

Technical Support Document

For proposed rulemaking:

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

RIN # A2060

March 15, 2004

Technical Support Document

I. Introduction

This document is the technical support document for EPA's proposed rulemaking titled: "Emission Durability Procedures for New Light-Duty Vehicles, Light-Duty Trucks and Heavy-Duty Engines", RIN # A2060. The technical discussion, development, and rationale for the proposal are discussed in the preamble. This document provides the publicly available data that the Agency used to develop the standard road cycle and standard bench procedures proposed in the previously cited rulemaking.

II. What information beyond that discussed in the preamble was used by the Agency to develop the Strawman proposal?

A. Literature Search

The first step to develop the strawman proposal was to collect the available information. The Society of Automotive Engineers has published a number of useful technical papers. The results of the Agency's literature search is contained in Attachment I. As discussed in the preamble, the Agency used this information to establish the factors that affect exhaust emission durability. Specific references to particular documents are given in the preamble.

B. The SMAP Cycle

The "Standard Mileage Accumulation" procedure" (SMA) was a durability driving cycle which EPA was considering adopting as part of a durability rulemaking. EPA presented a draft of the SMA at an EPA/Automotive Industry durability workshop on April 26, 1994. Details of the SMA cycle that were presented at this workshop are contained in Attachment II. The general Industry reaction to the SMAP at that time was that it was too complex and may be too severe. For a variety of reasons, EPA did not proceed with the rulemaking which was being considered at this workshop. Nor did the Agency propose the SMAP cycle in any subsequent regulation. Ultimately, the durability revisions considered at the April 26, 1994 workshop were addressed in the CAP 2000 rulemaking and are also the subject of this proposal.

C. Baltimore Speed & Acceleration Data

EPA published on May 14, 1993 a Preliminary Technical Report on the Federal Test Procedure Review Project (EPA 420-R-93-007) which gathered speed and acceleration information from a number of vehicles driven in the Baltimore, MD area. A final version of

the report was not issued. When developing the strawman cycle, EPA was interesting in including a significant portion of high speed driving because, as discussed in the preamble, high speed driving significantly contributes to emission deterioration in actual use. Attachment III contains the distribution of speeds in the high speed tail of the distribution (speeds of 65 miles-per-hour (mph) or greater). From this data EPA concluded that speeds were rarely above 80 mph. Attachment III also contains the positive acceleration distribution for the same Baltimore data fleet. From this data, EPA concluded that acceleration rates were rarely above 5 mph/sec.

D. Manufacturer Driving Cycles and Bench Aging Programs

EPA reviewed previously approved manufacturer driving cycles and bench aging programs. In some cases, certain manufacturers have claimed that aspects of their durability programs are subject to treatment as confidential business information (CBI) and consequently are not part of this document. The samples of information that are provided are representative of the information with is not being released due to claims of CBI.

Ford provided a general description of their durability process at a January 22, 2003 meeting. A copy of their presentation (with CBI removed) is in Attachment VI. Ford also provided a description of their High-Speed Cycle (HSC) road driving cycle in a January 21, 2003 letter to the Agency which is contained in Attachment VII.

GM provided a description of certain aspects of their road cycle and bench aging procedures which is contained in Attachment IX.

Toyota provided a description of their road cycles and bench aging procedures in Attachments XI and XII.

In summary, EPA learned from this investigation that manufacturers' driving cycles contained a mixture of low and high speed operation. High speed operation was generally at 70 MPH or higher speeds. Acceleration rates included hard and wide-open-throttle (WOT) accelerations. In one case where the manufacturer was using an accelerated mileage accumulation cycle (one mile of this accelerated cycle equaled several miles of normal mileage accumulation) the top speed was higher than 85 MPH.

EPA learned that bench cycles typically involved aging the catalyst-plus-oxygen-sensor on an catalyst aging bench. Accelerated aging was generally accomplished by increasing the temperature on the catalyst aging bench. In some cases, poisons were added to the fuel.

III. What is EPA's "strawman" durability proposal?

EPA presented a draft proposal for a durability road cycle and bench aging procedure (call the "strawman" proposal) at an EPA/Industry workshop on February 5, 2003. The EPA presentation

is contained in Attachment IV. At this meeting EPA requested comments and data on the appropriateness of the proposed procedures. The comments and data received are presented in the next section.

IV. What comments were received on EPA's strawman durability proposal?

A. Comments at the Workshop

At the EPA/Industry workshop on February 5, 2003 we received very few oral comments. There was some general concern expressed that to severity of the road cycle was not known. We were informed that we could expect written comments, however.

B. The Alliance and AIAM Written Comments

The Alliance and AIAM written comments on the strawman procedures are contained in Attachment V. They comment that the strawman road cycle is too severe. They also comment that EPA should allow manufacturers to use their own road and bench cycles for durability.

B. Ford Written Comments

Ford's written comments are contained in Attachment VIII. Ford proposed that we use a new road cycle which they developed called MOD1.

C. GM Written Comments

GM's written comments are contained in Attachment IX. GM provided us catalyst time-at-temperature data on their road cycle and the strawman road cycle. They concluded that the strawman cycle was more severe than their road cycle. They also provided a comparison of the bench aging time calculated using GM's methods and the strawman procedures. They concluded that the two procedures were essentially equivalent.

D. Honda Written Comments

Honda provided us with catalyst time-at-temperature data on an Accord test vehicle run on the strawman road cycle (labeled "EPA 7 lap" on their graph), Ford's proposed MOD1 cycle (labeled "EPA modified" on their graph, Ford's HSC cycle, and Toyota's U02 cycle. That data is contained in Attachment X. Honda concluded that the EPA strawman cycle was more severe than all the other cycles for the Accord.

E. Toyota Written Comments

Toyota provided several rounds of written comments which are contained in Attachments XI through XIV. Toyota provided us catalyst time-at-temperature data on two Toyota road cycles (the 9 Lap and the U02 cycles) and the strawman road cycle. They concluded that the strawman cycle was more severe than their road cycle on 3 of 4 comparisons and slightly less severe than the Corolla run on the 9 Lap cycle. Toyota expressed concerns that there were not sufficient fuel-cut (lean A/F ratio) operation on the strawman road cycle.

Based on the catalyst time-at-temperature data supplied by Honda, EPA calculated the number of aging hours necessary to replicate that thermal exposure on the strawman bench cycle. This calculation used the techniques discussed in the strawman proposal and did not use Toyota's method where separate aging time is calculated for rich, stoichiometric and lean A/F ratios. EPA's calculation is in Attachment XV.

V. What is the relative severity of the strawman cycle compared to approved manufacturer cycles?

Based on the catalyst time-at-temperature data provided by the manufacturers, EPA calculated the bench aging time for the manufacturer's cycle and for the strawman road cycle. EPA calculated the MFR/EPA relative severity ratio by dividing the aging time for the manufacturer cycle by the bench aging time for the strawman cycle. The results of this study is contained in Attachment XVI.

The MFR/EPA severity ratios ranged from 45% to 105%. Five of the severity comparisons were in a tight band of between 61% and 65%. As discussed in the preamble, EPA targeted the Standard Road Cycle (SRC) which is the subject of the proposal to approximately replicate this tight band of severity data.

VI. What are typical evaporative and refueling deterioration factors in today's durability program?

EPA analyzed the current evaporative and refueling deterioration factors (Dfs) for the 2002 and 2003 model years. The results of that study are contained in Attachment XVII. EPA concluded from the study that the Dfs were typically low. Dfs were frequently zero and the 70 percentile DF was approximately 5% to 7% of the standard.