2005. Docket No. EPA-HQ-OAR-2005-0169-0058.

Finally, AAM/AIAM commented that the proposed test procedure changes impose significant additional costs without a value-added benefit. We proposed these changes to ensure that the fuel economy test procedures more closely represent real-world conditions, and we disagree with this comment for the following reasons. First, the proposed changes apply to existing test procedures and do not require new test procedures or alter any of the drive schedules. Second, some modifications specifically for the two-bag US06 exhaust collection, have an initial fixed cost for minor site modifications, if necessary, including dynamometer analyzer software revisions, additional analyzer sampling hardware (i.e., exhaust sample bags, exhaust tubing, etc.), and post-revision validation testing. In response, we have modified the final rule to allow for alternative methods of determining the city/highway ratio using a one-bag US06. Third, we have revised certain test procedure changes in the final rule for the Cold FTP diesel test; as a result, some anticipated hardware changes are no longer necessary. We changed these procedures to enable manufacturers to use the 5-cycle approach without the additional test burden of generating 5-cycle data inputs. Therefore, we believe that the test procedure changes provide sufficient added benefit without additional significant cost.

6.2 Test Requirements for Vehicles Currently Exempt from Certain Emissions Tests

6.2.1 Diesel Vehicles

What we proposed:

Diesel vehicles are not currently subject to Cold CO emission standards and, thus, do not have a 20 degree F FTP fuel economy result to use in the 5-cycle equation. Therefore, beginning with the 2008 model year, we proposed that diesel vehicles must perform a Cold FTP for the purpose of collecting fuel economy data. We proposed the use of a winter grade diesel fuel for such a test.

What commenters said:

AAM/AIAM raised numerous concerns with subjecting diesels to the Cold FTP test in the 2008 to 2010 timeframe, arguing that EPA does not recognize the significant laboratory changes that will be needed. They cite the potential for major laboratory retrofitting, which in some cases might not even be possible with the existing lab configuration. They also remarked that that there are no test protocols developed for new diesel technologies on the horizon. They also noted that the proposed regulations would require Cold FTP testing on all diesel certification vehicles, unlike the gasoline requirements which require testing on a durability group basis. For these reasons, AAM/AIAM recommends that EPA wait until the 2011 model year to require diesels to perform the Cold FTP, giving them more time to address test facility concerns. Although they did not oppose the test fuel proposal beyond lead time issues, they proposed to instead calculate fuel economy based on CO and CO_2 measurements, excluding HC.

Volkswagen, DaimlerChrysler, and Nissan reiterated the concerns expressed by AAM/AIAM. Volkswagen noted that their preliminary testing indicates the possible presence of some issues with diesels that are not yet fully understood, thus arguing for additional lead time. Nissan stated specific technical issues that they could not likely overcome before the 2010 model year. DaimlerChrysler supported the notion that fuel economy values should reflect cold testing, but reiterated AAM/AIAM's lead time concerns, suggesting that Cold FTP testing for diesels be optional in the 2008 – 2010 model years.

Our response:

We agree that significant laboratory changes are necessary for Cold FTP diesel testing, since diesel vehicles are not currently subject to FTP testing at 20 degree F. Therefore, we are revising the proposed provisions for Cold FTP diesel testing as detailed in the paragraphs below.

First, we are not requiring the measurement of particulate matter (PM) during the Cold FTP diesel test, since PM is not part of the fuel economy calculation, and thus has no impact on fuel economy. This eliminates the need for a PM diesel tunnel, an extensive change that would have been required under the proposal.

Second, we are delaying the requirement for Cold FTP diesel testing to allow manufacturers additional lead time to address facility concerns. For manufacturers that choose to use the 5-cycle approach during the 2008 – 2010 model years, we are requiring diesel Cold FTP testing, but fuel economy may be reported based on CO and CO_2 measurements only. We are not requiring the measurement of hydrocarbons (HC) during the Cold FTP diesel test during the 2008-2010 model years, because according to current HC data, excluding HC from the fuel economy calculation has a negligible impact (i.e., less than 0.1%) on diesel fuel economy reporting. This also provides additional lead time for manufacturers to make laboratory upgrades such as a heated flame ionization detector (FID), heated sample lines and additional, external drying capacity for diesel HC measurement.

Third, in the 2011 model year, we are requiring manufacturers to conduct and report results from the Cold FTP diesel testing, including HC measurements. Because diesel emission control technology is evolving rapidly, we believe that HC contribution will warrant future measurement and inclusion in the fuel economy calculation. This should provide sufficient lead time for any laboratory changes for cold temperature capability and specific HC measurement equipment.

Finally, any Cold FTP diesel testing performed for optional 5-cycle testing during model years 2008-2010 and/or for 2011 beyond must use the winter grade fuel specification discussed in the proposal and finalized in this rulemaking.

6.2.2 Alternative-Fueled Vehicles

What we proposed:

Flexible-fuel vehicles (FFVs) are subject to the Supplemental Federal Test Procedure (SFTP; which includes the US06 and SC03 tests) and Cold Carbon Monoxide (CO) emission standards and test requirements, but only when operating on gasoline. Thus, we proposed that the fuel economy label values of FFVs when operating on gasoline be determined using the same mpg-based or 5-cycle approaches applicable to gasoline vehicles and thus additional testing for US06, SC03 and Cold FTP while operating on the alternative fuel would not be required. We also proposed a methodology for how manufacturers of FFVs are to determine and report fuel economy label values, when a FFV is operated on the alternative fuel.

What commenters said:

We did not receive any comments on this proposal.

Our response:

Since we did not receive comments on this proposal, we are finalizing it as proposed.

6.3 Modifications to Existing Test Procedures

6.3.1 Revisions to US06 Bag Measurements

What we proposed:

The US06 driving schedule contains elements of both city and highway driving, yet the exhaust sample is collected in only one sample, or "bag." For an emissions test, the one-bag sample is appropriate, since emissions are summed over the entire test to determine compliance. However, the ideal methodology for fuel economy would be to reflect the city portion in the city miles per gallon (mpg) estimate and the highway portion in the highway mpg estimate. Consequently, we proposed a test protocol that would collect the US06 exhaust sample into two-bags. We conducted a test program that demonstrated that two-bag collection is technically feasible, requiring only some software reprogramming and minimal hardware reconfiguration. We also demonstrated that a split-phase sampling period does not significantly alter the criteria pollutant emission results.

What commenters said:

AAM/AIAM generally disagreed with EPA's assessment that the costs of collecting US06 exhaust emissions would be minimal, characterizing the test procedure change as "substantial," yet they did not provide data to support this comment. Toyota, Nissan, Mitsubishi, and DaimlerChrysler agreed.

AAM/AIAM expressed concern with the accuracy and variability of the test when split into two phases. They recommended that EPA not adopt the two-bag US06, but instead allow the use of ratio factors (i.e., ratio of the US06 city portion/whole US06 test and the US06 Highway portion/whole US06 test) or alternative methods to estimate the city and highway fuel consumption from a traditional single-bag US06. This approach, they argue, would result in substantially similar results at truly minimal cost. Toyota, Nissan, Mitsubishi, and DaimlerChrysler independently expressed a preference for ratio factors. They proposed the following:

- For conventional gasoline vehicles: Use ratio factors of 0.68 for the city fuel economy and 1.16 for the highway fuel economy, which were used to derive the mpg-based formulae.
- For hybrid vehicles: Use 0.68 and 1.16 ratio factors for 2008 through 2010 model years, and gather data to evaluate whether continued use of these factors is appropriate for hybrids.
- For diesels: Confirm the 0.68 and 1.16 ratio factors after compiling 2007 and 2008 test data.
- For all vehicles: Allow manufacturers to propose alternative ratio methods for EPA approval (e.g., fuel injector fuel economy data, model CO_2 data).

Toyota suggested that hybrid manufacturers submit data, and if it resembles that of conventional gasoline vehicles, then those factors can be used. If hybrids are seen to be substantially different, Toyota suggests that EPA allow each manufacturer to use their own factors based on data and good engineering judgment.

AAM/AIAM commented that separating the two-phase bag software from the one-phase PM sample collection system for diesels requires significant software changes, cost, and lead-time. They also noted that diesel testing will be complicated by the need to align integrated real-time collection of total hydrocarbon (THC) data for fuel economy calculations with bag collection of methane (CH_4) for emissions compliance. Nissan and DaimlerChrysler reiterated these diesel issues.

DaimlerChrysler also noted that this provision as proposed in 40 CFR Part 86 would impact all US06 testing, including certification and IUVP testing, and would result in additional unnecessary expense. They suggested that the two-phase US06 provision, if adopted, should be written into Part 60 to ensure that the context is limited to fuel economy testing.

Our response:

We disagree with the comments from AAM/AIAM, Toyota, Nissan, Mitsubishi, and DaimlerChrysler that the test procedure changes and the costs of collecting US06 exhaust emissions in two-bags are “substantial.” The changes necessary to enable two-bag US06 testing involve an initial, one-time, fixed cost software revision and, in some cases, an additional sample bag, sample line and analyzer plumbing for collection of US06 emissions in a second bag.

We also disagree with the comment from AAM/AIAM that splitting the US06 exhaust into two bags decreases accuracy and increases variability. As mentioned above, EPA performed a ten vehicle study to examine the correlation and variability of the one-bag and two-bag US06 exhaust sampling approach (Docket No. EPA-HQ-OAR-2005-0169-0058, Mitcham, A. & Fernandez, A., “Revising the US06 Test Procedure into a Two Sample Period Test” U.S. EPA, Office of Transportation and Air Quality, 2005.) which demonstrated low variability, nearly identical fuel economy results, and equivalent variability and measurement accuracy of criteria pollutants for the one-bag and two-bag US06. AAM/AIAM neither addressed the results of this study nor submitted additional data to refute the results of this study.

Regarding the suggestion from AAM/AIAM, Toyota, Nissan, Mitsubishi, and DaimlerChrysler to use alternate ratio factors, the ratio factors in the proposal were used for our 5-cycle assumptions based on the data available at the time. These ratio factors are clearly inappropriate for hybrid vehicles and other advanced technology vehicles (i.e., vehicles with cylinder deactivation, engine idle shut off operation, etc.).

Although we disagree with the comments that the cost and procedure changes are “substantial,” we recognize that these changes take time to implement. We also agree with the industry concern about accurately timing the real-time PM collection for emissions compliance with the bag collection of hydrocarbons for fuel economy information in the US06 test for diesels. Because manufactures may need additional lead time for gasoline vehicles and because two-bag diesel fuel economy testing is more complicated, we are revising the provisions for the applicable model years for the two-bag US06 from the proposal. We are not requiring the two-bag US06 for model years 2008 through 2010. However, for manufacturers choosing to use the 5-cycle approach for model years 2008 through 2010, the two-bag US06 must be conducted or data otherwise supplied in two-bag US06 format (as described further below). Therefore, for model year 2011 and beyond, we are requiring a city/highway US06 calculation for use in the 5-cycle approach.

In addition, as suggested by the Alliance and AIAM, we are allowing the use of additional methods for measuring and/or determining a two-bag US06 fuel economy in lieu of conducting an actual two-bag US06 test. Some suggested methods include: 1) conducting a one-bag US06 and using emissions analyzer modal data to determine the appropriate ratio of city and highway operation; or 2) conducting a one-bag US06 and using On-Board Diagnostic (OBD) fuel rate (e.g., grams of fuel per second) data to determine the appropriate ratio of city and highway operation over the one-bag US06. Additionally, the manufacturers may use other methods based on good engineering judgment, with EPA review and approval, as long as these methods achieve equivalent or more technically valid results, based on manufacturer submitted data. These additional options for deriving or measuring the city/highway US06 fuel economy are allowed for manufacturers optionally using the 5-cycle approach in model years 2008 through 2010, and for all manufacturers in model year 2011 and beyond, when the 5-cycle approach is required.

In the case when manufacturers conduct one-bag US06 tests and use modal emissions and onboard diagnostic (OBD) fuel rate data, the ratio of city and highway operation over the one-bag US06 is applied to the CO, CO2 and HC results in order to determine the city and highway US06 fuel economy values, constituting a "virtual" two-bag US06. However, this option only applies for determining the city and highway US06 fuel economy and, thus, is not applicable for determining US06 emissions. This option should also address the concerns of one-phase PM sample collection systems, integrated real-time total hydrocarbon data collection for fuel economy calculations, and the timing of CH_4 bag measurements for diesels since a one-bag US06 can still be used.

We disagree with the comments from Daimler-Chrysler that writing this provision as proposed in 40 CFR Part 86 would impact all US06 testing, including certification and IUVP testing, resulting in additional and unnecessary expense. We proposed using existing test procedures for emissions testing in order to minimize test burden and any unnecessary expenses. Writing the requirements for a two-bag US06 test into Part 600 for fuel economy purposes would require manufacturers to conduct a one-bag US06 for emissions purposes and an additional, two-bag US06 for fuel economy purposes, adding additional, unnecessary testing and expenses, and duplicating effort. We are writing the final regulation such that 40 CFR part 86 will contain both 1-bag or 2-bag US06 as an option. Part 600 will require that manufacturers determine the US06 City/Highway ratios based on one of several methods, with 2-bag US06 results as one of these options.

6.3.2 Heater/Defroster Use During the Cold FTP

What we proposed:

The current Cold FTP test conducted at 20 degrees F provides the option to use the header and/or defroster. Some manufacturers routinely use this option to heat the vehicle cabin, others do not. In order to more closely reflect real-world operation, and to ensure a level playing field across manufacturers and vehicle lines when performing this test, we requested comment on whether we should require operation of the heater/defroster during this test. We suggested a test protocol for doing so, but we also noted that there are many possible approaches. We proposed to set the heat level to high and direct the airflow to the windshield for defrost. After two minutes the fan speed would be turned to high and left there for the duration of the test. Automatic climate control systems would be set to defrost mode and to a temperature of 72 degrees F.

What commenters said:

AAM/AIAM proposed that EPA defer consideration of this concept until we have a better understanding of real-world operation and of the potential impact on the stringency of existing and upcoming emission standards (e.g., Mobile Source Air Toxics).[33] They argued that a driver would not likely maintain a maximum fan speed for 43 minutes (the effective length of the test given the emission weighting equation), and that this worst-case scenario surpasses EPA's intent to reflect real-world conditions. AAM/AIAM also noted that many electronic systems automatically reduce fan speed as the vehicle warms up, and that some vehicles can not operate the defroster without the blower, as we proposed in the first two minutes of the test. They suggested that we allow manufacturers choosing the 5-cycle approach in the 2008 – 2010 model years to use the heater/defroster for testing of fuel economy data vehicles "per manufacturer procedure using good engineering judgment and with consideration of expected typical real-world operating patterns."

DaimlerChrysler, Mitsubishi, and Nissan independently reiterated these comments and recommended that EPA reevaluate how well the concept represents real-world behavior. Mitsubishi noted that their test data indicates a far smaller impact on fuel economy due to defroster/heater operation than EPA estimates in the proposal, but did not provide data to support this claim. Toyota also called for more data and a better understanding of the fuel economy and emission impacts of heater/defroster operation, and suggested along with DaimlerChrysler that changes to the cold test method should be reevaluated in the context of the proposed Mobile Source Air Toxics regulations.

Bluewater Network, UCS, NYDEC, Montana-CHEER, and Public Citizen support using the heater/defroster during the Cold FTP test. Some suggested that the protocol could be improved with additional data and study of real-world driving conditions. UCS suggested that EPA develop a standardized methodology based on realistic usage patterns. Public Citizen highlighted that without a heater/defroster requirement, manufacturers who choose to use more realistic test conditions may be penalized relative to those who do not.

Our response:

The purpose of requiring heater or defroster use during the Cold FTP is to more closely reflect real-world operation, and to ensure a level playing field across manufacturers and vehicle lines when performing this test. Based on the comments we received, we are finalizing the requirement for mandatory heater/defroster operation during the Cold FTP. We are revising the approach outlined in the NPRM to reflect

[33] See regulation in 40 CFR §86.1811-10(g) (March 29, 2006).

more closely real-world operation, and by accommodating various climate control systems and addressing issues of lead time with respect to applicable model years for mandatory heater/defroster operation during the Cold FTP.

First, we agree with the AAM/AIAM comment that a driver will not likely maintain a maximum fan speed for 43 minutes since in reality the vehicle interior would reach a comfortable temperature for occupants and the fan speed would manually or automatically be reduced to a lower setting. Therefore, for manual climate control systems, the final regulations will require that the fan speed setting be reduced to the lowest possible to maintain air flow at approximately 505 seconds after the start of the test during the idle period between "hill" 5 and "hill" 6 of the FTP (the point that corresponds to the end of bag 1 and the start of bag 2), and the temperature setting will remain at the hottest setting. These settings will be held for the remainder of the test, including the final bag following the 10 minute soak period. For automatic climate control systems, the selector will be set to heater or defroster mode and to a temperature of 72 degrees F for the duration of the test. We are finalizing all other aspects of heater/defroster operation as outlined in the proposal.

For vehicles with multiple zone climate control systems, the same fan and temperature settings should be maintained throughout the zones for both manual and automatic interior climate control systems. This and other unique designs may require special, alternative protocols/procedures during the Cold FTP. Therefore, with prior agency approval, manufacturers may request and use alternative heater/defroster test protocols/procedures if they have a unique climate control system.

Finally, we are revising the applicable model year for implementation of mandatory heater/defroster operation during the Cold FTP from model year 2008 to model year 2011. This will allow manufacturers time to fully assess any impacts related to the Mobile Source Air Toxic (MSAT) cold volatile organic compound (VOC) proposed standards, which would also be determined based on the Cold FTP test. However, if manufacturers choose to perform 5-cycle testing between the 2008 through 2010 model year, they must follow the heater/defroster protocols/procedures set forth in this regulation.

6.3.3 4-Phase, 4-Bag FTP for Gasoline-Electric Hybrid Vehicles

What we proposed:

The FTP consists of two parts, referred to in the regulations as the "cold start" test and the "hot start" test. Each of these parts is divided into two periods, or "phases": a "transient" phase and a "stabilized" phase. For conventional vehicles, the stabilized phase of the hot start test has been assumed to be identical to the stabilized phase of the cold start test, allowing the test to be shortened by not running the hot start stabilized phase. However, because gasoline-electric hybrid vehicles have two energy sources that can be combined in many ways, EPA and manufacturers recognized that the assumption regarding the equivalence of the stabilized phases of the hot and cold start tests may be invalid for hybrid vehicles. Consequently, we have historically required vehicles with gasoline-electric hybrid systems to perform the complete set of four phases of the FTP under existing provisions referenced in the regulations (40 CFR §86.1840-01) for special test procedures. Rather than continue this practice, we proposed to develop explicit regulatory language to require full-four phase testing of hybrid-electric vehicles. We proposed to require that hybrid vehicles conduct all four phases of the FTP for both emissions and fuel economy testing, including the Cold FTP.

What commenters said:

AAM/AIAM cited 40 CFR 86.1811-04(n), which aligns with California, as already requiring two full Urban Dynamometer Driving Schedules (UDDSs) for hybrid vehicles and allowing the emissions to be collected in two-bags (one per UDDS). AAM/AIAM supported extending the two-UDDS requirement to hybrid vehicles conducting the Cold FTP. While they agreed that we should require all four phases of the FTP, they disagreed with our proposal requiring that emissions be collected in four bags. They suggested that we allow manufacturers the option to use four sample bags, because requiring this methodology would force lead-time issues and costly facility modifications. They also noted that the four-phase two-bag approach improves accuracy and alignment with California. They proposed the following:

- Retaining section 86.1811-04(n) as-is;
- Consider a new section 86.1811-11(n) that would delay these requirements for the Cold FTP test;
- Define both two-Bag FTP and four-Bag FTP in Part 600.002
- Add 5-cycle fuel economy equations that clarify the application for both two-bag and four-bag testing;
- Weight the bag fuel consumption elements of the 5-cycle equations by theoretical distance traveled to ensure consistent label adjustments between two- and four-bag data.

Nissan noted that in order to implement a 4-bag FTP, they would need new hardware, software, and test equipment, thus making the 2008 model year difficult to achieve. They also expressed concern that a 4-bag requirement might not be consistent with California, and that auto companies may need to support two test equipment regimes.

Our response:

There are two distinct but related protocols for FTP testing of hybrid-electric vehicles: 1) the driving schedule, which requires performance of the FTP over four phases (i.e., two consecutive Urban Dynamometer Driving Schedule or UDDS cycles) versus the three phase FTP for conventional vehicles (i.e., one UDDS and repeat of only the first 505 seconds (Hot 505) of the UDDS with the emissions from last 864 seconds of the UDDS assumed to be same as in the first UDDS), and 2) the measurement of emissions during the four phase FTP by either collecting emissions in 2-bags, combining emissions from the first two and last two phases, or collecting emission in 4-bags by measuring emissions during each of the four phases. We proposed provisions for both protocols and we will address them beginning with the four-phase FTP and then the 4-bag versus 2-bag FTP.

The AAM/AIAM commented that 40 CFR 86.1811-04(n), which aligns with California, already requires two full UDDSs for hybrid vehicles. Regulatory language contained in 40 CFR §86.1811-04(n) refers to and incorporates by reference the California procedure entitled “California Exhaust Emission Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes” (August 5, 1999). In the California procedure, section 6.2 describes the dynamometer procedures for hybrid electric vehicle emission testing and states: “…The dynamometer run consists of two tests, a “cold” start test…and a “hot” start test…” by conducting two consecutive UDDS cycles. Before this statement, the introductory paragraph for this section also states that “Alternative procedures may be used if shown to yield equivalent results.” In addition, EPA proposed that hybrid electric vehicles undergo a full four-phase FTP under the special test provisions in 40 CFR §86.1840-01.

In the proposal, we intended to develop explicit regulatory language that would require manufactures to use a full four-phase FTP test for hybrid-electric vehicles instead of continuing to reference the special test procedure provisions in 40 CFR §86.1840-01. However, upon further review, we agree with AAM/AIAM that 40 CFR §86.1811-04(n), which references the CARB procedure requiring the full four-phase FTP for hybrid-electric vehicles, adequately covers the requirement for a full four-phase FTP. Therefore, we will retain §86.1811-04(n) as written, which addresses the comments from AAM/AIAM and Nissan and no longer need to develop further explicit regulatory language requiring a full four-phase FTP for hybrid-electric vehicles.

EPA currently collects the emissions in four bags corresponding to the following four phases: cold transient emissions collected in bag 1 (505 seconds), cold stabilized emissions collected in bag 2 (864 seconds), hot transient emissions collected in bag 3 (505 seconds or a Hot 505), and hot stabilized emissions collected in bag 4 (864 seconds. For conventional vehicles, bag 4 is not repeated since we assume that the emissions are the same as in the cold stabilized phase). Accordingly, our test procedures are aligned with CARB for hybrid-electric vehicles, contrary to the comments from Nissan, since both tests require the full four phases, or two consecutive UDDS cycles. Therefore, the only difference between a four-phase, 2-bag FTP (where bag 1+bag 2 = bag A and bag 3+bag 4 = bag B) and a four-phase, 4-bag FTP is the emissions sample collection method and the analysis of the test results.

The AAM/AIAM commented that it supports extending the use of a four-phase FTP to hybrid vehicles conducting the Cold FTP. However, after further consideration, we are not going to extend the requirement for four-phase FTP testing of hybrid vehicles to the Cold FTP as originally stated in the proposal. The lower temperature (20º F) for the Cold FTP versus the typical temperature (75º F) for the FTP could impact the hot stabilized phase (i.e., bag 4) fuel economy for the Cold FTP in that the vehicle may not truly be “hot” or “stabilized” during the normally substituted cold stabilized phase (i.e., bag 2) of a 3 bag test. This is the case for both conventional and hybrid vehicles and therefore retaining the current Cold FTP 3 bag test procedures maintains a level playing field between conventional and hybrid vehicles when calculating running fuel consumption at 20º F. Further, the comments cited that requiring four bags would force facility modifications with significant costs and lead time issues. We feel that is particularly relevant in the case of 20º F Cold FTP test facilities which have been strictly designed around the 3-bag FTP test procedures. Therefore, for hybrid-electric vehicles, the Cold FTP will continue to omit the fourth phase of the FTP emission test and collect the emissions for the remaining three phases (i.e., 3-bag FTP), as currently required.

AAM/AIAM disagreed with our proposal requiring that emissions be collected in four bags, stating that the four-bag approach would require costly facility modifications and lead-time issues. Accordingly, AAM/AIAM suggested that a 4-bag FTP be optional, indicating that a 2-bag FTP increases accuracy and alignment with CARB. We recognize that some manufacturers and CARB may require new hardware, software, and test equipment to implement a 4-bag test. Since our test procedures are aligned with CARB requiring full four phase FTP testing for hybrid-electric vehicles, this is an issue of how to divide and analyze the emissions results. Therefore, we agree with the AAM/AIAM suggestion to optionally allow a 4-bag FTP. As a result, we will accept both four-phase, 2-bag FTP results and four-phase, 4-bag FTP results. Accordingly, we will develop an optional 2-bag 5-cycle fuel economy formula/equation that will use appropriate 5-cycle, bag fuel consumption weightings based on theoretical distance traveled to ensure consistent label adjustments for two-bag and four-bag FTP testing, as suggested by AAM/AIAM.

We disagree with the AAM/AIAM recommendation to consider a new section in 40 CFR §86.1811-11(n) that would delay the requirement for the four-phase, 4-bag Cold FTP test and define both the two-bag FTP and four-bag FTP in 40 CFR §600.002. First, the 3-bag FTP is currently required and used for Cold FTP testing of hybrid-electric vehicles, and thus it is unnecessary to create a new section in 40 CFR §86.1811-11(n) to delay the four-phase, 4-bag Cold FTP. Second, the FTP definition in Subpart A – “Fuel Economy Regulations for 1977 and Later Automobiles – General Provisions” 40 CFR §600.002-85(a)(7) references “procedures described in part 86,” including 40 CFR §86.1811-04(n), which references the California procedure and describes the four-phase, 2-bag FTP. Therefore, we also do not believe it is necessary to further define the 2-bag and 4-bag FTP in 40 CFR §600.002, since they are completely described in the referenced part 86 provisions.

6.4 Test Fuels

What we proposed:

With the exception of specifying a fuel to be used for Cold FTP testing of diesel vehicles, we did not propose changes to the fuels used for current emission or fuel economy tests. However, in the proposed rule's discussion of the Energy Policy Act of 2005, we interpreted the statute's reference to "current reference fuels" to mean the laboratory fuels used to perform the fuel economy tests. We understood the underlying concern of Congress to be the possibility that the high-quality lab fuels would give higher fuel economy results that the typical fuel used by consumers. The test fuel specifications are detailed in the emission compliance regulations. The test fuel is roughly equivalent to premium, high-octane fuel available at the pump.

What commenters said:

The NYDEC disagreed with the use of premium, high-octane fuel, and suggested that actual in-use fuels provide fuel economy estimates closer to what consumers would actually experience in real world conditions.

Our response:

We disagree with the comments from NYDEC regarding the use of in-use fuels. The test fuel used for emissions certification and fuel economy testing is required to have specific and repeatable characteristics to ensure consistency in test results. While certification fuel is roughly equivalent to premium, high octane fuel available to consumers, EPA has previously established requirements for emissions and fuel economy testing that ensure that the octane level of certification fuels does not influence emissions or fuel economy test results.

Under the provisions of 40 CFR §86.090-27, EPA requires manufacturers to show prior to certification that knock sensor equipped vehicles, which could take advantage of elevated octane levels, could operate on 91 research octane number (RON) (equivalent to commercially available 87 octane fuel) without affecting emissions or fuel economy. Manufacturers are required to perform testing on both 95 RON (equivalent to commercially available 93 octane fuel) and 91 RON, compare the data for 91 versus 95 RON, and are not allowed to have more than a 3% difference between the emissions and fuel economy results. These procedures were streamlined in 1997, as detailed in the manufacturer guidance document "VPCD-97-01" available on the EPA website (http://epa.gov/otaq/cert/dearmfr/vpcd9701.pdf) and still apply today. Therefore, this provides some measure of confidence that premium, high-octane fuels do not impact fuel economy results. Additionally, under our Compliance Assurance Program 2000 (CAP 2000), the manufacturers are required to conduct In-Use Verification Program (IUVP) FTP, highway, and US06 testing on in-use vehicles at 10,000 and 50,000 miles as-received with the in-use fuel in the fuel tank (40 CFR §86.1845-04). Therefore, in the future, any indications of advantages resulting from testing on high octane, premium fuels may be detected in the IUVP fuel economy data results.

6.5 Hybrid-Electric Vehicle Battery State of Charge

What we proposed:

EPA did not propose anything specific regarding the measurement of battery state of charge (SOC) and fuel economy. However, the manufacturers raised a related issue.

What commenters said:

AAM/AIAM expressed concern with the criteria used at EPA's laboratory for confirmatory testing of hybrid-electric vehicles, because it imposes a maximum absolute state of charge (SOC) deviation equivalent to 1% of the battery's rated capacity. This is inconsistent with the criteria outlined in the Code of Federal Regulations (CFR) and in California regulations, which include a maximum absolute SOC deviation criterion equivalent to 1% of fuel energy consumed. They also stated that the regulations do not provide flexibility to correct fuel economy when the SOC criterion is exceeded, thus leading to possibly unnecessary additional testing. They recommended that EPA immediately align laboratory practice with the SOC criterion in the CFR, and that the regulations include flexibility to either void tests under certain criteria or validate data by applying SOC corrections approved by EPA to the fuel economy data. They noted that a modified version of the draft SAE J2572 procedure might be useful for determining SOC corrections.

Toyota commented that it did not support EPA's proposal to apply SOC criteria to each bag. Instead, they suggested that EPA provide an option to correct fuel economy results based on battery charge/discharge when the balance exceeds 1 percent.

Our response:

EPA did not propose any regulatory changes to the measurement of battery state of charge (SOC). The comments regarding EPA laboratory practices are tangential to this rulemaking effort.

Thus far, all hybrid-electric vehicles tested at EPA's National Vehicle and Fuel Emissions Laboratory (NVFEL) have passed compliance using the battery SOC limits of +/- 1% [34] and the current practice of measuring the battery SOC over the entire

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[34] Society of Automotive Engineers (SAE) Standard J1711 – "Recommended Practice for Measuring the Exhaust Emissions and Fuel Economy of Hybrid-Electric Vehicles," March 1, 1999 and SAE J2711 – "Recommended Practice for Measuring Fuel Economy and Emissions of Hybrid-Electric and Conventional Heavy-Duty Vehicles," September 1, 2002.

procedure for battery SOC neutrality/equilibrium. In addition, if the SOC neutrality/equilibrium exceeds the initial SOC by +1%, the maximum allowed SOC deviation criterion, the manufacturers are afforded the opportunity for a re-test, at their discretion.

Regarding comments from the AAM/AIAM and Toyota regarding flexibility to correct fuel economy results based on battery charge/discharge when the balance exceeds 1 percent. We would be willing to evaluate such a proposal to allow data validation by applying battery SOC corrections to fuel economy results, in addition to the existing provision for a discretionary re-test. We believe the following considerations would be important: 1) statistical criteria (e.g., 95% confidence intervals, statistical f- and t-test, etc.) must be defined and applied to the correction factors, 2) contiguous data points for plotting the change in charge for the rechargeable energy storage system (RESS) versus fuel consumption. EPA would reserve the right to request and review the underlying data points and other information used to develop the RESS change in charge versus fuel consumption plot. Further, EPA has been and plans to continue participating in the development of SAE practices, specifically SAE J2572[35] as mentioned by the commenters, and any other committees related to hybrid-electric vehicle practices.

[35] SAE Standard J2572 - "Recommended Practice for Measuring Fuel Consumption and Range of Fuel Cell and Hybrid Fuel Cell Vehicles Powered by Compressed Gaseous Hydrogen," August 1, 2006.

Chapter 7: Cost Analysis

7.1 Testing Burden

7.1.1 Testing Burden for Small Manufacturers

What we proposed:

Testing Burden includes an estimate of the number of new tests required by the rule, and a cost per test in terms of labor and operations and maintenance costs. The added costs of new facilities to conduct the tests are considered separately as capital costs, and one-time startup costs are considered separately as startup capital costs.

The proposal did not include any specific provisions that were designed to lessen the compliance burden for small manufacturers. We did propose and finalize many features designed to provide adequate lead time and to minimize testing burdens that apply to both large-volume and small-volume manufacturers.

What commenters said:

Mitsubishi commented that EPA should recognize that there may be a disproportionate testing burden for some manufacturers. Ferrari asked that EPA recognize the unique position of small-volume manufacturers, noting that they are especially concerned regarding the potential number of new tests they will be required to perform.

Our response:

EPA has a number of provisions in its existing certification regulations that reduce the burden of Clean Air Act compliance for small-volume manufacturers. For example, special durability demonstration and in-use vehicle program testing requirements apply under 40 CFR, Subpart S. Similarly, small manufacturers are eligible to apply for reduced certification fees. It is true, however, that in general existing emissions and fuel economy requirements are governed by environmental and compliance considerations that do not vary as a function of manufacturer size, including city and highway emissions and fuel economy testing for certification. This approach is carried through in this rule. However, we are finalizing a number of provisions designed to reduce test burdens that apply to large-volume and small-volume manufacturers. During the Model Year 2008 to 2010 transition period, manufacturers have an alternative to additional testing: they may opt to use the mpg-based fuel economy calculation. Second, in MY 2011 and beyond, only those vehicles falling below the mpg-based tolerance bands must undergo full 5-cycle testing. Third, where applicable we allow fuel economy data to be determined based on analytically derived fuel economy (ADFE) calculations.

7.1.2 2008 – 2010 Model Year Testing Costs: Testing Issues

What we proposed:

The proposal set forth specific test procedure changes as follows: 1) collection of the US06 exhaust sample into two bags as opposed to the current one-bag sample; 2) required heater/defroster operation during the Cold FTP testing as opposed to current optional operation; 3) requiring Cold FTP testing for diesel vehicles, which is currently not required; and 4) codifying requirements for four-phase, four-bag FTP testing of gasoline-electric hybrid vehicles rather than allowing this practice under special test procedures contained in 40 CFR §86.1840-01. As stated in the proposal, all of these changes were to take effect beginning with the 2008 model year, which, for a particular test group, could be as early as January 2, 2007.

What commenters said:

AAM/AIAM and several manufacturers disagreed with the assessment in the NPRM that test volume and test facility costs for the 2008 through 2010 time period will be zero. They suggest that this assumption did not take into account the cost associated with performing the proposed Cold FTP on diesel vehicles or performing the two-bag US06 tests on all applicable vehicles. They believe that major test cell modifications or new facilities will be required to perform Cold FTP tests on diesel powered vehicles, noting that from their perspective the requirement to perform Cold FTP tests is particularly onerous as this test data is not required for the calculation of fuel economy label values until the 2011 model year. Concerns were also expressed about the difficulty of compliance with the heater/defroster provisions during the transition period, and with the four-bag FTP testing requirement both as a matter of adequate lead time and as potentially requiring costly facility modifications, especially if EPA requirements were inconsistent with California's. Lead time concerns were also expressed by NADA.

Our response:

These issues are addressed in detail in Section 6 of the Response to Comments. The cost implications of these issues and their resolutions are highlighted here.

The final regulations clarify that the cold FTP diesel testing requirement only begins with model year 2011 (except for those vehicles for which manufacturers choose to voluntarily use the 5-cycle method). Consequently, the final rule continues to anticipate no test burden or facility costs during the transition period attributable to this cost item.

As discussed in detail in Section 6, EPA has offered alternative methods for calculating two-bag US06 data. These alternatives are available during the transition period for those manufacturers choosing to use the 5-cycle approach, and we feel this largely addresses the concerns regarding lead time. EPA's evaluation indicates that the hardware changes to perform two-bag collection would be minimal and that the three-model year lead time is adequate to implement them. Information system reprogramming as well as validation tests were already included as startup costs in the proposal, and these have been retained.

We are finalizing a provision to require the mandatory use of heater/defroster, but have extended the effective date until MY 2011 (except for those vehicles for which manufacturers choose to apply the 5-cycle method). We believe this addresses any cost concerns regarding this provision.

As discussed in detail in Section 6, for the model year 2008 four-phase FTP testing for hybrids, we will allow consistency with California. We believe these modifications of the proposal adequately address the lead-time and facility modification cost issues, and consequently no cost has been added to the final cost analysis for this item.

7.1.3 2011 and Later Model Year Testing Costs: Inclusion of MDPVs

What we proposed:

As discussed in Section 4 of the Response to Comments, EPA sought comment on a voluntary labeling program for vehicles above 8500 pounds gross vehicle weight rating (GVWR), and how such a program might be implemented.

What commenters said:

Environmental groups supported the proposal, and Public Citizen argued that EPA has the authority to make the requirement mandatory. AAM/AIAM suggested that labeling of these heavier vehicles will not produce information that is comparable to the labels on light duty vehicles, and may in fact create more confusion and misunderstanding than additional value in the marketplace.

Our response:

As discussed in Section 4, we are finalizing in this rule a fuel economy labeling program for MDPVs beginning in model year 2011. Testing will be limited to the FTP and HFET tests. This is congruent with regulations finalized by NHTSA's expansion of the CAFE program to include MDPVs beginning the same model year. The testing required under the CAFE and fuel economy labeling programs are overlapping, but not identical; in general, more vehicles must be tested for CAFE, and therefore we do not expect that inclusion of MDPVs in the labeling program will require additional testing.

MDPVs are already subject to FTP emissions standards, and may also conduct the HFET due to California requirements. NHTSA assessed the additional cost burden of testing MDPVs in its light-truck CAFE rule (see Final Regulatory Impact Analysis, page VII-19).[36]

7.2 Facilities Costs

7.2.1 Facility Upgrades for Cold FTP Testing

What we proposed:

The proposal did not consider any facility costs for cold diesel testing as distinct from the capitalized cost of facility capacity to conduct additional Cold FTP tests for all vehicles covered, including diesel vehicles. The calculation used as a baseline the number of city/highway fuel economy tests conducted according to EPA's database for model year 2004. No allowances were made for potential increases in the fleet size in future years.

What commenters said:

AAM/AIAM along with Volkswagen, Nissan, and Daimler Chrysler, believe that major test cell modifications or new facilities will be required to perform Cold FTP tests on diesel powered vehicles, noting that from their perspective the requirement to perform Cold FTP tests is particularly onerous as this test data is not required for the calculation of fuel economy label values until the 2011 model year. As mentioned above, they further note that the proposed two-bag US06 test would require significant cost to change both sample system hardware and software. They do not have specific estimates of the costs associated with these changes, but they note that the costs "are likely to be substantial."

Our response:

EPA agrees that there may be some facility upgrades needed for some manufacturers conducting cold FTP testing on diesel vehicles for model year 2011 and later. Based on cost estimates developed by EPA's testing facilities in Ann Arbor, Michigan, EPA has added a capital cost item corresponding to $55,000 for each of ten cold testing facilities to conduct diesel hydrocarbon testing, including FIDs (flame ionization detectors) as well as heated sample probes, sample lines and sample filters. The number of cold FTP tests to be performed has also been increased to reflect the possibility of growth in the diesel fleet between the MY 2004 dataset that was the

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[36] Final Regulatory Impact Analysis: Corporate Average Fuel Economy And CAFE Reform For MY 2008-2011 Light Trucks. U.S. Department of Transportation, National Highway Traffic and Safety Administration, Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis, March, 2006. Available at http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/2006_FRIAPublic.pdf

baseline for cost calculations and MY 2011, although this number is speculative (increase from 5 test groups in MY 2006 to 10 in MY 2011). There are permanent upgrades that will be required on a continuing basis for cold testing facilities conducting diesel testing, and therefore are treated as facility capital costs rather than one-time startup capital costs.

7.3 Startup Burden

7.3.1 Dual Information Systems for CAFE/Gas Guzzler and Label Calculations

What we proposed:

The proposal contemplated no change in the existing system of translating test vehicle fuel economy values (now to be calculated using the mpg-based or 5-cycle formulas) into model type fuel economy label values. Under the existing system, fuel economy label values for test vehicles are arrived at through several steps. These ratings are computed as the sales-weighted harmonic mean of the “base levels” within each model type, which in turn are calculated as the sales-weighted harmonic mean of the configurations and subconfiguration fuel economy values within each base level. This procedure is intended to insure that the most representative fuel economy values are posted on new vehicles, which are sold by the manufacturer’s model designation rather than categories that correspond to the test groups that are used for generating fuel economy data as a part of the certification testing process. Under the proposal, this same methodology would apply to the mpg-based fuel economy, or the full 5-cycle values would similarly be plugged in at each level. Thus, the proposal applied the mpg-based adjustments at the test level. These values would then feed into fuel economy values for each vehicle configuration, which ultimately feed into the label value.

What commenters said:

AAM/AIAM pointed out that the proposal would require one calculating system for the new label values and a separate system, preserving the existing system, for calculation of CAFE fuel economy values. This is because current regulations apply 10% and 22% downward adjustment factors for label values at the model type rather than test level, whereas these adjustments are not applied to the CAFE calculation. If label value adjustments are applied at the test level on up, as in the proposal, then the model level fuel economy value can no longer be applied to CAFE by simply leaving off the 10% and 22% adjustments. Accordingly, AAM/AIAM requested that the mpg-based calculation be allowed at the model type level rather than the test level, so that the existing information processing programming architecture could be preserved for both.

Our response:

EPA agrees that there may be some convenience in applying the derived 5-cycle equation at the model-type level for manufacturers who wish to use the same data management system for reporting CAFE and label values. This may be particularly true for the early part of the transition period. However, this approach is not available for the vehicle-specific 5-cycle label calculations, and any manufacturers who use it during the phase-in period during the 2008-2010 model years will encounter an information cost not contemplated in the proposal – a dual calculation procedure will be needed. Similarly, a dual calculating system will be needed for model years 2011 and after.

The cost analysis has been updated to account for this increased information system burden. Based on a projection of EPA's information development contract costs, and an estimate of the portion of those costs attributable to the dual information system possibility, we have increased the industry information startup costs (unamortized) by $933,450.

7.3.2 Additional Startup Costs

What we proposed:

The proposal contained several provisions that had potential cost impacts having to do with the timing of new requirements or possible future adjustments. The proposed effective date for the methodology for calculating label values and changes to the design and content of the label was model year 2008, which for some vehicles can start as soon as January 2, 2007. Of the four proposed new labels required for model year 2008, two were positioned vertically ("portrait"). The proposal stated that we would publish the equations for the mpg-based approach by January 1 of the calendar year prior to the model year to which the equations would first apply (e.g., for model year 2010 fuel economy calculations, the equations would be made available before January 1, 2009).

What commenters said:

As discussed in detail in Section 2, commenters argued that the sticker label requires prior arrangements with suppliers. In addition, the possibility was raised of two separate rounds of label adjustments to also reflect new NHTSA safety label rating requirements that apply to vehicles manufactured on or after September 1, 2007. The industry argued for an effective date for label changes should be September 1, 2007, or a year after the publication of the final rule. Similarly, several manufacturers noted that a change from the current landscape label orientation would cause costly modifications, particularly for those like GM, who have redesigned their label in the landscape orientation to accommodate the new NHTSA label requirements. As for updating of the mpg-based equations, AAM/AIAM describes concerns with lead time and with the frequency of such updates: making the equations available on January 1 of the model year prior to the model year for which they first apply provides insufficient lead time for manufacturers, since the start of production for some vehicles of a model year can be as early as January 1 of the prior calendar year. Consequently, they advocate making the new equations available no later than January 1 of the model year two years prior to the model year to which the equations would first apply.

Our response:

EPA acknowledges the cost concerns about redesigning pre-existing price stickers and recognizes the challenges posed by simultaneously incorporating two new labels onto the price sticker - the NHTSA crash rating label and the fuel economy label. We are therefore aligning the mandatory date for using the new fuel economy label with that of NHTSA's new crash test rating label. EPA believes that with these modifications no significant new costs will be incurred by industry.

The final rule requires that all 2008 models manufactured on or after September 1, 2007 have the new label format. Manufacturers will be allowed to use the new label design as soon as possible, and are encouraged to do so. The current label design can be used until September 1, 2007 with certain additional information included. We are also finalizing a horizontal label orientation. Thus, the cost concerns mentioned by industry for redesigning the price sticker would not be realized.

As discussed in Section 3.2, we are finalizing regulations that require EPA to issue guidance regarding revisions to the equations by no later than July 1 of the calendar year prior to the earliest start of the model year that starts in the following calendar year. In other words, for new equations to be applicable to the 2010 model year (which can begin as early as January 2, 2009), EPA must issue guidance prior to July 1, 2008.