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Emission Durability Procedures for New Light-Duty Vehicles, Light-Duty Trucks and Heavy-Duty Vehicles; Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 86

[FRL–7638–8]

RIN 2060–AK76

Emission Durability Procedures for New Light-Duty Vehicles, Light-Duty Trucks and Heavy-Duty Vehicles

AGENCY: Environmental Protection Agency.

ACTION: Notice of proposed rulemaking.

SUMMARY: This proposed rulemaking contains procedures to be used by manufacturers of light-duty vehicles, light-duty trucks, and some heavy-duty vehicles to demonstrate, for purposes of emission certification, that new motor vehicles will comply with EPA emission standards throughout their useful lives. Today's action proposes procedures to be used by manufacturers to demonstrate the expected rate of deterioration of the emission levels of their vehicles.

DATES: Written comments on this NPRM must be submitted on or before May 17, 2004. A public hearing will be held on April 19, 2004. Requests to present oral testimony must be received on or before April 12, 2004. If EPA receives no requests to present oral testimony by this date, the hearing will be canceled.

ADDRESSES: *Comments:* Comments may be submitted by mail to: Air Docket, Environmental Protection Agency, Mailcode: 6102T, 1200 Pennsylvania Ave., NW., Washington, DC 20460, Attention Docket ID No. OAR–2002–0079. Comments may also be submitted electronically, by facsimile, or through hand delivery/courier. For more information submitting comments and on the comment procedure and public hearings, follow the detailed instructions as provided in Section V, ''Public Participation'' section. We must receive them by the date indicated under **DATES** above. Paper copies of written comments (in duplicate if possible) should also be sent to the general contact person listed below.

FOR FURTHER INFORMATION CONTACT:

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SUPPLEMENTARY INFORMATION:

I. Background

A. Overview of Certification Process, CAP 2000 History

Before a manufacturer may introduce a new motor vehicle into commerce, the manufacturer must obtain an EPA certificate of conformity indicating compliance with all applicable emission standards over the vehicle's useful life period. The useful life for cars and light trucks is currently 100,000 miles or 10 years, whichever occurs first; for heavy light trucks, medium duty passenger vehicles (MDPV) and complete heavy duty vehicles the useful life period is 120,000 miles or 11 years, whichever occurs first. [Section 202(d) of the Clean Air Act and 40 CFR 86.1805–04]

To receive a certificate, the manufacturer submits an application to EPA containing various information specified in the regulations, including emissions test data. EPA reviews the submitted information as well as any other relevant information, and issues a Certificate upon a determination that the manufacturer has demonstrated that its new motor vehicle will meet the requirements of the Clean Air Act (Act) and the regulations. [40 CFR 86.1848–01] A certificate of conformity is effective for only one model year, therefore, new vehicle certification must occur annually.

EPA's regulations detail the process motor vehicle manufacturers must follow to obtain EPA emissions certification. In 2000, EPA issued a comprehensive update to the certification regulations for light-duty vehicles and light-duty trucks.[1] These

[1] Separate certification regulations exist for heavy-duty highway vehicles and engines, which

certification regulations are known as ''CAP 2000'' (Compliance Assurance Program).[2] They include detailed procedures on the selection of vehicles for testing and testing procedure, specifications on the information that must be submitted to EPA, and other requirements pertaining to reporting and testing.

Issuance of a certificate is based on a determination by EPA that the vehicles at issue will conform with the applicable emissions standards. Compliance with the emissions standards requires that the vehicles meet the standards for the specified useful life period. A determination of compliance, therefore, must be based on an evaluation of both the performance of the vehicles' emissions control system when new, as well as performance over the entire time period of the vehicles' useful life.[3]

The process of predicting how and to what degree a vehicle's emission levels will change over its useful life period [emissions deterioration] as well as the robustness of the vehicle's emission-related components [component durability] is known as an emission durability demonstration.[4] Today's action specifies the methods that manufacturers must use to determine emissions deterioration for the purpose of certification. EPA is not proposing to change the existing regulations for determining emissions-related component durability.

Over the years, EPA has promulgated regulations prescribing several different emissions durability demonstration methods to fulfill EPA's need to determine compliance with emission standards over the vehicle's full useful life. The following is a short summary of this prior regulatory history, to put today's proposal in context.

B. Durability Demonstration Process History

1. Durability Demonstration Methods Used Prior to the CAP 2000 Regulations

Prior to CAP 2000, EPA's regulations (ref. 40 CFR part 86) specified the method to demonstrate a vehicle's emission durability. The method used a whole vehicle mileage accumulation cycle, commonly referred to as the Approved Mileage Accumulation (AMA) cycle. It required manufacturers to accumulate mileage on a pre-production vehicle, known as a durability data vehicle (DDV), by driving it over the prescribed AMA driving cycle for the full useful life mileage.[5] This was to simulate the real-world aging of the vehicle's emissions control systems over the useful life.

The DDV was tested in a laboratory for emissions at periodic intervals during AMA mileage accumulation, and a linear regression of the test data was performed to calculate a multiplicative deterioration factor (DF) for each exhaust constituent. Then, low mileage vehicles more representative of those intended to go into production (referred to as ''emission data vehicles,'' or EDVs) were emission-tested. The emission results from these tests were multiplied by the DFs[6] to project the emissions levels at full useful life (referred to as the ''certification levels''). The certification levels had to be at or below the applicable emission standards in order to obtain a certificate of conformity.

EPA was concerned about the ability of any fixed cycle—including the AMA cycle—to produce emission durability data that accurately predicted in-use deterioration for all vehicles. EPA had particular concerns that the AMA did not represent current driving patterns and did not appropriately age current design vehicles. In addition, manufacturers have long identified the durability process based on mileage accumulation using the AMA cycle as very costly and requiring extensive lead time for completion. As a result, EPA came to believe that the AMA had become outdated.[7]

The AMA cycle was developed before vehicles were equipped with catalytic converters. It contains a substantial portion of low speed driving, designed to address concerns about engine deposits. While engine deposits were a major source of emissions deterioration in pre-catalyst vehicles, the advent of catalytic converters, better fuel control, and the use of unleaded fuel shifted the causes of deterioration from low speed driving to driving modes which include higher speed/load regimes that cause elevated catalyst temperatures. The AMA driving cycle does not adequately focus on these higher catalyst temperature driving modes. It also contains numerous driving modes which do not significantly contribute to deterioration. This makes the process longer but adds little benefit in predicting emission deterioration.

In response to these concerns, EPA began a voluntary emission durability program in the 1994 model year for light-duty vehicles. This program allowed manufacturers to develop their own procedures to evaluate durability and deterioration subject to prior Agency approval.[8] EPA's approval criteria required the manufacturer to demonstrate that the durability procedures would cover a significant majority of in-use vehicle's emission deterioration.[9] One additional condition for approval was that the manufacturer conduct or fund an in-use test program to evaluate the effectiveness of its predictions. The initial program was referred to as revised durability program I (RDP I). It was an interim program scheduled to expire after the 1995 model year and was intended to serve as a bridge to an anticipated complete revision to the durability process. The provisions of RDP I were extended in a

refer to the light-duty certification procedures. Today's proposal will apply to those subsets of heavy-duty vehicles which use the same certification procedures as light-duty trucks. For convenience, the term ''vehicle'' or ''motor vehicle'' will be used in this preamble to mean those light-duty and heavy-duty motor vehicles subject to the proposed regulations.

[2] 63 FR 39654 (July 23, 1998).

[3] Since a certificate must be issued before the new vehicles may be introduced into commerce, the emissions testing and other relevant data and information used to support an application for a certificate are usually developed on pre-production prototypes.

[4] The durability demonstration program consists of two elements: Emission deterioration and component durability. Emission deterioration prediction is a process of predicting to what degree emissions will increase during the vehicles useful life. The deterioration factor (DF) is a measure of the deterioration. Component durability is a demonstration that the emission control components will not break and will continue to operate as described in the Application for Certification during the minimum maintenance interval proscribed in 40 CFR 1834–01. The component durability demonstration is conducted by the manufacturer using good engineering judgement.

[5] At the time this durability procedure was effective, the useful life mileage for light-duty vehicles was 100,000 miles. Refer to 40 CFR 86.1805–04 for current useful life mileage values.

[6] A multiplicative DF is calculated by performing a least-squares regression of the emission versus mileage data for each exhaust emission constituent and dividing the emission level at full useful life (historically, 100,000 miles) by the emission level at the 4,000 mile point.

[7] Reference: 63 FR 39653, 39659 (July 23, 1998) (CAP 2000 NPRM).

[8] EPA approved three types of emission durability programs under these procedures: whole vehicle, full mileage; whole vehicle, accelerated mileage; and bench aging procedures which involved thermal aging of the catalyst-plus-oxygen-sensor system.

[9] Reference EPA Guidance Letter No. CD–94–13, ''Alternative Durability Guidance for MY94 through MY98'', dated July 29,1994. This letter explained that as-received, un-screened in-use data should be compared to vehicles run on the alternative durability program (ASADP). A ''significant majority'' of the in-use data should be covered by the durability program. We defined the acceptance criteria in that letter as follows: ''EPA does not require ASADPs to meet a specific minimum severity level (or confidence level) because different methods may be used to estimate the degree of severity. * * * However, an ASADP would be acceptable to EPA if EPA believes that it were designed to match the in-use deterioration of 90–95 percent of vehicles in the engine family.''

series of regulatory actions.[10] Ultimately, the Agency instituted a comprehensive revision to the durability process as part of the CAP 2000 rulemaking.

For evaporative and refueling emissions deterioration, EPA allowed manufacturers to develop their own process to either bench age components or do whole vehicle aging, also subject to Agency review and approval. The evaporative and refueling deterioration factor is required to be additive.[11]

2. Emission Durability Procedures Under CAP 2000

The CAP 2000 rulemaking was a comprehensive update to the entire light-duty vehicle certification process. One part of this involved the manufacturer's required demonstration of emission durability. The Agency eliminated the use of AMA for new durability demonstrations. In CAP 2000, the Agency replaced the AMA-based durability program with a durability process similar to the optional RDP–I program. Each manufacturer, except small volume manufacturers, was required to develop an emission durability process which would accurately predict the in-use deterioration of the vehicles they produce. The manufacturer had the flexibility to design an efficient program that met that objective.

The manufacturer's plan was then reviewed by EPA for approval.[12] Approval from the Agency required a demonstration that the durability process was designed to generate DFs representative of in-use deterioration. This demonstration was more than simply matching the average in-use deterioration with DFs. Manufacturers needed to demonstrate to EPA's satisfaction that their durability process would result in the same or more deterioration than is reflected by the in-use data for a significant majority of their vehicles. Manufacturers were required to provide evidence that their durability process resulted in predicted emission deterioration that were equal to or more severe than the deterioration rates experienced by a significant majority (approximately 90%) of candidate in-use vehicles.[13] Furthermore, this demonstration was required to cover the breadth of the vehicles covered by the durability procedure.

This evaluation concerning coverage of a significant majority of the in-use data was usually made independently on several potential worst-case vehicles which bound the envelope of vehicles covered by the durability procedure. Manufacturers typically demonstrated that emission deterioration predicted by their durability program would cover approximately 90 percent of the in-use population using one (or more) of the following sources of data: in-use emission tests, in-use driving characteristics, or in-use catalyst temperature measurements. At that time EPA had not developed a specific required method to make this demonstration.

Two major types of durability processes emerged from the CAP 2000 experience: whole vehicle and bench aging processes.

The whole vehicle aging procedures involve driving vehicles on a track or dynamometer on an aggressive driving cycle of the manufacturer's design. In general, the speed, acceleration rates, and/or vehicle load are significantly increased compared to the AMA cycle or normal in-use driving patterns. The vehicle can be driven either for full useful-life mileage, or, for a higher stress cycle, the vehicle can be driven for a reduced number of miles (*e.g.*, 1 mile on the high speed cycle equals 2 miles in use). In either case, the vehicle is tested periodically and a DF is calculated.

The bench aging procedures involve the removal of critical emission components, such as the catalyst and oxygen sensor, and the accelerated aging of those components on an engine dynamometer bench.[14] During the bench aging process important engine/catalyst parameters are controlled to assure proper aging. Usually, elevated catalyst temperatures are maintained while fuel is controlled to include lean, rich, and stoichiometric control. Through a series of tests, manufacturers determine the amount of time needed to bench-age a catalyst so it is aged to the equivalent of 100,000 miles. In some cases the manufacturer developed the amount of aging time using catalyst temperature data measured on a road cycle. In other cases, the manufacturer developed the aging time through a trial and error process. Typical bench aging periods are 100–300 hours, although these can vary from manufacturer to manufacturer. Sources of deterioration other than thermal aging can be accounted for by aging the catalyst for an additional amount of time.

The CAP 2000 regulations allow manufacturers to choose from three different methods to demonstrate emissions durability. Manufacturers could calculate additive DFs, multiplicative DFs, or test EDVs with aged hardware[15] installed on them.

Regardless of whether manufacturers used whole vehicle or bench aging durability procedures, CAP 2000 also required the manufacturer to later collect emission data on candidate in-use vehicles selected under the provisions of the in-use verification program (IUVP).[16] Among other uses of the data, the IUVP data must be used by the manufacturer to check on and improve its durability program. The data also is available to assist the Agency to target vehicle testing for its recall program. The Agency may intercede[17] when the in-use data indicate the durability process underestimates in-use emission levels.

The CAP 2000 regulations did not change the previous procedures used to obtain DFs for evaporative/refueling families.

C. Ethyl Petition To Reconsider the CAP 2000 Rules

On August 17, 1999, Ethyl Corporation petitioned EPA to

[10] Ref. 59 FR 36368 (July 18, 1994), 62 FR 11082 (March 11, 1997), 62 FR 11138 (March 11, 1997) and 62 FR 44872 (August 22, 1997).

[11] An additive DF is calculated by performing a least-squares regression of the emission versus mileage data for each exhaust emission constituent and subtracting the 4,000-mile emission level from the full useful life emission level (historically, 100,000 miles). The DF is then used with emission data from the emission data vehicle to demonstrate compliance with the standards for the purpose of certification. The sum of the emissions from the EDV plus the additive DF is referred to as the certification level and must be less than or equal to the emission standard to receive a certificate of conformity.

[12] The CAP 2000 regulations ''grand-fathered'' procedures which had been already approved under the RDP provisions. Consequently, these grand-fathered procedures were not approved again under the CAP 2000 provisions. [63 FR.39661]

[13] Candidate in-use vehicles are vehicles selected under the provisions of the in-use verification program (IUVP). This includes mileage restrictions, procurement requirements, and screening requirements designed to eliminate only tampered, mis-used or unsafe vehicles. [Reference: 40 CFR 86.1845–01 and 40 CFR 86.1845–04]

[14] An engine dynamometer bench generally consists of an engine dynamometer, a ''slave'' engine, and required controllers and sensors to achieve the desired operation of the engine on the dynamometer.

[15] Under this alternative, emission components aged to the equivalent of full useful life would be installed on EDVs. The test data from the EDV would then serve to establish the certification level and show compliance with the full useful life emission standards.

[16] Reference: 40 CFR 86.1845–01 and 40 CFR 86.1845–04.

[17] The Agency may withdraw approval for a durability process if the Administrator determines, based on IUVP or other data, that the durability process does not accurately predict emission levels or compliance with the standards. [Ref. 40 CFR 86.1923–01 (h)]. In addition, where the average in-use verification data for a test group (or several test groups) exceeds 1.3 times the applicable emission standard and at least 50% of the test vehicles fail the standard in use, manufacturers are required to supply additional ''recall quality'' in-use data. [Ref. 40 CFR 86.1846–01]

reconsider the CAP 2000 regulations. EPA requested public comment on the petition, 64 FR 60,401 (November 5, 1999 and 64 FR 70,665 (December 17, 1999), and received comments from various interested parties. After consideration of the petition and of all comments, EPA denied the petition for reconsideration. 66 FR 45,777 (August 30, 2001).

Ethyl Corporation also petitioned the Agency to reconsider the final rule entitled ''Emissions Control, Air Pollution From 2004 and Later Model Year Heavy-Duty Highway Engines and Vehicles; Light-Duty On-Board Diagnostics Requirements, Revision; Final Rule,'' 65 FR 59896–59978 (referred to here as the ''Heavy Duty Rule''). After consideration of the petition and all of the comments, EPA denied the petition for reconsideration. 66 FR 45,777 (August 30, 2001).

D. Judicial Review of the CAP 2000 Rules

Ethyl Corporation petitioned for review of the CAP 2000 rulemaking, claiming among other things that the CAP 2000 durability provisions were unlawful as EPA had not promulgated methods and procedures for making tests by regulation as required by § 206. [*Ethyl Corp.* v. *EPA,* 306 F.3d 1144 (D.C. Cir. Oct. 22, 2002).]

In an opinion issued on October 22, 2002, the Court found that the CAP 2000 regulations did not satisfy the requirements of Section 206(d) of the CAA to establish methods and procedures for making tests through regulation.

The Court recognized that there was an important distinction between an EPA regulation that established general or vaguely articulated test procedures, with more specific details provided in a later proceeding, and a regulation which failed to establish any test procedures at all and only adopted procedures for the later development of tests. The former situation would receive deferential judicial review under the applicable case law. The latter case, however, would fail to meet the requirements of section 206(d). The Court held that the CAP 2000 regulations fell into this latter group, and were improper because EPA itself failed to establish any test procedures at all in the regulation, vaguely articulated or not. EPA's regulation provided only for the manufacturer to develop its own test procedure and submit it for later EPA approval. This was inconsistent with the scope of section 206(d), [*Ethyl* at 1149–50.]

The Court also said that ''nothing in our opinion requires that EPA use only a 'one-size-fits-all' test method. All that is required is that it establish its procedures, no matter how variegated, 'by regulation.' '' [*Ethyl* at 1150.]

The Court's decision stated that ''CAP 2000, rather than constituting an EPA establishment 'by regulation' of 'methods and procedures for making tests,' as required by section 206(d), is instead a promulgation of criteria for the later establishment of such methods and procedures by private negotiation between the EPA and each regulated auto maker. So it is 'not in accordance with law.' '' The Court vacated ''the CAP 2000 program'' and remanded the case to the EPA with instructions to establish test methods and procedures by regulation. [*Id.*]

Since the issue before the Court was the legality of EPA's adoption of the CAP 2000 durability provisions, the court's vacature of ''the CAP 2000 program'' is limited to vacating the CAP 2000 durability provisions.

The Court also remanded the case to EPA with instructions to establish test methods and procedures by regulation. Today's proposal is the result of the court's decision, and is limited to emission durability procedures.

II. How Did EPA Develop the Proposed Durability Procedures?

The process and data used to develop the proposed durability procedures is discussed below. Additional data and analysis used by EPA in the regulation development process are contained in the Agency's Draft Technical Support Document (TSD).

A. What Is the Purpose of the Durability Program?

EPA issues certificates of conformity based on testing and other information submitted by manufacturers which verifies compliance with the applicable emission standards over the vehicles' useful life. The durability program is the tool used to adjust low mileage test results from emission data vehicles (EDV's) to predict emission results at full useful life mileage.

The purpose of the durability program is to provide EPA with reasonable assurance that vehicles covered by a certificate of conformity will, in actual use, comply with the applicable emission standards over their useful life. We believe that the durability process used to support an application for certification should cover a significant majority of in-use vehicles that will be covered by that certificate. In the CAP 2000 rulemaking, EPA established the requirement that manufacturers demonstrate the ''adequacy of [their] durability processes to effectively predict emission compliance for candidate in-use vehicles.[18]'' This objective remains in today's proposal.

Production variability or other reasons can lead to differences in actual emission levels among vehicles of the same nominal design. In the CAP 2000 rulemaking, EPA required that a durability program adequately predict emission deterioration for a significant majority of in-use vehicles. This was typically approximately 90 percent coverage of the distribution.[19] In today's proposal we are taking the same approach, such that a durability program is expected to effectively predict a ''significant majority'', meaning coverage of approximately 90 percent of the distribution of in-use emission levels and deterioration.

In summary, the objective of the durability program is to effectively predict in-use emission deterioration rates and emission levels by covering the significant majority, meaning approximately 90 percent, of the distribution of emission deterioration of candidate in-use vehicles of each vehicle design which uses the durability program.

A durability group [20] can include several different vehicle designs which may have different emission levels and deterioration rates. In the CAP 2000 rulemaking, EPA required that the durability data vehicle (DDV) be the vehicle with the highest expected emission deterioration of the vehicles within the durability group [ref. 86.1820–01]. (We are not proposing to change the DDV selection criteria in this rulemaking.)

The durability program is used to calculate certification levels either by applying DFs to EDV low-mileage test data or by testing EDVs with aged emission control hardware installed. EPA issues a certificate when the certification levels of the EDV comply with the emission standards. Manufacturers normally design with an additional compliance margin between the standard and the certification level, to address various uncertainties. Especially for EDVs with certification levels at or just under the standards, we believe it is important to have some level of assurance that those levels are indeed predicting the full useful life emission levels of the significant

[18] Ref. 40 CFR 86.1823–01(b)(1). The term ''candidate in-use vehicles'' means vehicles which would meet the selection criteria of the in-use verification program (IUVP)).

[19] Ref. 63 FR 39660 (July 23, 1998).

[20] A durability group is the basic classification unit of a manufacturer's product line as defined in § 86.1822–01.

majority of in-use vehicles covered by the certificate.

B. What Are the Factors That Affect Exhaust Emission Deterioration?

The first step in developing an exhaust durability program is identifying the significant sources of emission deterioration. Emission levels will increase over mileage if either (1) the engine-out emissions [21] of the engine increase or (2) the effectiveness of the exhaust after-treatment devices decreases.

For all current-design light- and heavy-duty vehicles (excluding diesel-fueled vehicles) the catalytic converter is the only exhaust after-treatment device in use.[22] EPA presented evidence in its draft technical support document for the CAP 2000 proposal [23] that engine-out emissions exhibit no significant deterioration for these current technology vehicles. This conclusion is also supported by an Society of Automotive Engineers (SAE) paper.[24] Consequently, the Agency believes that engine-out emission increase is not a significant source of emission deterioration. Whatever minor level of deterioration may occur as a result of engine-out emission increases, it can be represented by an additional amount of catalyst aging.

The major source of emission deterioration in current technology vehicles today is the loss of catalyst efficiency. The two major sources of this efficiency loss are accumulated thermal exposure and poisoning. Minor sources of deterioration include coating of the catalyst substrate with fuel impurities, and physical deterioration of the catalysts such as the loss of catalytic material. Loss of effective fuel control due to deterioration of the oxygen sensor can also lead to lower catalyst efficiency as the vehicle ages and, therefore, to increased emission deterioration.

The sources of catalyst poisoning are compounds contained in the fuel and in the lubricating oil (chiefly lead (Pb), phosphorus (P), and sulfur (S)). EPA has made significant strides to reduce poisons in fuels by fuel regulation, including regulations that have eliminated lead and significantly reduced sulfur levels in automobile fuels. The Alliance of Automobile Manufacturers (the ''Alliance'') has conducted periodic surveys of fuel used across the United States which have documented the extent of these reductions. Manufacturers generally use representative commercially-available fuel for testing and mileage accumulation on durability data vehicles. They are required to do so [25] for mileage accumulation on EDVs. Lubrication oils have also improved over the years. While EPA does not regulate the oils, the American Petroleum Institute (API) together with the International Lubrication and Standardization and Approval Committee (ILSAC) have developed voluntary oil certification levels and evaluation procedures. Only oils with the best certification levels are allowed to use the API ''star-burst'' certification mark in packaging and advertisement. Over the years, API and ILSAC have established lower levels of phosphorous with new levels of oil certification. Today the most advanced oils are designated as GF3. Market forces have proven sufficient to encourage manufacturers to market oils that meet the latest API/ILSAC requirements. Today, almost all of oil used in automobile applications meet the GF3 oil specifications. The advances in oil and fuel formulation have reduced poisoning of the catalyst but have not eliminated it.

Exposure to high temperatures leads to three major deterioration mechanisms in catalysts. First, high temperatures cause the coalescence of active material, called sintering. Sintering reduces the surface area available to perform catalytic reactions. This then reduces the effectiveness of the catalyst. Second, loss of wash-coat surface area is also accelerated at high temperatures. The loss of wash-coat surface area is an indirect cause of active material sintering. Finally, high temperatures can promote chemical reaction of one type of active material with another type of active material (such as the formation of Pt Pd alloy) and with other compounds in the catalyst (such as the formation of Pt Ni alloy). In their new chemical state the active material is less effective at reducing emissions. It has been widely reported in the technical literature that the effects of high catalyst temperature are cumulative and generally increase exponentially with increased temperature.[26]

It is also reported in the technical literature that the air/fuel (A/F) ratio in the catalyst can affect the rate of thermal deterioration.[27] The same temperature exposure experienced during lean catalyst A/F ratio causes significantly more deterioration than at rich or stoichiometric operation.

Three-way catalysts are only simultaneously effective at oxidizing hydrocarbons (HC) and carbon monoxide (CO) and reducing oxides of nitrogen (NO_X) in a very narrow window of catalyst A/F ratio near stoichiometry.[28] To maintain the A/F ratio control needed to assure high catalyst efficiency, all modern gasoline vehicles use feed-back fuel control. The feed-back control system uses an oxygen sensor located just in front of the first catalyst to monitor whether the instantaneous A/F ratio is rich or lean and a computer engine controller to adjust the fuel system (in the opposite direction) to move towards stoichiometry. Although the A/F ratio may be sightly rich or lean at any given second, on a time-averaged basis the feed-back fuel system is able to control the fuel to very near stoichiometric levels. The oxygen sensor is the critical part of this system and is subject to the same sources of deterioration as the catalyst—thermal exposure, poisoning, physical deterioration, and coating.

Physical deterioration of the catalyst or oxygen sensor such as cracking or loss of the catalyst substrate, are rare events that typically occur because of a faulty design. These concerns are addressed by the component durability feature of the durability program. Under the component durability provisions, manufacturers are responsible to demonstrate using good engineering judgement that all emission related components are durable in the operating environment they will experience throughout the vehicle's useful life.

[21] Engine-out emissions are the engine's emissions before they are treated by the catalytic converter or other after-treatment emission control devices.

[22] Issues related to emissions deterioration for diesel-fueled vehicles are discussed in section II E.

[23] The technical support document for CAP 2000 proposal can be viewed in docket number A–96–50. The data that supports stable engine-out emissions is contained in Appendix I of that document.

[24] Reference: ''In-Use Emissions with Today's Closed-Loop Systems'' by H. Haskew and T. Liberty of General Motors, SAE No. 910339.

[25] Reference: 40 CFR 86.113–04(a)(3) or 40 CFR 86.113–94(a)(2).

[26] References: ''Thermal Effect on Three-Way Catalyst Deactivation and Improvement'' by K. Ihara, K. Ohkubo, and Y. Niura of Mazda, SAE No. 871192 and ''High Temperature Deactivation of Three-Way Catalyst'' by L. Carol, N. Newman, and G. Mann of General Motors, SAE No. 892040.

[27] References: ''Effect of High Temperatures on Three-Way Automobile Catalysts'' by R. H. Hammerle and C. H. Wu of Ford, SAE No. 840549; ''Thermal Effect on Three-Way Catalyst Deactivation and Improvement'' by K. Ihara, K. Ohkubo, and Y. Niura of Mazda, SAE No. 871192, and ''Thermal Deterioration Mechanism of Pt/Rh Three-Way Catalysts'' by S. Matsunaga, K. Yokota, D. Hyodo, T.Suzuki, and H. Sobukawa of Toyota, SAE No. 982706.

[28] Reference: ''Operational Criteria Affecting the design of Thermally Stable Single-Bed Three-Way Catalysts'' by B. Cooper and T. Truex of Johnson Matthey, SAE No. 850128.

Coating of the catalyst substrate or the oxygen sensor generally occurs due to contaminants in the fuel. These contaminants are not part of the fuel formulation, but occur by accident due to mishandling of fuel in the distribution process. Coating caused by contaminants in the fuel is beyond the scope of the durability program. On-the-other hand, coating of the oxygen sensor may also occur due to installation of the oxygen sensor with an improper anti-seize compound that contains material that coats the oxygen sensor in actual use. Coating of the oxygen senor in this case should be addressed during the component durability portion of the durability process.

C. The Strawman Durability Procedures

In preparing this proposal, EPA initially developed ''strawman'' durability procedures. The strawman durability procedures contained both whole-vehicle and bench aging procedures. A copy of the strawman durability procedure is contained in the TSD. The following discussion summarizes the strawman durability procedures and the development rationale for those procedures.

The strawman proposal was used to solicit feedback from key stakeholders. Today's proposal is based on the strawman durability procedures with adjustment reflecting our response to the comments we received from vehicle manufacturers, emission control equipment manufacturers, and Ethyl Corporation.

1. The Whole-Vehicle Aging Procedure

Sources of emission deterioration on a road cycle.

Whole-vehicle aging consists of running the entire vehicle on a track or engine dynamometer. The vehicle is driven on a road cycle which usually consists of a speed-versus-time trace with specified acceleration rates, fuel properties, and vehicle load. Vehicles aged using whole-vehicle aging procedures experience: (1) Catalyst thermal deterioration due to the heat generated in the catalyst during vehicle operation, (2) poisoning of the catalyst due to the consumption of fuel and lubrication oil, (3) degradation of the accuracy of fuel control, and (4) engine-out emission deterioration. Of these four sources of deterioration, catalyst temperature exposure is the predominant source and the easiest to control. Consequently, once a road cycle has been established that has a reasonable amount of poisoning, fuel control deterioration (typically from the oxygen sensor), and engine-out emissions deterioration, catalyst temperature exposure can be used to adjust the severity of the driving cycle to meet the desired objective.

Poisoning is basically a function of number of miles run and the type and amount of the fuel and lubricating oil which is consumed. Engine-out emission deterioration is largely a function of miles run, but as discussed previously, engine-out emission deterioration is thought to be near zero. If the road cycle incorporates the full number of useful life miles and the fuel and oil used are representative of in-use, poisoning and engine-out deterioration should be appropriately accounted for.

As previously discussed, oxygen sensor deterioration is a function of thermal exposure, poisoning, physical deterioration and coating. As discussed above, coating and physical deterioration are rare and more properly addressed by the component durability provisions than the emission deterioration procedures that are the subject of this proposal. Poisoning is caused from ingested oil and compounds in the fuel burned in the engine, the same sources of poisons experienced by catalysts. Addressing the poisoning issues for catalysts will address the same poisoning concerns for oxygen sensors because the sensors are in the same exhaust stream as the catalyst and will experience the same poisons as the catalyst. The remaining source of deterioration of oxygen sensors is thermal exposure. Since oxygen sensors are installed near the catalyst in the exhaust stream they experience the same heat transfer effect from the hot exhaust stream as the catalyst. Consequently, appropriate control of catalyst temperature during the road cycle will lead to appropriate oxygen sensor deterioration.

Higher catalyst temperatures occur at higher engine speed and engine load. Engine speed and load are higher when vehicle speed, acceleration rates, and vehicle loading are higher. Consequently the speed and acceleration distribution of a road cycle will determine the amount of catalyst temperature and oxygen sensor deterioration.

Developing a standard road (SRC) cycle to achieve the durability objective.

An appropriate road cycle is one that meets the severity objective for the mileage accumulation cycle. As discussed previously, the objective of EPA's proposed durability program is to effectively cover a significant majority (approximately 90 percent) of the distribution of in-use emission deterioration of candidate in-use vehicles across the entire fleet of vehicles covered by the durability program. In developing a standard road cycle applicable to all manufacturers, the objective encompasses the entire fleet of vehicles.

Once the test vehicle is selected and the vehicle load and fuel specifications are fixed, the only variable remaining that can influence the severity of a road cycle is the speed-versus-time distribution of the cycle. Simply matching the speed and acceleration distribution of typical or average in-use driving is not appropriate, because our objective is ninety percent coverage of the in-use emission deterioration. Average in-use driving speeds and accelerations represent only fifty percent coverage. Matching the driving speed and acceleration of the ninetieth percentile driver would not automatically accomplish that objective by itself, because there are additional variables in actual driving that influence the work performed by the engine and, consequently, the rate of emission deterioration. In-use driving includes operating the vehicle on various road surfaces (such as gravel and rough roads), over various road grades (up or down hills), in various weather conditions (cold, hot, raining, snowing, and winds), and with various accessories in operation (such as air conditioning, defroster, and headlights). Directionally, all of these additional variables result in additional engine work, and consequently lead to higher catalyst temperatures and more emission deterioration than operating the vehicle at the same speed-versus-time trace on a smooth, level track or on a dynamometer.

Strawman road cycle.

EPA developed a strawman version of a standard road cycle based the data available at that time. EPA reviewed speeds and acceleration rates that are typically encountered in-use[29] and extrapolated what speeds and acceleration might be typical for the ninetieth-percentile driver. As discussed previously, EPA believed that the appropriate speed and accelerations should be higher than the ninetieth-percentile driver due to additional variables seen in actual driving that affect deterioration. EPA also reviewed the speeds and acceleration rates used by manufacturers' road cycles previously approved by EPA under the CAP 2000 regulations (or approved under the RDP process and subsequently grand-fathered into the

[29] Reference: ''Federal Test Procedure Review Project: Preliminary Technical Report'', EPA publication no. 420–R–33–007.

CAP 2000 program)[30]. To be approved under CAP 2000 or the RDP program, as applicable, the manufacturers provided information that EPA believed showed that these cycles covered the significant majority, approximately 90 percent, of the distribution of emission deterioration rates seen in-use on their vehicles. This would cover deterioration from in-use speeds, accelerations, other driving conditions, vehicle load, fuel, and the like. EPA developed speeds and acceleration rates for the strawman standard road cycle in the high range of severity compared to the manufacturer-specific cycles, because the standard EPA cycle was to cover the entire fleet of vehicles while the individual manufacturer's cycle was targeted to only cover the breadth of their specific product line. Consequently, the strawman standard road cycle was conservative and targeted at a higher degree of severity than most manufacturer cycles.

The road cycle developed for the strawman durability procedures is described in the technical support document for this rule.

At the time the strawman road cycle was being developed EPA did not have any catalyst time-at-temperature data measured on this cycle. This data became available as part of the comments received on the durability strawman proposal. As we will discuss in section II.D., we ultimately revised the strawman road cycle to better achieve our durability target based on this catalyst time-at-temperature data. That revised cycle became the standard road cycle that we are proposing today.

Early termination of mileage accumulation.

One concern with performing mileage accumulation on a whole vehicle over its full useful life period is the amount of time it takes. In the strawman road cycle, running a vehicle for 100,000 miles was estimated to take about 103 days.[31] For Tier 2 vehicles with full useful life periods of 120,000 or 150,000 miles the time would be even higher (120 and 147 days, respectively).

The strawman whole-vehicle procedure contained a provision allowing manufacturers to terminate mileage accumulation early at a minimum of 75% of full useful life, and to project the full useful life deterioration factors using the upper 80% statistical confidence limit. This provision is similar to one contained in the RPD I regulations with the added limitation of using the upper 80th% confidence limit. [Ref. § 40 CFR 86.094–26(a)(4)(i)(B)] It allows manufacturers to reduce the time and money associated with full useful life mileage accumulation. At the same time, it protects the integrity of the deterioration factor by requiring that a higher than average (upper 80% statistical confidence limit[32]) DF be projected.

Customization of strawman road cycle.

We did not include provisions allowing customization of the strawman road cycle, other than to allow for early termination, as discussed above. Before considering customization, EPA needed more information, including data, on whether or not the strawman road cycle would achieve the durability objective discussed in II B.1 below. In the strawman proposal, we requested manufacturers to provide catalyst time-at-temperature data on the road cycle and the manufacturer's approved CAP 2000 durability cycle. We did receive some comparative catalyst data and other comments on the strawman proposal, discussed below, which led us to conclude that it would be appropriate to propose approval criteria allowing customization of the standard road cycle or alternative road cycles.

2. The Bench Aging Procedures

Background.

Bench aging procedures generally involve removing critical emission components, such as the catalyst and oxygen sensor, from the DDV and aging those components in an accelerated manner on an aging bench. The aged components are then either reinstalled on the DDV and emission tests are conducted to calculate a DF, or the EDV is tested with aged components which are directly installed on the test vehicle. In the latter case, the results of EDV testing are used to represent the certification levels without the need to calculate a DF. The objective of the bench aging procedure is to produce the desired target level of deterioration in a much shorter period of time than running a vehicle on a road cycle. If the bench aging is properly conducted then it will yield equivalent results to whole-vehicle aging.

Sources of emission deterioration on the aging bench.

As previously discussed, catalyst thermal exposure is the predominant source of emission deterioration. Temperature exposure of the catalyst can be more conveniently controlled on an aging bench than other sources of deterioration. On the catalyst aging bench, other sources of deterioration can be accounted for by increasing the amount of thermal aging of the catalyst.

Degradation of the fuel control systems is one additional source of deterioration. It can lead to reduced efficiency of the catalyst and, therefore, to increased emission deterioration. In the modern feed-back fuel system the oxygen sensor is the critical emission control component. The oxygen sensor deteriorates due to accumulated thermal exposure as well as other reasons. As with the catalyst, thermal aging of the oxygen sensor can be used to represent all the sources of deterioration of the oxygen sensor.

Using the bench procedures to replicate the emission deterioration seen on the road cycle.

In summary, a bench aging procedure can use thermal aging of the catalyst-plus-oxygen-sensor [the ''catalyst system''] as a surrogate for whole-vehicle aging. By selecting the proper temperatures, amount of aging time, and mix of A/F ratios, the bench aging procedure can be designed to match the rate of deterioration predicted by a whole-vehicle aging cycle, and meet the in-use emission performance design objectives expected of the durability program.

The effects of temperature exposure on the catalyst are cumulative and increase exponentially with the temperature. Consequently, it is possible to replace a long period of catalyst exposure at a certain temperature with a shorter period of time at a higher temperature. By applying this principle over the entire range of catalyst temperature exposure, it is possible to represent the entire lifetime of catalyst temperature exposure as a much shorter period of time at a single elevated reference temperature.

Determining the aging time on the bench.

In 1889, the Swedish scientist Svent Arrehenius developed a theoretical formula, which came to be known as the Arrehenius equation, which relates chemical reaction rates with temperature. The Arrehenius equation is widely cited in chemical technical literature and it is noted that ''most chemical reactions closely follow''[33] the equation. For our strawman procedure, we developed a version of the Arrehenius equation, called the Bench

[30] Several approved manufacturer road cycles are discussed in the TSD.

[31] Assuming a 22 hour workday, it would take 89 days to drive the full useful life miles and 14 days to perform the needed emission tests, for a total of 103 days.

[32] The 80% statistical confidence limit means that 80% of the time the real deterioration rate would be lower than the extrapolated value.

[33] Reference: *General Chemistry*, by D. Ebbing and M. Wrighton, published in 1990 by Houghton Mifflin Co., Boston.

Aging Time (BAT) equation. The BAT equation compares the deterioration rates that occur at two different temperatures. The BAT equation allows us to convert a given amount of aging time at one temperature to a lesser time at a higher temperature while maintaining the same degree of emission deterioration.

Since the implementation of the RDP I regulations, beginning in the 1993 model year, EPA has been evaluating the applicability of the BAT equation to durability demonstrations and experimenting with different coefficients for the equation. EPA also has been approving manufacturer-designed durability procedures under the RDP I and CAP 2000 procedures. As part of the approval process, EPA required catalyst temperature histograms [34] of both the manufacturer's procedures and the 70-mph AMA.[35] EPA used this data to compare the severity of the AMA and the manufacturer's cycles. In general, we found that the BAT equation predicted a similar ratio of severity (the manufacturer's cycle divided by the AMA) for different manufacturers. Also, EPA noted that some manufacturers were also basing their bench cycle aging time calculations on similar principles as the Arrehenius equation and that they had developed coefficients similar to the ones we were using with the BAT equation. The BAT equation that EPA developed for the strawman durability process is discussed in the Technical Support Document for this rule.

To use the BAT equation to select the bench aging time for a given temperature, it is necessary to start with a known distribution of time-at-temperatures for the catalyst. The strawman version of the standard road cycle was designed to replicate the appropriate level of aging and it specifically targeted catalyst temperature as a method to accomplish the aging. Consequently, the distribution of catalyst time at temperature data on the standard road cycle is an appropriate target for a standard bench aging procedure. Therefore, the strawman durability program used catalyst temperature histograms run on the standard road cycle on the DDV configuration as input to the BAT equation to determine the bench aging time and temperature.

The BAT equation and the Arrehenius equation upon which it is based assume that deterioration is determined strictly based on time-at-temperature. However, as discussed previously, the A/F ratio in the catalyst can significantly affect the rate of deterioration that occurs for the same temperature exposure. Catalyst deterioration is highest when the A/F ratio of the catalyst is lean.

One approach to address the effect of A/F ratio on aging is to separate the aging time into the three A/F ratio regimes; rich, stoichiometry, and lean; and consider each sub-set separately. Another approach would be to control the proportion of rich/stoichmetric/lean operation during bench aging and use a composite value of the catalyst thermal reactivity coefficient [36] (R–value) based on that distribution in the BAT equation. Since EPA developed the R–value using this composite approach, this is the option we chose for the strawman durability program.

Another variable that effects deterioration is poisoning. Little poisoning occurs on the bench cycle because the duration of the test is short (typically 100 to 300 hours). Consequently, only a limited amount of fuel is used and little lubrication oil is consumed by the engine. Nevertheless, although the effect is small, it is important to specify the fuel used. The strawman procedure specified the fuel as normal mileage accumulation fuel, which is representative of commercially available fuel. The strawman procedures did not discuss specifications for the oil to be used on the bench engine. Today's proposal requires that the oil used in the bench engine is to be selected using good engineering judgement.

Controlling the A/F ratio on the bench [the strawman bench cycle].

For the BAT equation to work properly, it is necessary to have an appropriate and fixed mix of A/F ratios experienced in the catalyst. This pre-determined mix of A/F ratios in the catalyst on the aging bench is called the ''bench cycle''. The technical literature [37] discusses one bench cycle, called RAT A, that has been used to age catalysts on an aging bench. This bench cycle is also used by several manufacturers in their own procedures to conduct bench aging.

The proportion of rich/stoichiometric/lean A/F ratios on the RAT A cycle follows the general trend of A/F ratios seen in the catalyst in use.[38] The RAT A cycle has mostly stoichiometric A/F ratios with a small amount of lean and an even smaller amount of rich operation. The bench cycle does not need to exactly replicate what happens in use, in fact the RAT A cycle does not replicate typical in-use A/F ratios. The BAT equation, with the proper coefficients, will adjust aging time on that bench cycle to assure that the correct amount of aging occurs. EPA developed the proposed BAT coefficients using catalyst time-at-temperature data measured on the RAT A cycle. The purpose of the bench cycle is to establish a fixed cycle of A/F ratios on the bench to eliminate A/F ratio as an uncontrolled variable. By developing a fixed bench cycle, the reference temperature of the cycle and catalyst time-at-temperature data are the remaining independent variables to determine aging time on the bench. The bench cycle established in the strawman durability program is a slightly modified version of this RAT A cycle where the time at rich and lean operation was rounded to an even number of seconds.

The strawman durability program bench cycle consists of a 60–second cycle which is defined as follows based on the A/F ratio of the engine (which is part of the aging bench) and the rate of secondary air injection (shop air which is added to the exhaust stream in front of the first catalyst):

01 to 40 secs:
  14.7 A/F, no secondary air injection
41 to 45 secs:
  13.0 A/F ratio, no secondary air injection
46 to 55 secs:
  13.0 A/F ratio, 4% secondary air injection
56 to 60 secs:
  14.7 A/F ratio, 4% secondary air injection

Strawman bench aging procedures and equipment

The BAT equation uses a specific reference temperature to perform the bench aging time calculation. Because

[34] Ref. Advisory Circular No. 17–F (November 16, 1982).

[35] The 70 mph AMA is the original AMA promulgated in Appendix IV to Part 86 in 1977. It has a high speed on lap 11 of 70 mph. By policy, EPA had allowed manufacturers to use lower speeds (as low as 55 mph) on lap 11 of the AMA in response to the 55 mph National Speed Limit which was enacted after promulgation of the AMA cycle in the appendix.

[36] The catalyst thermal reactivity is the ''R–Factor'' in EPA's proposed BAT equation to calculate the bench aging time. It is a measure, determined experimentally, of how sensitive the catalyst is to high temperature exposure. The BAT equation is discussed in more detail in section III of the preamble.

[37] The RAT A cycle is referenced in ''Application of Accelerated Rapid Aging Test (RAT) schedules with Poisons'' by D. Ball, A Mohammed, and W. Schmidt of Delphi, SAE No. 972846; ''A Survey of Automotive Catalyst Technologies using Rapid Aging Test Schedules which Incorporate Engine Oil Derived Poisons'' by D. Ball, and C. Kirby of Delphi, SAE No. 973050; and ''The Effects of Oil Derived Poisons on Three-Way Catalyst Performance'' by D. Lafyatis, R. Petrow, and C. Bennet of Johnson Matthey, SAE No. 2002–01–1093.

[38] The TSD presents a study of rich/stoichiometry/lean A/F percentages provided by a manufacturer on one of their vehicles.

the catalyst temperature varies during the bench cycle, the strawman durability program included experimental procedures to determine the effective reference temperature for the bench cycle. The effective temperature was calculated using the BAT equation and catalyst temperature histogram data measured on the aging bench following the bench cycle. The BAT equation is used to calculate the effective reference temperature by trial-and-error changes to the reference temperature (T_r) until the calculated aging time equals the actual time represented in the catalyst temperature histogram.

As previously discussed, the BAT equation is used to take the time-at-temperature data measured during an approved road cycle and determine the amount of time to age a catalyst system following the bench cycle on the aging bench that is necessary to recreate the deterioration effect of the road cycle's catalyst temperature exposure. The effects of A/F ratio on the severity of temperature exposure are addressed by the bench cycle's use of an appropriate mix of A/F ratios on the bench.

There are additional sources of deterioration that occur on the road cycle that are not directly replicated on the bench. Engine-out deterioration is one source, but as previously discussed, engine-out deterioration is near zero. Of more significance, a road cycle accounts for more poisoning than the bench aging cycle. To account for the additional poisoning seen on the road cycle, and any engine-out deterioration that may exist, the aging time on the bench is increased to replace these shortfalls with additional thermal aging. In the strawman durability bench procedures we addressed the potential shortfall by the use of an ''A-factor'' in the BAT equation. The A-factor increases the amount of thermal aging to account for all sources of non-thermal deterioration. The strawman procedure specified an A-factor of 1.1, which increases aging time by 10 percent. We believe that there is very little deterioration left unaccounted by the BAT equation, Consequently, we selected an A-factor value of 1.1 (a 10% adjustment).

The strawman durability procedures contain a description of equipment for an aging bench. Briefly, this includes a slave engine mounted to an engine dynamometer with an engine controller and provisions for secondary air injection. This bench aging configuration has been used by several manufacturers to conduct bench aging. It was also the method of aging that was used with the RAT A bench aging cycle which serves as the basis of the bench aging cycle developed for the strawman.

The strawman bench aging procedures are discussed in more detail in the TSD. Briefly, the bench aging procedures begin by measuring catalyst time-at-temperature data on the standard road cycle for at least 100 miles. The data collected on the road is proportionally increased to represent the full useful life of the vehicle. The time-at-temperature data and the effective temperature of the bench cycle (determined experimentally using a procedure being proposed today) are entered into the BAT equation to calculate how long to age the catalyst system on the bench. The catalyst-plus-oxygen-sensor system is installed on the aging bench. An engine controller controls the A/F ratio, speed, and spark timing of the engine and adds secondary air in front of the first catalyst according to the bench cycle. The bench cycle is repeated as necessary to conduct aging for the amount of time calculated from the BAT equation. Using this method, the bench aging procedures can reproduce the emission deterioration seen on any road cycle.

3. Allowable Customization of the Bench Aging Procedures

The strawman bench procedure allowed the following bench aging variables to be customized by individual manufacturers in order to better achieve the durability program objective.

a. *The control temperature of EPA's rapid aging bench cycle.* The BAT equation can be used to determine the appropriate aging time for any reasonable temperature experienced on the bench cycle and still provide equivalent aging to the strawman bench aging procedure. Choosing a higher temperature will shorten the aging time, while a lower temperature will lengthen the time. Because the relationship between deterioration and aging temperature is exponential, a small change in temperature will lead to a dramatic change in aging time. For example, changing the effective bench temperature from 800 to 850° C will cut the aging time by more than 50 percent. However, care needs to be taken so that the maximum temperature seen on the bench does not exceed the temperature limit that leads to catalyst damage, generally in the range of 1000 to 1050° C. EPA selected 800° C as approximately the lowest reasonable control temperature which results in a relatively short aging time for many applications and which should keep the catalyst below the damage limit. Manufacturers would be allowed to use 800° C without prior approval. Selection of another value for the control temperature on the bench cycle would allow manufacturers to complete the aging in a shorter period of time, but would have no effect on the amount of deterioration produced by the bench aging when calculating aging time with the BAT equation.

b. *The R-factor.* The R-factor represents the catalyst sensitivity to temperature exposure. The catalyst design will affect the R-factor. In Appendix IX to the proposed regulations, we discuss how an R-factor may be determined for a catalyst. The R-factors developed by EPA are based on experience with historical catalysts. An appropriately calculated R-factor (determined using the procedures of Appendix IX on the specific catalyst in question) will improve the accuracy of bench aging to meet the ninety percent deterioration objective.

c. *The A-factor.* The A-factor represents how much extra catalyst thermal aging is necessary to reflect the additional catalyst deterioration experienced in use, from causes other than thermal exposure. Manufacturers can determine an appropriate A-factor based on IUVP or other in-use data. The use of a more appropriate A-factor will improve the accuracy of bench aging.

d. *Use fuel with additional poisons.* Catalyst poisoning is a real-world source of catalyst deterioration. The strawman bench aging procedures replace some the deterioration due to poisoning with additional thermal aging of the catalyst, reflected by the A-factor. Changing the bench aging to include more poisoning deactivation, *e.g.* by using fuel with lead, sulfur or phosphorus, would reduce the A factor.

D. Development of Today's Proposal From the Strawman Durability Procedures

EPA provided the strawman durability procedures to many interested parties and received comments from a number of them. EPA also met individually with many automobile manufacturers and other parties. EPA refined and changed elements of the strawman durability procedures based on comments that we received from stakeholders on the strawman procedures and our improved understanding of how to accomplish our original objectives for the durability program. The principal comments [39] that we received were:

(1) The strawman standard road cycle is too severe. It does not match in-use

[39] A full text of the comments (to the extent that they are releasable and not claimed as CBI) is contained in the TSD.

distributions of speed and acceleration rates.

(2) The road cycle does not have enough fuel cuts to match in-use driving experience.

(3) Manufacturers should be allowed to use their own durability procedures.

(4) The strawman bench aging cycle has a temperature spike occurring at a lean catalyst A/F ratio, which is not representative of in-use driving.

(5) The BAT equation generates results that very nearly equal General Motors' own internal calculations.

(6) The strawman bench aging cycle should have a defined high temperature value rather than defining the A/F ratio and secondary air injection rates

(7) A defined approach of when and how to use IUVP data to adjust durability procedures is not appropriate.

(8) If the IUVP data shows that a manufacturer meets emission standards in use (because, for example, the manufacturer certified with a sufficient compliance margin, known as ''headroom''), the Agency should not be concerned and should not make decisions based on the accuracy of the certification emission deterioration projection seen in isolation.

(9) The public should be provided with sufficient information to duplicate the deterioration results of any manufacturer-specific procedures that are CBI.

(10) The Agency should mandate the public release of all information provided by manufacturers (required or voluntarily submitted) to obtain approval for an alternative cycle.

1. The Durability Objective

EPA continues to believe that the objective established for the strawman durability program is appropriate. It is the same objective that EPA had stated in the CAP 2000 rulemaking for durability procedures. EPA received no adverse comments on the durability objective when it was presented as part of the strawman durability discussion.

EPA is proposing that the objective of the durability program is to predict an expected in-use emission deterioration rate and emission level that effectively represents a significant majority (approximately 90 percent) of the distribution of emission levels and deterioration in actual use over the full and intermediate useful life of candidate in-use vehicles of each vehicle design which uses the durability program. A significant majority means approximately 90% of the distribution.

2. Cycle Severity for the SRC (Comments 1 and 2)

Several manufacturers commented that the strawman road cycle was too severe, *i.e.*, that the strawman road cycle produced more emission deterioration than necessary to meet the durability objective of 90 percent effective coverage. Several manufacturers supplied data that compared the thermal severity of their cycle, or a publically available cycle, to the strawman road cycle. The manufacturer cycles used in this comparison, with one exception, have been approved under the CAP 2000 durability regulations. During that approval process, the manufacturers provided information[40] that EPA believed showed that the cycles effectively covered approximately 90 percent of the in-use distribution of emission deterioration for their vehicles. The in-use data supplied by those manufacturers as part of the RDP I [IUVP in-use data is not yet available] process over several years have demonstrated good compliance with emission standards in use. For the durability programs used in the analysis discussed later in this section, all the in-use data demonstrated at least 90 percent compliance with the standards. Furthermore, the DFs used during certification were, for the most part, significantly larger than average deterioration represented by the in-use data. We also evaluated several of these durability processes using the available RDP in-use emission data and, although the amount of data does not meet our minimum data requirement of 20 test vehicles, we have concluded that these processes appear to meet the approval criteria and durability objective being proposed today. Based on these screening criteria, we believe that these durability processes generally meet the durability objective which is being proposed today.[41]

Therefore, we would expect that EPA's standard road cycle, if properly targeted to achieve the durability objective, should result in similar catalyst temperature exposure as the manufacturers cycles. The fact that the strawman road cycle proved more severe than the manufacturers' cycles indicated it was also more severe than necessary to meet EPA's durability objective.

[40] In-use emissions information supplied by manufacturers is contained in the technical support document and docket to the CAP 2000 rule.

[41] EPA has pursued remedies whenever a manufacturer's in-use data demonstrates that the objective of the durability process was not achieved in actual use.

The relative severity data supplied[42] in the manufacturers' comments showed that the strawman road cycle was about 50 percent more severe than the average manufacturer road cycle. That is, the amount of deterioration from the strawman road cycle was approximately 50 percent more than that of the average manufacturer's road cycle. The data ranged from approximately equal severity, to the strawman being about twice as severe as the manufacturer's cycle. The results depended on the type of vehicle that was used to make the comparison and the cycle to which it was compared.

This catalyst time-at-temperature data was not available when the strawman road cycle was being developed. Prior to the availability of this data our estimate of how closely the strawman road cycle achieved the durability objective was based mainly on driving characteristics and extrapolated expected effects on catalyst temperature. Based on this new data, EPA now believes that the strawman road cycle is too severe compared to the stated objective for the durability program. The Standard Road Cycle (SRC) that EPA is proposing today has been modified from the strawman version to reduce its severity and to more accurately achieve EPA's durability objective for the entire fleet of vehicles.

Since the objective of the durability program is to effectively cover a significant majority of emission deterioration, we did not attempt to match average in-use speed or acceleration rate distributions. Matching average in-use driving experience on the SRC would lead to a cycle that only covered 50 percent of the distribution of in-use emission deterioration. Consequently, EPA rejected the suggestion that the SRC merely match the in-use distributions of speed and acceleration rates. The speeds and acceleration rates of the SRC are generally somewhat higher than average in-use data to fulfill our target of effectively covering 90 percent of the population's in-use emission levels.

To develop the SRC that EPA is proposing, EPA reviewed those manufacturer cycles which used a speed-versus-time trace run for the vehicle's full useful life to see how they developed their road cycle to reach an appropriate target level of severity. We reviewed speed and acceleration rates

[42] Refer to the TSD for a full presentation of the comparative severity between the strawman road cycle and various manufacturer cycles.

used on the Ford HSC and Toyota's U02 and 9-Lap cycles.[43]

Each of these cycles contained a high-speed driving mode which accounted for over one-third of the driving time; speeds in the high-speed mode varied between 60 and 75 mph. The balance of the cycle time was spent in four lower speed laps which consisted of 30, 40, 50, and 55 mph for the U02 and 9-Lap cycle and 35, 45, 55, and 45 mph [again] for the HSC cycle.

EPA received catalyst temperature histogram data from General Motors (GM) which showed that the strawman road cycle produced three temperature peaks with little time at temperatures between these peaks. This contrasted with GM's own cycle which resulted in a more filled-out distribution resembling a typical skewed-normal distribution. GM commented that the strawman's unrealistic tri-modal temperature distribution was caused by the use of a few discrete-speed laps rather than a richer mixture of driving speeds and loads that occur in normal driving. EPA agrees with GM's observation that a more filled-out distribution of catalyst temperatures is a desirable outcome of a road cycle because it more closely matches a normal in-use distribution of catalyst temperatures.

Toyota commented that the strawman does not contain enough fuel cuts.[44] Toyota notes that fuel cuts lead to lean catalyst A/F ratios which in turn lead to more deterioration than the same temperature exposure at stoichiometric operation. EPA agrees with Toyota that a inclusion of a realistic number of fuel cuts in the SRC is desirable for the reasons discussed above.

Toyota recently re-designed their 9-Lap cycle to more closely match in-use levels of fuel-cuts. They call their new cycle the U02 cycle. To add more fuel cuts to their 9-Lap cycle, Toyota added three to five speed ''dips'' (of 5 to 15 mph) to each of the constant-speed laps in their cycle. The U02 also added an over-acceleration, coast-down event to each of their higher-speed modes, such as could occur when merging on to a limited-access highway. This event causes high temperature exposure to occur at a lean A/F in the catalyst.

Ford suggested that EPA use a cycle they recently developed called MOD1. The MOD1 cycle was based on EPA's strawman road cycle but Ford reduced the maximum cruise speed to 80 mph and reduced the high-speed acceleration rates to 3 or 4 mph/second. Based on relative severity data supplied by Honda, the MOD1 cycle is about one-third less severe than the strawman cycle. The MOD1 cycle was slightly higher than midway in severity between the HSC and U02 cycles, less severe than Ford's HSC cycle, and more severe than Toyota's U02 cycle. Based on this data, the MOD1 cycle sits among the manufacturer's approved cycles which have been demonstrated to effectively meet the 90 percent durability target. Consequently, the MOD1 cycle seems to be a well-measured step in the right direction for overall severity. However, it did not address Toyota's comments that more fuel cuts were needed, nor GM's comments that a richer mix of speed distribution was desirable.

Although there is a fair amount of variability in the manufacturers' relative severity data, about half of the severity data lie within a close band.[45] That band of severity included the MOD1 cycle. Consequently, because our target for the standard bench cycle is the same target (effective coverage of 90 percent) as the manufacturers' programs, it is appropriate to target near this consensus level of severity.

EPA used all this information to develop the standard road cycle (SRC) proposed today. The SRC is targeted to effectively cover 90 percent of the distribution of emission deterioration rates that occur on candidate vehicles in use, across the entire fleet. The speeds and acceleration rates on the SRC are reduced from the strawman proposal. The average speed has been lowered from 51.3 to 46.3 mph, the maximum cruise speed was lowered from 85 to 75 mph, and the acceleration rates for higher speed operation were lowered from 5 to 3 mph/second.

The SRC also includes more fuel-cuts and a broader range of speed operation than seen on the strawman cycle to more closely match in-use experience. The number of fuel-cut events were increased from 14 to 24 events during the seven laps (25.9 miles) of the cycle. The duration of each fuel-cut was also increased by employing slower rates of deceleration (deceleration rates varied between 5 and 8 mph/s in the strawman cycle and from 1 to 5 mph/s in the SRC). To expand the speed-diversity of the road cycle, the number of different cruise speeds was increased from 6 speeds in the strawman cycle to 11 speeds in the SRC.

3. Alternative and Customized Cycles (Comment 3)

Manufacturers suggested that they should be allowed to use their own durability procedures.

Background.

The CAP 2000 durability procedures required manufacturers to develop their own durability process subject to EPA approval. In the CAP 2000 rulemaking EPA established an objective for the durability process to ''predict the deterioration of a significant majority of in-use vehicles.''[46] In addition to being effective at predicting emission deterioration rates and compliance of candidate in-use vehicles, these processes also reduced manufacturers' compliance costs by using methods that were already part of their development process.

Although EPA is proposing standard whole-vehicle and bench-aging durability procedures, EPA is aware that the standard procedures may not achieve the durability objective, discussed in section II.D.1., for all manufacturers or for certain vehicle models. Because EPA's standard procedures are targeted to achieve the objective for the overall fleet of vehicles, they may over- or under-achieve the durability objective for some particular manufacturers or vehicles. For example, certain vehicles may have more available power than the vehicles EPA considered when designing the standard procedures. Such vehicles may be operated more aggressively in use than on the SRC. Similarly, vehicles which have less power may be operated less aggressively than on the SRC. When the standard procedures fail to achieve the durability objective, EPA believes that it is appropriate to allow an alternative process when it is necessary to achieve that objective.

In addition, where the manufacturer durability procedure results in approximately equivalent levels of emission deterioration to those of the SRC being proposed today, the use of those procedures may represent a significant time and/or cost savings to the manufacturer because they may already be conducted as part of the manufacturer's development process. If a manufacturer can demonstrate that their alternative process is essentially equivalent to EPA's proposed standard road cycle, use of that process would have no effect on the emission

[43] Refer to the TSD for a description of Toyota's U02 and 9–Lap cycles and Ford's HSC cycle. The GM road cycle was not included in the analysis because it does not involve mileage accumulation based on a speed-versus-time trace.

[44] For most current technology vehicles the engine controller stops fueling the engine when the vehicle is stopping or experiencing a significant deceleration. These events are referred to as fuel cuts.

[45] The manufacturer supplied data showed a range of relative thermal severity (manufacturer/strawman) from 105% to 45%, 5 of the 11 data points were in the range of 65% to 60%. The TSD contains the data and has an expanded discussion of our review of the data.

[46] Ref. 63 FR 39661 (July 23, 1998).

compliance determination made during certification.

For these reasons, EPA is proposing that manufacturers may customize the standard EPA whole vehicle and certain aspects of bench aging durability processes. The proposed customization provisions include the ability to use either a ''customized SRC'' (the SRC cycle run for a different number of miles) or an alternative road cycle. EPA believes that these options will effectively address some manufacturers' desire to use the manufacturer-specific procedures in the future durability program.

Customization of the SRC includes running the SRC for a shorter or longer period of time than specified and/or changing the fuel to include poisons such as lead or phosphorus combined with running the SRC for a shorter period of time. Alternatives to the SRC involve road cycles that employ time/speed traces different than the SRC.

EPA is proposing approval criteria for these customized/alternative procedures. Any existing durability procedures approved under CAP 2000 would have to be re-evaluated and approved under the requirements of the proposed regulations.

Customized/Alternative Road Cycles. To obtain approval of a customized/alternative road cycle the manufacturer must demonstrate that the durability program will likely achieve the durability objective. As previously discussed, the proposed objective of the durability program is to predict an expected in-use emission deterioration rate and emission level that effectively represents a significant majority (approximately 90 percent) of the distribution of emission levels and deterioration in actual use over the full and intermediate useful life of candidate in-use vehicles of each vehicle design which uses the durability program.

To make the initial demonstration necessary for the Agency to approve a customized/alternative cycle, EPA is proposing that the manufacturer supply high mileage in-use emission data on applicable candidate in-use vehicles. The vehicles would be randomly procured from actual customer use, generally with an age of 4 to 5 years and with a minimum of approximately 50,000 miles. They would cover the breadth of the vehicles that the manufacturer intends to certify using the customized/alternative cycle. Vehicles would be procured and FTP tested as received under the provisions of the IUVP program (ref: 40 CFR 86.1845–04). Manufacturers could use previously generated in-use data from the CAP 2000 high mileage IUVP program or the fourth-year-of-service RDP ''reality check'' in-use program as well as other sources of in-use emissions data for this purpose. EPA will also consider additional emissions data or analyses that the manufacturer may choose to provide, including data from vehicles which have been screened for proper maintenance and use.

Because historical in-use data would be used to approve the manufacturer's durability process for current and future vehicles, it is necessary to limit that data to those that are applicable to the vehicle designs the manufacturer intends to cover with the durability process. Manufacturers must remove from the sample the following types of unrepresentative data: (1) Data which was collected on an engine/emission control system which is not comparable to the current production designs, (2) data collected on a vehicle design which has been recalled due to a defective emission related part (unless the recall repair was performed on the test vehicle), or (3) data from vehicles that have been operated in an abnormal fashion that has impaired the effectiveness of the emission control system. In addition, manufacturers may also replace data from previously tested vehicles under the following conditions: (1) for in-use vehicles which have been primarily operated on high sulfur fuel (fuel with more than 80 ppm sulfur), if EPA has approved sulfur-removal preconditioning the manufacturer may replace the as-received testing with a second test conducted after sulfur-removal preconditioning has been performed, and (2) on a case-by-case basis, EPA may approve replacing the as-received testing performed on a vehicle which displays a MIL light that affects emission results with a second test performed after restorative maintenance has been performed. EPA would consider other exclusions or replacements of data on a case-by-case basis.

The amount of in-use emission data required is based on whether the customized/alternative cycle is more or less severe than the SRC. In most cases, EPA will accept a minimum of 20 candidate in-use vehicles. There is less risk of underestimating actual in-use emission levels when the customized/alternative cycle is more severe than the SRC. EPA is reasonably confident that the SRC will achieve the durability objective for the general population of vehicles. Consequently, if the customized/alternative cycle is significantly more severe than the SRC, EPA may accept less data. Conversely, if the customized/alternative cycle is significantly less severe than the SRC, EPA may require more data up to a maximum of 30 vehicles. EPA encourages the manufacturer to submit more data than these minimum levels.

The relative stringency of the customized/alternative cycle compared to the SRC must also be demonstrated. This could be accomplished by an evaluation of the two cycles using catalyst time-at-temperature data from both cycles and using the BAT equation to calculate the required bench aging time of each cycle. For example, if the BAT equation calculates that 170 hours of aging on the SBC would be necessary to reproduce the thermal exposure of full useful life mileage on the SRC and 200 hours of aging to reproduce the thermal exposure on the customized SRC or alternative cycle, the manufacturer's cycle would be 85% as severe as the SRC (SRC/MFR $\times$ 100% = (170/200) $\times$ 100%= 85%). This value (85%) is the equivalency factor. The 85% equivalency factor means that running a vehicle on the SRC for 85% of the required mileage would result in the same emission deterioration as conducting full mileage on the alternative/customized cycle.

If emissions data is available from the SRC, as well as catalyst time-at-temperature data, then that emissions information should be included in the evaluation of the relative stringency of the two cycles and the development of the equivalency factor. For example, if the manufacturer has calculated DFs using both cycles then these values may be compared directly. If the manufacturer cycle generates an additive DF for CO of 0.25 using the SRC and 0.20 using the manufacturer cycle, the manufacturers cycle would be 80% as severe as the SRC (Mfr/SRC $\times$ 100% = (.20/.25) $\times$ 100% = 80%). The equivalency factor is the highest value calculated for the FTP emission constituents. In this example, assuming that the CO value is the highest of HC, CO, and NO_X emission constituents, then the equivalency factor is 80%.

This analysis would demonstrate the relative stringency between the customized SRC or alternative cycle and the SRC. It would also demonstrate the level of stringency of the SRC and the effectiveness of the SRC in meeting the durability objective. In many cases, especially before experience is gained in using the SRC to develop emissions data or certification levels, the same analysis will be used for demonstrating the relative stringency of the SRC noted above and developing the equivalency factor.

In summary, approval of a customized/alternative road cycle requires an analysis of whether the cycle will achieve the durability program objective using in-use emissions data and an evaluation of the relative stringency of the SRC and the manufacturer's program.

Once the customized/alternative durability process is approved, EPA is proposing that for each test group the manufacturer must determine, using good engineering judgement, whether to apply the durability procedure to that particular test group. Manufacturers should only apply a durability process to a test group when they determine that the durability objective will be achieved for that test group in actual use on candidate in-use vehicles.

Furthermore, EPA is proposing that the manufacturer may make modifications to an approved customized/alternative road cycle and apply them to a test group, to ensure that the modified cycle will effectively achieve the durability objective for future candidate in-use vehicles. The manufacturer would be required to identify such modifications in its certification application and explain the basis for them. Manufacturers must use good engineering judgement in making these decisions. Significant, major, or fundamental changes to a customized/alternative cycle would be considered new cycles and would require advance approval by EPA.

EPA considered a more objective criteria for approval which would have required manufacturers to demonstrate that the customized/alternative road cycle resulted in (1) a specified percent of the in-use emission results that were less than or equal to the certification levels, and (2) at least 90 percent of the in-use emission data passing the applicable emission standards. However, EPA is not proposing such criteria because of concerns that the restrictions of such objective criteria are not needed to determine whether an alternative/customized cycle would meet the durability objective, and given the wide variety of circumstances and relevant data that might be employed in making a decision, it could lead to disapproval of a cycle that would achieve the durability objective.

Alternative Bench Procedures

EPA believes that every bench aging procedure should be based upon measured vehicle performance on either the SRC or an EPA-approved road cycle. It is through the connection to the road cycle that EPA is assured that the alternative bench procedures will result in emission deterioration that achieves our durability objective. The BAT equation will calculate how much aging time is necessary on the bench to result in the same amount of emission deterioration experienced on the road cycle. As previously discussed, manufacturers must demonstrate that all customized/alternative road cycles meet the durability objective prior to Agency approval.

EPA believes that customizing certain aspects of the standard bench aging procedure is appropriate if the modified procedure continues to produce the same amount of emission deterioration as the SRC or approved road cycle. Specifically, EPA believes that customization of the following aspects are appropriate for the reasons discussed below.

a. Increasing the control temperature will reduce the time necessary to age the catalyst system on the bench, but it will not affect the severity of the aging because the BAT equation assures that the thermal aging seen on the road cycle is reproduced on the bench regardless of the effective temperature of the bench cycle.

b. EPA believes that an experimentally-determined R-factor using the actual catalyst to be produced is expected to be more accurate than using the standard R-factor specified by EPA which was developed to apply to the industry as a whole. EPA is proposing a standard experimental procedure which manufacturers can use to develop a R-factor that specifically applies their products. EPA believes that a R-factor developed using this standard process will be more accurate than the standard R-factor because its development is based on data generated on the catalyst in question. The procedures for experimentally developing a R-factor are presented in Appendix IX of the proposed regulation.

EPA will also consider the use of alternative methods to determine the R-factor. To have an alternative method approved by EPA, the manufacturer must demonstrate that the R-factor determined by this alternative process results in the same (or more) emission deterioration than the applicable approved road cycle.

One method to make this demonstration is to determine FTP emission levels from a sufficient number of vehicles to meet the 80% statistical confidence criteria (discussed below) which have completed whole vehicle aging on the applicable road cycle. These vehicles must represent the breadth of the vehicles to be covered by this alternative method. These results are compared with results from the same (or a similar) vehicle which was tested with a catalyst system aged on the bench for the amount of time calculated from the BAT equation using the experimentally determined R-factor. To be approved, the emission results from the vehicle with the bench-aged catalyst system should be greater than or equal to the emission results for the vehicle aged on the road cycle with a minimum of 80% statistical confidence.

c. The A-factor used in the BAT equation is designed to account for sources of deterioration other than thermal aging of the catalyst that occur in actual use but are not represented by the bench aging process. Determining the A-factor by actual in-use data is generally superior to the standard A-factor of 1.1.

d. Conducting bench aging using fuel with additional poisons is worst case, consequently it is appropriate to do so without further evaluation by EPA. EPA expects when a manufacturer uses fuel with additional poisons during bench aging, they would also adjust the bench aging time by either calculating a new R-factor or a new A-factor. In that case, the approval procedures applicable to changing those factors would also apply.

e. Generally, the SRC is used for generating the catalyst aging temperature histogram data used in the BAT. Using another road cycle is appropriate if the cycle has been approved as discussed above. The approval process assures that the alternative road cycle is expected to achieve the durability objective. Consequently, using an approved cycle to generate catalyst temperature histogram data is appropriate without further evaluation by EPA.

f. EPA's standard bench cycle was developed to include an appropriate amount of rich, lean, and stoichiometric A/F operation on the bench for the typical vehicle. However, some vehicles have a fuel control strategy that controls fuel within a narrower band than typically occurs. In those cases, use of the SBC may over- or under-predict actual emission deterioration in use. It is also possible that the SBC may result in a proper prediction of in-use emission deterioration, but a manufacturer may wish to use another bench cycle for reasons of cost and/or time savings, because that cycle is performed as part of the manufacturer's development process.

If the manufacturer can demonstrate that bench aging following an alternative bench cycle results in the same (or more) emission deterioration than the SRC or an approved road cycle (whichever cycle is applicable), then the use of the alternative bench cycle will maintain or improve the ability to achieve the durability objective. In these cases, it is appropriate to allow the use of a different bench cycle because the alternative bench cycle will accurately reproduce the emission deterioration seen on a road cycle which meets the durability objective. If a manufacturer uses a different bench cycle, they must also experimentally determine a R-factor for the BAT equation. The manufacturer may use EPA's experimental process or another approved method to determine an R-factor. [See paragraph b., above, for approval criteria to determine a customized R-factor]

g. There may be some vehicles for which the BAT equation does not calculate appropriate aging times on the bench, although EPA is not aware of such vehicles at this time. In those cases, it would be appropriate to allow a manufacturer to use an alternative to the BAT equation provided it can demonstrate that bench aging time calculated by this alternative process results in the same (or more) emission deterioration than the road cycle upon which it is based.

This demonstration can be made by determining FTP emission levels from a sufficient number of vehicles to meet the 80% statistical confidence criteria (discussed below) which have completed whole vehicle aging on the applicable road cycle. These vehicles must represent the breadth of the vehicles to be covered by the alternative cycle. The results are compared with results from the same (or a similar) vehicle which was tested with a catalyst system aged on the bench for the amount of time calculated from the alternative BAT equation. To be approved, the emission results from the vehicle with the bench-aged catalyst system should be greater than or equal to the emission results for the vehicle aged on the road cycle with a minimum of 80% statistical confidence.

4. The Standard Bench Cycle (Comment 4)

The standard bench cycle (SBC) consists of a plot of catalyst temperature and A/F ratio versus time which is followed during bench aging. As discussed previously, the catalyst temperature and A/F ratio in the catalyst are the most important variables that affect the thermal aging rate of the catalyst. EPA is using its strawman bench aging cycle as the SBC in today's proposal. As discussed above, the SBC was developed based on methods reported in the literature which were also used effectively by automobile and catalyst manufacturers in the past.

We received comments that the SBC may not represent the mixture of A/F ratios seen on certain vehicles during in-use operation. Furthermore, there was concern that lean catalyst A/F ratios occur during the higher catalyst temperatures experienced on the SBC. EPA agrees that the use of certain fuel control technologies, such as A/F ratio sensors rather than traditional oxygen sensors to control fuel metering and the use of algorithms to predict A/F ratio so that less switching between rich and lean A/F ratios is required for effective fuel control, could lead to less variation in A/F ratios in use. Such vehicles may see less time at lean A/F ratios in the catalyst. Consequently, those vehicles may be over-aged using the SBC. To address this concern, EPA is proposing to allow manufacturers to use a different bench cycle and/or bench aging time equation than the standard procedure, subject to EPA approval, as discussed above.

5. Bench Aging Time (Comment 5)

EPA received a comment that the bench aging time (BAT) equation used in the strawman produced results nearly equal to those produced by General Motors' internal calculation. EPA also received confidential information from a manufacturer that the BAT equation resulted in nearly equal results as their confidential procedures. Based on this positive input, EPA has not changed the BAT equation for today's proposal from the equation used in the strawman durability procedures.

6. Bench Aging Specifications (Comment 6)

In the strawman durability procedures, EPA defined the high temperature seen on the bench cycle indirectly by specifying the A/F ratio and the amount of secondary air injection. General Motors (GM) commented that it would be better to define high temperature directly because the high temperature has a significant impact on the aging that occurs on the aging bench. We agree that directly controlling the high temperature spike is a better procedure.

Based on data from GM, the high temperature is usually about 90° C higher than the lower control temperature. We believe that there will be a similar temperature change on the SBC because it was developed from the RAT A cycle which GM used to generate this temperature data. Based on this data, EPA is proposing that the high temperature control point be 90° C (± 10° C) higher than the low temperature control point. In the SBC the lower control temperature is proposed to be 800° C (± 10° C) and the higher temperature to be 890° C (± 10° C). The specification for the A/F ratio is now defined as ''rich'' with the exact A/F ratio to be selected to achieve the desired high temperature of 890° C.

We also changed the secondary air injection rate from 4% to 3% to match the RAT A cycle which was the basis of the strawman proposal. The higher rate of air injection prompted concerns about the ability to deliver that much air homogeneously across the exhaust flow. The original purpose of the secondary air injections was to assure a lean catalyst A/F ratio (how lean was not the issue) and to determine the amount of temperature rise that occurred in the exhaust stream. Now that we are specifying the temperature rise of the exhaust stream directly, it is not necessary to require a particularity high rate of air injection. Consequently we harmonized the amount of secondary air injection with the established RAT A procedure.

7. Adjusting Durability Procedures Based on IUVP Data (Comments 7 and 8)

Manufacturers commented that a defined approach of when and how to use IUVP data to adjust durability procedures is not appropriate. Furthermore they commented that EPA should not be concerned whether the durability process accurately predicts in-use emission deterioration if the manufacturer is complying with the standards in use.

The CAP 2000 regulations specified that the in-use data collected under the in-use verification program (IUVP) testing provisions would be used to determine if the manufacturer's durability process was adequately predicting in-use emission levels (ref. 86.1823–01((g), and (h)). EPA continues to believe it is very important to compare actual in-use emission levels to the emission levels predicted at the time of certification and that this in-use information should be used to improve the durability process used to make those predictions.

In the strawman procedures, EPA proposed calculating a least-squares best-fit in-use DF for each durability group using the emission data from the IUVP. EPA suggested in the strawman process that its proposed durability regulation should contain a requirement that the manufacturer correct its durability prediction if the certification DF developed by the process for a specific durability group was significantly different from the in-use DF, or if there was a statistically significant general offset trend shown. The strawman proposal did not fully develop the procedures to be used to conduct this analysis. These offsets were to be corrected by either mathematically adjusting the DFs by at least half the difference or increasing the number of miles/hours run during durability mileage accumulation/ catalyst aging.

The automotive industry commented that it would be very difficult to determine statistical significance, given the limited amount of in-use verification data, and that this provision could place an unnecessary burden on those manufacturers who were over-predicting, rather than under-predicting emission deterioration. They also commented that as long as the in-use data was indicating that their vehicles were meeting the emission standards in use, that it should not be a concern to the Agency if the rate of deterioration calculated at the time of certification does not match that of in-use vehicles. They recommended that EPA retain the CAP 2000 regulations whereby the in-use verification data must be taken into consideration when deciding if the durability process is adequately predicting emission deterioration.

EPA agrees that the approach taken in the CAP 2000 rulemaking is appropriate, because it provides a reasoned framework for when to require analysis and review by manufacturers, and provides the needed discretion for deciding when approval for a program should be withdrawn or modifications required. EPA still has the same concerns about durability accuracy expressed during the CAP 2000 rulemaking: ''An accurate durability process facilitates a more meaningful certification process which identifies noncompliance before the vehicles are produced and avoids excess in-use emissions. The in-use verification program is a tool which can be used by the Agency and the manufacturers to improve the durability process and avoid excessive emissions in use and costly recalls.'' [47] It is the Agency's expectation when it issues an approval that a durability program will achieve the durability objective in use. EPA expects manufacturers to use the results of the IUVP testing to improve their durability projections when necessary to better achieve the durability objective.

As in the CAP 2000 program, EPA is proposing to require manufacturers to conduct an analysis of their durability program if certain objective criteria discussed below are met. In addition EPA may require such an analysis on a case by case basis even if the criteria are not met. EPA also reserves the authority to withdraw approval of a durability program or require its modification if it determines that the manufacturer's program does not meet the objectives for a durability program.

The Agency is proposing to continue the requirement established in the CAP 2000 rule for the manufacturer to reevaluate the validity of a durability process in achieving the durability objective by performing an analysis when the average IUVP data exceeds 1.3 times the applicable emission standard and at least 50% of the test vehicles fail the standard in use (evaluated independently for all applicable emission constituents). These proposed analysis trigger criteria are intentionally loose enough to require an analysis only in cases where it is highly likely that durability programs that were failing to meet the durability objective. The Agency is also proposing that it may, at its discretion, require manufacturers to analyze available IUVP data, or other information, when it appears that the durability objective is not being achieved for some portion of the fleet of vehicles covered by a durability procedure regardless of whether the analysis trigger criteria have been met.

As part of the analysis, the manufacturer should address the applicability of the data to current vehicle designs and to the current durability procedures used by the manufacturer. Manufacturers may remove from the sample the following types of unrepresentative data: (1) Data which was collected on an engine/ emission control system which is not comparable to the current production designs, (2) data collected on a vehicle design which has been recalled (voluntarily or otherwise) due to a defective emission related part (unless the recall repair was performed on the test vehicle), or (3) data from vehicles that have been operated in an abnormal fashion that has impaired the effectiveness of the emission control system. In addition, manufacturers may also replace data from previously tested vehicles under the following conditions: (1) For in-use vehicles which have been primarily operated on high sulfur fuel (fuel with more than 80 ppm sulfur), if EPA has approved sulfur-removal preconditioning the manufacturer may replace the as-received testing with a second test conducted after sulfur-removal preconditioning has been performed, and (2) on a case-by-case basis, EPA may approve replacing the as-received testing performed on a vehicle which displays a MIL light that affects emission results with a second test performed after restorative maintenance has been performed. EPA would consider other exclusions or replacements of data on a case-by-case basis. The manufacturer may also provide additional in-use data with the analysis.

As in the CAP 2000 program, EPA is proposing that it may withdraw approval of a durability program or require its modification if it determines that the program does not meet the objectives for a durability program. In those cases, the Agency is proposing to give the manufacturer a preliminary notice at least 60 days prior to rendering a final decision to withdraw approval for or require modifications to a durability procedure. EPA may extend the 60-day period upon request by a manufacturer when it is necessary to complete a thorough analysis. During this period the manufacturer may submit technical discussion, statistical analyses, additional data, or other information that is relevant to the decision. This may include an analysis to determine whether factors other than the durability program, such as part defects, are the source of the problem. The Administrator will consider all information submitted by the deadline before reaching a final decision. A final decision to withdraw approval or require modification to a durability procedure would apply to future applications for certification and to the portion of the manufacturer's product line (or the entire product line) that the Administrator determines to be affected.

These proposed requirements would apply to the EPA standard road and bench durability procedures as well as customized/alternative durability procedures.

If the manufacturer was using the standard road cycle or standard bench cycle, EPA would require the manufacturer to adjust the durability process so it would achieve the durability objective. The Agency is proposing two options in this situation: (1) Increasing future DFs by the average percent-difference between certification levels and IUVP data, or (2) increasing the whole vehicle miles driven or catalyst aging time by the average percent-difference between certification levels and IUVP data. Additionally the manufacturer may obtain approval for a new alternative durability process that has been demonstrated to meet the durability objective. If the data set used in the analysis contains less than 20 pieces of data, the Administrator may reduce the degree of adjustment required to account for uncertainty in the data.

If EPA determines that the SRC or the standard durability bench procedures generally do not meet the durability objective for a large number of manufacturers, EPA will adjust the standard procedures by rulemaking.

[47] Ref. 63 FR 39663.

As with the criteria for original approval of an alternative durability program, EPA considered a more stringent objective criteria for using IUVP data to evaluate durability procedures which would have required manufacturers to demonstrate that the durability procure resulted in (1) in-use emission results that are at least a specified percent less than or equal to the certification levels, and (2) at least 90 percent of the in-use emission data that pass the applicable emission standards. EPA is not proposing such criteria for the reasons described above regarding approval criteria.

8. Reproducibility by Outside Parties (Comment 9)

We received comments supporting the goal that the public should be provided sufficient information to duplicate the deterioration results of any manufacturer-specified procedures that are CBI.

In some cases, manufacturers have claimed that certain aspects of their manufacturer-specific durability procedures are confidential business information (CBI). As discussed above, the approval process for all alternative cycles includes a determination of the relative severity of the alternative cycles compared to the SRC by means of the calculation of an equivalency factor.[48]

EPA believes that a manufacturer's equivalency factor should not be considered confidential business information. The equivalency factor is developed using EPA-prescribed methods so there is no manufacturer practice to be protected. The factor relates to how much driving on the SRC is required to meet the durability objective. The SRC is a publicly available cycle developed by EPA. Furthermore, knowing that a certain amount of driving on the SRC produces the same amount of in-use emission deterioration as on the manufacturer cycle would not reveal any potentially confidential aspects of the manufacturers in-house durability procedures. For example, there would be many different road cycles that would result in the same equivalency factor to the SRC. EPA invites comment on whether the equivalency factor should be eligible for CBI treatment, including any justification for treating it as confidential. In the absence of a compelling justification to treat this equivalency factor as CBI, EPA intends to determine that a manufacturer's equivalency factor would not be considered CBI. Furthermore, EPA intends to publish a list of manufacturers which have obtained approval to use alternative cycles together with a manufacturer's equivalency factor for each test group which uses those cycles.

The equivalency factor will provide the public with sufficient information to duplicate the amount of deterioration produced by a manufacturer-specific procedure. Even if a manufacturer asserts that their cycle is CBI, the public will have a pre-determined amount of mileage accumulation on the SRC that will result in an equivalent amount of emission deterioration. Consequently, any interested party could run the SRC for the appropriate number of miles and get the same results that the manufacturer developed during certification.

To reproduce the deterioration generated by a manufacturer which certified using a customized road cycle, standard bench procedure, or alternative bench procedure, an outside party may run a vehicle using the SRC for the number of miles indicated by the equivalency factor.

Similarly, an outside party will be able to perform bench aging using the SBC. The aging time may be calculated using the BAT equation and measured catalyst temperature on the SRC (with full-useful-life-mileage adjusted by the equivalency factor).

9. Confidentiality of Emission Test Results Submitted Under the Durability Program

Under the durability regulations, a variety of provisions require manufacturers to submit to EPA the results of emissions testing. For example, emissions test results are submitted as part of the approval process for alternative driving cycles. They may also be submitted subsequent to approval as part of an analysis of whether an alternative durability program continues to meet the objective of the durability program. The results of emissions testing are also submitted to EPA as part of the IUVP and confirmatory testing programs. Emissions test results would be submitted to EPA under 40 CFR 86.1823(e)(1)(A), 86.1847(b)(1), and (f)(1). Emissions test results may also be submitted to EPA under other provisions of the durability regulation.

EPA believes that the results of this emissions testing would be emissions data as defined by 40 CFR 2.301. Emissions data are not eligible for confidential treatment. 40 CFR 2.301(e). EPA invites comment on why these data should be eligible for CBI treatment. In the absence of a compelling justification received during the comment period, EPA intends to release emissions test results submitted to EPA as noted above. EPA is not attempting at this time to decide what other data, if any, would be emissions data under 40 CFR 2.301.

E. Diesel Vehicle Exhaust Deterioration

EPA expects that diesel-fueled vehicles will be largely driven in the same fashion as gasoline-fueled vehicles. The SRC was developed to include sufficient amount of high catalyst temperature to age the catalyst on an Otto cycle engine. However, the same operation that causes high temperatures in catalysts also causes high engine load and high in-cylinder temperatures which increase engine wear in diesel vehicles and lead to emission deterioration. The SRC also contains a reasonable amount of slower speed operation and coast-downs followed by deep accelerations which increase lubricating oil consumption, fuel injection deterioration, and increase particulate formation. For these reasons, the SRC is considered to be fuel-neutral, that is, appropriate for any motor vehicle, regardless of the fuel used. Thus, the SRC may be used to evaluate exhaust emission deterioration of vehicles using any fuel. Furthermore, the provisions to customize the SRC or develop an alternative road cycle would for the same reason apply equally to vehicles, regardless of the fuel used.

The same is not true for bench aging procedures, however. The bench procedures are only applicable to vehicles which use a catalyst as the principal exhaust emission control strategy. The proposed bench procedures accelerate the normal vehicle aging process by increasing the thermal aging of the catalyst. This strategy will not work acceptably for vehicles that do not have a catalyst, rely significantly less on the catalyst to provide emission reduction, or use after-treatment devices that are significantly different from catalysts used on gasoline-fueled vehicles, *e.g.* NO_X adsorbers or catalyzed particulate filters. For that reason the bench procedures proposed today are not applicable to diesel vehicles.

As of the date of this proposal, EPA is not aware of any effective bench aging process for diesel vehicles. At a later date, EPA may choose to propose regulations providing bench aging procedures applicable to diesel-fueled vehicles. In the meantime, diesel-fueled vehicles must use the proposed whole vehicle exhaust durability provisions.

[48] Refer to section II D 2 for a discussion of how to calculate the equivalency factor.

F. Evaporative and Refueling Durability Procedures

The CAP 2000 regulations for evaporative and refueling emission deterioration procedures are similar to the exhaust durability regulations, in that manufacturers had to propose a durability process for EPA approval. Our proposal incorporates procedures for determining evaporative and refueling emission deterioration levels.

The proposed objective for the evaporative and refueling deterioration programs is the same one proposed for exhaust durability: to predict the expected evaporative and refueling emission deterioration of candidate in-use vehicles over their full useful life, covering a significant majority of deterioration. [Ref 40 CFR 86.1824–01 for evaporative emissions and 40 CFR 86.1825–01 for refueling emissions].

Unlike durability procedures to determine exhaust emission deterioration, EPA has never specified a standard procedure to determine evaporative emission deterioration. Instead, manufacturers were required to report to EPA evaporative deterioration factors that were ''designed and conducted in accordance with good engineering practice.'' [ref. 86.091–23(b)(2)]

Since evaporative and refueling emissions are controlled by a similar vapor control system, the deterioration rates for evaporative and refueling emissions are generally determined using the same methods. Most vehicles use integrated refueling systems where a single charcoal canister handles both evaporative and refueling emission control.

The factors affecting deterioration of evaporative control systems are different from those of exhaust emission systems. Evaporative and refueling emissions are controlled primarily by an activated-carbon canister. The canister stores the hydrocarbon (HC) fumes coming from the vehicle's fuel tank and fuel system. While the engine is running, the HC is purged from the canister and ingested by the engine. Other components which control evaporative emissions include fuel hoses and lines and the gas tank cap.

To predict evaporative emissions deterioration, it is necessary to assess the useful-life performance of these vapor control components. Sources of potential deterioration are deactivation of the carbon in the canister, loss of carbon from the canister, degradation of hoses and lines due to environmental conditions (such as temperature extremes and exposure to ozone, ultraviolet light, and vibration), and fuel cap deterioration due to wear.

Vehicle operating events that may lead to deterioration of the vapor control system include, (1) cycling of canister loading due to diurnal and refueling events, (2) vibration of components, (3) deterioration of hoses due to environmental conditions, and (4) deterioration of fuel cap due to wear.

In addition, hosing used in fuel lines are subject to ''permeation''—fuel vapors which seep out of microscopic pores in the material. Emissions due to permeation through the hoses generally stabilize after about a month of use and hence do not generally affect the long-term deterioration of the evaporative system.[49] Beginning with the 2004 model year, EPA's ''Tier 2'' regulations include new, more stringent evaporative emission standards. Concern about the permeability effect of alcohol fuels on hoses and other evaporative components led EPA to require that manufacturers account for this effect in developing their evaporative durability processes [ref. 86.1824–01(a)(iii), (iv) and (v)].[50]

Most of the potential causes of vapor control system deterioration are based on time rather than miles driven. Canister loading is caused mainly by diurnal events, the heating/cooling cycle that occurs over a 24-hour day. For that reason, it is difficult to compress a full lifetime of diurnal events into a reasonable period of time on a whole vehicle.

It is also desirable for cost reasons to combine a whole vehicle based evaporative/refueling deterioration evaluation with the whole vehicle exhaust durability program to save the expense of running two separate programs. For exhaust deterioration the important parameter is miles traveled following the SRC, for vapor control deterioration canister loading and purge events are more important. The whole vehicle exhaust durability program is generally completed in about 100 days. During that time, the vehicle would experience about 100 diurnals (one per day), which is much less than experienced during the vehicle's full useful life.[51] A vehicle aged on the SRC would experience approximately the correct number of refueling events. While this shortfall in diurnal events could theoretically affect projections of deterioration, in actuality, the overall vapor control deterioration is so small that it does not significantly impact the deterioration rate calculation.

Manufacturers have stated that evaporative emissions over the life of a vehicle do not generally increase. An EPA study of evaporative and refueling certification deterioration factors for the 2002 and 2003 model years shows that these DFs are zero or close to zero for many vehicles.[52] When there are evaporative or refueling failures in use, these failures can generally be attributed to failed parts or improper design rather than gradual increases in emissions due to deterioration.

EPA is proposing that manufacturers may determine their evaporative/refueling deterioration by adding evaporative and refueling tests to the SRC or an approved whole vehicle exhaust durability program. EPA is making this proposal knowing that the road cycle will not include a full lifetime of diurnal events. In making this decision, EPA is relying on the fact that the deterioration rates of current-design evaporative system is very small and a more comprehensive procedure would not significantly improve the accuracy of predicting deterioration, but could significantly increase costs.

EPA is also proposing that the evaporative/refueling deterioration may also be measured using a bench procedure. EPA is proposing that manufacturers evaluate the effects of certain sources of deterioration in the bench procedure. The manufacturer should establish an evaporative/refueling durability program that effectively covers a significant majority (approximately 90 percent) of in-use emission deterioration. A manufacturer may determine certification levels using a bench procedure when it determines (using good engineering judgement) that the bench procedure is more accurate than the SRC to achieve the durability objective. While the manufacturer does not need to submit their bench durability procedures for approval, EPA may review any certification level submitted during certification for its appropriateness. EPA is not promulgating specific methods to perform these evaluations. The emission deterioration sources that are proposed to be evaluated in the bench durability procedure are:

[49] Refer to ''Fuel Permeation Rates of Elastomers after Changing Fuel'' by R. Stevens and R. Fuller of Dupont Dow, SAE No. 970307.

[50] Numerous SAE papers examine the permeability of fuel and evaporative system materials as well as the influence of alcohols on permeability. See, for example SAE Paper Nos. 910104, 920163, 930992, 970307, 970309, 930992, and 981360.

[51] Based on 7 to 10 years of use the number of lifetime diurnals would range from 2000 to 3500 events.

[52] Refer to the TSD for a study of DFs for evaporative emissions. Most DFs were zero, the 70-percentile DF was 5% of the standard.

1. Cycling of canister loading due to diurnal and refueling events;
2. Use of various commercially available fuels, including the Tier 2 requirement to include alcohol fuel;
3. Vibration of components;
4. Deterioration of hoses, *etc.* due to environmental conditions;
5. Deterioration of fuel cap due to wear.

Finally, EPA is proposing that it will allow manufacturers to determine evaporative and refueling DFs based on good engineering judgement without prior EPA approval.

III. What Is EPA Proposing Today?

Today's proposal includes two well-defined test methods for determining the exhaust emissions durability of vehicles from which manufacturers may choose: the standard whole vehicle aging process and the standard bench aging process. It also includes well-defined criteria allowing EPA to approve customization of or alternatives to these test methods, based upon a demonstration to EPA of the level of stringency needed to meet the durability objective, and the level of stringency demonstrated for the SCR and the customization or alternative. The rationale for how the proposals in this section were developed is discussed in more detail in Section II. above.

A. Standard Whole Vehicle Exhaust Durability Procedure

EPA is proposing a standard road cycle (SRC) which is targeted to effectively cover a significant majority of the distribution of exhaust emission deterioration rates that occur on candidate in-use vehicles. The SRC is fuel-neutral. It applies to all vehicles, regardless of fuel used. The SRC consists of seven laps of 3.7 miles each. The average speed on the SRC is 46.3 mph, the maximum cruise speed is 75 mph, and the acceleration rates range from light to hard accelerations. Most accelerations are moderate and there are no wide-open-throttle accelerations. The SRC contains 24 fuel-cut decelerations. The deceleration rates range from coast-down (no brake force applied) to moderate.

EPA is proposing a standard whole vehicle durability procedure which consists of running a vehicle (the durability data vehicle (DDV)) on the SRC for the full useful life mileage of the vehicle. We are also proposing that manufacturers may terminate mileage accumulation at 75% of full useful life and project DFs based upon the upper 80% statistical confidence limit.

The weight of the vehicle during SRC mileage accumulation is proposed to be the loaded vehicle weight (curb plus 300 pounds) for light-duty vehicles and adjusted loaded vehicle weight ((curb + gross vehicle weight)/2) for all other vehicles covered by this rule. The fuel used on the SRC is proposed to be representative of commercially available gasoline (with a provision that extra poisoning may be added, such as phosphorus, sulfur or lead).

EPA is proposing to retain the CAP 2000 options of determining emission compliance levels by either (1) calculating deterioration factors (DF) and applying the DF to the emission data vehicle (EDV) emission results or (2) testing the EDV with emission control components aged using the SRC and installed prior to testing. If DF's are to be calculated, emission testing would be conducted at periodic intervals during mileage accumulation. A minimum of one test at each of five different mileage points (total of five tests) are proposed.

B. Standard Bench Aging Exhaust Durability Procedure

Bench aging is a different way to achieve the same emission deterioration as whole-vehicle aging using a road cycle. EPA is proposing a standard bench aging procedure that uses the BAT equation and the standard bench cycle (SBC) to reproduce emission deterioration from a road cycle. EPA's proposed standard bench procedure specifies that the SRC be used to generate the catalyst temperature histogram needed to determine bench aging time. Because the proposed standard bench aging procedure relies on increasing catalyst thermal aging to account for all sources of emission deterioration, this procedure is not applicable to diesel fueled vehicles or vehicles which do not use a catalyst as the principal after-treatment emission control device.

The standard bench aging durability procedure has been designed to reproduce the exhaust emission deterioration that occurs on the standard whole vehicle durability procedure. The standard bench aging procedure is as follows:

a. Catalyst temperature data is measured at the rate of one hertz (one measurement per second) during at least two replicates of the standard road cycle (SRC). The temperature results are tabulated into a histogram with temperature bins of no larger than 25° C.

b. The effective reference temperature of the standard bench cycle (SBC), described below, is determined for the catalyst system and the aging bench which is to be used for the bench aging.

c. The bench aging time is calculated using the bench aging time (BAT) equation, described below, using the effective reference temperature of the SBC and the catalyst temperature histogram measured on the SRC.

d. The exhaust system (including the catalyst and oxygen sensors) is installed on the aging bench. The aging bench follows the SBC for the amount of time calculated from the BAT equation.

e. Catalyst temperatures and A/F ratios are measured during the bench aging process to assure that the proper amount of aging has actually occurred. Aging on the bench is extended if the aging targets are not properly achieved.

1. The Standard Bench Cycle (SBC)

EPA is proposing a standard bench cycle (SBC) which contains a mix of rich, lean and stoichiometric A/F ratios designed to achieve appropriate emission deterioration on the aging bench when operated for the period of time calculated from the BAT equation.

The standard bench cycle consists of a 60-second cycle which is defined as follows based on the A/F ratio of the engine (which is part of the aging bench) and the amount of secondary air injection (shop air which is added to the exhaust stream in front of the first catalyst):

01 to 40 secs:
14.7 A/F, no secondary air injection
41 to 45 secs:
Rich A/F ratio, no secondary air injection
46 to 55 secs:
Rich A/F ratio, 3% (± 0.1%) secondary air injection
56 to 60 secs:
14.7 A/F ratio, 3% (± 0.1%) secondary air injection

The catalyst temperature (called the low control temperature) is controlled during the period of stoichiometric operation (Seconds 1 to 40 of the cycle) to be 800° C (± 10° C). The A/F ratio during the "rich" phase of operation is selected [53] to achieve a maximum catalyst temperature [54] (called the high control temperature) over the cycle of 890° C (± 10° C). If an alternative low control temperature is utilized (as allowed in the customization options, discussed below), the high control temperature is 90° C (± 10° C) higher than the low control temperature.

2. The Bench Aging Time (BAT) Calculation

EPA is proposing a bench aging time (BAT) equation to calculate the

[53] A typical value of the "rich" A/F ratio is approximately 13.5.

[54] The highest temperature generally occurs close to the 55-second point in the cycle.

appropriate length of time to age a catalyst system on an aging bench to yield equivalent emission deterioration as running a vehicle on an approved road cycle. The standard bench aging durability procedure uses catalyst temperatures measured on the SRC to calculate the bench aging time necessary to reproduce the thermal exposure seen on the SRC. As discussed in Section II, the BAT equation is based on the Arrehenius equation which relates chemical reaction rates with temperature. EPA is proposing the following BAT equation:

t_e for a temperature bin = $t_h\ e^{((R/Tr)-(R/Tv))}$

Total t_e = Sum of t_e over all the temperature bins

Bench Aging Time = A (Total t_e)

Where:

A = 1.1 or a value determined by the manufacturer using in-use data and good engineering judgement to adjust the catalyst aging to include deterioration that may come from sources other than thermal aging of the catalyst

R = Catalyst thermal reactivity coefficient. For the SBC, R=17500 for Tier 2 vehicles and R=18500 for all other vehicles. For cycles other than the SBC, the R factor must be determined experimentally using good engineering judgement. The manufacturer may also determine the R-factor experimentally for the SBC.

t_h = The time (in hours) measured within the prescribed temperature bin of the vehicle's temperature histogram adjusted to be on a full useful life basis (if the histogram represented 400 miles, and full useful life was 100,000 miles; all histogram time entries would be multiplied by 250 (100000/400))

Total t_e = The equivalent time (in hours) to age the catalyst at the temperature of T_r on the catalyst aging bench using the catalyst aging cycle to produce the same amount of deterioration experienced by the catalyst due to thermal deactivation over the vehicle's full useful life.

t_e for a bin = The equivalent time (in hours) to age the catalyst at the temperature of T_r on the catalyst aging bench using the catalyst aging cycle to produce the same amount of deterioration experienced by the catalyst due to thermal deactivation at the temperature bin of T_v over the vehicle's full useful life.

T_r = The effective reference temperature (in °K) of the catalyst on the catalyst bench

T_v = The mid-point temperature (in °K) of the temperature bin of the vehicle on-road catalyst temperature histogram

3. The Effective Reference Temperature for the SBC

The BAT equation uses a single temperature value called the effective reference temperature to represent the entire temperature-history experienced during the SBC on the catalyst aging bench. EPA is proposing to calculate the effective reference temperature using catalyst temperature histogram data measured in the catalyst on the aging bench following the SBC. The BAT equation would then be used to calculate the effective reference temperature by iterative changes to the reference temperature (T_r) until the calculated aging time equaled the actual time representing in the catalyst temperature histogram. The resulting temperature is the effective reference temperature for the SBC.

C. Customization of the Standard Procedures

1. Customization of the Standard Road Cycle

EPA is proposing that to obtain approval for a customized/alternative road cycle the manufacturer would demonstrate that the objective of the durability program will be achieved for the breadth of the vehicles which are covered by the cycle. Approval of a customized/alternative road cycle requires a thorough analysis of whether the cycle will achieve the durability program objective using in-use emissions data, including a demonstration of the relative stringency of the SRC and the manufacturer's program.

To make the initial demonstration necessary for the Agency to approve a customized/alternative cycle, EPA is proposing that the manufacturer supply high mileage in-use emission data on applicable candidate in-use vehicles. The vehicles would be randomly procured from actual customer use, generally with an age of 4 to 5 years and with a minimum of approximately 50,000 miles. They would cover the breadth of the vehicles that the manufacturer intends to certify using the customized/alternative cycle. Vehicles would be procured and FTP tested as received under the provisions of the IUVP program (ref: 40 CFR 86.1845–04). Manufacturers could use previously generated in-use data from the CAP 2000 high mileage IUVP program or the fourth-year-of-service RDP ''reality check'' in-use program as well as other sources of in-use emissions data for this purpose. EPA will also consider additional emissions data or analyses that the manufacturer may choose to provide, including data from vehicles which have been screened for proper maintenance and use.

The amount of in-use emission data required for this analysis is based on whether the customized/alternative cycle is more or less severe than the SRC. In most cases, EPA will accept a minimum of 20 candidate in-use vehicles. There is less risk of underestimating actual in-use emission levels when the customized/alternative cycle is more severe than the SRC. However, if the customized/alternative cycle is significantly more severe than the SRC, EPA may accept less data. Conversely, if the customized/alternative cycle is significantly less severe than the SRC, EPA may require more data up to a maximum of 30 vehicles.

EPA will also consider the equivalency factor of the customized/alternative cycle (discussed in section III.C.3) when evaluating the cycle for approval.

Once the durability process is approved, EPA is proposing that for each test group the manufacturer must determine, using good engineering judgement, whether to apply the durability procedure to that particular test group. Furthermore, EPA is proposing that the manufacturer may make modifications to an approved customized/alternative road cycle and apply them to a test group to ensure that the modified process will effectively achieve the durability objective for future candidate in-use vehicles. The manufacturer would be required to identify such changes in its certification application and explain the basis for the changes. Manufacturers must use good engineering judgement in making these decisions. Significant, major, or fundamental changes to a customized/alternative cycle would be considered new cycles and would require advance approval by EPA.

2. Customization of Standard Bench Procedures

EPA is also proposing to allow, subject to Agency approval, a limited degree of manufacturer customization of the standard bench procedures. However, in all cases EPA is proposing that alternative bench aging procedures be based upon measured vehicle performance (such as catalyst temperature) on an approved road cycle.

Specifically EPA is proposing to allow customization of any or all of the following parameters when the accompanying conditions for approval are met:

a. The lower control temperature on the SBC may be modified without prior EPA approval provided that the high control temperature is set 90° C (± 10° C) above the lower control temperature and an approved BAT equation is used to calculate bench aging time.

b. The R-factor used in EPA's BAT equation may be determined experimentally using EPA's standard procedures (specified in the appendix to the regulations) without prior EPA approval. Other experimental techniques to calculate the R-factor require advance EPA approval. To obtain approval, the manufacturer must demonstrate that the calculated bench aging time results in the same (or larger) amount of emission deterioration as the associated approved road cycle.

c. The A-factor used in EPA's BAT equation may be modified, using good engineering judgement without prior EPA approval, to ensure that the modified durability process will effectively predict (or overstate) emission deterioration of a significant majority (approximately 90%) of future candidate in-use vehicles.

d. Bench aging may be conducted using fuel with additional poisons (such as phosphorus, sulfur and lead) without prior EPA approval. Using fuel with additional poisons is worst case for emissions deterioration. Normally a manufacturer using fuel with additional poisons will either calculate a new R-factor or A-factor to assure that the durability objective (effective coverage of 90 percent of in-use emission deterioration) is not overstated by the worst-case fuel usage.

e. An approved alternative road cycle or customized SRC may be used to develop catalyst temperature histograms for use in the BAT equation without additional EPA approval beyond the original approval necessary to use the road cycle for mileage accumulation.

f. A different bench cycle may be used during bench aging with prior EPA approval. To obtain approval the manufacturer must demonstrate that bench aging with the new bench cycle provides the same (or larger) amount of emission deterioration as the associated approved road cycle.

g. A different method to calculate bench aging time may be used with prior EPA approval. To obtain approval the manufacturer must demonstrate that bench aging for the time calculated by the alternative method results in the same (or larger) amount of emission deterioration as the associated approved road cycle.

3. Reproducibility by Outside Parties

As discussed in the preceding sections, EPA is proposing that an alternative road cycle must be designed to achieve the durability objective proposed in this rule (effectively predicts a significant majority of the distribution of in-use emission deterioration on candidate in-use vehicles). As part of this evaluation, EPA is requiring in this proposal that all alternative road cycles are equated to the SRC by means of an equivalency factor that determines the amount of SRC-driving that results in the same emission deterioration as the alternative cycle. EPA is requiring in this proposal that every alternative bench aging procedure be based upon measured vehicle performance on a road cycle. Lastly, EPA is proposing to require that any alternative bench cycle be designed to result in the same levels of emission deterioration as the road cycle upon which it was based.

An important element of the proposal is that, regardless of whether a manufacturer use the EPA standard procedures or customized procedures, any interested party will be able to use the equivalency factor to reproduce the amount of emission deterioration produced by any manufacturer's customized/alternative durability process used during vehicle certification. In the proposal, any alternative road or bench procedure is equated to a given number of miles on the SRC.

To reproduce the deterioration generated by a customized/alternative road cycle, standard bench procedure, or alternative bench procedure, an outside party may run a vehicle using the SRC for the number of miles indicated by the equivalency factor.

Similarly, an outside party will be able to perform bench aging using the SBC. The aging time may be calculated using the BAT equation and measured catalyst temperature on the SRC (with full-useful-life-mileage adjusted by the equivalency factor).

D. Using IUVP Data To Improve Durability Predictions

EPA is proposing to require a manufacturer to review its durability program and prepare an analysis for EPA evaluation when: (1) The IUVP emission levels exceed the applicable certification emission standard 50% or more of the test vehicles and (2) the average emission level is at least 1.3 times the applicable emission standard. These criteria would be evaluated independently for all applicable FTP emission constituents. Each constituent should be considered separately in this analysis.

The Agency is also proposing that it may, from time to time, require manufacturers to analyze available IUVP data, or other information, when it indicates that the durability objective is not being achieved for some portion of the fleet of vehicles covered by a durability procedure. This provision would apply whether or not the screening criteria are exceeded.

As in the CAP 2000 program, EPA is proposing that it may withdraw approval of a durability program or require its modification if it determines that the program does not meet the objectives for a durability program. The Agency is proposing to give the manufacturer a preliminary notice at least 60 days prior to rendering a final decision to withdraw approval for or require modifications to a durability procedure. During this period the manufacturer may submit technical discussion, statistical analyses, additional data, or other information that is relevant to the decision. This may include an analysis to determine whether factors other than the durability program, such as part defects, are the source of the problem. The Administrator will consider all information submitted by the deadline before reaching a final decision. A final decision to withdraw approval or require modification to a durability procedure would apply to future applications for certification and to the portion of the manufacturers product line (or the entire product line) that the Administrator determines to be affected.

If the manufacturer was using the standard road cycle or standard bench cycle, EPA would require the manufacturer to adjust the durability process so it would achieve the durability objective. The Agency is proposing two options in this situation: (1) increasing future DFs by the average percent-difference between certification levels and IUVP data, or (2) increasing the whole vehicle miles driven or catalyst aging time by the average percent-difference between certification levels and IUVP data. Additionally the manufacturer may obtain approval for a new alternative durability process that has been demonstrated to meet the durability objective. If the data set used in the analysis contains less than 20 pieces of data, the Administrator may reduce the degree of adjustment required to account for uncertainty in the data.

E. Evaporative and Refueling Durability

For reasons described in section II. above, EPA is proposing that manufacturers determine the evaporative/refueling deterioration using either whole vehicle durability or bench aging methods or a combination of the two methods.

Whole Vehicle Evaporative/Refueling Durability

EPA is proposing that manufacturers may conduct evaporative and/or refueling durability program by running the DDV on the SRC or an approved alternative road cycle and conducting the applicable test at each testing point. Manufacturers may combine exhaust and evaporative/refueling whole vehicle durability demonstrations.

Bench Aging Evaporative/Refueling Durability

EPA is proposing that manufacturers may use bench procedures designed, using good engineering judgement, to evaluate the following potential causes of evaporative emission deterioration and achieve the durability objective:

(1) Cycling of canister loading due to diurnal and refueling events,

(2) Use of various commercially available fuels, including the Tier 2 requirement to include alcohol fuel;

(3) Vibration of components;

(4) Deterioration of hoses, etc. due to environmental conditions; and

(5) Deterioration of fuel cap due to wear.

EPA is also proposing that it will allow manufacturers to determine evaporative and refueling DF's based on good engineering judgement without prior EPA approval.

F. Effective Date and Carryover of Existing Durability Data

1. Effective Date

Today's action is proposed to become effective with the 2006 model year. Because this is a Court-ordered action, we believe that the rule should take effect in the shortest amount of time possible that provides manufacturers with enough lead time to comply with the new regulations. We considered proposing a 2005 model year effective date, but we anticipate that the final rule will not be promulgated until March, 2004. By that time, many, if not all manufacturers will have completed the durability demonstration phase of their certification process for the 2005 model year (which traditionally is launched in Fall of the previous calendar year). Thus, a 2005 model year effective date would not provide manufacturers with enough lead time to complete their durability demonstrations. Therefore, we are proposing the 2006 model year effective date which we believe provides adequate lead time for manufacturers to comply with today's proposed regulations.

2. Carrying-over Durability Data

EPA is not proposing any changes to the carryover provisions in the current regulations (ref. 40 CFR 86.1839–01). These provisions allow manufacturers to use durability data that was previously generated and used to support certification provided that the data ''represent a worst case or equivalent rate of deterioration''. After the 2005 model year, if a manufacturer can meet these requirements, it may use existing durability data (*i.e.*, DFs or aged hardware) that were approved prior to the vacature of the CAP 2000 regulations. Approved carry-over durability data may be used to support certification under the proposed rules.

EPA is proposing that the manufacturer may not, however, continue to use CAP 2000 durability processes to generate new data starting with the 2006 model year. When the proposed rule becomes effective in the 2006 model year, manufacturers must use durability procedures that have been approved under the new rules to generate new durability demonstrations.

G. Miscellaneous Regulatory Amendments and Corrections

1. With the addition of the new durability regulations (sections 86.1823–06, 86.1824–06, and 86.1825–06), the regulatory references in a number of other sections of Subpart S of Part 86 have been updated accordingly.

2. Section 1864 of Subpart S is being moved to section 1801. This section describes the applicability of Subpart S to heavy-duty vehicles, and is more appropriately located in the Applicability section of the regulations.

3. An outdated address in section 1817–05 has been corrected.

4. A typographical error in section 1830–01(c) has been corrected.

5. Section 86.1824–07 was originally promulgated to add the applicability to 2007 model year and later MDPVs and HDVs. To improve readability, this applicability has been incorporated into 86.1824–06, and the original section is reserved.

6. Two corrections are being made to Section 86.1806–05, on-board diagnostics. First, in a previous regulatory action, this section was amended to add provisions for diesel vehicles and HDVs and MDPVs. In doing this, an inadvertent error was made in paragraph (a)(3). The provision allowing compliance with 86.004–17, in lieu of 1806–05, should be limited to apply only to MDPVs and HDVs. The language has been revised accordingly. Second, in the original CAP 2000 regulation, there is an incorrect reference to section 86.094–17(e) and (f). The correct reference is 1806–05(e) and (f).

IV. What Are the Economic and Environmental Impacts?

A. Economic Impacts

1. Comparison to CAP 2000 Economic Impacts

In considering the economic and environmental impacts of today's proposal, we used the CAP 2000 regulations as a comparison benchmark. In those regulations, EPA estimated that there would be an average annual net savings to the automotive industry of about $55 million. The analysis performed to reach that conclusion was part of the record for the CAP 2000 regulation, and was not contested.

As we drafted today's proposal, one of our goals was to retain those savings. In the CAP 2000 cost analysis, about half of the total estimated annual savings was attributed to the durability component of the regulations. The elements of CAP 2000 durability which provided the most significant savings are:

a. *Reduced number of durability data vehicles (DDVs).* The creation of the ''durability group'' under CAP 2000 allowed manufacturers to significantly reduce the number of required durability demonstrations. The savings that are claimed in the CAP 2000 rule resulting from the ''durability group'' provision come from requiring physically fewer DDVs, fewer durability tests, and less reporting (*e.g.* instead of having to report 912 durability tests, there would only be 620 tests). The ''durability group'' concept was not part of the Ethyl v. EPA litigation, nor was it mentioned in the Court's opinion on this case. Thus EPA is not modifying the ''durability group'' regulations in today's proposal.

In fact, it is possible that today's proposal could actually slightly reduce some costs to the industry, in that manufacturers using one of the EPA-prescribed durability processes (either whole-vehicle or bench) would no longer have to provide a description of their durability process (which was required under CAP 2000, and would continue to be required for manufacturers using customized procedures under today's proposal).

b. *Reduced burden-hours per DDV.* In addition to fewer DDVs, EPA also slightly reduced the estimated number of burden-hours required per DDV. As above, this element was not affected by the Court mandate, and is not impacted by today's proposal.

2. Economic Impact of Today's Rule

Today's proposal prescribes two methods for determining the emission deterioration of vehicles over their useful life periods—the whole-vehicle procedure or the bench-aging procedure. Details of how to perform these procedures are prescribed in the proposed regulations. Because these procedures are similar in nature to those approved by EPA under the CAP 2000 regulations, the added burden for manufacturers utilizing them will be minimal.[55] The costs involved with either of these processes (equipment costs, vehicle costs, testing costs, labor costs, etc.) are fairly fixed. Manufacturers using one of the prescribed methods will not be required to make major changes to or add any new equipment, test any additional vehicles with any additional frequency, or to increase the amount of labor. We expect that manufacturers who, under the old CAP 2000 regulations, used a bench aging (or whole-vehicle) process will continue to use a bench aging (or whole-vehicle) process—the only difference is that now that process is codified.

Our proposed regulations also include the option for manufacturers to use customized or alternative procedures, with EPA approval. The approval requires the manufacturer to submit an analysis of about 20 in-use emission tests. Most manufacturers will be able to utilize in-use data and analyses that they have previously collected from other sources (such as the CAP 2000 in-use verification data). Some manufacturers may need to augment this data by running a few additional tests, but this would be a small, one-time cost. EPA estimates that this small added cost is more than offset by fact that once approved, manufacturers will be able to use their existing durability programs without the need to make any changes to those programs.

B. Environmental Impacts

In the CAP 2000 rule, no quantifiable environmental benefits were projected. Intangible benefits were possible due to the In-Use Verification Program (IUVP) element of the CAP 2000 rule—manufacturers would be able to use the in-use data from this program to identify and fix in-use compliance problems and to make improvements upon their certification durability processes. This intangible benefit is not changed in today's proposal—the in-use verification program is not affected by the Court mandate, and no changes to this program are being proposed. EPA is proposing to modify an existing CAP 2000 provision whereby manufacturers utilize the IUVP data to assess the ability of the durability program to predict in-use compliance. The modification includes more explicit instructions as to what the manufacturer is required to assess and when corrective action is required (*see* section III C.). This proposed provision will have the effect of improving the predictive qualities of the durability process, but again, with intangible environmental benefits.

V. What Are the Opportunities for Public Participation?

A. Copies of This Proposal and Other Related Information

1. Docket

EPA has established an official public docket for this action under Docket ID No. OAR–2002–0079. The official public docket consists of the documents specifically referenced in this action, any public comments received, and other information related to this action. Although a part of the official docket, the public docket does not include Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. The official public docket is the collection of materials that is available for public viewing by referencing Docket No. OAR–2002–0079 at the EPA Air Docket Section,(see **ADDRESSES** section above). You may submit comments electronically, by mail, or through hand delivery/courier as described below. To ensure proper receipt by EPA, identify the appropriate docket identification number in the subject line on the first page of your comment. Please ensure that your comments are submitted within the specified comment period. Comments received after the close of the comment period will be marked ''late.'' EPA is not required to consider these late comments. If you wish to submit CBI or information that is otherwise protected by statute, please follow the instructions in Section V.B.3 Do not use EPA Dockets or e-mail to submit CBI or information protected by statute.

2. Electronic Access

You may access this **Federal Register** document electronically through the EPA Internet under the ''Federal Register'' listings at *http://www.epa.gov/fedrgstr/.*

An electronic version of the public docket is available through EPA's electronic public docket and comment system, EPA Dockets. You may use EPA Dockets at *http://www.epa.gov/edocket/* to submit or view public comments, access the index listing of the contents of the official public docket, and to access those documents in the public docket that are available electronically. Once in the system, select ''search,'' then key in the appropriate docket identification number.

Certain types of information will not be placed in the EPA Dockets. Information claimed as CBI and other information whose disclosure is restricted by statute, which is not included in the official public docket, will not be available for public viewing in EPA's electronic public docket. EPA's policy is that copyrighted material will not be placed in EPA's electronic public docket but will be available only in printed, paper form in the official public docket. To the extent feasible, publicly available docket materials will be made available in EPA's electronic public docket. When a document is selected from the index list in EPA Dockets, the system will identify whether the document is available for viewing in EPA's electronic public docket. Although not all docket materials may be available electronically, you may still access any of the publicly available docket materials through the docket facility identified in Unit I.B. EPA intends to work towards providing electronic access to all of the publicly available docket materials through EPA's electronic public docket.

For public commenters, it is important to note that EPA's policy is that public comments, whether submitted electronically or in paper, will be made available for public viewing in EPA's electronic public docket as EPA receives them and without change, unless the comment contains copyrighted material, CBI, or other information whose disclosure is restricted by statute. When EPA identifies a comment containing copyrighted material, EPA will provide a reference to that material in the version of the comment that is placed in EPA's electronic public docket. The entire printed comment, including the copyrighted material, will be available in the public docket.

Public comments submitted on computer disks that are mailed or delivered to the docket will be transferred to EPA's electronic public docket. Public comments that are mailed or delivered to the Docket will be scanned and placed in EPA's electronic public docket. Where

[55] Added burden will be in the form of the one-time reprogramming of automated driving or bench-aging devices with the new driving/aging cycle, and other minor equipment adjustments.

practical, physical objects will be photographed, and the photograph will be placed in EPA's electronic public docket along with a brief description written by the docket staff.

B. Submitting Comments on This Proposal

You may submit comments electronically, by mail, by facsimile, or through hand delivery/courier. To ensure proper receipt by EPA, identify the appropriate docket identification number in the subject line on the first page of your comment. Please ensure that your comments are submitted within the specified comment period. Comments received after the close of the comment period will be marked ''late.'' EPA is not required to consider these late comments.

1. Electronically

If you submit an electronic comment, EPA recommends that you include your name, mailing address, and an e-mail address or other contact information in the body of your comment. Also include this contact information on the outside of any disk or CD ROM you submit, and in any cover letter accompanying the disk or CD ROM. This ensures that you can be identified as the submitter of the comment and allows EPA to contact you in case EPA cannot read your comment due to technical difficulties or needs further information on the substance of your comment. EPA's policy is that EPA will not edit your comment, and any identifying or contact information provided in the body of a comment will be included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment.

a. EPA Dockets.

Your use of EPA's electronic public docket to submit comments to EPA electronically is EPA's preferred method for receiving comments. Go directly to EPA Dockets at *http://www.epa.gov/edocket,* and follow the online instructions for submitting comments. To access EPA's electronic public docket from the EPA Internet Home Page, select ''Information Sources,'' ''Dockets,'' and ''EPA Dockets.'' Once in the system, select ''Quick Search,'' and then key in Docket ID No. OAR–2002–0079. The system is an ''anonymous access'' system, which means EPA will not know your identity, e-mail address, or other contact information unless you provide it in the body of your comment.

b. E-mail.

Comments may be sent by electronic mail to *hormes.linda@epa.gov,* Attention Docket ID No. OAR–2002–0079. In contrast to EPA's electronic public docket, EPA's e-mail system is not an ''anonymous access'' system. If you send an e-mail comment directly to the Docket without going through EPA's electronic public docket, EPA's e-mail system automatically captures your e-mail address. E-mail addresses that are automatically captured by EPA's e-mail system are included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket.

c. Disk or CD ROM.

You may submit comments on a disk or CD ROM that you mail to the mailing address identified in section I.C.2. These electronic submissions will be accepted in WordPerfect or ASCII file format. Avoid the use of special characters and any form of encryption.

2. By Mail

Send your comments to: Air Docket, Environmental Protection Agency, Mailcode: 6102T, 1200 Pennsylvania Ave., NW., Washington, DC, 20460, Attention Docket ID No. OAR–2002–0079.

3. By Hand Delivery or Courier

Deliver your comments to: EPA Docket Center, (EPA/DC) EPA West, Room B102, 1301 Constitution Ave., NW., Washington, DC., Attention Docket ID No. OAR–2002–0079. Such deliveries are only accepted during the Docket's normal hours of operation from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays.

4. By Facsimile

Fax your comments to: (202) 566–1741, Attention Docket ID. No. OAR–2002–0079.

5. Submitting Comments With Proprietary Information

Commenters who wish to submit proprietary information for consideration should clearly separate such information from other comments by (1) labeling proprietary information ''Confidential Business Information'' and (2) sending proprietary information directly to the contact person listed (*see* **FOR FURTHER INFORMATION CONTACT**) and not to the public docket. This helps insure that proprietary information is not inadvertently placed in the docket. If a commenter wants EPA to use a submission labeled as confidential business information as part of the basis for the final rule, then a non-confidential version of the document, which summarizes the key data or information, should be sent to the docket.

Information covered by a claim of confidentiality will be disclosed by EPA only to the extent allowed and by the procedures set forth in 40 CFR Part 2. If no claim of confidentiality accompanies the submission when it is received by EPA, the submission may be made available to the public without notifying the commenters.

C. Areas Where EPA Specifically Requests Public Comment

As discussed in the previous section, the public is invited to comment on any aspect of this proposed rule. The following are areas where EPA is specifically requesting comments:

1. Whether the ''equivalency factor'' is properly classified by EPA as not CBI.

2. What data provided by a manufacturer to obtain approval for an alternative cycle should or should not be classified as CBI.

3. The appropriateness of the proposed durability objective (effective coverage of approximately 90 percent of the distribution of emission deterioration rate on in-use candidate vehicles). EPA would appreciate any data showing the degree of coverage for durability programs approved under CAP 2000.

4. Whether the Standard Road Cycle (SRC) achieves EPA's durability objective. EPA would appreciate any emission and/or catalyst temperature data that demonstrates how the SRC compares to other cycles.

5. EPA is interested in receiving any catalyst temperature or emission data that exists on the SRC or other mileage accumulation road cycles.

6. The appropriateness of the Standard Bench Cycle (SBC). EPA would appreciate any catalyst temperature data and percent break-down of rich-lean-stoichiometric A/F ratios that support the comments.

7. The appropriateness of the Bench Aging Time (BAT) equation (and its coefficients) for a manufacturers product line. EPA would appreciate catalyst temperature data paired with calculated aging times that support the comments.

8. The appropriateness of the customization options and the approval process proposed.

9. The ability of outside parties to use the equivalency factor to replicate the durability rates used by manufacturers during certification.

10. The appropriateness of the IUVP data feedback provision of the proposal to accomplish the Agency's objective to assure accurate durability processes. EPA would appreciate any analysis of

in-use data under the proposed procedures that supports the comments.

D. Public Hearing

Anyone wishing to present testimony about this proposal at the public hearing (*see* **DATES**) should notify the general contact person (*see* **FOR FURTHER INFORMATION CONTACT**)no later than five days prior to the day of the hearing. The contact person should be given an estimate of the time required for the presentation of testimony and notification of any need for audio/visual equipment. Testimony will be scheduled on a first come, first serve basis. A sign-up sheet will be available at the registration table the morning of the hearing for scheduling those who have not notified the contact earlier. This testimony will be scheduled on a first come, first serve basis to follow the previously scheduled testimony.

EPA requests that approximately 50 copies of the statement or material to be presented be brought to the hearing for distribution to the audience. In addition, EPA would find it helpful to receive an advanced copy of any statement or material to be presented at the hearing at least one week before the scheduled hearing date. This is to give EPA staff adequate time to review such material before the hearing. Such advanced copies should be submitted to the contact person listed.

The official records of the hearing will be kept open for 30 days following the hearing to allow submission of rebuttal and supplementary testimony. All such submissions should be directed to the Air Docket Section, Docket No. OAR–2002–0079 (*see* **ADDRESSES**). The hearing will be conducted informally, and technical rules of evidence will not apply. A written transcript of the hearing will be placed in the above docket for review. Anyone desiring to purchase a copy of the transcript should make individual arrangements with the court reporter recording the proceedings.

If no one indicates to EPA that they wish to present oral testimony by the date given, the public hearing will be canceled.

VI. What Are the Statutory and Executive Order Reviews for This Proposed Rule?

A. Executive Order 12866: Regulatory Planning and Review

Under Executive Order 12866 (58 FR 51735 October 4, 1993), EPA must determine whether the regulatory action is ''significant'' and therefore subject to Office of Management and Budget (OMB) review and the requirements of this Executive Order. The Order defines a ''significant regulatory action'' as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, Local, or Tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, OMB has notified EPA that it considers this a ''significant regulatory action'' within the meaning of the Executive Order. EPA has submitted this action to OMB for review. Changes made in response to OMB suggestions or recommendations will be documented in the public record.

B. Paperwork Reduction Act

This action does not impose any new information collection burden under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* However, the Office of Management and Budget (OMB) has previously approved the information collection requirements contained in the existing regulations (64 FR 23906) under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* and has assigned OMB control number 2060–0104, EPA ICR number 0783.44. A copy of the OMB approved Information Collection Requests (ICR) may be obtained from Susan Auby, Collection Strategies Division; U.S. Environmental Protection Agency (2822T); 1200 Pennsylvania Ave., NW., Washington, DC 20460 or by calling (202) 566–1672.

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An Agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR part 9 and 48 CFR chapter 15.

C. Regulatory Flexibility Act

The Regulatory Flexibility Act generally requires an agency to conduct a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small not-for-profit enterprises, and small governmental jurisdictions.

For purposes of assessing the impacts of today's rule on small entities, small entity is defined as: (1) A small business that manufacturers automobiles as defined by NAIC code 336111. Based on Small Business Administration size standards, a small business for this NAIC code is defined as a manufacturer having less than 1000 employees; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

After considering the economic impacts of today's proposed rule on small entities, I certify that this action will not have a significant economic impact on a substantial number of small entities. The requirements are only applicable to manufacturers of motor vehicles, a group which does not contain a substantial number of small entities. Out of a total of approximately 80 automotive manufacturers subject to today's proposal, EPA estimates that approximately 15–20 of these could be classified as small entities based on SBA size standards. EPA's CAP 2000 compliance regulations include numerous regulatory relief provisions for such small entities. Those provisions remain in effect and are not impacted by today's proposal. Thus, we have determined that small entities will not experience any economic impact as a result of this proposal. We continue to be interested in the potential impacts of the proposed rule on small entities and welcome comments on issues related to such impacts.

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Pub. L. 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory action on state, local, and tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and proposed rules with ''Federal mandates'' that may result in expenditures by state, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year. Before promulgation an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective or least burdensome alternative if the Administrator publishes with the proposed rule an explanation why that alternative was not adopted.

Before we establish any regulatory requirement that may significantly or uniquely affect small governments, including tribal governments, we must develop, under section 203 of the UMRA, a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of our regulatory proposals with significant federal intergovernmental mandates. The plan must also provide for informing, educating, and advising small governments on compliance with the regulatory requirements.

EPA believes this proposed rule contains no federal mandates for state, local, or tribal governments. Nor does this rule have federal mandates that may result in the expenditures of $100 million or more in any year by the private sector as defined by the provisions of Title II of the UMRA. Nothing in the proposed rule would significantly or uniquely affect small governments.

E. Executive Order 13132 (Federalism)

Executive Order 13132, entitled ''Federalism'' (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure ''meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications.'' ''Policies that have federalism implications'' is defined in the Executive Order to include regulations that have ''substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.''

This proposed rule will impose no direct compliance costs on states. Thus, Executive Order 13132 does not apply to this rule.

In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comment on this proposed rule from State and local officials.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

Executive Order 13175, entitled ''Consultation and Coordination with Indian Tribal Governments'' (65 FR 67249, November 6, 2000), requires EPA to develop an accountable process to ensure ''meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications.'' ''Policies that have tribal implications'' is defined in the Executive Order to include regulations that have ''substantial direct effects on one or more Indian tribes, on the relationship between the Federal government and the Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes.''

This proposed rule does not have tribal implications. It will not have substantial direct effects on tribal governments, on the relationship between the Federal government and Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes, as specified in Executive Order 13175. The requirements proposed by this action impact private sector businesses, particularly the automotive and engine manufacturing industries. Thus, Executive Order 13175 does not apply to this rule.

G. Executive Order 13045: Children's Health Protection

Executive Order 13045: ''Protection of Children from Environmental Health Risks and Safety Risks'' (62 FR 19885, April 23, 1997) applies to any rule that: (1) Is determined to be economically significant as defined under E.O. 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

EPA believes this proposed rule is not subject to the Executive Order because it is not an economically significant regulatory action as defined by E.O. 12866.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This rule is not subject to Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use'' (66 FR 28355, May 22, 2001) because it is not a significant regulatory action under Executive Order 12866.

I. National Technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA), Pub. L. 104–113, 12(d) (15 U.S.C. 272), directs the EPA to use voluntary consensus standards (VCS) in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (*e.g.*, materials specifications, test methods, sampling procedures, business practices, etc.) that are developed or adopted by voluntary consensus standard bodies. The NTTAA requires EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This proposed rule does not involve consideration of any new technical standards. The durability test procedures that EPA is proposing are unique and have not been previously published in the public domain.

List of Subjects in 40 CFR Part 86

Environmental protection, Air pollution control, Motor vehicle pollution, Confidential business information, Reporting and recordkeeping requirements.

Dated: March 16, 2004.

Michael O. Leavitt,

Administrator.

For the reasons set out in the preamble, The Environmental

Protection Agency title 40, chapter I of the Code of Federal Regulations is proposed to be amended as follows:

PART 86—CONTROL OF EMISSIONS FROM NEW AND IN-USE HIGHWAY VEHICLES AND ENGINES

1. The authority citation for part 86 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart S—General Compliance Provisions for Control of Air Pollution From New and In-Use Light-Duty Vehicles, Light-Duty Trucks, and Complete Otto-Cycle Heavy-Duty Vehicles

2. Amend § 86.1801–01 to add a new paragraph (i) to read as follows:

§ 86.1801–01 Applicability.

* * * * *

(i) Optional chassis certification for diesel vehicles.

(1) A manufacturer may optionally certify 2007 and later model year heavy-duty diesel vehicles under 14,000 pounds GVWR to the standards specified in § 86.1816–08. Such vehicles must meet all requirements of Subpart S that are applicable to Otto-cycle vehicles, except for evaporative, refueling, and OBD requirements.

(2) Diesel vehicles optionally certified under this section are subject to the OBD requirements of § 86.005–17.

(3) Diesel vehicles optionally certified under this section may be tested using the test fuels, sampling systems, or analytical systems specified for diesel engines in Subpart N of this part.

(4) Diesel vehicles optionally certified under this section may not be included in any averaging, banking, or trading program.

(5) The provisions of § 86.004–40 apply to the engines in vehicles certified under this section.

(6) Diesel vehicles may be certified under this section to the standards applicable to model year 2008 prior to model year 2008.

(7) Diesel vehicles optionally certified under this section in model years 2007, 2008, or 2009 shall be included in phase-in calculations specified in § 86.007–11(g).

3. Amend § 86.1803–01 by adding a new definition in alphabetical order, to read as follows:

§ 86.1803–01 Definitions.

* * * * *

Secondary air injection means a system whereby air (not ingested by the engine) is introduced into the exhaust system in front of a catalyst.

* * * * *

4. Amend § 86.1804–01 by adding new acronyms in alphabetical order, to read as follows:

§ 86.1804–01 Acronyms and abbreviations.

* * * * *

A/F—Air/Fuel

* * * * *

BAT—Bench Aging Time

* * * * *

SBC—Standard Bench Cycle

* * * * *

SRC—Standard Road Cycle

* * * * *

5. Amend § 86.1817–05 by revising paragraph (i)(3)(i) to read as follows:

§ 86.1817–05 Complete heavy-duty vehicle averaging, trading, and banking program.

* * * * *

(i) * * *

(3) * * *

(i) These reports shall be submitted within 90 days of the end of the model year to: Director, Certification and Compliance Division, U.S. Environmental Protection Agency, Mail Code 6405J, 1200 Pennsylvania Ave. NW 20460.

* * * * *

6. Add a new § 86.1823–06 subpart S to read as follows:

§ 86.1823–06 Durability demonstration procedures for exhaust emissions.

This section applies to all vehicles which meet the applicability provisions of § 86.1801. Eligible small volume manufacturers or small volume test groups may optionally meet the requirements of §§ 86.1838–01 and 86.1826–01 in lieu of the requirements of this section. A separate durability demonstration is required for each durability group.

(a) Durability program objective. The durability program must predict an expected in-use emission deterioration rate and emission level that effectively represents a significant majority (approximately 90 percent) of the distribution of emission levels and deterioration in actual use over the full and intermediate useful life of candidate in-use vehicles of each vehicle design which uses the durability program.

(b) Required durability demonstration. Manufacturers must conduct a durability demonstration for each durability group using a procedure specified in either paragraph (c), (d), or (e) of this section.

(c) *Standard whole-vehicle durability procedure.* This procedure consists of conducting mileage accumulation and periodic testing on the durability data vehicle, selected under the provisions of § 86.1822 described as follows:

(1) Mileage accumulation must be conducted using the standard road cycle (SRC). The SRC is described in appendix V of this part.

(i) Mileage accumulation on the SRC may be conducted on a track or on a mileage accumulation dynamometer.

(ii) The fuel used for mileage accumulation must comply with the mileage accumulation fuel provisions of § 86.113 for the applicable fuel type (*e.g.*, gasoline or diesel fuel).

(iii) The DDV must be ballasted to a minimum of the loaded vehicle weight for light-duty vehicles and a minimum of the ALVW for all other vehicles.

(iv) The mileage accumulation dynamometer must be setup as follows:

(A) The simulated test weight will be the equivalent test weight specified in § 86.129 using a weight basis of the loaded vehicle weight for light-duty vehicles and ALVW for all other vehicles.

(B) The road force simulation will be determined according to the provisions of § 86.129.

(C) The manufacturer will control the vehicle, engine, and/or dynamometer as appropriate to follow the SRC using good engineering judgement.

(2) Mileage accumulation must be conducted for at least 75% of the applicable full useful life mileage period specified in § 86.1805. If the mileage accumulation is less than 100% of the full useful life mileage, then the DF calculated according to the procedures of paragraph (f)(1)(ii) of this section must be based upon a line projected to the full-useful life mileage using the upper 80 percent statistical confidence limit calculated from the emission data.

(3) If a manufacturer elects to calculate a DF pursuant to paragraph (f)(1) of this section, then it must conduct at least one FTP emission test at each of five different mileage points selected using good engineering judgement. Additional testing may be conducted by the manufacturer using good engineering judgement. The required testing must include testing at 5,000 miles and at the highest mileage point run during mileage accumulation (*e.g.* the full useful life mileage).

(d) *Standard bench-aging durability procedure.* This procedure is not applicable to diesel fueled vehicles or vehicles which do not use a catalyst as the principle after-treatment emission control device. This procedure requires installation of the catalyst-plus-oxygen-sensor system on a catalyst aging bench. Aging on the bench is conducted by following the standard bench cycle (SBC) for the period of time calculated from the bench aging time (BAT) equation. The BAT equation requires, as input, catalyst time-at-temperature data measured on the SRC.

(1) *Standard bench cycle (SBC).* Standard catalyst bench aging is conducted following the SBC.

(i) The SBC must be run for the period of time calculated from the BAT equation.

(ii) The SBC is described in appendix VII to part 86.

(2) *Catalyst time-at-temperature data.*

(i) Catalyst temperature must be measured during at least two full cycles of the SRC.

(ii) Catalyst temperature must be measured at the highest temperature location in the hottest catalyst on the DDV.

(iii) Catalyst temperature must be measured at the rate of one hertz (one measurement per second).

(iv) The measured catalyst temperature results must be tabulated into a histogram with temperature bins of no larger than 25° C.

(3) *Bench aging time.* Bench aging time is calculated using the bench aging time (BAT) equation as follows:

t_e for a temperature bin = $t_h\, e^{((R/Tr) - (R/Tv))}$

Total t_e = Sum of t_e over all the temperature bins

Bench Aging Time = A (Total t_e)

Where:

A = 1.1 This value adjusts the catalyst aging time to account for deterioration from sources other than thermal aging of the catalyst.

R = Catalyst thermal reactivity coefficient. For the SBC, R=17500 for Tier 2 vehicles and R=18500 for all other vehicles.

t_h = The time (in hours) measured within the prescribed temperature bin of the vehicle's catalyst temperature histogram adjusted to a full useful life basis *e.g.*, if the histogram represented 400 miles, and full useful life was 100,000 miles; all histogram time entries would be multiplied by 250 (100000/400).

Total t_e = The equivalent time (in hours) to age the catalyst at the temperature of T_r on the catalyst aging bench using the catalyst aging cycle to produce the same amount of deterioration experienced by the catalyst due to thermal deactivation over the vehicle's full useful life.

t_e for a bin = The equivalent time (in hours) to age the catalyst at the temperature of T_r on the catalyst aging bench using the catalyst aging cycle to produce the same amount of deterioration experienced by the catalyst due to thermal deactivation at the temperature bin of T_v over the vehicle's full useful life.

T_r = The effective reference temperature (in °K) of the catalyst on the catalyst bench.

T_v = The mid-point temperature (in °K) of the temperature bin of the vehicle on-road catalyst temperature histogram.

(4) *Effective reference temperature on the SBC.* The effective reference temperature of the standard bench cycle (SBC) is determined for the actual catalyst system design and actual aging bench which will be used using the following procedures:

(i) Measure time-at-temperature data in the catalyst system on the catalyst aging bench following the SBC.

(A) Catalyst temperature must be measured at the highest temperature location of the hottest catalyst in the system.

(B) Catalyst temperature must be measured at the rate of one hertz (one measurement per second) during at least 20 minutes of bench aging.

(C) The measured catalyst temperature results must be tabulated into a histogram with temperature bins of no larger than 10° C.

(ii) The BAT equation must be used to calculate the effective reference temperature by iterative changes to the reference temperature (T_r) until the calculated aging time equals the actual time represented in the catalyst temperature histogram. The resulting temperature is the effective reference temperature on the SBC for that catalyst system and aging bench.

(5) *Catalyst aging bench.* The manufacturer must design, using good engineering judgement, a catalyst aging bench that follows the SBC and delivers the appropriate exhaust flow, exhaust constituents, and exhaust temperature to the face of the catalyst.

(i) A manufacturer may use the criteria and equipment discussed in Appendix VIII to part 86 to develop its catalyst aging bench without prior Agency approval. The manufacturer may use another design that results in equivalent or superior results with advance Agency approval.

(ii) All bench aging equipment and procedures must record appropriate information (such as measured A/F ratios and time-at-temperature in the catalyst) to assure that sufficient aging has actually occurred.

(6) *Required testing.* If a manufacturer is electing to calculate a DF (as discussed in paragraph (f)(1) of this section), then it must conduct at least two FTP emissions tests on the DDV before bench aging of emission control hardware and at least two FTP emission tests on the DDV after the bench-aged emission hardware is re-installed. Additional testing may be conducted by the manufacturer using good engineering judgment.

(e) *Additional durability procedures.*

(1) *Whole vehicle durability procedures.* A manufacturer may use either a customized SRC or an alternative road cycle for the required durability demonstration, with prior EPA approval.

(i) *Customized SRC.* A customized SRC is the SRC run for a different number of miles and/or using a different mileage accumulation fuel with higher levels of certain compounds that may lead to catalyst poisoning, such as phosphorus, sulfur and lead, than specified in paragraph (c)(1)(ii) of this section.

(ii) *Alternative road cycle.* An alternative cycle is a whole vehicle mileage accumulation cycle that uses a different speed-versus-time trace than the SRC, conducted for either the full useful life mileage or for less than full useful life mileage. An alternative road cycle may also include the use of fuel with higher levels of certain compounds that may lead to catalyst poisoning, such as phosphorus, sulfur and lead, than specified in paragraph (c)(1)(ii) of this section.

(iii) *Approval criteria.* The manufacturer must obtain approval from EPA prior to using a customized/alternative road cycle. EPA may approve a customized/alternative cycle when the manufacturer demonstrates that the cycle is expected to achieve the durability program objective of paragraph (a) of this section for the breadth of vehicles using the customized/alternative cycle. To obtain approval the manufacturer must submit all the following information and perform all the following analyses:

(A) The manufacturer must supply in-use FTP emission data on past model year vehicles which are applicable to the vehicle designs it intends to cover with the customized/alternative cycle.

(*1*) The amount of in-use emission data required to demonstrate the effectiveness of a customized/alternative cycle in meeting the durability objective is based on whether the customized/alternative cycle is more or less severe than the SRC. In most cases, EPA will accept a minimum of 20 candidate in-use vehicles tested as-received on the FTP cycle. If the customized/alternative cycle is significantly more severe than the SRC, EPA may accept less data. Conversely, if the customized/alternative cycle is significantly less severe than the SRC, EPA may require more data, up to a maximum of 30 vehicles.

(*2*) This data set must consist of randomly procured vehicles from actual customer use. The vehicles selected for procurement will cover the breadth of the vehicles that the manufacturer intends to certify using the customized/alternative cycle. Vehicles should be procured and FTP tested in as-received condition under the guidelines of the high mileage IUVP program (ref: 40 CFR 86.1845–04).

(*3*) Manufacturers may use previously generated in-use data from the CAP 2000 IUVP or the RDP ''reality check'' in-use program as well as other sources of in-use emissions data for approval under this section.

(*4*) Manufacturers must remove unrepresentative data from the data set using good engineering judgement. The manufacturer must provide EPA with the data removed from the analysis and a justification for the removal of that data.

(*5*) Manufacturers may supply additional in-use data.

(B) The manufacturer must submit an analysis which includes a comparison of the relative stringency of the customized/alternative cycle to the SRC and a calculated equivalency factor for the cycle.

(*1*) The equivalency factor may be determined by an evaluation of the SRC and the customized/alternative cycle using catalyst time-at-temperature data from both cycles and the BAT equation to calculate the required bench aging time of each cycle. The equivalency factor is the ratio of the aging time on the SRC divided by the aging time on the alternative cycle.

(*2*) If emissions data is available from the SRC, as well as time-at-temperature data, then that emissions information may be included in the evaluation of the relative stringency of the two cycles and the development of the equivalency factor.

(*3*) A separate equivalency factor may be determined for each test group, or test groups may be combined together (using good engineering judgement) to calculate a single equivalency factor.

(C) The manufacturer must submit an analysis which evaluates whether the durability objective will be achieved for the vehicle designs which will be certified using the customized/alternative cycle. The analysis must address of the following elements:

(*1*) How the durability objective has been achieved using the data submitted in paragraph (e)(1)(iii)(A) of this section.

(*2*) How the durability objective will be achieved for the vehicle designs which will be covered by the customized/alternative cycle. This analysis should consider the emissions deterioration impact of the design differences between the vehicles included in the data set required in (e)(1)(iii)(A) of this section and the vehicle designs that the manufacturer intends to certify using the customized/alternative cycle.

(2) *Bench-aging durability procedures.* A manufacturer may use a customized or alternative bench aging durability procedure for a required durability demonstration, if approved as described in paragraphs (e)(2)(i) through (vii) of this sectiion. A customized/alternative bench aging procedure must use vehicle performance data (such as catalyst temperature) measured on an approved road cycle as part of the algorithm to calculate bench aging time. The manufacturer must obtain approval from the Agency prior to using a customized bench durability procedure.

(i) The lower control temperature on the SBC may be modified without prior EPA approval provided that the high control temperature is set 90° C above the lower control temperature and an approved BAT equation is used to calculate bench aging time.

(ii) The R-factor used in EPA's BAT equation may be determined experimentally using EPA's standard procedures (specified in Appendix IX of this part) without prior EPA approval. Other experimental techniques to calculate the R-factor require advance EPA approval. To obtain approval, the manufacturer must demonstrate that the calculated bench aging time results in the same (or larger) amount of emission deterioration as the associated approved road cycle.

(iii) The A-factor used in EPA's BAT equation may be modified, using good engineering judgement without prior EPA approval, to ensure that the modified durability process will achieve the durability objective of paragraph (a) of this section.

(iv) Bench aging may be conducted using fuel with additional compounds that may lead to catalyst poisoning, such as phosphorus, sulfur or lead, without prior EPA approval. A manufacturer using fuel with these additional compounds may either calculate a new R-factor or A-factor to assure that the durability objective of paragraph (a) of this section is properly achieved regardless of the use of worst-case fuel usage, in which case the approval criteria for those changes would apply.

(v) An approved customized/alternative road cycle may be used to develop catalyst temperature histograms for use in the BAT equation without additional EPA approval beyond the original approval necessary to use that cycle for mileage accumulation.

(vi) A different bench cycle than the SBC may be used during bench aging with prior EPA approval. To obtain approval the manufacturer must demonstrate that bench aging with the new bench cycle provides the same or larger amount of emission deterioration as the associated approved road cycle.

(vii) A different method to calculate bench aging time may be used with prior EPA approval. To obtain approval the manufacturer must demonstrate that bench aging for the time calculated by the alternative method results in the same or larger amount of emission deterioration as the associated approved road cycle.

(f) *Use of deterioration program to determine compliance with the standard.* A manufacturer may select from two methods for using the results of the deterioration program to determine compliance with the applicable emission standards. Either a deterioration factor (DF) is calculated and applied to the emission data vehicle (EDV) emission results or aged components are installed on the EDV prior to emission testing.

(1) *Deterioration factors.* (i) Deterioration factors are calculated using all FTP emission test data generated during the durability testing program except as noted:

(A) Multiple tests at a given mileage point are averaged together unless the same number of tests are conducted at each mileage point.

(B) Before and after maintenance test results are averaged together.

(C) Zero-mile test results are excluded from the calculation.

(D) Total hydrocarbon (THC) test points beyond the 50,000-mile (useful life) test point are excluded from the intermediate useful life deterioration factor calculation.

(E) A procedure may be employed to identify and remove from the DF calculation those test results determined to be statistical outliers providing that the outlier procedure is consistently applied to all vehicles and data points and is approved in advance by the Administrator.

(ii) The deterioration factor must be based on a linear regression, or another regression technique approved in advance by the Administrator. The deterioration must be a multiplicative or additive factor. Separate factors will be calculated for each regulated emission constituent and for the full and intermediate useful life periods as applicable. Separate DF's are calculated for each durability group except as provided in § 86.1839.

(A) A multiplicative DF will be calculated by taking the ratio of the full or intermediate useful life mileage level, as appropriate (rounded to four decimal places), divided by the stabilized mileage (reference § 86.1831–01(c), *e.g.*, 4000-mile) level (rounded to four decimal places) from the regression analysis. The result must be rounded to three-decimal places of accuracy. The rounding required in this paragraph must be conducted in accordance with § 86.1837. Calculated DF values of less than one must be changed to one for the purposes of this paragraph.

(B) An additive DF will be calculated to be the difference between the full or intermediate useful life mileage level (as appropriate) minus the stabilized mileage (reference § 86.1831–01(c), *e.g.* 4000-mile) level from the regression analysis. The full useful life regressed emission value, the stabilized mileage regressed emission value, and the DF result must be rounded to the same precision and using the same procedures as the raw emission results according to the provisions of § 86.1837–01. Calculated DF values of less than zero must be changed to zero for the purposes of this paragraph.

(iii) The DF calculated by these procedures will be used for determining full and intermediate useful life compliance with FTP exhaust emission standards, SFTP exhaust emission standards, and cold CO emission standards. At the manufacturer's option and using procedures approved by the Administrator, a separate DF may be calculated exclusively using cold CO test data to determine compliance with cold CO emission standards. Also at the manufacturer's option and using procedures approved by the Administrator, a separate DF may be calculated exclusively using US06 and/or air conditioning (SC03) test data to determine compliance with the SFTP emission standards.

(2) *Installation of aged components on emission data vehicles.* For full and intermediate useful life compliance determination, the manufacturer may elect to install aged components on an EDV prior to emission testing rather than applying a deterioration factor. Different sets of components may be aged for full and intermediate useful life periods. Components must be aged using an approved durability procedure that complies with paragraph (b) of this section. The list of components to be aged and subsequently installed on the EDV must selected using good engineering judgement.

(g) *Emission component durability.* The manufacturer must use good engineering judgment to determine that all exhaust emission-related components are designed to operate properly for the full useful life of the vehicles in actual use.

(h) *Application of the durability procedure to future durability groups.* The manufacturer may apply a durability procedure to a durability group, including durability groups in future model years, if the durability process approved under paragraph (c) of this section will achieve the objective of paragraph (a) of this section for that durability group. The manufacturer must use good engineering judgment in determining the applicability of an approved durability procedure to a durability group.

(1) The manufacturer may modify an approved durability procedure by increasing or decreasing the number of miles run on an approved road cycle to represent full or intermediate useful life emissions deterioration or by changing the A–Factor in the BAT equation for a bench aging, using good engineering judgment, to ensure that the modified procedure will achieve the objective of paragraph (a) of this section for that durability group.

(2) The manufacturer must notify the Administrator of its determination to use an approved (or modified) durability procedure on particular test groups and durability groups prior to emission data vehicle testing for the affected test groups (notification at an annual preview meeting scheduled before the manufacturer begins certification activities for the model year is preferred).

(3) Prior to certification, the Administrator may reject the manufacturer's determination in paragraph (h) of this section to apply an approved or modified durability procedure for a durability group or test group if:

(i) It is not made using good engineering judgment,

(ii) It fails to properly consider data collected under the provisions of §§ 86.1845–04, 86.1846–01, and 86.1847–01 or other information; or

(iii) The Administrator determines that the durability procedure has not been shown to achieve the objective of paragraph (a) of this section for particular test groups which the manufacturer plans to cover with the durability procedure.

(i) *Evaluation of the certification durability procedures based on in-use emissions data.*

(1) Manufacturers must use the information gathered from the IUVP, as well as other sources of in-use emissions data, to periodically review whether the durability procedure it employs achieves the objective specified in paragraph (a) of this section.

(2) Required analysis of a manufacturer's approved durability procedures.

(i) In addition to any periodic reviews under paragraph (i)(1) of this section, a manufacturer must conduct a review of whether the durability procedure it employs achieves the durability objective specified in paragraph (a) of this section when the criteria for additional testing specified in § 86.1846 (b) are activated.

(ii) These criteria are evaluated independently for all applicable FTP emission constituents.

(iii) This analysis must be performed for each test group certified by the manufacturer.

(iv) These procedures apply to the EPA standard durability procedures discussed in paragraphs (c) and (d) of this section as well as durability procedures approved under paragraph (e) of this section, including modifications under paragraph (h) of this section.

(v) The analysis must be submitted to EPA no later than 60 days after the submission of the IUVP data report specified in § 86.1847(f).

(3) EPA may require a manufacturer to perform an analysis as described in paragraph (i)(2) of this section if EPA is concerned that the manufacturer's durability procedure may not achieve the durability objective of paragraph (a) of this section.

(j) If, based on the analysis required in paragraph (i) of this section and/or any other information, EPA determines that the durability procedure does not achieve the durability objective of paragraph (a) of this section, EPA may withdraw approval to use the durability procedure or condition approval on modifications to the durability procedure. Such withdrawal or conditional approval will apply to future applications for certification and to the portion of the manufacturer's product line (or the entire product line) that the Administrator determines to be affected. Prior to such a withdrawal the Administrator will give the manufacturer a preliminary notice at least 60 days prior to the final decision. During this period, the manufacturer may submit technical discussion, statistical analyses, additional data, or other information which is relevant to the decision. The Administrator will consider all information submitted by the deadline before reaching a final decision.

(k) If EPA withdraws approval, under the provisions of paragraph (j) of this section, for a durability procedure approved under the provisions of paragraphs (c) and/or (d) of this section, the following procedures apply:

(1) The manufacturer must select one of the following options for future applications for certification for the applicable portion of the manufacturers product-line affect by the Agency's decision:

(i) Increase future DFs calculated using the applicable durability process by the average percent-difference between certification levels and IUVP data; or

(ii) Increase the miles driven on the SRC or the aging time calculated by the BAT equation by the average percent-difference between certification levels and IUVP data, or

(iii) The manufacturer may obtain approval for a new customized durability process, as allowed in paragraph (e) of this section, that has been demonstrated to meet the durability objective.

(2) If EPA's decision to withdraw approval under the provisions of paragraph (j) of this section is based on fewer than 20 tests, the Administrator may require a smaller adjustment than specified in paragraph (k)(1) (i) or (ii) of this section.

(l) Any manufacturer may request a hearing on the Administrator's withdrawal of approval in paragraphs (j) or (k) of this section. The request must be in writing and must include a statement specifying the manufacturer's objections to the Administrator's determinations, and data in support of such objection. If, after review of the request and supporting data, the Administrator finds that the request raises a substantial factual issue, she/he must provide the manufacturer a hearing in accordance with § 86.1853–01 with respect to such issue.

7. A new § 86.1824–06 is added to subpart S to read as follows:

§ 86.1824–06 Durability demonstration procedures for evaporative emissions.

This section applies to gasoline-, methanol-, liquefied petroleum gas-, and natural gas-fueled vehicles which meet the applicability provisions of § 86.1801. Eligible small volume manufacturers or small volume test groups may optionally meet the requirements of §§ 86.1838–01 and 86.1826–01 in lieu of the requirements of this section. A separate durability demonstration is required for each evaporative/refueling family.

(a) *Durability program objective.* The durability program must predict an expected in-use emission deterioration rate and emission level that effectively represents a significant majority (approximately 90 percent) of the distribution of emission levels and deterioration in actual use over the full and intermediate useful life of candidate in-use vehicles of each vehicle design which uses the durability program.

(b) *Required durability demonstration.* Manufacturers must conduct a durability demonstration which satisfies the provisions of either paragraph (c), (d), or (e) of this section.

(c) *Whole vehicle evaporative durability demonstration.*

(1) Mileage accumulation must be conducted using the SRC or any road cycle approved under the provisions of § 86.1823(e)(1).

(2) Mileage accumulation must be conducted for either:

(i) The applicable full useful life mileage period specified in § 86.1805, or

(ii) At least 75 percent of the full useful life mileage. In which case, the manufacturer must calculate a df calculated according to the procedures of paragraph (f)(1)(ii) of this section, except that the DF must be based upon a line projected to the full-useful life mileage using the upper 80 percent statistical confidence limit calculated from the emission data.

(3) The manufacturer must conduct at least one evaporative emission test at each of the five different mileage points selected using good engineering judgement. The required testing must include testing at 5,000 miles and at the highest mileage point run during mileage accumulation (*e.g.* the full useful life mileage). Additional testing may be conducted by the manufacturer using good engineering judgement. The manufacturer may select to run either the 2-day and/or 3-day evaporative test at each test point using good engineering judgement.

(d) *Bench aging evaporative durability procedures.* Manufacturers may use bench procedures designed, using good engineering judgement, to evaluate the emission deterioration of evaporative control systems. Manufacturers may base the bench procedure on an evaluation the following potential causes of evaporative emission deterioration:

(1) Cycling of canister loading due to diurnal and refueling events,

(2) Use of various commercially available fuels, including the Tier 2 requirement to include alcohol fuel;

(3) Vibration of components;

(4) Deterioration of hoses, etc. due to environmental conditions; and

(5) Deterioration of fuel cap due to wear.

(e) *Combined whole-vehicle and bench-aging programs.* Manufacturers may combine the results of whole vehicle aging and bench aging procedures using good engineering judgement.

(f) *Fuel requirements.* (1) For gasoline fueled vehicles certified to meet the evaporative emission standards set forth in § 86.1811–04(e)(1), any mileage accumulation method for evaporative emissions must employ gasoline fuel for the entire mileage accumulation period which contains ethanol in, at least, the highest concentration permissible in gasoline under federal law and that is commercially available in any state in the United States. Unless otherwise approved by the Administrator, the manufacturer must determine the appropriate ethanol concentration by selecting the highest legal concentration commercially available during the calendar year before the one in which the manufacturer begins its mileage accumulation. The manufacturer must also provide information acceptable to the Administrator to indicate that the mileage accumulation method is of sufficient design, duration and severity to stabilize the permeability of all non-metallic fuel and evaporative system components to the mileage accumulation fuel constituents.

(2) For flexible-fueled, dual-fueled, multi-fueled, ethanol-fueled and methanol-fueled vehicles certified to meet the evaporative emission standards set forth in § 86.1811–04(e)(1), any mileage accumulation method must employ fuel for the entire mileage accumulation period which the vehicle is designed to use and which the Administrator determines will have the greatest impact upon the permeability of evaporative and fuel system components. The manufacturer must also provide information acceptable to the Administrator to indicate that the mileage accumulation method is of sufficient design, duration and severity to stabilize the permeability of all non-metallic fuel and evaporative system components to mileage accumulation fuel constituents.

(3) A manufacturer may use other methods, based upon good engineering judgment, to meet the requirements of paragraphs (f) (1) and (2) of this section, as applicable. These methods must be approved in advance by the Administrator and meet the objectives of paragraphs (f) (1) and (2) of this section, as applicable: to provide assurance that the permeability of all non-metallic fuel and evaporative system components will not lead to evaporative emission standard exceedance under sustained exposure to commercially available alcohol-containing fuels for the useful life of the vehicle.

(g) *Calculation of a deterioration factor.* The manufacturer must calculate a deterioration factor which is applied to the evaporative emission results of the emission data vehicles. The deterioration factor must be based on a linear regression, or an other regression technique approved in advance by the Administrator. The DF will be calculated to be the difference between the full life mileage evaporative level minus the stabilized mileage (*e.g.*, 4000-mile) evaporative level from the regression analysis.

The full useful life regressed emission value, the stabilized mileage regressed emission value, and the DF result must be rounded to the same precision and using the same procedures as the raw emission results according to the provisions of § 86.1837–01. Calculated DF values of less than zero must be changed to zero for the purposes of this paragraph.

(h) *Emission component durability.* The manufacturer must use good engineering judgment to determine that all evaporative emission-related components are designed to operate properly for the full useful life of the vehicles in actual use.

(i) If EPA determines based on IUVP data or other information that the durability procedure does not achieve the durability objective of paragraph (a) of this section, EPA may withdraw approval to use the durability procedure or condition approval on modifications to the durability procedure. Such withdrawal or conditional approval will apply to future applications for certification and to the portion of the manufacturer's product line (or the entire product line) that the Administrator determines to be affected. Prior to such a withdrawal the Administrator will give the manufacturer a preliminary notice at least 60 days prior to the final decision. During this period, the manufacturer may submit technical discussion, statistical analyses, additional data, or other information which is relevant to the decision. The Administrator will consider all information submitted by the deadline before reaching a final decision.

(j) Any manufacturer may request a hearing on the Administrator's withdrawal of approval in paragraph (i) of this section. The request must be in writing and must include a statement specifying the manufacturer's objections to the Administrator's determinations, and data in support of such objection. If, after review of the request and supporting data, the Administrator finds that the request raises a substantial factual issue, she/he must provide the manufacturer a hearing in accordance with § 86.1853–01 with respect to such issue.

8. Remove § 86.1824–07.

§ 86.1824–07 [Removed]

9. Add a new § 86.1825–06 to Subpart S to read as follows:

§ 86.1825–06 Durability demonstration procedures for refueling emissions.

This section applies to light-duty vehicles, light-duty trucks, and heavy-duty vehicles which are certified under light-duty rules as allowed under the provisions of § 86.1801–01(c)(1) which are subject to refueling loss emission compliance. Refer to the provisions of §§ 86.1811, 86.1812, 86.1813, 86.1814, and 86.1815 to determine applicability of the refueling standards to different classes of vehicles for various model years. Diesel fuel vehicles may qualify for an exemption to the requirements of this section under the provisions of § 86.1810.

(a) *Durability program objective.* The durability program must predict an expected in-use emission deterioration rate and emission level that effectively represents a significant majority (approximately 90 percent) of the distribution of emission levels and deterioration in actual use over the full and intermediate useful life of candidate in-use vehicles of each vehicle design which uses the durability program.

(b) *Required durability demonstration.* Manufacturers must conduct a durability demonstration which satisfies the provisions of either paragraph (c), (d), or (e) of this section.

(c) *Whole vehicle refueling durability demonstration.* The following procedures must be used when conducting a whole vehicle durability demonstration:

(1) Mileage accumulation must be conducted using the SRC or a road cycle approved under the provisions of § 86.1823(e)(1).

(2) Mileage accumulation must be conducted for either:

(i) The applicable full useful life mileage period specified in § 86.1805, or

(ii) At least 75 percent of the full useful life mileage. In which case, the manufacturer must calculate a df calculated according to the procedures of paragraph (f) (1) (ii) of this section, except that the DF must be based upon a line projected to the full-useful life mileage using the upper 80 percent statistical confidence limit calculated from the emission data.

(3) The manufacturer must conduct at least one refueling emission test at each of the five different mileage points selected using good engineering judgement. The required testing must include testing at 5,000 miles and at the highest mileage point run during mileage accumulation (*e.g.* the full useful life mileage). Additional testing may be conducted by the manufacturer using good engineering judgement.

(d) *Bench aging refueling durability procedures.* Manufacturers may use bench procedures designed, using good engineering judgement, to evaluate the emission deterioration of evaporative/refueling control systems. Manufacturers may base the bench procedure on an evaluation of the following potential causes of evaporative/refueling emission deterioration:

(1) Cycling of canister loading due to diurnal and refueling events;

(2) Use of various commercially available fuels, including the Tier 2 requirement to include alcohol fuel;

(3) Vibration of components;

(4) Deterioration of hoses, etc. due to environmental conditions; and

(5) Deterioration of fuel cap due to wear.

(e) *Combined whole-vehicle and bench-aging programs.* Manufacturers may combine the results of whole vehicle aging and bench aging procedures using good engineering judgment.

(f) [Reserved]

(g) *Calculation of a deterioration factor.* The manufacturer must calculate a deterioration factor which is applied to the evaporative emission results of the emission data vehicles. The deterioration factor must be based on a linear regression, or another regression technique approved in advance by the Administrator. The DF will be calculated to be the difference between the full life mileage evaporative level minus the stabilized mileage (*e.g.*, 4000-mile) evaporative level from the regression analysis. The full useful life regressed emission value, the stabilized mileage regressed emission value, and the DF result must be rounded to the same precision and using the same procedures as the raw emission results according to the provisions of § 86.1837–01. Calculated DF values of less than zero must be changed to zero for the purposes of this paragraph.

(h) *Emission component durability.* The manufacturer must use good engineering judgment to determine that all refueling emission-related components are designed to operate properly for the full useful life of the vehicles in actual use.

(i) If EPA determines based on IUVP data or other information that the durability procedure does not achieve the durability objective of paragraph (a) of this section, EPA may withdraw approval to use the durability procedure or condition approval on modifications to the durability procedure. Such withdrawal or conditional approval will apply to future applications for certification and to the portion of the manufacturer's product line (or the entire product line) that the Administrator determines to be affected. Prior to such a withdrawal the Administrator will give the manufacturer a preliminary notice at least 60 days prior to the final decision. During this period, the manufacturer may submit technical discussion, statistical analyses, additional data, or other information which is relevant to the decision. The Administrator will consider all information submitted by the deadline before reaching a final decision.

(j) Any manufacturer may request a hearing on the Administrator's withdrawal of approval in paragraph (i) of this section. The request must be in writing and must include a statement specifying the manufacturer's objections to the Administrator's determinations, and data in support of such objection. If, after review of the request and supporting data, the Administrator finds that the request raises a substantial factual issue, she/he must provide the manufacturer a hearing in accordance with § 86.1853–01 with respect to such issue.

10. Amend § 86.1826–01 by revising paragraphs (a) and (b)(3)(iv) to read as follows:

§ 86.1826–01 Assigned deterioration factors for small volume manufacturers and small volume test groups.

(a) Applicability. This program is an option available to small volume manufacturers certified under the small volume manufacturer provisions of § 86.1838–01(b)(1) and small volume test groups certified under the small volume test group provisions of § 86.1838–01(b)(2). Manufacturers may elect to use these procedures in lieu of the requirements of §§ 86.1823, 86.1824, and 86.1825 of this subpart.

(b) * * *

(3) * * *

(iv) The manufacturer must develop either deterioration factors or aged components to use on EDV testing by generating durability data in accordance with §§ 86.1823, 86.1824, and/or 86.1825 on a minimum of 25 percent of the manufacturer's projected sales (based on durability groups) that is equipped with unproven emission control systems.

* * * * *

11. Amend § 86.1829–01 by revising paragraphs (a)(3) and (d)(1) to read as follows:

§ 86.1829–01 Durability and emission testing requirements; waivers.

(a) * * *

(3) The DDV shall be tested and accumulate service mileage according to the provisions of §§ 86.1831–01, 86.1823, 86.1824 and 86.1825. Small volume manufacturers and small volume test groups may optionally meet the requirements of § 86.1838–01.

* * * * *

(d)(1) Beginning in the 2004 model year, the exhaust emissions must be measured from all LDV/T exhaust emission data vehicles tested in accordance with the federal Highway Fuel Economy Test (HWFET; 40 CFR part 600, subpart B). The oxides of nitrogen emissions measured during such tests must represent the full useful life emissions in accordance with § 86.1823–06(f) and subsequent model year provisions. Those results are then rounded and compared with the applicable emission standard in § 86.1811–04. All data obtained from the testing required under this paragraph (d) must be reported in accordance with the procedures for reporting other exhaust emission data required under this subpart.

* * * * *

12. Amend § 86.1830–01 by revising paragraph (b)(1), (b)(2), (c)(1), (c)(2), (c)(3) and (c)(4) to read as follows:

§ 86.1830–01 Acceptance of vehicles for emission testing.

* * * * *

(b) Special provisions for durability data vehicles. (1) For DDV's, the mileage at all test points shall be within 250 miles of the scheduled mileage point as required under § 86.1823–06(c)(3). Manufacturers may exceed the 250 mile upper limit if there are logistical reasons for the deviation and the manufacturer determines that the deviation will not affect the representativeness of the durability demonstration.

(2) For DDV's aged using the standard or a customized/alternative whole-vehicle cycle, all emission-related hardware and software must be installed and operational during all mileage accumulation after the 5000-mile test point.

* * * * *

(c) Special provisions for emission data vehicles. (1) All EDV's shall have at least the minimum number of miles accumulated to achieve stabilized emission results according to the provisions of § 86.1831–01(c).

(2) Within a durability group, the manufacturer may alter any emission data vehicle (or other vehicles such as current or previous model year emission data vehicles, running change vehicles, fuel economy data vehicles, and development vehicles) in lieu of building a new test vehicle providing that the modification will not impact the representativeness of the vehicle's test results. Manufacturers shall use good engineering judgment in making such determinations. Development vehicles which were used to develop the calibration selected for emission data testing may not be used as the EDV for that configuration. Vehicles from outside the durability group may be altered with advance approval of the Administrator.

(3) Components used to reconfigure EDV's under the provisions of paragraph (c)(2) of this section must be appropriately aged if necessary to achieve representative emission results. Manufacturers must determine the need for component aging and the type and amount of aging required using good engineering judgment.

(4) Bench-aged hardware may be installed on an EDV for emission testing as a method of determining certification levels (projected emission levels at full or intermediate useful life) using bench aging procedures under the provisions of § 86.1823.

13. Amend § 86.1831–01 by revising paragraphs (a)(1) and (b)(1) to read as follows:

§ 86.1831–01 Mileage accumulation requirements for test vehicles.

(a) Durability Data Vehicles. (1) The manufacturer must accumulate mileage on DDV's using the procedures in § 86.1823.

* * * * *

(b) * * *

(1) The standard method of mileage accumulation for emission data vehicles and running change vehicles is mileage accumulation using either the Standard Road Cycle specified in Appendix V to this part or the Durability Driving Schedule specified in Appendix IV to this part.

* * * * *

14. Amend § 86.1838–01 by revising paragraph (c)(1) to read as follows:

§ 86.1838–01 Small volume manufacturers certification procedures.

* * * * *

(c) * * * (1) Durability demonstration. Use the provisions of § 86.1826–01 rather than the requirements of §§ 86.1823, 86.1824, and/or 86.1825.

* * * * *

15. Amend § 86.1839–01 by revising paragraph (b) to read as follows:

§ 86.1839–01 Carryover of certification data.

* * * * *

(b) In lieu of using newly aged hardware on an EDV as allowed under the provisions of § 86.1823–06(f)(2), a manufacturer may use similar hardware aged for an EDV previously submitted, provided that the manufacturer determines that the previously aged hardware represents a worst case or equivalent rate of deterioration for all applicable emission constituents for durability demonstration.

16. Amend § 86.1841–01 by revising paragraphs (a)(1) introductory text and (a)(2) and removing and reserving paragraph (a)(3) to read as follows:

§ 86.1841–01 Compliance with emission standards for the purpose of certification.

(a) * * *

(1) If the durability demonstration procedure used by the manufacturer under the provisions of §§ 86.1823, 86.1824, or 86.1825 requires a DF to be calculated, the DF shall be applied to the official test results determined in § 86.1835–01(c) for each regulated emission constituent and for full and intermediate useful life, as appropriate, using the following procedures:

* * * * *

(2) If the durability demonstration procedure used by the manufacturer under the provisions of §§ 86.1823, 86.1824, or 86.1825, as applicable, requires testing of the EDV with aged emission components, the official results of that testing determined under the provisions of § 86.1835–01(c) shall be rounded to the same level of precision as the standard for each regulated constituent at full and intermediate useful life, as appropriate. This rounded emission value is the certification level for that emission constituent at that useful life mileage.

(3) [Reserved]

* * * * *

17. Amend § 86.1844–01 by revising paragraph (d)(4) to read as follows:

§ 86.1844–01 Information requirements: Application for certification and submittal of information upon request.

* * * * *

(d) * * *

(4) Durability information.

(i) A description of the durability method used to establish useful life durability, including exhaust and evaporative/refueling emission deterioration factors as required in §§ 86.1823, 86.1824 and 86.1825 when applicable.

(ii) The equivalency factor required to be calculated in § 1823–06(e)(iii)(B), when applicable.

* * * * *

18. Remove and reserve § 86.1863–07.

§ 86.1863–07 [Reserved]

19. Add appendices V, VII, VIII, and IX to part 86 to read as follows:

Appendix V to Part 86—The Standard Road Cycle (SRC)

1. The standard road cycle (SRC) is a mileage accumulation cycle that may be used for any vehicle which is covered by the applicability provisions of § 86.1801. The vehicle may be run on a track or on a mileage accumulation dynamometer.

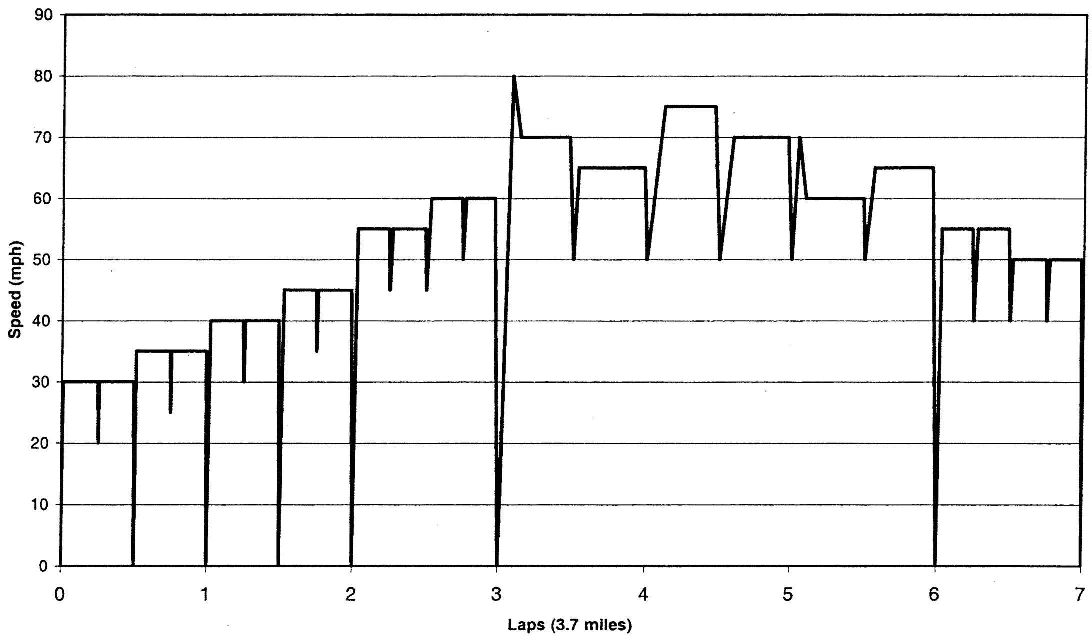
2. The cycle consists of 7 laps of a 3.7 mile course. The length of the lap may be changed to accommodate the length of the service-accumulation track.

DESCRIPTION OF THE SRC

Lap	Description	Typical accel rate (MPH/s)
1	(start engine) Idle 10 sec	0
1	Mod accel to 30 MPH	4
1	Cruise at 30 MPH for ¼ lap.	0
1	Mod. decel to 20 MPH	−5
1	Mod accel to 30 MPH	4
1	Cruise at 30 MPH for ¼ lap.	0
1	Mod. decel to stop	−5
1	Idle 5 sec	0
1	Mod accel to 35 MPH	4
1	Cruise at 35 MPH for ¼ lap.	0
1	Mod. decel to 25 MPH	−5
1	Mod accel to 35 MPH	4
1	Cruise at 35 MPH for ¼ lap.	0
1	Mod. decel to stop	−5
2	Idle 10 sec	0
2	Mod accel to 40 MPH	3
2	Cruise at 40 MPH for ¼ lap.	0
2	Mod. decel to 30 MPH	−5
2	Mod accel to 40 MPH	3
2	Cruise at 40 MPH for ¼ lap.	0
2	Mod. decel to stop	−5
2	Idle 5 sec	0
2	Mod accel to 45 MPH	3
2	Cruise at 45 MPH for ¼ lap.	0
2	Mod. decel to 35 MPH	−5
2	Mod accel to 45 MPH	3
2	Cruise at 45 MPH for ¼ lap.	0
2	Mod. decel to stop	−5
3	Idle 10 sec	0
3	Hard accel to 55 MPH	4
3	Cruise at 55 MPH for ¼ lap.	0
3	Mod. decel to 45 MPH	−5
3	Mod accel to 55 MPH	2
3	Cruise at 55 MPH for ¼ lap.	0
3	Mod. decel to 45 MPH	−5
3	Mod accel to 60 MPH	2
3	Cruise at 60 MPH for ¼ lap.	0
3	Mod. decel to 50 MPH	−5
3	Mod. accel to 60 MPH	2
3	Cruise at 60 MPH for ¼ lap.	0
3	Mod. decel to stop	−4
4	Idle 10 sec	0
4	Hard accel to 80 MPH	3
4	Coastdown to 70 MPH	−1
4	Cruise at 70 MPH for ½ Lap.	0
4	Mod. decel to 50 MPH	−3
4	Mod accel to 65 MPH	2
4	Cruise at 65 MPH for ½ lap.	0
4	Mod. decel to 50 MPH	−3
5	Mod accel to 75 MPH	1
5	Cruise at 75 MPH for ½ lap.	0
5	Mod. decel to 50 MPH	−3
5	Lt. accel to 70 MPH	1
5	Cruise at 70 MPH for ½ lap.	0
5	Mod. decel 50 MPH	−3
6	Mod accel to 70 MPH	2
6	Coastdown to 60 MPH	−1
6	Cruise at 60 MPH for ½ lap.	0
6	Mod. decel to 50 MPH	−4
6	Mod. accel to 65 MPH	1
6	Cruise at 65 MPH for ½ lap.	0
6	Mod. decel to stop	−4
7	Idle 45 sec	0
7	Hard accel to 55 MPH	4
7	Cruise at 55 MPH for ¼ lap.	0
7	Mod. decel to 40 MPH	−5
7	Mod accel to 55 MPH	2
7	Cruise at 55 MPH for ¼ lap.	0
7	Mod. decel to 40 MPH	−5
7	Mod accel to 50 MPH	2
7	Cruise at 50 MPH for ¼ lap.	0
7	Mod. decel to 40 MPH	−5
7	Mod. accel to 50 MPH	2
7	Cruise at 50 MPH for ¼ lap.	0
7	Mod. decel to stop	−5

The standard road cycle is represented graphically in the following figure:

Standard Road Cycle (SRC)



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Appendix VII to Part 86—Standard Bench Cycle (SBC)

1. The standard bench aging durability procedures [Ref. § 86.1823–06 (d)] consist of aging a catalyst-oxygen-sensor system on an aging bench which follows the standard bench cycle (SBC) described in this appendix.

2. The SBC requires use of an aging bench with an engine as the source of feed gas for the catalyst.

3. The SBC is a 60-second cycle which is repeated as necessary on the aging bench to conduct aging for the required period of time. The SBC is defined based on the catalyst temperature, engine air/fuel (A/F) ratio, and the amount of secondary air injection which is added in front of the first catalyst.

Catalyst Temperature Control

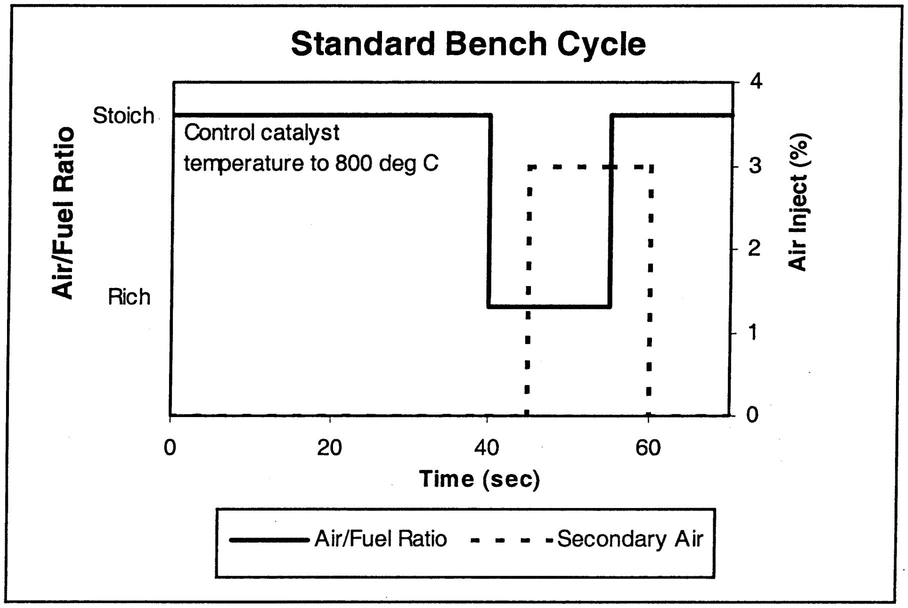
1. Catalyst temperature shall be measured in the catalyst bed at the location where the highest temperature occurs in the hottest catalyst. Alternatively, the feed gas temperature may be measured and converted to catalyst bed temperature using a linear transform calculated from correlation data collected on the catalyst design and aging bench to be used in the aging process.

2. Control the catalyst temperature at stoichiometric operation (01 to 40 seconds on the cycle) to a minimum of 800° C (± 10° C) by selecting the appropriate Engine speed, load, and spark timing for the engine. Control the maximum catalyst temperature that occurs during the cycle to 890° C (± 10° C) by selecting the appropriate A/F ratio of the engine during the ''rich'' phase described in the table below.

3.If a low control temperature other than 800° C is utilized, the high control temperature shall be 90° C higher than the low control temperature.

STANDARD BENCH CYCLE (SBC)

Time (seconds)	Engine air/fuel ratio	Secondary air injection
01–40	14.7 (stoichiometric, with load, spark timing, and engine speed controlled to achieve a minimum catalyst temperature of 800° C).	None.
41–45	''Rich'' (A/F ratio selected to achieve a maximum catalyst temperature over the entire cycle of 890° C, or 90° higher than low control temperature).	None.
46–55	''Rich'' (A/F ratio selected to achieve a maximum catalyst temperature over the entire cycle of 890° C, or 90° higher than low control temperature).	3% (± 0.1%).
56–60	14.7 (stoichiometric, same load, spark timing, and engine speed as used in the 01–40 sec period of the cycle).	3% (± 0.1%).



Appendix VIII to Part 86—Aging Bench Equipment and Procedures

This appendix provides specifications for standard aging bench equipment and aging procedures which may be used to conduct bench aging durability under the provisions of § 86.1823–06.

1. Aging Bench Configuration

The aging bench must provide the appropriate exhaust flow rate, temperature, air-fuel ratio, exhaust constituents and secondary air injection at the inlet face of the catalyst.

a. The EPA standard aging bench consists of an engine, engine controller, and engine dynamometer. Other configurations may be acceptable (*e.g.* whole vehicle on a dynamometer, or a burner that provides the correct exhaust conditions), as long as the catalyst inlet conditions and control features specified in this appendix are met.

b. A single aging bench may have the exhaust flow split into several streams providing that each exhaust stream meets the requirements of this appendix. If the bench has more than one exhaust stream, multiple catalyst systems may be aged simultaneously.

2. Fuel and Oil

The fuel used by the engine shall comply with the mileage accumulation fuel provisions of § 86.113 for the applicable fuel type (*e.g.*, gasoline or diesel fuel). The oil used in the engine shall be representative of commercial oils and selected using good engineering judgement.

3. Exhaust System Installation

a. The entire catalyst(s)-plus-oxygen-sensor(s) system, together with all exhaust piping which connects these components, [the ''catalyst system''] will be installed on the bench. For engines with multiple exhaust streams (such as some V6 and V8 engines), each bank of the exhaust system will be installed separately on the bench.

b. For exhaust systems that contain multiple in-line catalysts, the entire catalyst system including all catalysts, all oxygen sensors and the associated exhaust piping will be installed as a unit for aging. Alternatively, each individual catalyst may be separately aged for the appropriate period of time.

4. Temperature Measurement

Catalyst temperature shall be measured using a thermocouple placed in the catalyst bed at the location where the highest temperature occurs in the hottest catalyst (typically this occurs approximately one-inch behind the front face of the first catalyst at its longitudinal axis). Alternatively, the feed gas temperature just before the catalyst inlet face may be measured and converted to catalyst bed temperature using a linear transform calculated from correlation data collected on the catalyst design and aging bench to be used in the aging process. The catalyst temperature must be stored digitally at the speed of 1 hertz (one measurement per second).

5. Air/Fuel Measurement

Provisions must be made for the measurement of the air/fuel (A/F) ratio (such as a wide-range oxygen sensor) as close as possible to the catalyst inlet and outlet flanges. The information from these sensors must be stored digitally at the speed of 1 hertz (one measurement per second).

6. Exhaust Flow Balance

Provisions must be made to assure that the proper amount of exhaust (measured in grams/second at stoichiometry, with a tolerance of ±5 grams/second) flows through each catalyst system that is being aged on the bench. The proper flow rate is determined based upon the exhaust flow that would occur in the original vehicle's engine at the steady state engine speed and load selected for the bench aging in paragraph (7).

7. Setup

a. The engine speed, load, and spark timing are selected to achieve a catalyst bed temperature of 800° C (± 10° C) at steady-state stoichiometric operation.

b. The air injection system is set to provide the necessary air flow to produce 3.0% oxygen (±0.1%) in the steady-state stoichiometric exhaust stream just in front of the first catalyst. A typical reading at the upstream A/F measurement point (required in paragraph 5) is lambda 1.16 (which is approximately 3% oxygen).

c. With the air injection on, set the ''Rich'' A/F ratio to produce a catalyst bed temperature of 890° C (±10°C). A typical A/F value for this step is lambda 0.94 (approximately 2% CO).

8. Aging Cycle

The standard bench aging procedures use the standard bench cycle (SBC) which is described in Attachment VII to Part 86. The SBC is repeated until the amount of aging calculated from the bench aging time (BAT) equation [ref. § 86.1823–06 (d)(3)].

9. Quality Assurance

a. The temperatures and A/F ratio information that is required to be measured in paragraphs (4) and (5) shall be reviewed periodically (at least every 50 hours) during aging. Necessary adjustments shall be made to assure that the SBC is being appropriately followed throughout the aging process.

b. After the aging has been completed, the catalyst time-at-temperature collected during the aging process shall be tabulated into a histogram with temperature bins of no larger than 10 C. The BAT equation and the calculated effective reference temperature for the aging cycle [ref. § 86.1823–06(d)] will be used to determine if the appropriate amount of thermal aging of the catalyst has in fact occurred. Bench aging will be extended if the thermal effect of the calculated aging time is not at least 95% of the target thermal aging.

10. Startup and Shutdown

Care should be taken to assure that the maximum catalyst temperature for rapid deterioration (*e.g.*, 1050° C) does not occur during startup or shutdown. Special low temperature startup and shutdown procedures may be used to alleviate this concern.

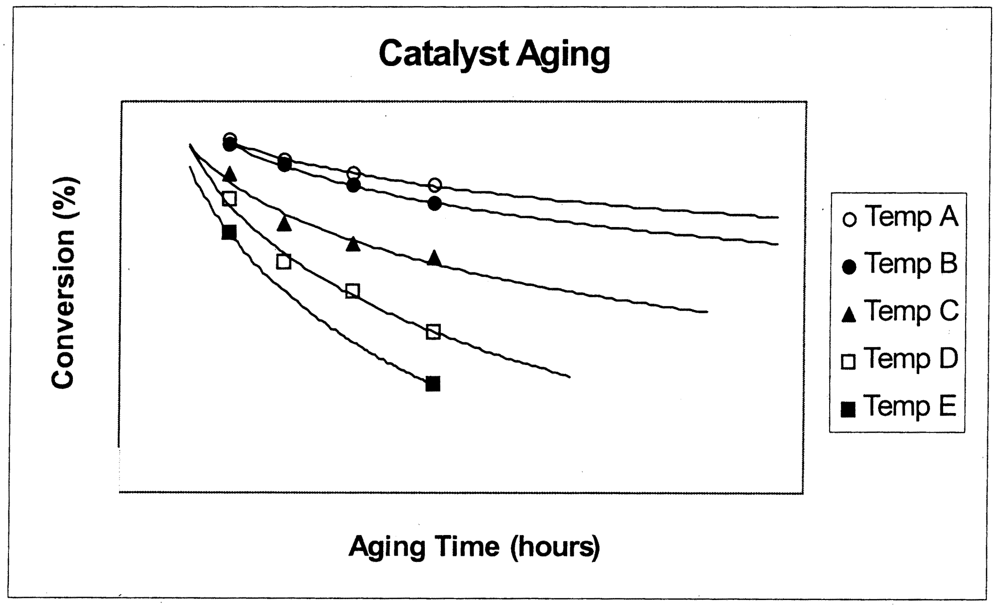
Appendix IX to Part 86—Experimentally Determining the R-Factor for Bench Aging Durability Procedures

The R–Factor is the catalyst thermal reactivity coefficient used in the bench aging time (BAT) equation [Ref. § 86.1826–06(d)(3)]. Manufacturers may determine the value of R experimentally using the following procedures.

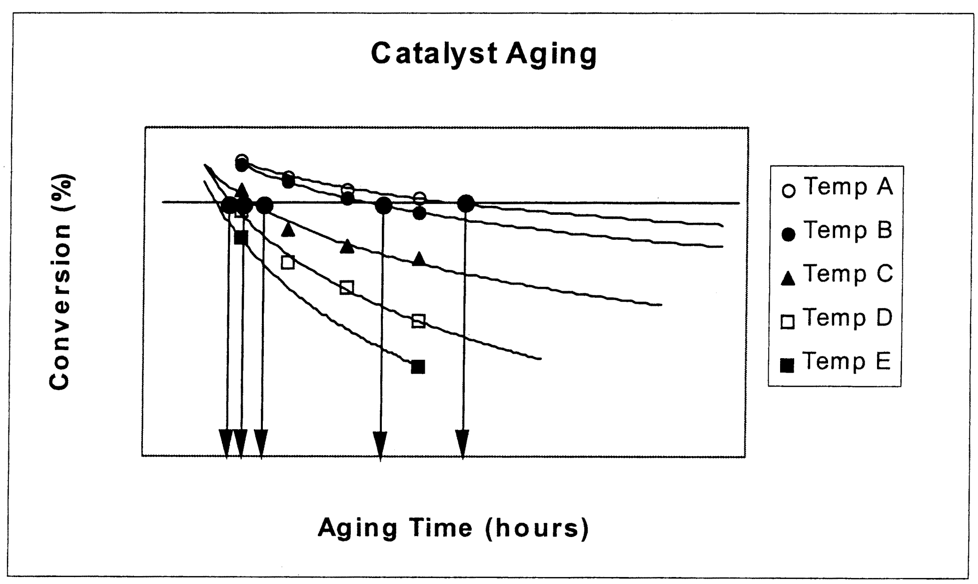
1. Using the applicable bench cycle and aging bench hardware, age several catalysts (of the same catalyst design) at different control temperatures and measure catalyst efficiency periodically for each constituent.

2. Estimate the value of R and calculate the effective reference temperature (Tr) for the bench aging cycle for each control temperature according to the procedure described in § 86.1826–06(d)(4).

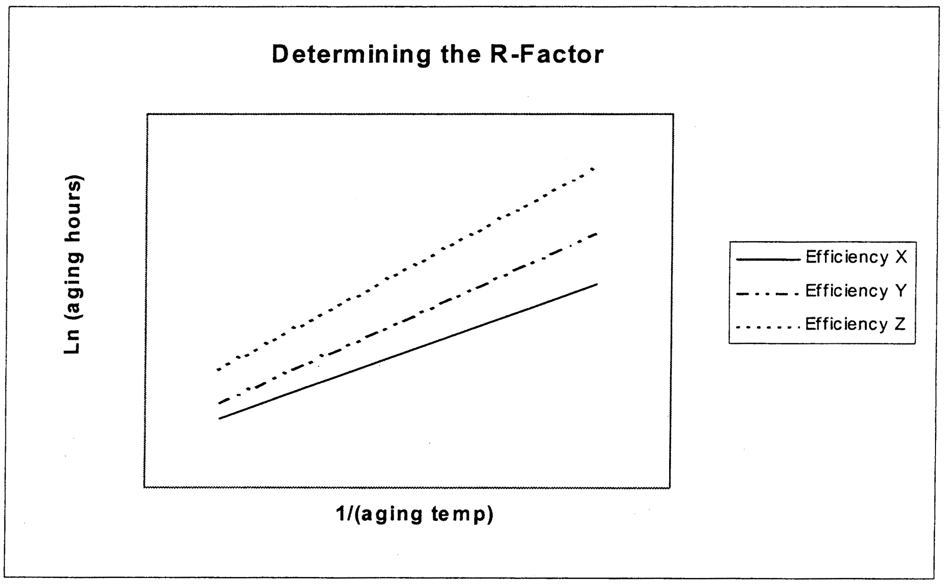
3. On the same set of axes, plot the percent of catalyst conversion efficiency along the vertical axis, versus hours of aging time on the horizontal axis for each of the catalysts. Draw a logarithmic best-fit line through the data for each aging temperature, as shown in the following graph.



4. On the plot of aging time versus conversion efficiency, draw horizontal lines at several different values of constant conversion efficiency. Where the horizontal line intercepts each of the constant temperature aging curves, read the corresponding aging time on the horizontal axis. The following graph shows an example of a horizontal line drawn for one value of constant conversion efficiency.



5. Plot the natural log (ln) of the aging time in hours along the vertical axis, versus the inverse of aging temperature (1/(aging temperature, deg K)) along the horizontal axis, for several constant-catalyst-efficiencies for each constituent. Fit least-squared best-fit lines through the constant-efficiency data. The slope of the line is the R-factor. Use the smallest R-factor (worst case). See the following graph for an example.



6. Compare the R-factor to the initial value that was used in Step 2. If the calculated R-factor differs from the initial value by more than 5%, choose a new R-factor that is between the initial and calculated values, then repeat Steps 2–6 to derive a new R-factor. Repeat this process until the calculated R-factor is within 5% of the initially assumed R-factor.

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