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Environmental Protection Agency

Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Gaseous Emission Regulations for 1985 and Later Model Year Light-Duty Trucks and 1986 and Later Model Year Heavy-Duty Engines

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 86

[AMS-FRL 1699-8]

Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Gaseous Emission Regulations for 1985 and Later Model Year Light-Duty Trucks and 1986 and Later Model Year Heavy-Duty Engines

AGENCY: Environmental Protection Agency.

ACTION: Advance notice of proposed rulemaking.

SUMMARY: The Clean Act requires EPA to regulate nitrogen oxides (NO_x) emissions from certain light-duty trucks and heavy-duty engines. This Advance Notice requests information and comment on our preliminary analysis and on possible standards. We expect to propose standards, effective for all 1985 and later model year light-duty trucks (LDTs) and 1986 and later model year heavy-duty engines (HDEs).

Section 202(a)(3(A) of the statute (42 U.S.C. 7521(a)(3)(A)) requires a 75 percent reduction in NO_x emissions (compared to uncontrolled levels) from heavy-duty engines, a requirement that would result in a standard of 1.7 grams per brake horsepower-hour (g/BHP-hr). However, our preliminary analysis indicates that it may not be technologically feasible for diesel-powered heavy-duty trucks to meet this standard by 1986. Section 202(a)(3)(C) of the Act pemits EPA to set a different standard if the 75 percent reduction level cannot be reached "without increasing cost or decreasing fuel economy to an unreasonable degree". Since this appears to be the case, we do not expect to propose 1.7 g/BHP-hr for heavy-duty engines. We are requesting information to help us choose a more feasible standard and to develop a public record to support it.

This Advance Notice also contains a discussion of changes to the HDE and LDT certification processes that we expect to propose with new NO_x standards in the summer of 1981. These include the following: An in-use durability program similar to the one proposed as a part of the 1984 HC and CO rulemakings; a provision requiring manufacturers to show a "reasonable likelihood" that in-use maintenance will be performed on key emission-related components; and minimum maintenance intervals for electronic engine controls. We are requesting comment on the draft regulations embodying these concepts.

DATES: EPA will hold a public hearing on this Advance Notice approximately 30 days after the date of publication. The time and place of the hearing will be announced later by a hearing notice published in the **Federal Register**.

ADDRESSES: Comments should be submitted (4 copies if possible) to: Central Docket Section (A-130), Environmental Protection Agency, Attn: Docket No. A-80-31, 401 M St. SW, Washington, D.C. 20460.

Docket No. A-80-31 also contains supporting material relevant to this rulemaking, and is located in the U.S. Environmental Protection Agency, Central Docket Section, West Tower Lobby, Gallery I, 401 M St., S.W., Washington, D.C. The docket may be inspected between 8 a.m. and 4 p.m. on weekdays, and a reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: Tad Wysor, Emission Control Technology Division, U.S. Environmental Protection Agency, 2565 Plymouth Road, Ann Arbor, MI 48105, Telephone: (313) 668-4497.

SUPPLEMENTARY INFORMATION:

I. Introduction

Initially, we did not plan to issue an Advanced Notice of Proposed Rulemaking (ANPRM) for LDT and HDE NO_x control. An NPRM was prepared and a regulatory analysis performed for a 0.9 gpm standard for light-duty trucks and a 1.7 gpm standard for heavy-duty trucks. However, during the regulatory development process it became apparent that we needed more information to choose and to support appropriate standards. We are issuing this ANPRM announcing our general intentions and requesting information and comment on possible standards. Also included in the ANPRM are certain changes in vehicle certification procedures that the Agency plans to propose.

The discussion and analysis of the economic, environmental and other effects of possible NO_x standards draws heavily on the Draft Regulatory Analysis EPA prepared when we believed we would soon propose truck NO_x standards. Because the Agency is not committed to the standards analyzed in the "Regulatory Analysis," its usefulness is somewhat limited. However, we think that much of the information it contains may be valuable to potential commenters, and are therefore including it (along with a set of draft regulations) in the public docket (referenced earlier).

EPA will consider a number of options in the preparation of a Notice of Proposed Rulemaking. In each of the components of the rulemaking—the standards and their stringency, the revised durability requirements, and the new allowable maintenance provisions—there will be alternatives to consider. Please refer to Chapter VI of the Draft Regulatory Analysis for a more complete discussion of the alternatives.

Under Section 202(a)(3) of the Clean Air Act, EPA is empowered to consider NO_x standards representing a full 75 percent reduction from uncontrolled NO_x levels. However, there are three potential courses of action. First, the standards can be promulgated at that level if they are not changed for feasibility* or health effects reasons pursuant to Sections 202(a)(3)(B) and/or (E). The second path, the one that we expect to follow in this rulemaking, results if there is a feasibility problem, in which case section 202(a)(3)(B) authorizes EPA to promulgate a standard at the level of maximum feasible reduction (assuming an adequate record to support such an action is established). Since we believe there is a feasibility problem for HDDs, we expect to propose a temporary standard under section 202(a)(3)(B) that is less stringent than statutory standard. This course of action is coupled with a requirement to revisit the standard every three years and successively tighten it until the 75 percent reduction is achieved. The third possible scenario relates to the relationship between the level of the standard and the health effects of the pollutant. Under section 202(a)(3)(E), EPA may adjust a standard either up or down to account for effects on public health. Although we expect to follow the second course of action (as indicated above), the choice among these options, and the level of any "revised" standard under option two, will depend largely on the information received in public comments during the rulemaking.

Several other options relating to the stringency of the standards also are available. The disproportionate difficulty which heavy-duty diesel engine manufacturers will experience in meeting the proposed HDE standard compared to HDG engine manufacturers suggests the possibility of two different standards for heavy-duty engines. A second option regarding the standards arises because there are currently two methods of diesel NO_x measurement—bag sampling and direct sampling—and it appears that it may be appropriate to apply to correction factor to the

*"Feasibility" here refers not only to technical aspects but also includes cost, lead time, and fuel economy effects.

standard if direct NO_x measurement is used (since the baseline was based on bagged NO_x sampling). A final option which will be considered involves the issue of whether we should pursue a standard representing equivalent stringency for LDVs and LDTs or whether we must propose a standard based on a mechanical calculation of a 75 percent reduction from the baseline, as will be discussed below in the "Emission Standards" section. All of these options will be considered further as we receive comments. A final alternative that is related to standard stringency, an averaging concept, is being pursued in a separate rulemaking as discussed in Section E below.

We are also considering alternatives to the proposed heavy-duty in-use durability program. Retaining the current dynamometer-based service accumulation procedure is possible but there is considerable agreement (even in the industry) that this method is not realistic. Another option, modifying the dynamometer procedure to be more representative of in-use operation, would cost significantly more than the in-use program we expected to propose. We thus at this time plan to abandon a dynamometer approach in the proposal. An issue paper which goes into some depth on this issue may be found in the public docket for this rulemaking under the title "Heavy-Duty Engine Durability Testing."

The final area in which we have considered alternative paths is allowable maintenance. An issue paper is available from the docket which addresses this issue ("1985 HDV/LDT NO_x NPRM Allowable Maintenance Provisions"). Its conclusion is that an improved version of the regulations proposed in earlier rulemakings (cited above) should be proposed. What we outline here and expect to propose is based heavily on the conclusions of the issue paper.

II. Summary of the ANPRM

While we will continue to consider the options outlined above as well as others that emerge as a result of the information and comments EPA receives as a result of this ANPRM, we nevertheless describe in this ANPRM a more specific program. This program represents our best (if on some points rough) estimate at the present time of what we will be proposing this summer. We believe it is in the interest of responsible rulemaking to lay out this information in as much detail as we have for comment.

This ANPRM announces consideration of a program for implementing (1) the remaining aspects of EPA's direct congressional mandate regarding gaseous emission control for vehicles whose GVWRs (gross vehicle weight ratings) exceed 6,000 lbs., (2) emission standards for light-duty trucks whose GVWRs are 6,000 lbs. or below (these we expect to be the same standards as those proposed for the over-6,000 lbs. GVWR light-duty trucks), (3) changes in the certification process which we proposed earlier in a similar form but did not promulgate, and (4) minor changes to the heavy-duty transient test procedure. This package of anticipated requirements is planned to be another stage in the comprehensive regulatory approach we began in the two recent rulemakings. Following the completion of the heavy-duty nonconformance penalty and diesel particulate rulemakings, most aspects of the LDT and HDE emission control programs will be in place. The following paragraphs detail each of the aspects of this ANPRM.

A. Emission Standards

The "heavy-duty" class created by Congress in the 1977 amendments to the CAA includes not only EPA's "heavy-duty engine" class but a portion of its light-duty truck class as well. Thus, the emission reductions mandated by Congress for vehicles (and engines in vehicles) which exceed 6,000 lbs. GVWR actually apply to two EPA classes—the heavy-duty engine class (engines used in vehicles with GVWRs exceeding 8,500 lbs.) as well as to the upper, "heavy" portion of our light-duty truck class (LDTs between 6,001 and 8,500 lbs. GVWR). for convenience, we will refer to LDTs between 0 and 6,000 lbs. GVWR as "light" LDTs, and LDTs between 6,001 and 8,500 lbs. GVWR as "heavy" LDTs. We anticipate that our rulemaking will propose emission standards for heavy-duty engines and for the entire light-duty truck class (both above and below 6,000 lbs. GVWR). The inclusion of the "light" LDTs is explained later in this section under *"'Light' Light-Duty Trucks"*.

1. *Heavy-Duty Engines and "Heavy" Light-Duty Trucks:*

As mentioned earlier, the Clean Air Act (Section 202(a)(3)(A)(ii) of the Act, 42 U.S.C. 7521(a)(3)(A)(ii)), contains a requirement for a 75% reduction in heavy-duty truck NO_x. This reduction is to be measured against a baseline sampling of pre-controlled, gasoline-fueled, heavy-duty engines. The reduction also applies to vehicles exceeding 6,000 lbs. GVWR. The NO_x regulations were to apply beginning in the 1985 model year. While we do indeed plan to propose the LDT NO_x standard for 1985, certain leadtime considerations which we discuss later have led us to anticipate proposing the HDE NO_x requirements for 1986.

In order to determine the "baseline" level of NO_x emissions—that is, the level which existed before there were Federal regulations for NO_x control—EPA completed two baseline testing programs, one for LDTs and one for HDEs. While the 1973 model year was the last year before Federal NO_x regulations were enacted, some manufacturers anticipated the change and voluntarily installed NO_x controls on their 1973 models. Therefore, our baseline samples consist of both 1972 and 1973 vehicles and engines, depending on which model year immediately preceded NO_x controls on a given engine. Samples of 25 LDTs and 26 HDEs made up the baseline programs.

The "statutory" heavy-duty standard is computed directly from the results of the baseline testing. The sales-weighted NO_x emission level from the HDE program multiplied by a factor of 0.25 yields a Congressionally mandated 75 percent reduction standard, with a value of 1.7 g/BHP-hr. As discussed later in this document, we do not believe this to be a feasible level for heavy-duty diesel engines. Because of this, EPA will probably revise the standard for heavy-duty engines. Based upon limited (and largely confidential) data currently available to us we believe that an appropriate level for a revised standard would be approximately 4.0 g/BHP-hr. Of course, the standard finally established will have to be based on a publically disclosable record, to be established during this rulemaking.

In the case of LDTs, the 75 percent reduction calculation from the LDT baseline yields a value of 0.9 g/mi. This value would represent a tighter standard than will exist for 1981 and later light-duty *vehicles* (LDVs). Since LDTs are generally larger, have larger engines, and carry heavier loads than LDs, their average emissions are slightly higher. Clearly, it will be more difficult for LDTs to meet a standard of 0.9 g/mi than for LDVs to meet 1.0 g/mi. However, we believe that Congress intended the 75 percent NO_x reduction to parallel the anticipated gains in passenger car NO_x control; i.e., to require approximately equivalent control efforts in the two areas.

In promulgating the *1979* LDT NO_x standard of 2.3 g/mi we applied a "worst-case" formula to the LDV NO_x standard of 2.0 g/mi. The formula was based on the ratio of the emissions of the heaviest LDTs to the heaviest LDVs when both used the same control technology. Applying the same ratio to the new LDV standard of 1.0 g/mi yields a value of 1.2 g/mi.* We believe this value to be of essentially equal stringency to the LDV standard.

2. *"Light" Light-Duty Trucks:*

We expect to apply the same, presumably revised, standard to all LDTs, above and below 6,000 lbs. GVWR. Although the "light" LDTs (those below 6,000 lbs. GVWR) are not covered by section 202(a)(3)(A)(ii) of the Act, authority for their regulation is found in the general authority of section 202(a)(1), 42 U.S.C. 7521(a)(1). The September 25, 1980 LDT rulemaking invoked this authority in establishing the same HC and CO standards for the "light" LDTs as for the "heavy" LDTs. Each of the prerequisites to the regulation of "light" LDTs under section 202(a)(1) is met. It is clear that NO_x emissions from "light" LDTs contribute to air pollution which endangers public health. (A thorough discussion of the health effects associated with NO_x emissions can be found in Chapter IV of the Draft Regulatory Analysis). The other factors which must be considered before regulating under section 202(a)(1)—leadtime, feasibility, and cost—are each discussed later in this document.

Finally, at least two additional considerations suggest that a single LDT standard should apply to trucks above and below 6,000 lbs. GVWR. First, applying a stiffer standard to the "light" LDTs than to the "heavy" LDTs (the lighter vehicles are cleaner in NO_x than the heavier ones and hence could meet a lower standard) could discourage the current trend toward downsizing LDTs to more fuel efficient models. Second, it is more consistent to apply a common standard across the entire LDT class and to follow the same regulatory approach for NO_x as was followed for HC and CO. By maintaining this kind of regulatory consistency, both the manufacturers and EPA should be able to manage their respective emission control programs much more efficiently than if two sets of standards existed or if compliance requirements varied among the pollutants.

B. Changes in the Certification Process

In addition to new NO_x standards, EPA anticipates for LDTs and HDEs two significant changes in the way vehicles and engines are certified for production. One is a program that requires that service accumulation be accomplished by in-vehicle, on-the-road operation. The other requires manufacturers to give some indication that the maintenance they recommend to their customers will actually be performed in the field. Both initiatives were proposed earlier during the recent LDT and HDE rulemakings. (Those Notices of Proposed Rulemaking are found in the **Federal Register** at 44 FR 9464 (heavy-duty) and 44 FR 40784 (light-duty trucks)). The two proposed actions were withdrawn from the rulemakings for further consideration, and we plan to repropose them in modified forms.

A third concept which affects certification is discussed later (Part F of Section III) but will not be contained in our anticipated proposal. That concept is a framework which would make it possible to introduce an increased measure of flexibility into the certification process by allowing some form of averaging of emissions. Development of averaging is now proceeding as a separate rulemaking, initiated by the publication of an ANPRM on November 28, 1980 (45 FR 79382).

1. Revised Durability Testing Procedures

The procedures used to determine deterioration factors (DFs) for HDE and LDT engine family certification have recently been changed (as a part of the recent HDE and LDT rulemakings cited earlier). The new provisions, identical for both HDEs and LDTs, resulted from a decision *not* to promulgate a proposed program of in-service mileage accumulation. What was left in each case was the portion of the proposal that described the procedure for determining preliminary, temporary deterioration factors. Whereas in the original proposals these manufacturer-determined deterioration factors would have been eventually superseded by factors calculated from the in-service durability fleet, the removal of the in-service requirements left the "preliminary" deterioration factors as the sole and final factors. The effect of our planned proposal would be to restore to these manufacturer-determined deterioration factors the status of "preliminary" factors and to repropose the associated in-service requirements in a slightly different form. Because they affect testing to determine emission compliance, these changes fall under the authority of section 206 of the Act.

It will be helpful to define the three types of deterioration factors which enter into the program. We have already mentioned "preliminary" DFs. They, in turn, are superseded by "in-use" DFs which, as this section will describe, are derived from in-service operation. However, in-use DFs are to be used while the in-service vehicles are still accumulating mileage as well as after they are finished. Thus, a further refinement into "interim in-use" DFs and "final in-use" Dfs is useful.

The durability regulations which we expect to propose would be rather detailed, but their general thrust would be very straightforward. As the paragraphs above imply, there would be a dual system for determining deterioration factors. Manufacturers would have the complete responsibility for establishing the preliminary DFs, subject only to three constraints. Manufacturers would be required to (1) design any testing so that it simulates, in their judgment, real-world emission deterioration, (2) conduct that testing according to good engineering practice, and (3) comply with the provisions relating to maintenance. Otherwise, the manufacturer would be free to design and conduct any testing and to derive deterioration factors in any manner it chooses. EPA would not approve or disapprove either the testing or the DFs. Once submitted the preliminary DF would be used to project the low-mileage emissions of the emission-data vehicle out to the end of its engine-family's useful life.

Under the expected program, a set of preliminary DFs (one DF for each pollutant) would be submitted and used for each engine family-control system combination (hereafter called a family-system combination), with the exception of those using the small-family waiver discussed later in this document. This would occur for *all* (unwaivered) family-system combinations in the initial model year of the in-use program (1985 for LDTs, 1986 for HDEs). After that, preliminary DFs would be needed each time a manufacturer introduced a new family-system combination or redesigned an existing combination to such an extent that a new combination was created. Preliminary DFs would be used in certification until the manufacturer's in-use durability vehicles had logged enough mileage to become the basis for the second type of deterioration factor, the in-use DF. In-use DFs, either interim or final, would supersede the preliminary DFs under the proposed system and would be used in all subsequent extrapolations of low mileage data.

The in-use mileage accumulation program which would eventually yield interim and/or final in-use DFs would begin early, shortly after preliminary

*The difference in the units of the anticipated HDE and LDT standards reflects the different testing methodologies applied in the two classes. As with passenger cars, LDT emissions are expressed on a per-mile basis; HDE emissions are expressed on a per-unit-of-work basis in order to avoid penalizing an engine which performs more useful work while travelling the same distance.

DFs were first used in certification. First, the manufacturer would choose at least three *production* vehicles (LDT) or engines (HDE) to become durability-data vehicles/engines. The manufacturer's responsibility would then be to make arrangements for placing the vehicles into service (engines would of course have been installed in vehicles), selecting applications which well represented ordinary operation. While we expect to propose the option of operation on a test track or road route, manufacturers would also be able to integrate the durability-date vehicles into their normal corporate operations. For example, LDT durability-data vehicles could become a part of a company motor pool, or heavy-duty durability-data vehicles might serve a second purpose as a part of a corporate truck fleet.

A fundamental reason for the use of preliminary DFs is that it is not practical to collect in-use data prior to the initial year's certification of a new engine family. Such a requirement would impose several years of additional leadtime for the introduction of a new engine family and would not allow the use of actual production engines. Rather than impose such a burden on manufacturers, we would allow the use of preliminary DFs, which would later be confirmed by in-use data. Even if an engine family is taken out of production it would still be necessary to substantiate the preliminary DF which was applied to those engines already sold. The automatic regulatory provisions for what to do if the in-use DF is too large (i.e., change future engines, as discussed below) would no longer apply since they would not be retroactive to engines that have already been produced. However, it would still be the manufacturer's responsibility to verify that it is indeed supplying valid preliminary DFs to EPA. In addition, there are recall provisions in the Clean Air Act which apply to heavy-duty vehicles. Although in-use fleet data would not alone be sufficient to require a recall, it could alert EPA to a potential in-use problem needing investigation. Therefore, even if an engine family goes out of production, it would still be necessary for the manufacturer to continue operating the in-use fleet.

As the durability vehicles accumulated mileage, the manufacturer would periodically test them for emissions. By compiling the results of these tests, manufacturers would assemble a periodically updated base of information about each family/system's on-the-road emission deterioration characteristics. The interim DFs would be calculated from this data and hence would themselves be updated. (The actual calculation of DFs is discussed later). This process of testing, compiling results, and updating the interim DFs would continue until the durability vehicles had reached the end of their useful life (as defined in § 86.084–2, 45 FR 63734). At that time the *final* DF for the family/system would be computed.

At some point the preliminary DFs would be superseded by the in-use DF. Which model year it occurred in would depend to a certain extent on the preference of the manufacturer. This is because for the second model year, the manufacturer would have the option of either carrying over its previous certification based on the preliminary DFs or using an interim in-use DF, provided that the minimum annual mileage had been accumulated (10 percent of the family's useful life). (If the carryover option is chosen, it would still be necessary to submit any accumulated in-use data to EPA at the time of the application.) For the third model year after the preliminary DFs were first used, the regulations would *require* the use of the interim or final in-use DFs.

When the preliminary DFs are superseded, the most current in-use DFs would then be used. Each subsequent year's updated in-use DFs would supersede the previous DF until each durability vehicle has reached its useful life. After that, the final in-use DF would remain in effect for as long as the family/system combination exists.

The manufacturer would be confronted by one of two situations when it substitutes a new in-use DF for a preliminary DF or for an interim in-use DF. On the one hand, it might find that the new DF is smaller than the previous DF, meaning that the earlier DF overestimated the rate at which the emissions were deteriorating. Obviously, this would be a favorable situation from the manufacturer's standpoint. It would mean that when the low-mileage emission values from the emission-data vehicle or engine were projected out to account for deterioration, the result would fall somewhat below the standard. The manufacturer would have exceeded its requirements and would be in compliance with the regulations.

If, on the other hand, the manufacturer found that a subsequent year's in-use DF is greater than the preliminary DF of the previous in-use DF—and the performance of the emission system on the low-mileage emission-data vehicle does not provide enough of a margin of safety to accommodate the larger factors—then the manufacturer would have to act to correct the situation. This most current in-use emission data for that family-system combination would have indicated that the earlier DF underestimated emission deterioration. A small recalibration of the engine or emission system might be enough to compensate and allow a continuation of the certification process. Alternatively, the manufacturer might find it necessary to redesign the family-system combination for lower low-mileage emissions or for reduced deterioration characteristics.

It would be our intent in a proposal to restart the multi-year certification cycle—that is, emission-data collection and preliminary DFs followed by annually-updated in-use DFs—whenever the manufacturer makes a design change which can be expected to affect emission deterioration. To make this criterion more specific, we anticipate that in most cases a design change which affects emission-system durability would include changes in features (called determinants) which distinguish one family-system combination from another. Conversely, we expect that changes in these determinants would usually occur with changes that affect emission deterioration. Therefore, we would key the beginning of the certification cycle to the first year in which a manufacturer applied for a certificate of conformity for a given family-system combination.

A pitfall of such a system would be that a manufacturer might choose to change the engine periodically to avoid ever using an in-use DF. Nothing in the regulations as they are now would prevent this from happening, but two provisions would discourage such a practice. On one hand, it would take a fairly large—and expensive—change to create a new engine family under the current regulations. Thus, such a change would not be a trivial effort. Also, as noted earlier, even if a family went out of production it would be necessary to keep running the durability fleet out to its useful life. The combination of these provisions should prevent large-scale circumventing of the in-use program through engine family changes.

A related problem might arise if a manufacturer wanted to make a change which, although it didn't alter any existing engine family determinants, did have the potential for influencing (and presumably improving) deterioration characteristics. Because the existing determinants would not have changed, the certification cycle would not automatically start again. The Administrator, however, already has the discretion to introduce engine family determinants not currently specified in the regulations (and an engine family determinant is by definition an engine family-control system determinant). He would be able to take advantage of that discretion if the particular circumstances of a situation indicate that re-starting the certification cycle would be advisable.

As a final note on this subject, it is important to stress that restarting the certification cycle for a new family-system combination would also mean retesting an *emission-data* vehicle or engine which incorporates the new changes.

Because responses to the earlier proposed versions of the in-use durability program revealed some confusion, it is worth stressing the following point. Any increase in the DF resulting from the in-use emissions data would not be retroactive. In other words, the earlier model year(s) of production, certified according to the previous DF, would not be affected. (The recall provisions of the CAA would remain in force however.) What *would* be affected is the next model year's production, which could not proceed until some adjustment or change in the engine or emission system was made and, if it affected engine family determinants, the certification was begun again (emission-data tests, preliminary DF, and subsequent in-use service accumulation). It is likely that the manufacturer would foresee from the accumulating data that by the beginning of the next model year a change would be needed. Thus, enough time to incorporate the change should exist before the next year's production begins.

Any proposal would also likely include a measure of protection for a manufacturer that believed it had made a favorable durability-related change but had failed to persuade the Administrator to restart the certification cycle. That protection would be the ability to start another in-use durability fleet. A manufacturer could at any time place additional fleets into operation. After the new fleet(s) had run to the end of their useful life, the manufacturer would use their emission results for the DF calculation instead of those of the original fleet. In this way, a manufacturer that made an improvement in durability could in all cases begin realizing the benefits of the change within a few model years (that is, when the new fleet had finished), regardless of whether EPA accepted the change as a new family-system combination.

Also a part of the proposal which we expect to issue is an important change in the way deterioration factors are calculated from durability data, a change that corrects a potential deficiency in the method currently used (that is, prior to 1984). Simply put, the present method determines the DF by calculating a linear regression of the mileage/emission level points derived from the durability-data vehicle (or engine). The problem is that if an important component fails on the durability-data vehicle/engine either early in the service accumulation or late in the process, the emissions may suddenly jump upward significantly compared to the gradual deterioration during the remainder of the process. The linear regression, however, would tend to "wash out" the evidence of the failure, giving an incomplete view of the true deterioration.

The current regulations partially guard against this pitfall by prohibiting "line-crossing," meaning the durability-data engine or vehicle may not exceed the standard at any time up to the useful life. Thus a failure in an important component would probably cause "line-crossing." If the manufacturer can show that the failure is unrepresentative, EPA may allow the running of new vehicles, which will in turn either confirm the "statistical freak" or exhibit line-crossing themselves. In the latter case, EPA would be in a position to deny certification.

Under the anticipated proposal line-crossing *would be allowed* during in-use service accumulation. This provision would appear primarily for two reasons. First, the in-use durability program would take years, not months. It would not be practical to start a new vehicle if one vehicle line-crossed. Thus, allowing an individual *durability* vehicle to exceed the standard would be a necessary by-product of the in-use program. Second, allowing line-crossing would be appropriate because there would be much more certainty in the proposed program than in the current program that an individual data point which line-crossed really represented what would happen in the field. The greater certainty would arise because at least three vehicles—*production* vehicles—would be running. A component failure in one or more of them would be likely to also occur in the field and it is important for EPA to know this. In any event, we do not expect that line-crossing would be a frequent phenomenon.

If, however, a data point were far removed from the trend that was set by the rest of the data, we believe it should be reflected in the DF, whether or not line-crossing occurred. The proposed regulations would provide that if an individual vehicle's data point fell beyond a certain distance from the least-squares best-fit line of all the points, then that point would become a candidate for the DF calculation. That is, instead of extending the *best-fit* line out to the appropriate point and dividing the predicted high mileage emissions level by the low-mileage emission level, the *outlying point* itself would be used in the DF calculation. The DF would simply be the ratio of the emission level of the "outlier" to the low-mileage emission level. If this DF were larger than that resulting from the least-squares fit then it would be used as that vehicle's DF in future calculations.

We expect to propose that the measure of whether an average data point is an "outlier" be twice the standard error of the distribution of all points around the best fit line. We believe any point which lies more than that distance from the line would be a real indication of the kind of problem which the DF should reflect.

Two final aspects of the anticipated proposal deserve comment, both of which were not a part of the original proposed programs. The first provision would relate to the DF calculation process, and it would act to reduce the manufacturer's risk when DFs were determined from less-than-full-useful-life data (that is, interim DFs). Because extrapolating early data to a "distant" full-life point might be unrealistic, we would propose that extrapolations be made to a point separated from the test point by no more than 50 percent of the useful life of the family-system combination. Thus, if it happened that the early test points were unrepresentative of the full-life trend, the effect of extending their regression out from these points would be blunted.

The remaining provision we are considering would significantly reduce the effort required by the manufacturers, while retaining the bulk of the benefits of the in-use program. This proposal would be to waive in-use testing requirements for each engine family for which the expected production is less than 5,000 vehicles or engines, up to a total of 5,000 per manufacturer. Use of the waiver by manufacturers for each eligible heavy-duty family would reduce the number of in-use fleets by 52 percent while still allowing for in-use data on 90 percent of the sales. (The impact on the light-duty truck industry would be minimal because of the scarcity of small-volume LDT families). In place of the preliminary and in-use DFs would be an EPA-assigned DF, based on historical data.

Finally, we wish to make clear to the reader that the foregoing discussion covers only the most substantial aspects of the program we expect to propose. The complete requirements are found in §§ 86.085–21 through 26, 28, and 30 of the draft regulations available in the public docket.

2. Proof of In-Use Maintenance

The recently-published LDT and HDE rulemakings restricted allowable maintenance which is done on certification engines and vehicles. By limiting emission-related maintenance to no more often than certain specified intervals, we hoped to encourage the design of more durable emission-oriented components. While the success of this program will reduce the amount of maintenance which needs to be done to keep the emission systems operating, the program lacks any way of assuring that necessary maintenance will actually be performed.

An emission system that tends to be neglected by the owner—because it too often requires maintenance or because the neglect has no effect on the operation of the vehicle, for example—may not serve the purpose for which it was installed. We believe that if a "critical" emission-related component* requires attention or replacement during the useful life of the vehicle or engine, the manufacturer should accept the burden of showing that the work is likely to be performed by the owners. Otherwise, the installation of the control system could be a mere formality that is exercised to receive a certificate but then fails to accomplish its intended emission reduction in the actual on-the-road vehicles. The additional maintenance regulations which we are considering proposing, like the maintenance restrictions already in place, would help to re-focus the attention of manufacturers from simply passing a laboratory certification test toward designing and mass producing vehicles and engines which remain clean in actual use.

Specifically, we anticipate provisions which would require for each "critical" emission-related component that the manufacturer establish a "reasonable likelihood" that proper maintenance will be performed in actual use. The manufacturer could establish "reasonable likelihood" by compliance with one of four criteria, designed to cover several kinds of situations. We expect that manufacturers would most often install an audible and/or visual signal to indicate that maintenance is due, followed up by a survey to gauge the success of the signal in encouraging proper maintenance. It would also be an acceptable indication of "likelihood" if a manufacturer chose to bear the cost of the maintenance or replacement. For components which had already been in service long enough to have accumulated in-use experience, a survey showing that proper maintenance was currently performed would fulfill the "reasonable likelihood" requirement. And finally, if failing to perform a maintenance item seriously harmed the performance of the vehicle, EPA would consider that to be enough assurance that the maintenance would be done by the owners. We expect to propose the regulations in such a way that EPA could approve a different method of meeting this requirement if it confirmed the likelihood of proper in-use maintenance.

In addition, minimum maintenance intervals are expected to be proposed for certain new emission-related components. Maintenance on electronic engine controls and related sensors and actuators during mileage accumulation would be proposed to be limited to every 100,000 miles. The authority for establishing minimum maintenance intervals is found in sections 206(d) and 207(c)(3)(A) of the Act.

C. Changes in the Heavy-Duty Test Procedure

As we have accumulated experience on the new transient heavy-duty test procedure promulgated in the January 21, 1980 rulemaking (referenced earlier), we have been able to make minor improvements in several aspects of the test. We intend to incorporate them into a proposed revised Subpart N and will include adjustments to the forced-cool-down procedure and the mapping methodology as well as various equipment specifications.

III. Major Issues and Impacts

This section presents an overview of the analyses and discussions found in our preliminary Draft Regulatory Analysis document (referenced at the end of this Notice). Because the analyses were done at a time when it still appeared that this notice might be issued much earlier, 1985 is used as the first year of implementation of the regulations for both LDTs and HDEs. The one year postponement in the effectives model year which we expect to propose for HDEs would have little effect on the conculsions of the analyses,* and we have left them as they originally were—with 1985 as the initial model year.**

We discuss 1.2 and 4.0 because we think they are the most likely alternative levels. Others may be more appropriate, however, depending on comments received as a result of this ANPRM.

A. Technological Feasibility and Leadtime

An analysis of the feasibility of the NO_x standards need to be broken down according to class (HDE and LDT) and by engine technology (gasoline and diesel). As the following discussion will detail, the degree of difficulty which would be likely to be encountered by manufacturers in complying with the standards by the proposed model years varies considerably.

At one extreme fall gasoline-powered light-duty trucks, which appear to be within reach of a 1.2 g/mi standard. Three-way catalyst/feedback carburetor systems are available today which allow light-duty *vehicles* to comply with the 1981 standard of 1.0 g/mile. And one 1980 LDT is already certified at 0.7 g/mi using a 3-way/feedback system, even though EGR was not used. Because of the similarity in emission control technology between LDVs and LDTs, LDTs would probably be able to meet a 1.2 g/mi standard by 1985.

The most uncertain aspect of gasoline LDT feasibility seems to be maintaining the conversion efficiency of three-way systems at high mileage. We believe that such common approaches as increased catalyst loading and sizing would be effective in addressing this problem.

Diesel LDTs would not have the benefit of three-way systems, but other control options are available. EGR, or increased EGR where it is already in place, would be the most abvious approach. Also, combustion chamber and/or injector re-design, retarded injector timing and advanced (higher pressure) fuel injection are paths which would be open to some manufacturers. Finally, the popularization of electronic controls in gasoline engines suggests that this technology may soon be applied to diesels for such purposes as modulating the EGR or varying the injector timing. It is also significant that the manufacturers have up until now had to expend very little effort to meet the existing 2.3 g/mi NO_x standard with diesel LDTs. Accordingly, past efforts are probably not indicative of the

*Defined as a component installed for the sole purpose of complying with emission standards.

*The industry would have an extra year to rebound, probably making capital formation easier. The additional year would also provide more time for the optimization of electronic controls. In general, though, costs, leadtime, feasibility, and air quality benefits would remain aprpoximately as we analyzed them.

**To avoid unnecessary confusion in this Preamble, however, we have substituted "1986" for "1985" where it is appropriate. For the same reason, the dates in the title of the preliminary Draft Regulatory Analysis have also been changed.

amount of control that could be achieved.

On the one hand, some manufacturers are already beginning to work which would make the task of reaching the anticipated NO_x standard (in the presence of a tight particulate standard) easier with respect to diesel LDTs. Both General Motors and Volkswagen were recently granted waivers of the 1981 light-duty *vehicle* standard for their diesel powered passenger cars. The two-year waivers of the 1.0 g/mi standard were granted specifcally to allow the companies to do development work toward reaching that standard without excessive harm to fuel economy, particulate control, and durability. Work is also progressing toward meeting the 1985 LDV particulate standard under the current NO_x standard. Since LDT diesel engines are currently very similar to LDV diesel engines, these two manufacturers (who are the only diesel LDT makers at this time) are in effect beginning development work now toward the equivalent stringency LDT NO_x standard we anticipate proposing in this rulemaking, as well as the 1985 LDT particulate standard. It is reasonable to conclude at this point that a standard in the 0.9–1.2 g/mi range would be a realistic goal for 1985 light-duty diesel trucks.

Turning now to heavy-duty engines, we find a sharp contrast in the ability of gasoline and diesel engines to reach the statutory 1.7 g/BHP-hr standard by 1986. In the case of HDGs, we can point to a clear technological path to compliance. On the other hand, it appears that no HDDs would be able to reach the 1.7 g/BHP-hr level. Thus, revising the standard upward to near 4.0 g/BHP-hr for the whole heavy-duty class will probably be necessary. (Reasons for including gasoline engines in the revised standard are discussed presently). We would expect to propose such a revised standard based on information currently in our hands and the information we receive or develop as a result of this Advanced Notice.

For heavy-duty gasoline engines, it appears technologically feasible to reduce emissions to a level of 1.7 g/BHP-hr by 1986. As in the case of gasoline LDTs, three-way/feedback systems could be used, perhaps in conjunction with oxidation catalysts (to clean up residual HC and CO). In an ongoing test program at the EPA Motor Vehicle Emission Laboratory, we have already been able to closely approach the required target emission level with a 1978 IHC 404 engine retrofitted with a three-way plus-oxidation-catalyst system (see our Draft Regulatory Analysis for details). Without ignoring the durability issue, the ease with which EPA has been able to assemble a well performing NO_x control system for a rather large engine speaks to the strong potential for 1986 HDG compliance with the proposed standards. Further, since three-way systems are not conceptually new and have already seen extensive development and use in passenger cars, compliance by 1985 may even be possible.

Given the preceding discussion, one could conclude that a revision of the HDE standard to a level near to 4.0 g/BHP-hr would place manufacturers of gasoline engines in an easy compliance posture. Indeed, manufacturers might be able to comply without adopting three-way systems. There would be the potential for a fuel economy penalty if less expensive means like EGR were used, but even in that case we believe a penalty could be avoided.

In the case of heavy-duty diesel engines (HDDs) we find no current engines which even approach the statutory 1.7 g/BHP-hr level. Indeed, up until now there has been little pressure to develop low-NO_x technology for HDDs. But while we believe that substantial NO_x reductions can be obtained, it appears that such a standard would be out of reach.

We believe that a combination of conventional approaches and more advanced techniques could offer significant HDD NO_x reduction. The more familiar approaches of EGR and retarded injector timing are inexpensive but can result in lost fuel economy and increased particulate emissions. More promising are such things as electronic engine controls, electronic fuel injection, advanced inter-/aftercooling, high-pressure injection, and design modifications to engines, combustion chambers, and injectors. Electronic controls are perhaps the most promising technology because of their potential to modulate injector timing, EGR, degree of aftercooling, and other parameters throughout the range of engine operating conditions.

There is another NO_x control approach which is less promising but nevertheless deserves mentioning. We know of one manufacturer which has developed a working ammonia-injection catalyst. The ammonia catalyst has been demonstrated to EPA, and preliminary data indicates that it could be capable of attaining the 1.7 g/BHP-hr standard. Use of this tecnology can result in lower NO_x levels for diesels. On the other hand, there are clear enforceability problems because the ammonia supply would need to be frequently replenished. Also, establishing a distribution system to make ammonia readily available would be very difficult. Lastly, the cost of adopting this technology could be quite high. Therefore, we do not believe such a system will be practicable for the 1986 model year. We request that comments on this system (particularly hardware and operating costs) and other advanced technologies be included in response to the requests for comments found later in this Preamble.

The Agency also has been exploring a fundamental technological alternative to conventional approaches to oxides of nitrogen and particulate control. This alternative is the use of methanol as a fuel. Methanol may be attractive from several perspectives: (1) it is readily available from plentiful domestic sources such as coal and biomass, (2) it can probably be produced by more thermally efficient and environmentally acceptable processes than many processes which yield syncrude, (3) it can be prodcued with readily available, commerically proven technology which requires less capital investment than syncrude production processes, and (4) methanol appears to have the potential for very low particulate, oxides of nitrogen, hydrocarbon and biologically active organic emissions. EPA is currently evaluating a Volvo heavy-duty engine equipped with diesel fuel pilot injection and methanol combustion (i.e., a dual injection system). We are testing this engine for emissions (including unregulated pollutants) as part of the heavy-duty test program at Southwest Research Institute. The results of these studies will certainly influence the degree to which the government actively pursues this alternative. In any case, we do not today view widespread conversion to methanol as a possibility for the 1986 model year.

Revision of the Heavy-Duty Standard

Based on the analysis highlighted above, we expect to propose a revised standard for all HDEs for 1986, based on the limitations of diesel NO_x control. Such a revision to the Congressionally mandated 75 percent reduction standards would be proposed pursuant to Section 202(a)(3)(B) and would depend on EPA's being able to make the findings specified in subsections (3)(B) and (3)(C) of that section. The limited data we have seen so far, combined with our projections of technological progress lead us to a preliminary conclusion that a NO_x standard in the area of 4.0 g/BHP-hr would be attainable by diesels without increasing other pollutants or affecting fuel consumption to an unreasonable degree. We expect that manufacturers would use combinations of the following approaches: Electronic controls and/or electronic fuel injection, inter-/aftercoolers (perhaps modulated), higher pressure fuel injection engine or injector modifications, and perhaps limited EGR and retarded injector timing. Later in this Preamble we request specific comments and data on both the 1.7 and 4.0 g/BHP-hr levels (as well as higher or lower levels), and we will rely heavily on this data in making any findings under subsection (3)(c). In determining an appropriate level for a revised standard we have had to rely on information which manfacturers to date have considered confidential. It is our intention to make decisions for the NPRM and eventual final rulemaking based upon information available in the public record of the rulemaking and available to all interested parties. It is crucial that the information submitted by the manufacturers during this rulemaking present an accurate portrayal of all NO_x control strategies, their potential, their trade-offs, and their leadtime characteristics. We are confident that significant reductions in NO_x are achievable.

The attainment of any substantial NO_x reduction for heavy-duty diesels without significant fuel economy degradation would require time-consuming development and testing work. At this time we do not believe such a effort could be completed in time for the 1985 model year. Therefore, we expect to propose that 1986 be the effective model year for heavy-duty engines, rather than the 1985 model year specified in the Act. On the other hand, we believe that the reductions required for LDTs can be attained by 1985. Therefore, we expect to propose the LDT standard for the 1985 model year. Consistent with the position we took in the recent HDE and LDT rulemakings, we believe that if enough leadtime is available, the statutory model year of compliance should be retained.

We expect to propose a single revised heavy-duty standard covering gasoline engines as well as diesels. The Clean Air Act clearly places both types of engines in a single heavy-duty engine class, and EPA has always applied the same standard to both types of engines. We believe that it would be inequitable to establish different requirements for competing engines within the same class. By applying the same standards to both gasoline and diesel engines, we hope to avoid the appearance of treating one power plant more favorably than another one with which it must compete in the heavy-duty market. If diesel manufacturers would have relatively more difficulty than gasoline engine manufacturers in meeting a given heavy-duty standard, this is because of the inherently higher NO_x emissions of diesels—not because of inequitable treatment by EPA. In addition, the fraction of gasoline heavy-duty engines sold relative to diesels has been rapidly diminishing (Tables II–Y and II–Z, Draft Regulatory Analysis, Chapter II), and we project this trend to continue, reducing each year the contribution of emissions from gasoline engines.

Finally, if gasoline engines were required to incorporate the additional hardware and engine modifications necessary to reduce their NO_x emissions from 4.0 to 1.7 g/BHP-hr, then the stringent standard would accelerate the decline of the gasoline engine—simply because it could be made to comply with the standard. Since the engines displacing the gasoline engines would be diesels emitting at the 4.0 g/BHP-hr level, it seems both inequitable and illogical to force the cleaner engine out of production and have it replaced by the higher emitting engine. (Diesels also emit much higher levels of fine particulate than gasoline engines.) In addition, the basic structure of the Clean Air Act contemplates application of the same standard to any engine or vehicle within a a given class without regard to its design.

EPA is required to review any "revised" standard every three years and tighten it until the statutory standard is reached. During the three years following the promulgation of a revised standard we would be looking at new ways of improving NO_x control (without increasing other pollutants or harming fuel economy), of which the most promising seems to be new fuels such as methanol. We fully expect to be able to adopt a significantly lower NO_x standard for HDEs by the end of that time, perhaps even the 1.7 g/BHP-hr statutory standard itself.

Particulate/NO_x Interaction

A matter relating to HDDs is the question of particulate emissions. In parallel with this NO_x rulemaking, EPA recently proposed a particulate standard for heavy-duty diesel engines. Since some NO_x control techniques can adversely affect particulate emissions, the relationship between these two pollutants will need to be considered in establishing final NO_x levels.

We determined in the particulate NPRM (referenced earlier) that a feasible level of engine-out particulate emissions (that is, prior to any exhaust aftertreatment device) is 0.41 g/BHP-hr, and we have used this level in developing our proposed particulate standard. In the analysis for that proposal, we established as a constraint that we would not consider engine modifications which reduce particulates but at the same time increase NO_x. Thus, 0.41 g/BHP-hr represents what we believe to be the best feasible particulate level if NO_x emissions are not to be compromised. Conversely, in determining a proposed NO_x standard we will use a level which can be attained without having to increase engine-out particulate levels above 0.41 g/BHP-hr. This constraint should not be interpreted to mean that we are excluding consideration of NO_x control techniques which, if applied alone, would increase particulates above 0.41 g/BHP-hr. That would be unnecessarily limiting. We will rather be evaluating an overall combination of techniques, including particulate-reducing engine modifications not otherwise required to meet the particulate proposal.

Particulate/NO_x tradeoffs are also an issue for diesel LDTs, and we will, of course, consider the final stage of the LDT particulate regulations as we determine a proposed LDT NO_x standard.

Fuel Economy

Finally, establishment of stringent NO_x reductions would have the potential to affect the fuel economy of LDTs and HDEs. Gasoline-powered light-duty trucks might experience an actual improvement in fuel economy from moving to three-way/feedback systems. This improvement could occur as well in gasoline HDEs if they, too, were to adopt feedback systems. If EGR and/or retarded spark time were used instead, then fuel consumption might increase. In the case of diesels, we believe that substantial fuel economy penalties could be avoided by sing a proper mix of controls. (Fuel economy will certainly be considered in establishing proposed levels.) Again, however, reliance on substantial EGR or retarded timing might harm fuel economy. We have little data to indicate how much fuel economy improvement or penalty might occur and are requesting comment on this issue. We have not attempted to quantify or attribute a cost to changes in fuel economy. We have, however, calculated the sensitivity of lifelong operating costs to fuel economy penalties (Chapter V, Draft Regulatory Analysis).

B. Environmental Impact

Atmospheric nitrogen and oxygen combine in the high-temperature environment of the combustion chamber to form NO and a comparatively small amount of NO_2. In the atmosphere, the

NO is converted into NO_2 by direct reaction with oxygen and through photochemical processes. It is NO_2 that is responsible for most of the adverse effects of NO_x emissions. NO_2 in the atmosphere also acts as a precursor to ozone formation.

Elevated levels of NO_2 in the air have been correlated with both long-term and short-term harm to the respiratory system. In addition to these health effects, NO_2 damages some materials and impairs visibility with a brownish haze. Further, NO_x emissions have been implicated in contributing to the formation of "acid rain," which is capable of eliminating life from lakes and streams, leaching nutrients from the soil, and causing damage to crops and such materials as steel, paint, and concrete.

As noted previously, our initial preparation of this action was based on the planned proposal of the statutory standards (0.9 g/mi for LDTs, 1.7 g/BHP-hr for HDEs). We have done a preliminary environmental impact analysis based on the assumption of compliance with these standards. We have not yet analyzed the environmental impact of either a 1.2 g/mi LDT standard or a 4.0 g/BHP-hr HDE standard. Such an analysis will be done in our proposal for whatever levels we actually propose.

In reviewing the results of our preliminary analysis, it is important to emphasize the assumption of compliance with the statutory 75 percent reduction levels. This is especially true in the case of heavy-duty diesels, for which the feasibility of the 1.7 g/BHP-hr level has not been established. As the environmental analysis shows, compliance with this standard would result in considerably greater emission improvements for diesel HDEs than for the other truck classes. Clearly, if less stringent standards are promulgated, there will be some reduction in emission benefits, and we will carefully analyze these in the proposal.

A look at the per-vehicle NOx emission reductions which would be achieved highlights immediately the contribution of heavy-duty diesels were they to meet a 1.7 g/BHP-hr standard. Low-altitude non-California vehicles would experience lifetime NOx reductions of 0.19 ton, 0.92 ton, and 7.82 tons for LDTs, HDGs, and HDDs, respectively, as compared to 1984 LDTs and 1985 HDEs. On a percentage basis, the reductions are 59 percent for LDTs, 77 percent for HDGs, and 79 percent for HDDs.

Currently, the ambient NOx problem is somewhat localized; only a few air quality regions exceeded the ambient NO_2 standard in 1976. It is crucial to realize, however, that the growth of NOx emission sources, especially in the absence of these regulations, would cause a substantial increase in NOx emissions over the next decades. The regulations noticed here would help minimize that growth.

The impact of such regulations on urban air quality—and hence on health—is best analyzed by looking at the specific regions that already have high ambient NO_2 levels. Using 1976 as a base year, our analysis of these regions indicates that (if the unrevised standards were adopted) there would be an improvement of approximately 30 percent compared to what would occur without the new standards. In the absence of any new NOx regulations for HDE and LDTs, there would be a large net loss in air quality in those regions.

On the other hand, *nationwide* emission reductions are important from the standpoint of welfare effects, such as damage to materials, reduced visibility, and acid rain. The per-vehicle reductions estimated above translate into a 12 percent reduction in the nationwide NOx emissions which would otherwise occur by 1999.

C. Economic Impact

Although a great amount of information about the costs of compliance is not available at this early stage of the rulemaking process, we have been able to construct a reasonable projection of the economic impact. The analysis is very detailed and attempts to look at all possible economic costs which are likely to fall on the manufactures of LDTs and HDEs, on consumers, and on the nation as a whole.The basis for much of this analysis is our projection of the probable emission control strategies which would be pursued in response to the 75 percent reduction emission levels (0.9 g/BHP-hr for LDTs, 17. g/BHP for HDEs). (Chapter III, Regulatory Analysis). In the probable event that less stringent standards are proposed, costs will accordingly be less in most cases. (HDDs are in exception, since their costs here are actually based on the same technology we believe would be used to reach 4.0 g/BHP-hr.)

1. Light-duty Trucks

The costs attributable to the regulations as we expect to propose them go toward 1) research and development, 2) emission control hardware, 3) certification, 4) the in-use durability program, and 5) the new allowable maintenance requirements. We have made estimates for each of these costs and have summed them to arrive at the total manufacturers' cost. Translating this into a sales-weighted average cost results in a per-vehicle first-price increase of $153, the lion's share of which ($146) would go for emission control hardware. If diesel LDTs are broken out, we estimate a $47 rise in their prices. Because the fuel consumption of gasoline LDTs would be unlikely to increase if these regulations are proposed, their owners would not experience an increase in operating costs. But fuel costs might go up for owners of diesel LDTs since some NOx control measures can hurt fuel economy.

We have calculated aggregate cost to the nation from the array of detailed cost estimates. The total cost over five years of production is found to be equivalent to a $2.4 billion investment at the beginning of 1985, expressed in 1980 dollars using a discount rate of 10 percent. Since we are not able to quantify the extent to which fuel economy would be affected, this cost does not include any increased fuel costs.

2. Heavy-Duty Engines

Gasoline and diesel HDEs were treated separately in the analysis but in general would both require the same types of costs: development, production, and installation of new systems, certification, in-use testing, and costs associated with the new allowable maintenance requirements (the latter would apply to diesels only if electronic controls were adopted).

The first price of the average gasoline HDE would increase by about $284, or (at most) 2.8 percent of the price of a new heavy-duty vehicle if the statutory standard were adopted. HDDs would increase by $741, or (at most) 7.4 percent of the vehicle price. While we do not think a fuel economy penalty need occur among the gasoline engines, there might be some increase in fuel costs for operators of heavy-duty diesels if EGR or retarded timing were used. Our lack of certainty about the types of emission controls which HDD manufacturers would pursue and how successful they could be in achieving low NOx emissions makes it unwise for us to attempt to quantify a loss in fuel economy.

Finally, we have computed an estimated aggregate cost to the nation of the heavy-duty portion of these regulations if the 1.7 g/BHP-hr standard were promulgated. Expressing this cost as a lump sum spent at the beginning of 1986, in 1980 dollars, the aggregate cost would be $1.8 billion. This number is calculated assuming that gasoline HDEs would meet the statutory 1.7 g/BHP-hr NOx level. In the anticipated range of the revised HDE standard, this aggregate cost would be less because some manufacturers would be able to comply without EECs or three-way catalysts.

D. Cost Effectiveness

Cost effectiveness analysis is a way of gauging the "economic efficiency" of a regulatory program. In the case of air pollution regulations, cost effectiveness is generally expressed in dollars per ton of pollutant reduced.

We have calculated cost effectiveness in two distinct ways—on an incremental basis and an integrated basis. The incremental analysis shows the effect of removing each of the individual components of the proposal from the "package" of regulations. The second approach looks at the cost effectiveness of the total package as an integrated strategy. Only the overall cost effectiveness numbers appear below; the figures for the individual components are found in Chapter VII of the Draft Regulatory Analysis with the complete cost effectiveness discussion.

Because the Draft Regulatory Analysis is based on the original 75 percent reduction standards, the cost effectiveness numbers need special explanation. In the case of light-duty trucks, the numbers are based on compliance with the 0.9 g/mi level. Costs and benefits will be slightly less if a 1.2 g/mi standard is proposed, but the cost effectiveness values should not change greatly. The heavy-duty gasoline engine cost effectiveness number was calculated assuming compliance with the 1.7 g/BHP-hr level. At a revised level in the vicinity of 4.0 g/BHP-hr, benefits and possibly costs would drop since three-way systems are unlikely to be pursued.

Because of the special problem of heavy-duty diesel feasibility, HDD benefits are based on the estimated 40.0 g/BHP-hr revised level; the original costs are valid. The original cost effectiveness analysis which appears in the Regulatory Analysis assumed HDD compliance with the 1.7 g/BHP-hr standard.

None of the overall cost effectiveness numbers, which are presented in the following table, include fule-related costs:

Cost Effectiveness*—($/ton of NOx reduction)

LDT (gasoline)—900.
LDT (diesel)—276.
HDE (gasoline)—326.
HDE (diesel)—157.

These values are cost effective as compared to other NOx control regulations. For example, the 90 percent control performance standard for utility boilers has an estimated cost-effectiveness value of $1200 per ton (Interagency Task Force on Motor Vehicle Goals Beyond 1980, March 1976).

E. The Concept of Averaging

EPA is considering a sweeping change in the way motor vehicle certification has been done for nearly a decade. The goal is to introduce some method of emissions "averaging" in order to inject some flexibility and presumably some cost savings into the certification program. Any such averaging system would need to be designed (1) to maintain the same average NO_x emission benefits as are offered by the non-averaging system we expect to propose in this rulemaking and (2) to be consistent with existing programs (such as recall and inspection/maintenance). Of course, such a system would not change the NO_x standard but rather would change how EPA assesses compliance. The design would also have to take into account the Clean Air Act's intent that *each vehicle* pass the standard, the concept that is embodied in the 10 percent Acceptable Quality Level used in the Selective Enforcement Auditing Program. To design and implement such a program is clearly a major task.

The prospect that a carefully designed averaging system could increase flexibility for the industry while at the same time retaining the air quality benefits of the existing programs makes it nearly certain that EPA will soon propose such a system. A task force has been established to explore concrete ideas, and a workshop with industry representatives is scheduled for January 29 and 30 in Ann Arbor. We have initiated the beginning stages of an averaging rulemaking, and an Advance Notice of Proposed Rulemaking was published recently (45 FR 79382, November 28, 1980). We will attempt to complete any resulting rulemaking as close as possible to the final action on the proposal contemplated by today's Notice.

F. Nonconformance Penalties

Section 206(g) of the Clean Air Act provides for nonconformance penalties (NCPs) "* * * in the case of any class or category of heavy-duty vehicles or engines to which a standard promulgated under Section 202(a) of this Act applies * * *." Accordingly, the emission standards we expect to propose for 1985 light-duty trucks (LDTs) over 6,000 pounds GVWR for 1986 heavy-duty engine (HDEs) will be subject to nonconformance penalties.

As discussed elsewhere in this document, EPA, at this time, has varying degrees of certainty depending on the class or category of engines or vehicles, concerning the technological feasibility of LDTs and HDEs complying with the NO_x emission standards we expect to propose. The technological feasibility section of this document indicates that for each class or category of engines or vehicles, a manufacturer may need to do substantial development work and/or make substantial modifications to existing emission control techniques to both certify and produce HDEs and LDTs capable of complying with all regulatory requirements. In such instances, there is some risk that unforeseen circumstances could result in "technological laggards," i.e., manufacturers whose HDEs or LDTs are incapable of complying with the regulatory requirements. EPA intends to make NCPs available for any proposed NO_x emission standards for this reason. The effect of all of the regulatory changes contemplated in this notice on a manufacturer's ability to both certify and produce HDEs and LDTs capable of complying with all regulatory requirements could also necessitate making NCPs available for other appropriate pollutant standards in the 1985 and 1986 model years.

We do not anticipate proposing NCPs in the NPRM. These will be proposed at a later date through a separate rulemaking, with full opportunity for public comment. EPA's intention to offer NCPs does not affect leadtime considerations in meeting the NO_x emission standards and all other regulatory requirements in the applicable model years. When the NO_x emission standards are issued, if not before, all manufacturers should begin making good faith efforts toward compliance. We intend to structure the NCPs, as required by the Act, to remove any competitive disadvantage to manufacturers complying with the regulatory requirements. The penalty will also increase periodically to provide a further incentive to bring nonconforming vehicles/engines into compliance as expeditiously as possible or to develop new replacement engines.

As discussed elsewhere in this document, EPA has a number of alternatives to evaluate in developing the proposed rulemaking. The use of any of these alternative courses of action might affect the Agency's posture on the applicability of NCPs to any pollutant affected by the regulatory requirements of the final rule.

Requests for Specific Comments:

In the past, rulemakings similar to this one have prompted the submission of a large volume of comments. However, many of these comments have been of little use to EPA in preparing proposed or final rules because of their lack of specificity, clarity, completeness, and/or factual support. As indicated above EPA's choice among alternative options in this rulemaking may depend heavily on information submitted in public comments. Accordingly, the following requests for comments are arranged to encourage submission of more helpful information. We ask that commenters follow the outline in their submissions, indicating the number of the question to which a particular comment responds. If a particular question is not addressed, we would appreciate a short explanation as to why it is not. Finally, we do not in any way intend to limit the range or nature of comments, and we will, of course, consider comments which do not fall within the boundaries of the outline.

Responses should include specific quantitative values whenever possible, as well as supporting data for such values. Failure to include such data will make it difficult for us to meaningfully evaluate your comments.

All comments should be submitted to the Public Docket, at the address given earlier in this Notice (see "ADDRESS").

I. Technology and Feasibility (please specify LDT or HDE and gasoline or diesel.)

A. What techniques/technology do you believe are or could be effective in reducing NO_x emissions?

B. Which of these approaches would you consider available for the anticipated applicable model year (1985 for LTDs, 1986 for HDEs).

C. If the list in Question I.B. is different from that in Question I.A., why is this so? When would the remaining items become available?

D. To the extent possible, please identify the effectiveness of each the various approaches listed in your response to Question I.A. in reducing NO_x emissions. Do you have test data which illustrates this effectiveness? What are the incremental emission reductions associated with each approach?

E. If tradeoffs in such things as fuel economy, durability, and particulate emissions are excluded for the moment, is (are) the standard(s) contemplated in this notice feasible using the approaches you identified in Question I.A.? For what model year? Please answer as well for an approximate revised heavy-duty engine standard of 4.0 g/BHP-hr and for the 75 percent reduction LDT level of 0.9 g/mi.

F. If you believe an anticipated proposed standard is not feasible for the applicable model year, identify the lowest NO_x level which you believe is feasible for that model year, subject to the qualifications of Question I.E. above. Provide supporting data and rationale.

G. To whatever extent you can, please show how each of the following items changes, and how they interact, as the level of NO_x emissions is reduced. Please be as specific as possible and include as wide a range of NO_x levels as you can. Also, please include all supporting data. A matrix-style table may be the best way to present this information.

1. Fuel economy.
2. Engine durability.
3. Particulate or other emissions.
4. Earliest model year of production.

H. Are the effects from Question I.G. a function of the control approach that is used? What approach(es) is the information in I.G. based on?

I. If other pollutants are increased by NO_x control techniques, please answer Question I.D. for any additional controls necessary for those other pollutants.

J. Heavy-duty only: If the trends demonstrated in Question I.G. are based on steady-state or bench testing, can you estimate how those trends would be different in transient engine testing, and to what degree? Please supply any test data which you might have to verify this.

K. For gasoline-fueled LTDs and HDEs, please discuss the fuel economy impacts on the following:

1. Eliminating or reducing air injection requirements with three-way catalyst systems.
2. For HDEs, attainment (where possible) of the 4.0 g/BHP-hr approximate revised level by other means than a three-way system (e.g., EGR). At what NO_x level does a three-way system become necessary in order to avoid an unacceptable fuel economy penalty? Please compare the fuel economy impacts of your likely response to each of the possible proposed standards of 1.7 and 4.0 g/BHP-hr.
3. Fully interactive electronic engine controls.
4. The efficient use of fuel purged from the evaporative emission canister.

II. Leadtime

A. Please place estimates for the period of time necessary for each of the following items on a time-line. Assume the use of the control approaches which are most likely to be used to comply with the regulations. For gasoline HDEs, please do parallel analyses assuming a standard of 1.7 g/BHP-hr and a standard of 4.0 g/BHP-hr. For HDDs, assume a standard of 4.0 g/BHP-hr (or the nearest feasible standard if you believe 4.0 g/BHP-hr is out of reach). In addition, please show the maximum reasonable amount of overlap among the items which can occur. The time-line should at least cover 1981, 82, 83, 84, 85, and, for HDEs, 1986. Please indicate how the time-line might be different for different engine families.

If you believe that a standard could not be reached, please complete the timeline assuming the greatest degree of control you think is possible.

1. Research and development.
2. Tooling.
3. Determination of the deterioration factor.

a. Preliminary DF.
b. Interim DF.
c. Date of beginning of in-use fleet.

4. Certification.
5. Date of engine job #1.
6. Date of vehicle job #1 (if applicable).

B. Please analyze the effect on leadtime of implementation of the other technologies identified in question I.A.

III. Cost

A. To the extent possible, please break out anticipated costs separately for *each* of the program(s) outlined in Section II according to the following outline.

Wherever the choice of control technique affects the cost, please provide separate data for each technique identified in Section I. If techniques vary among families or configurations, please show how costs would subsequently vary. Also, please indicate the year(s) during which each expenditure is likely to take place. Finally, where it is not clear, please give the methodology used in the calculations.

1. Research and development costs.
2. Emission control system costs. Please respond in as much detail as you can.
3. Certification costs.

a. Preliminary DF assessment.
b. In-use durability testing.
c. Emission-data testing.
d. Other costs.

4. Costs resulting from new maintenance requirements.
5. Aggregate cost to the manufacturer (present value at start of 1985 (for LDTs) or 1986 (for HDEs), 10 percent discount rate, 1980 dollars).

B. Can you give a specific estimate of how the demand for your vehicles or engines would change as a result of the additional cost? As a result of other factors related to this rulemaking (e.g., fuel economy)?

C. How will operators' costs change if these regulations are proposed and finalized (for example, a penalty or bonus in fuel economy)?

D. Please comment on EPA's estimated fleetwide sales projections and characteristics for LDTs and HDEs (dieselization and engine downsizing).

E. Please summarize the anticipated capital investment and give a schedule of expenditures and amortization of the costs.

IV. Policy Issues

A. Please comment on the issue of whether it would be appropriate to revise the statutory standard for diesel—but not gasoline-fueled—HDEs. To some extent this is an issue of equity. For example, is it important to retain standards of equal numerical stringency for both engine technologies, or would an emphasis on equal effort of compliance for both gasoline and diesel engine manufacturers (i.e., through separate standards) be more reasonable? If an equal effort approach is favored, what would be the appropriate measure of effort?

B. Please comment on any perceived anti-competitive effects of this rulemaking. In particular, comments are requested on possible anti-competitive effects from the proof of in-use maintenance provisions, where the manufacturer may establish the "reasonable likelihood" of maintenance being performed by assuming the cost and/or providing the maintenance free to vehicle owners. We welcome suggestions for specific steps which we could take to accomplish the desired end without creating a potential or perceived disruption of the marketplace.

V. Environmental Impact

A. Do you see any flaws in the *methodology* used in EPA's preliminary calculation of the emission reductions and air quality benefits of this rulemaking? Please be specific.

B. Please analyze and evaluate the environmental impact of a revised standard of 4.0 g/BHP-hr for HDEs.

VI. Additional Requests

A. What is the variability (standard deviation divided by the mean) of NOx emissions in your current production vehicles or engines on an engine family-control system configuration basis? How will this change with the control technologies required to meet the standards which we expect to propose?

B. What would be the anticipated low-mileage emission target levels for NOx? How might the target levels for other pollutants be affected by the contemplated regulations?

Administrative Designation and Regulatory Analysis

Since we expect that a proposed action along the lines of this notice will be a "significant" regulation, as mentioned earlier, while we were working towards the proposal itself we prepared a preliminary document entitled "Draft Regulatory Analysis, Environmental Impact Statement, and NOx Pollutant Specific Study for Proposed Gaseous Emission Regulations for 1985 and Later Model Year Light-Duty Trucks and 1986 and Later Model Year Heavy-Duty Engines." It includes assessments of environmental and economic impacts, feasibility, and alternative actions as well as an analysis of Urban and Community Impacts. This document may be found in the Public Docket (as described early in this Preamble). Also, free single copies are available upon request through the Director, Emission Control Technology Division, 2565 Plymouth Road, Ann Arbor, MI 48105, Attn: Heavy-Duty Section.

Pollutant Specific Study

Section 202(a)(3)(E)(i) of the 1977 amended Clean Air Act calls for the preparation of pollutant specific studies "concerning the effects of each air pollutant emitted from heavy-duty vehicles or engines and from other sources of mobile source related pollutants on the public health and welfare." In the case of NOx, the document described in the preceding paragraph also incorporates a preliminary draft of the pollutant specific study, and when finalized (with the final regulations), it will be published in the Federal Register and submitted to Congress.

Draft Regulations

A set of draft regulations embodying the concepts discussed in this ANPRM have been prepared and are available in the docket. These should be referred to for further understanding of the concepts EPA expects to propose.

Authority for this rulemaking is found in Sections 202, 206, 207, 208, and 301 of the Clean Air Act (42 U.S.C. 7521, 7525, 7541, 7542, and 7601).

Dated: January 13, 1981.

Douglas M. Costle,

Administrator.

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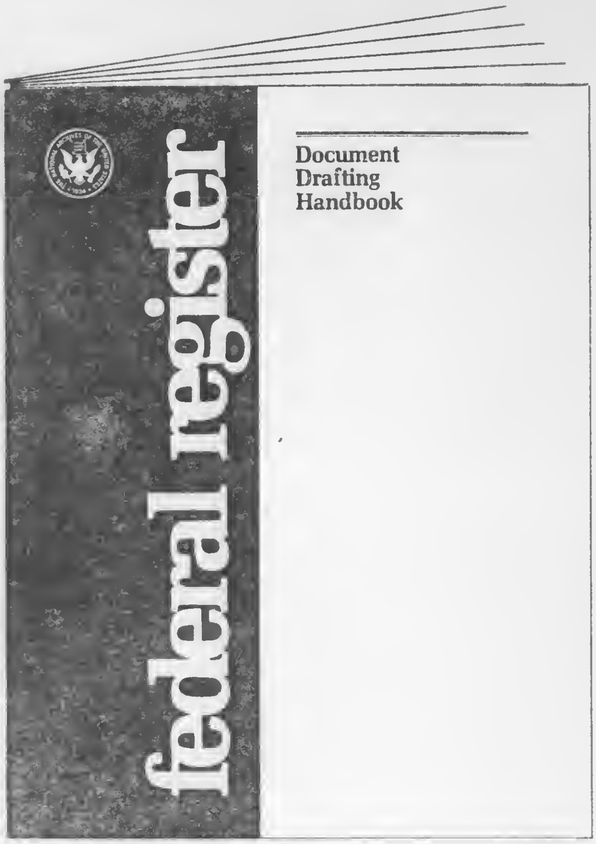

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