Summary and Analysis of Comments: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines

EPA United States Environmental Protection Agency

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Engine Programs and Comliance Division
Office of Mobile Sources
U.S. Environmental Protection Agency

EPA United States Environmental Protection Agency

EPA-420-R-97-102
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List of Commenters

1. 76 Products Company
2. American Lung Association (ALA)
3. American Lung Association of New York State
4. American Petroleum Association (API)
5. American Trucking Associations
6. Arizona Center for Law in the Public Interest
7. Association of Local Air Pollution Control Officials (ALAPCO)
8. Boston Gas Company
9. California Environmental Protection Agency (Cal/EPA)
10. California Natural Gas Vehicle Coalition
11. Caterpillar
12. Chrysler Corporation
13. Clark Refining & Marketing
14. Coalition for Clean Air
15. Commonwealth of Massachusetts
16. Cummins Engine Company
17. Detroit Diesel Corporation
18. Engine Manufacturers Association (EMA)
19. Engine Rebuilders Association (AERA)
20. Environmental Advocates
21. Environmental Defense Fund
22. Ford Motor Company
23. General Motors (GM)
24. Interstate Clean Transportation Corridor (ICTC) Project
25. Mack Trucks
26. Manufacturers of Emissions Controls Association (MECA)
27. National Automotive Dealers Association (NADA)
28. National Petroleum Refiners Association
29. Natural Gas Vehicle Coalition (NGVC)
30. Natural Resources Defense Council (NRDC)
31. Navistar
32. New Jersey Environmental Lobby
33. New Jersey Public Interest Research Group, Citizen Lobby
34. New York City Environmental Justice Alliance
35. Northeast States for coordinated Air Use Management (NESCAUM)
36. Rhône-Poulenc
37. Scenic Hudson
38. Sierra Club of California
39. Southern California Gas Company (SoCalGas)
40. State & Territorial Air Pollution Program Administrators (STAPPA)
41. Texas Natural Resource Conservation Commission
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43. Tri-State Transportation Campaign
44. Union of Concerned Scientists
45. Ventura County Air Pollution Control District
46. Western Highway Institute (WHI)
47. West Harlem Environmental Action

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1. Standards

a. Level of Standards

Summary/Description of the Issue

In the NPRM, EPA proposed emission standards for on-highway heavy-duty engines beginning in 2004. The focus of these standards was a combined NMHC+NOx standard of 2.4 g/bhp-hr with the option of 2.5 g/bhp-hr NMHC+NOx provided that NMHC is less than 0.5 g/bhp-hr. No further PM control was proposed in addition to this standard. The proposed levels were based on what EPA considered to be the greatest achievable reductions from technology expected to be available in 2004, giving appropriate consideration to cost, energy, and safety. Because this is a technology forcing standard with a long lead time, EPA proposed that any final standards, including PM, would be subject to a review scheduled to take place in 1999.

Comments

Commenters showed general support for the NMHC+NOx standard proposed by EPA. Manufacturers expressed specific support for the option of two NMHC+NOx standards and stated that they believed that lower PM levels would not be feasible in 2004 in addition to lower NMHC and NOx levels. These comments were stated to be subject to the results of the 1999 review.

Several commenters disagreed, however, with the proposed omission of further PM control in 2004. Several commenters stated that they thought that a target of 0.05 g/bhp-hr PM would be more appropriate. They commented that a stringent standard should be targeted as part of the 1999 review and only then relaxed if necessary. One of these commenters stated that this level is feasible and appropriate since urban buses currently certify to 0.05 g/bhp-hr PM.

Other reasons that were suggested for a more stringent PM standard include: recent epidemiological evidence on the health effects of particulate matter, EPA staff's recommendation to lower the PM NAAQS and consider a fine PM standard, and the commented belief that HDE emissions are the largest transportation source of both PM10 and PM2.5. One commenter noted that almost all diesel PM emissions are less than 1.0 microns in size, and stated that particles of that size are especially hazardous. The commenter alleged that by not proposing a tighter PM standard, EPA is sending a message that HDD PM control is not a high priority. Another commenter suggested that the NPRM ignored the potential of aftertreatment to lower PM without adversely affecting NOx emissions. In addition, EPA received comments both supporting and opposing the implementation of a standard for particulate matter less than 2.5 microns in diameter (PM2.5).

Analysis/Response

EPA understands the concerns that have been raised and has an interest in pursuing further control of PM emissions if appropriate. As discussed in more detail in the Regulatory Impact Analysis, PM emissions can cause risks to public health and welfare, including a range of respiratory illnesses and aggravation of cardiovascular disease. EPA is reviewing and will continue to review many strategies for reducing harmful emissions of PM, including reduction of emissions from internal combustion engines. In fact, the reductions in NOx emissions resulting from this rule will significantly lower secondary formation of nitrate PM.[1]

However, based on the information available today and the statutory factors set forth in §202(a)(3)(A) of the Clean Air Act, EPA cannot conclude at this time that the current diesel PM standards can or should be lowered in 2004 in the context of an approximate 50 percent reduction in NOx. Because of the trade-off between NOx and PM emissions, manufacturers will have to undertake considerable effort to keep PM emissions below the current standard while essentially halving NOx emissions. This trade-off is discussed in more detail in the Regulatory Impact Analysis. EPA cannot be certain at this time that any further reductions in PM emissions can be realized in a manner that is durable, reliable for the majority of the fleet, and cost-effective.

Open issues regarding control technology and strategy have contributed to the Agency's decision not to lower PM standards at this time. To date, most medium heavy-duty and all heavy heavy-duty diesel engine families have been successful in meeting the 0.10 g/bhp-hr diesel PM standard using in-cylinder or engine-based control strategies. However, most of the light heavy-duty diesel engines have employed the use of aftertreatment devices such as oxidation catalysts to reach this level. All urban bus engines have used aftertreatment to achieve the applicable 0.05 g/bhp-hr diesel PM standard, albeit at somewhat higher cost and cost effectiveness values than for truck engines. While there are clearly different emission control strategy philosophies among the manufacturers and differences among engine technologies that lead to these variations in technological approach, further work is needed to identify and evaluate what set of control strategies have the greatest potential to achieve full life emission control at diesel PM levels less than 0.10 g/bhp-hr while also reducing NOx to approximately 2 g/bhp-hr. This ultimate set of strategies may involve aftertreatment techniques similar to those currently used on light heavy-duty diesel engines and urban buses or could be a technology still in research and development. At this time, it is highly uncertain that potential methods for heavy-duty engines to get down to levels below 0.10 PM and 2.0 NOx are reliable for the full useful life for the great majority of the heavy-duty fleet.

The ability of urban buses to achieve a PM level of 0.05 g/bhp-hr does not necessarily mean that this level is feasible for all heavy duty diesel engines. Urban buses operate at much lower speeds and loads than most heavy-duty vehicles which reduces the stress on aftertreatment

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[1]Benefits of Mobile Source NOx Related Particulate Matter Reductions, October 1996, EPA Contract No. 68-C5-0010.

devices. Most urban bus operators have maintenance facilities which can handle any special maintenance needs related to emission control equipment. Urban buses experience a typical duty-cycle for which equipment can be designed as opposed to truck engines which can be applied to several different types of truck applications and can experience a much wider range of duty-cycles. Some of these duty-cycles may be much more stressful than the duty-cycle of urban buses. Duty-cycle is important because the engines must be designed to meet the standards over their full useful lives. Requiring a small subset of engines to meet a more stringent standard does not necessarily justify the feasibility or cost-effectiveness of the standard for all heavy-duty engines. Finally, urban buses are under congressional mandate for lower PM emissions because they operate in heavily populated areas where higher costs are justified. This is not to say that it would be impossible or inappropriate for the Agency to mandate a standard of 0.05 g/bhp-hr for all heavy-duty engines in the future, but further work is needed to address the different strategies that may be needed for these engines.

Closely related are the issues of cost and cost effectiveness. The purchase and operating cost implications of any additional control technology must be considered as part of further evaluation, as should the cost-effectiveness of further reductions in new engine emission standards. This is best evaluated in the context of the possible control technologies as discussed above. Although a 0.05 g/bhp-hr standard would represent a 50 percent reduction in the PM standard, it would yield significantly less emission benefit than past incremental changes in the PM standard (e.g., 0.60 g to 0.25 g in 1991 and 0.25 g to 0.10 g in 1994). If high-cost aftertreatment technology is needed to achieve a new standard, the cost effectiveness may be significantly higher than with past standards.

There are other open scientific and technical issues that EPA plans to consider prior to the 1999 review. One is related to the form of the diesel particulate standard. Current EPA diesel particulate standards are based on mass per unit work (g/bhp-hr), and EPA continues to believe that this is the appropriate form for setting standards. Recently, an issue of a potential impact of technology on particle size distribution has arisen. Virtually all diesel particulate matter has a diameter less than 1.0 micron and is thus fully respirable by humans. A recent study sponsored by the Health Effects Institute on two similar and recent engine models (one of a later technology) indicated that while the total mass of PM emissions was lower in the newer technology engine, the remaining particles from the new engine were smaller in diameter and more numerous[2]. The implications of this information are not clear either with regard to technology or health effects. While EPA continues to believe that mass-based emission standards for PM are the most appropriate form, more information on the impact of any advanced engine and emission control technology on diesel PM size, particle count, and chemical constituents as well as the health effects of any changes in these particle characteristics would be helpful.

K.J. Baumgard, J.H. Johnson, "The Effect of Fuel and Engine Design on Diesel Exhaust Particle Size Distributions," Society of Automotive Engineers, 960131, 1996.

Another issue is related to the magnitude of the directly-emitted diesel PM inventory and its relative air quality impact. Unlike nonroad diesel engines PM emissions, highway diesel engine PM emissions have been controlled since 1988, and represent an 80 to 90 percent reduction over uncontrolled levels. Nonetheless, it is clear that control of diesel PM emissions is important, and more data on the percentage of highway engine diesel PM in the various urban areas and nonattainment area inventories and the in-use performance of controlled highway diesels would be helpful in guiding the Agency's future initiatives with regard to potential highway diesel engine PM control strategies. As noted above, tightening NOx standards alone results in lower levels of ambient PM due to the accompanying reduction in secondary formation of nitrate PM, as discussed elsewhere in this rulemaking.

In conclusion, EPA believes there are too many uncertainties at this time to mandate a lower standard for PM at the same time EPA is requiring a virtual halving of the NOx standard. Moreover, as EPA did not propose a lower PM standard, it could not take final action on any such lower standards without notice and comment. However, EPA is committed to further review of control of highway diesel engine PM emissions. EPA considers such emission control to be an important air quality goal and plans to further study these issues and others over the next two years, and to reassess the diesel PM standard in the 1999 review. In that context, EPA encourages continued research and development on PM control technology and seeks input in all of the areas described above.

b. Stringency of Heavy-Duty Gasoline Engine Standards

Summary/Description of the Issue

EPA proposed to adopt the same emission standards applicable to both diesel and Otto-cycle heavy-duty engines. Otto-cycle heavy-duty engines are primarily gasoline-fueled engines.

Comments

Gasoline engine manufacturers commented that the proposed standards were sufficient and would be technologically challenging due to high in-use deterioration of emission control technologies used in gasoline engines.

Prior to publication of the proposal, however, environmental groups provided comments highlighting manufacturers' certification data for the 1996 model year, which included some engine families with emission levels considerably below the standards proposed for the 2004 model year. EPA raised this issue in the proposal by requesting comment on the possibility of adopting more stringent emission standards for heavy-duty gasoline engines. Certification data for 1997 showed a greater number of engine families emitting at or below the 2004 levels, with some engines certified at emission levels only ten to twenty percent of the 2004 emission standards.

Analysis/Response

At this point, EPA is not ready to take final action on the issues associated with Otto-cycle HDEs and is not finalizing any revised standards for heavy-duty Otto-cycle engines. EPA intends to issue a Supplemental Notice of Proposed Rulemaking to address these engines specifically. A variety of options are under consideration for inclusion in the supplemental proposal. First, as described in the initial proposal, EPA may pursue a more stringent numerical standard using the existing test on an engine dynamometer. Second, EPA will evaluate the appropriateness of adopting emission standards for some otto-cycle heavy-duty vehicles based on testing with a chassis dynamometer. Chassis testing, and associated standards, could be patterned after the program adopted by the California Air Resources Board for medium-duty vehicles. Alternatively, EPA could develop a test and standard using the chassis test cycle specified in 40 CFR 86, Subpart M for heavy-duty gasoline vehicles.

c. Period of Stability

Summary/Description of the Issue

The Clean Air Act requires a three year minimum period of stability for any new standard applicable to highway heavy-duty engines [see 42 U.S.C. 7521 (a)(3)(C)]. There is no intended period of stability discussed in the NPRM; however, the cost-effectiveness analysis in the RIA assumes five years to recoup the fixed costs.

Comments

Several heavy-duty engine manufacturers commented that they consider an eight year minimum period of stability to be necessary to make the investment in technology required by the proposed standards. A period of stability longer than three years required by the CAA was also supported by a petroleum refiners' association with the rationale that there is a low or nonexistent return on money invested to reduce emissions.

Analysis/Response

EPA has not included any provisions regarding stability in the final rule since the period of stability would instead be addressed in any future rulemakings. EPA thought it reasonable to spread the fixed costs over five years in its cost analysis; however, this is not directly related to the period of stability. EPA has received a great deal of public comments asking for greater PM reductions. The ultimate period of stability will be defined in any future rulemaking to revise the standards; in no case will the period of stability for the standards finalized today be less than the statutory three year minimum.

d. Harmonization

Summary/Description of the Issue

EPA has proposed that the standards in the NPRM apply nationwide. This does not represent a preemption of California's authority to set lower standards, but rather represents cooperation between the U.S. EPA and the California EPA. To contribute to the nationwide harmonization of engine standards, California has changed its intentions of a ULEV program which would require 15 percent of vehicles from 6,000 to 14,000 lbs GVWR to meet a 0.05 g/bhp-hr PM standard. Under the changed ULEV program, all heavy-duty engines will have to meet the previous ULEV NMHC+NOx standard of 2.5 g/bhp-hr rather than the previous LEV standard of 3.5 g/bhp-hr, but the ULEV PM level will be raised to 0.1 g/bhp-hr.

Comments

California and other commenters were generally supportive of a 50-state standard including truckers who support harmonization so they can travel uninhibited between states. However, one commenter was concerned that harmonization will result in increased PM in California because the ULEV standard of 0.05 g/bhp-hr would not be put in place.

Analysis/Response

EPA agrees that a uniform standard provides less economic burden to heavy-duty engine manufacturers and truckers than does separate Federal and California standards. In addition, EPA has calculated that any increase in the California ULEV PM level would be more than offset by the secondary PM reductions from NOx control on interstate trucks used in California. This is especially true since the vehicles over 8,500 lbs GVWR would most likely not be certified to the 0.05 g/bhp-hr PM standard since the ULEV standard is more easily met by lighter trucks and California allows ABT. Even if the 15 percent of heavy-duty engines sold in California met the ULEV standards were distributed evenly (rather than the majority of ULEVs being between 6,000 and 8,500 lbs), EPA calculates that the national program finalized today will result in more than three times the PM reductions in California from heavy-duty engines than the ULEV program through secondary PM reductions. This calculation was made based on the following assumptions:

1) 25 percent of the heavy-duty vehicle miles traveled in California are from out of state trucks (based on ARB data),
2) the CA ULEV program results in a 0.05 g/bhp-hr engine specific PM benefit (for ULEV engines) over the proposed national program,
3) the NPRM would result in a 1 g/bhp-hr NOx engine specific NOx benefit over the CA ULEV engines, and

4) the fraction of NOx converted to nitrates in southern California is approximately 0.07 g/g (based on an October 1996 SAI report to EPA titled "Benefits of Mobile Source NOx Related Particulate Matter Reductions").

e. Urban bus standard

Summary/Description of the Issue

The proposed NMHC+NOx standard would apply to urban bus engines, and the PM standard for these engines would remain at the current level of 0.05 g/bhp-hr for new engines and 0.07 g/bhp-hr in use.

Comments

Manufacturers commented that the urban bus PM standard would have to be relaxed to meet the proposed NMHC+NOx standards. These commenters stated that a 0.10 g/bhp-hr PM standard would be more appropriate because reducing NMHC+NOx from these engines will require significant technical improvements and there is generally a trade-off between NOx and PM emissions. One manufacturer stated that they understood that a maximum standard of 0.07 g/bhp-hr PM would be allowed by the Clean Air Act. However, others commented that 0.05 g/bhp-hr PM would be feasible for all HDEs. These comments are described earlier under "Level of Standards."

Analysis/Response

Urban bus engines are and will continue to be a special case because they have unique operating characteristics, are used in only a limited range of vehicle applications, and are treated differently than truck engines in the Clean Air Act. Urban buses experience a typical duty cycle for which engines can relatively easily be designed; truck engines, in contrast, can be applied to several different types of truck applications and can experience a much wider range of duty cycles. The duty cycle that engines will see is important because manufacturers must design engines to meet the standards over their full useful lives. Moreover, the particular emphasis on PM reduction in section 219 indicates that Congress was especially interested in such reductions from urban buses, which operate in heavily populated areas, and that Congress considered more stringent standards appropriate for such engines. For these reasons, EPA believes that the new NMHC+NOx standard along with the more stringent urban bus PM standard will be feasible and appropriate for urban buses. As part of the 1999 review, EPA will reevaluate the appropriateness of the urban bus standards. Even should new information available in 1999 suggest the standards of 2.4 g/bhp-hr NMHC+NOx and 0.05 g/bhp-hr PM beginning in 2004 would not be appropriate for urban buses, EPA would not expect to relax PM control in order to save the 2.4 g/bhp-hr NMHC+NOx standard beginning in 2004 given Congress' focus on PM control from urban buses.

f. Alternative Fuel Forcing Standard

Summary/Description of the Issue

The NPRM proposed standards that would apply to all on-highway heavy-duty engines regardless of the fuel they use. The proposal was based on the lowest appropriate standards from heavy-duty diesel engines, which make up the majority of on-highway heavy-duty engines.

Comments

Most commenters supported a single set of standards that diesel, gasoline, and alternative-fueled HDEs could meet. EPA received comment from a trucking organization that the marketplace should determine the fuel used in trucks. However, one commenter stated that EPA is failing to take advantage of the greatest possible emission reductions by proposing a standard defined by diesel technology. According to this commenter, natural gas heavy-duty truck engines are commercially available today that have NOx levels that are less than 2.0 g/bhp-hr.

Analysis/Response

The proposed standards were driven by the largest feasible reductions from the most widely used engines currently in the market. In other words, the proposed NOx and PM levels are driven by diesel-fueled engine technology. It is not EPA's intent to require standards that can only be met using alternatively fueled engines. EPA does not believe that section 202 requires emission standards that would effectively prohibit the sale of diesel-fueled engines, which represent the majority of engines currently in-use.

g. Equity in Burden Among NOx Sources

Summary/Description of the Issue

This rule seeks emission reductions from highway HDEs as a means to improve ozone air quality.

Comments

Several commenters made statements about the appropriateness of new controls for highway HDEs relative to controls on other emission sources. Trucking representatives (American Trucking Associations and Western Highway Institute) stated their belief that highway HDEs have been regulated more stringently than locomotives, nonroad equipment, and some stationary sources. Others expressed the opposite concern, that some sources like light-duty vehicles have borne relatively more emission reduction burden than highway HDEs and that new standards for HDEs provide a degree of balance.

Analysis/Response

EPA believes that this regulatory action needs to be viewed in the context of several other initiatives that EPA is undertaking. In 1990, Congress directed EPA to study the emission impacts of nonroad engines, vehicles, and equipment and regulate them if they contribute significantly to ozone and other air pollution in more than one nonattainment area. See 42 USC 7547. EPA has already finalized emission standards for several categories of new nonroad engines, vehicles and equipment and has proposed or plans to propose standards for other categories (including standards for locomotives and further standards for nonroad diesels that are comparable to those finalized for highway HDEs).

In the preamble and Regulatory Impact Analysis (RIA) associated with this action, EPA summarizes its position that large NOx reductions are needed from many sources if ozone air quality is to reach acceptable levels in many areas. For the foreseeable future, EPA and the states will need to seek cost effective emission reductions from as many sources as possible if air quality goals are to be met. EPA believes that new standards for highway HDEs are consistent with this perspective and an important part of a balanced overall solution.

EPA agrees with other commenters that its current efforts to promulgate more stringent standards for heavy-duty engines is prudent and necessary. However, EPA notes that current and previous standards are based on the technology that is feasible and appropriate at the time the standards are promulgated.

2. Averaging, Banking, and Trading

EPA proposed establishing a modified averaging, banking, and trading (ABT) program for Otto- and diesel-cycle engines to begin in 1998 and end in 2006. The primary features of the modified program would be that credits generated for use in meeting the new standards would have no life limits and credits would not be discounted. The current ABT program, which would stay in place for credits used to help comply with the NOx and PM emission standards between 1998 and 2003, limits credit life to three years and discounts banked credits by 20 percent. Due to the change in the form of the standard from NOx to NOx plus NMHC, EPA proposed to allow NOx-based credits to be used to meet the NOx plus NMHC standard. Credits could only be generated and not used in the modified program prior to 2004. Credits could be transferred from the modified program to the current program but would be subject to its life limit and discount provisions. EPA also proposed to allow both credit generation and credit use on a sales-weighted average horsepower basis in lieu of the "buy high/sell low" provisions of the current ABT program, as found in 40 CFR §86.094-15 (c)(2). In addition, the proposal included provisions to require that manufacturers maintain a compliance margin (the difference between the certification level and the Family Emissions Limit (FEL)) of at least 5 percent unless data was available to show that a lower value was justified. The modifications were proposed to be available for both NOx and PM emissions. The following is a summary of the significant comments EPA received on various aspects of the proposal and EPA's analysis/response.

a. Heavy-duty Otto-cycle Engines

EPA proposed the same standards for all heavy-duty engines, both Otto-cycle (i.e., gasoline-fueled) engines and diesel engines. EPA also proposed to apply the modified ABT program provisions to all heavy-duty engines. EPA noted its concern that the ABT modifications could provide gasoline-fueled engine manufacturers with windfall credits due to the fact that some engines were already certified at levels well below the 1998 and later model year standards. EPA requested comments on whether or not the modified ABT program should be available to gasoline-fueled engines. EPA also requested comment on the need for a lower standard for Otto-cycle engines.

Due to EPA's evaluation of critical comments received by the Agency, EPA is not finalizing new standards for Otto-cycle engines in this rulemaking (as discussed in Section IV.B. of the preamble). Therefore, the 1998 and later model year standards shall remain in effect until new standards are finalized. Because the Agency is not finalizing any new standards for this category of engines, EPA also is not finalizing any changes to the ABT program for the category. Appropriate changes to the ABT program are dependent on the form and level of stringency of the new standard and are best considered along with changes to the standard. The current ABT program remains in effect for Otto-cycle engines. The remainder of this section applies only to diesel-cycle heavy-duty engines.

b. General Need for and Effects of a Modified ABT Program (Diesel-cycle Engines)

Summary/Description of the Issue

An ABT program allows the Agency to propose and finalize a more stringent engine standard than might otherwise be appropriate under the CAA, since ABT reduces the cost and improves the technological feasibility of achieving the standard. EPA proposed the changes to the ABT program with the intent that the changes would enhance the technological feasibility and cost-effectiveness of the new standard, and thereby help to ensure the new standards would be attainable earlier than would otherwise be possible. The changes would provide manufacturers with additional product planning flexibility and the opportunity for a more cost effective introduction of product lines meeting the new standard. Also, EPA believes that ABT creates an incentive for early introduction of new technology which allows certain engine families to act as trail blazers for new technology. This can help provide valuable information to manufacturers on the technology prior to manufacturers needing to apply the technology throughout their product line. This further improves the feasibility of achieving the standard. This early introduction can also provide valuable information for use in other regulatory programs that may benefit from similar technologies (e.g., nonroad programs). EPA viewed the effect of the ABT program itself as environmentally neutral because the use of credits by some engines is offset by the generation of credits by other engines. However, when coupled with the new standards, the ABT program would be environmentally beneficial because it would allow the new standards to be implemented earlier than would otherwise be appropriate under the Act.

Comments

Manufacturing organizations, including the Engine Manufacturers Association (EMA) and the Natural Gas Vehicle Coalition (NGVC), commented that manufacturers need the flexibility of an expanded ABT program in order for the 2004 standards to be cost effective and technologically achievable for diesel-cycle engines.

Health and environmental groups[3] and two state organizations believe that the effect of the proposed modified ABT program would be environmentally negative. While commenters did not question the theoretical value of ABT, some questioned whether the current ABT program achieved its goals. These commenters suggested that until EPA can show that the current program is effective in promoting the greatest level of emission reductions and stimulating technological advances, EPA should take no action to expand ABT. Some commenters stated that the ABT program offers manufacturers an opportunity to reduce and delay their responsibility to limit emissions from heavy-duty engines. Commenters questioned whether or not the program achieves the same emission reductions as an "every engine" standard. The skepticism of these commenters was linked to their assertion that EPA does not have an effective in-use compliance program for highway HDEs. They suggested that the current ABT program without the potential deterrence provided by an effective in-use program offers manufacturers the opportunity to game the certification process and avoid introducing advanced control technology. One commenter also commented that EPA has not provided sufficient evidence that the further flexibility proposed is needed for NOx compliance purposes. For these reasons, commenters also suggested that the program modifications should not apply to PM, especially since EPA did not propose a change to the PM standard.

Analysis/Response

As described below, EPA has made some changes to the modified ABT program in response to comments on particular issues such as credit discounting. For diesel engines, EPA believes that the final version of the modified ABT program helps make the 2.4 g/bhp-hr standard in model year 2004 appropriate under the CAA. EPA is able to impose a more stringent standard in model year 2004 by modifying the ABT program. As discussed below, EPA also continues to believe that, even with the modifications proposed, the effect of the ABT program alone, separate from the level of the standard, is at worst environmentally neutral. Moreover, it is clear that the program provides emissions reductions earlier than would otherwise be achieved. Although all engines would not meet the more stringent standard beginning in 2004, their excess emissions are offset by engines that are cleaner than the applicable standard prior to 2004. Moreover, the more stringent standard is itself based on the availability of credits, and thus may not have been mandated in the absence of such credits. Furthermore, these early emissions reductions prior to

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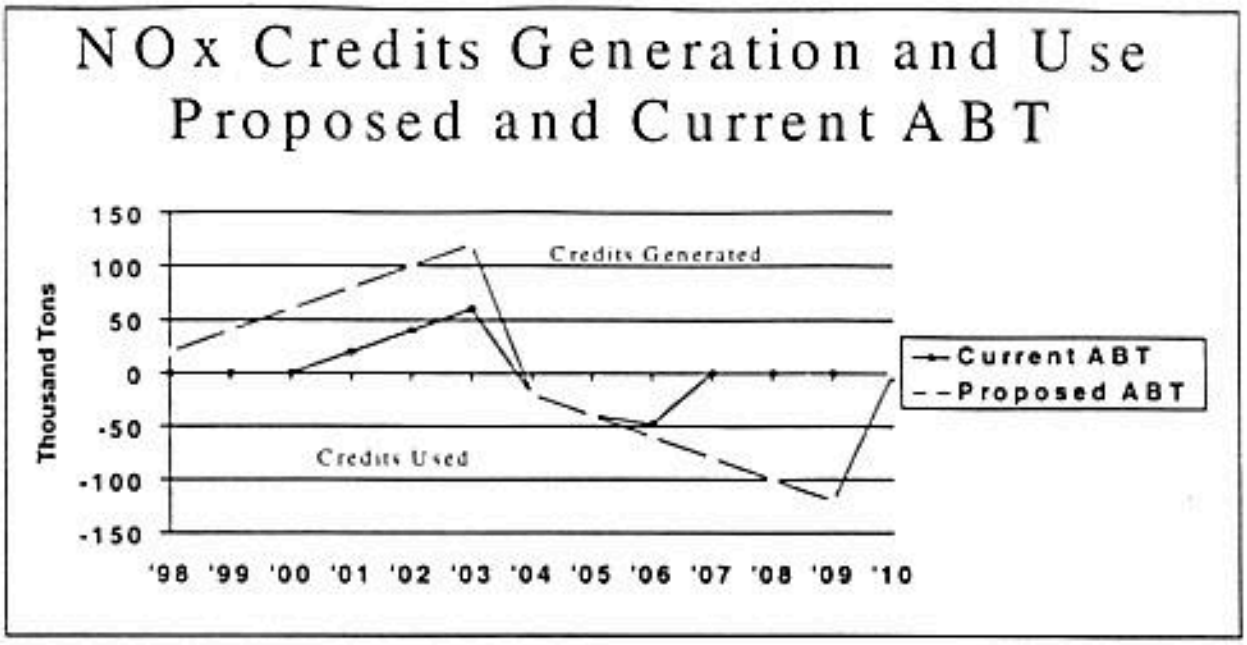
[3] "Health and environmental groups" refers to comments submitted by the Union of Concerned Scientists and the Natural Resources Defense Council on behalf of several organizations, September 11, 1996, Docket A-95-27, #IV-D-15.

2004 represent the early introduction of emissions reduction technologies or strategies that manufacturers would not otherwise be required to apply, which has the advantages discussed above. Manufacturers are able to earn credits for experimentation with advanced technologies. In addition, by spreading out the emissions reductions, manufacturers are able to optimize their product plans without overall loss of emissions reductions. All of these points help to allow for the adoption of a lower standard than would otherwise be reasonably achievable. The ABT changes therefore should not add uncertainty to air quality planners' ability to rely on these reductions.

Figures 1 and 2 provide an illustration of these points. They show a scenario where credits are accumulated and then used at a consistent annual rate of 0.5 g/bhp-hr per engine for NOx and 0.01 g/bhp-hr per engine for PM. The effect of the proposed changes are that manufacturers are able to accumulate credits and use them over a longer period of time such that there are more credits available and more flexibility. Figure 3 illustrates the effect of the use of the proposed ABT program on average per vehicle fleet emissions over the first several years of the program under a scenario where 0.5 g/bhp-hr of credit is earned per engine sold for 6 years prior to 2004, and then 1.0 g/bhp-hr of credits per engine is used for the following 3 years.[4] The figures show how credits may be earned through early emissions reductions and the credits are then used to offset excess emissions later with a net impact on emissions reductions of zero when compared to the baseline impact of the standard itself. Manufacturers do not reduce their emissions reductions at all and only delay reductions to the extent that they have achieved extra reductions earlier.

[4] Based on MOBIL5 model.

Figure 1



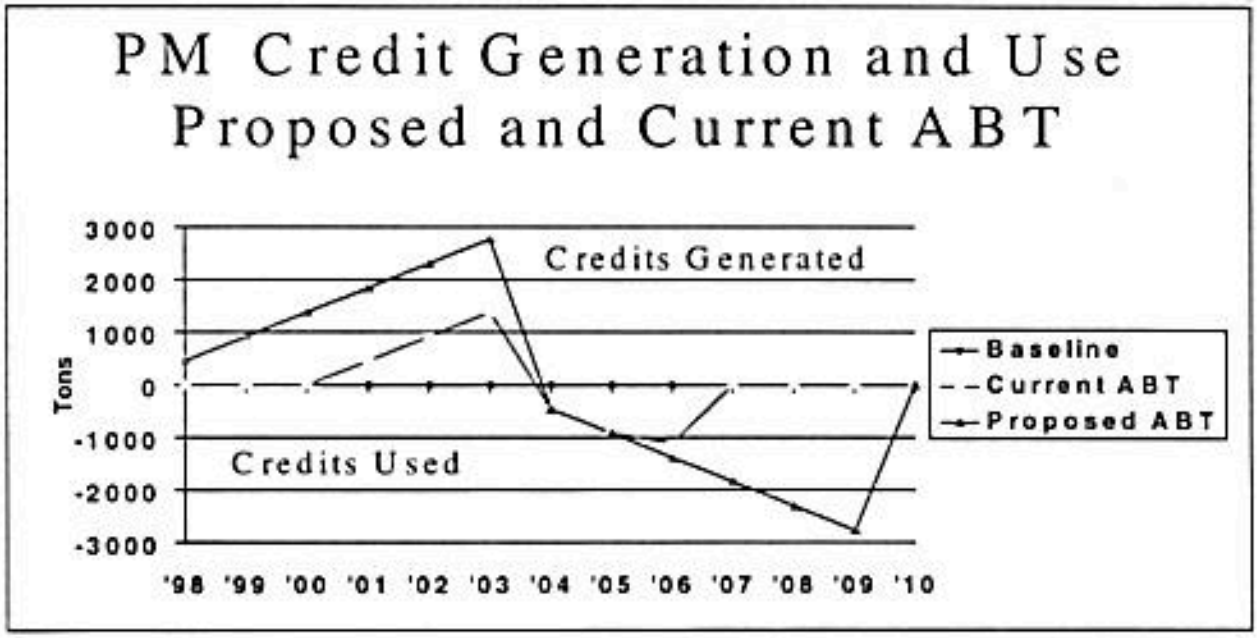
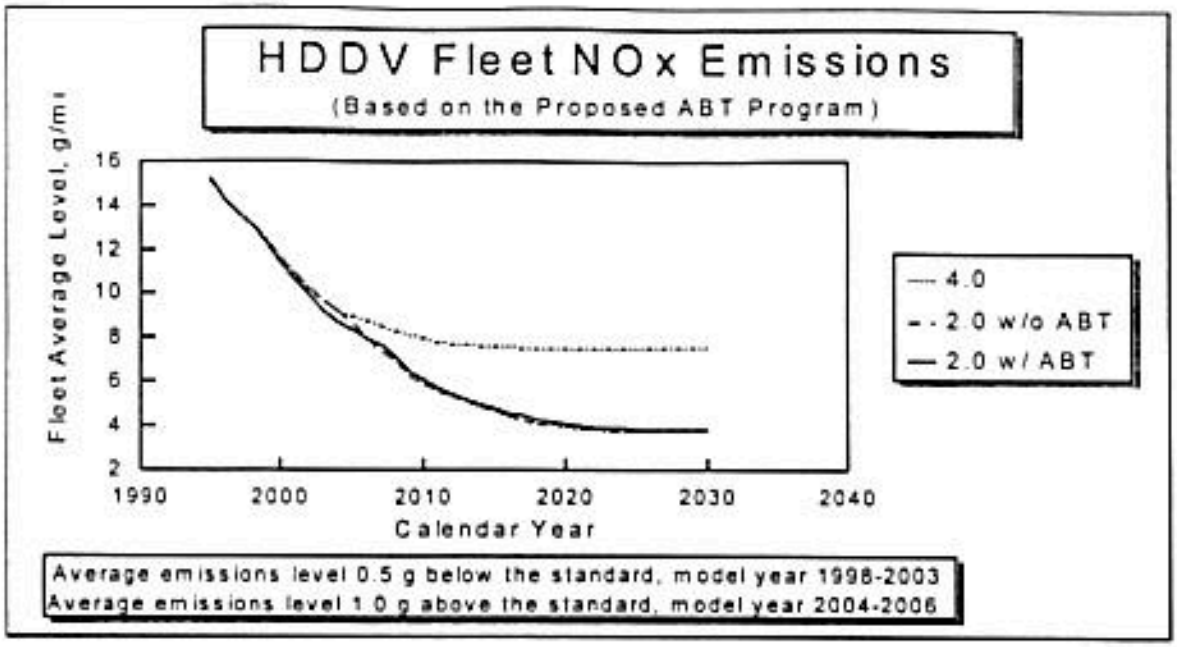


Figure 2

Figure 3



EPA does not believe that the ABT program results in the loss of emissions reductions. One primary issue raised by commenters concerns the lack of an in-use compliance threat and compliance margin shaving issues. These issues are addressed below in section 2.f. With the 4.0 g/bhp-hr standard, which is effective beginning in 1998, EPA does not believe there is potential for windfall credits for diesel engines. Rather, certifying engines below the 4.0 g/bhp-hr level will require manufacturers to make changes to their engines. Figures 4 and 5 show 1997 certification for NOx and PM emissions from diesel engines. Of the 102 diesel engine families listed in the Table, only eight have NOx certification levels less than 4.0 g/bhp-hr, and the majority are certified at a level of 4.5 g/bhp-hr or more.[5] For diesel engines, EPA has also concluded that the task facing the manufacturers is difficult and that there is a need for modified ABT provisions to improve technological feasibility.

[5] The NOx standard prior to the 1998 model year is 5.0 g/bhp-hr, with a 4.0 g/bhp-hr becoming effective for the 1998 model year.

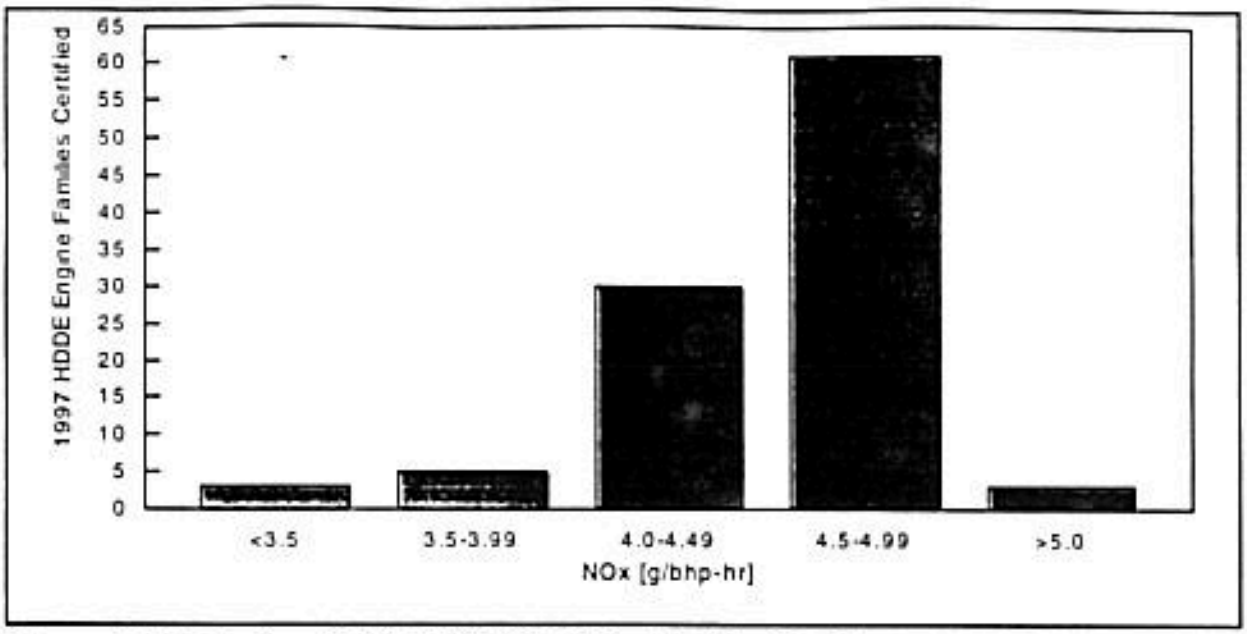


Figure 4: Distribution of 1997 NOx HDDE Certification Levels

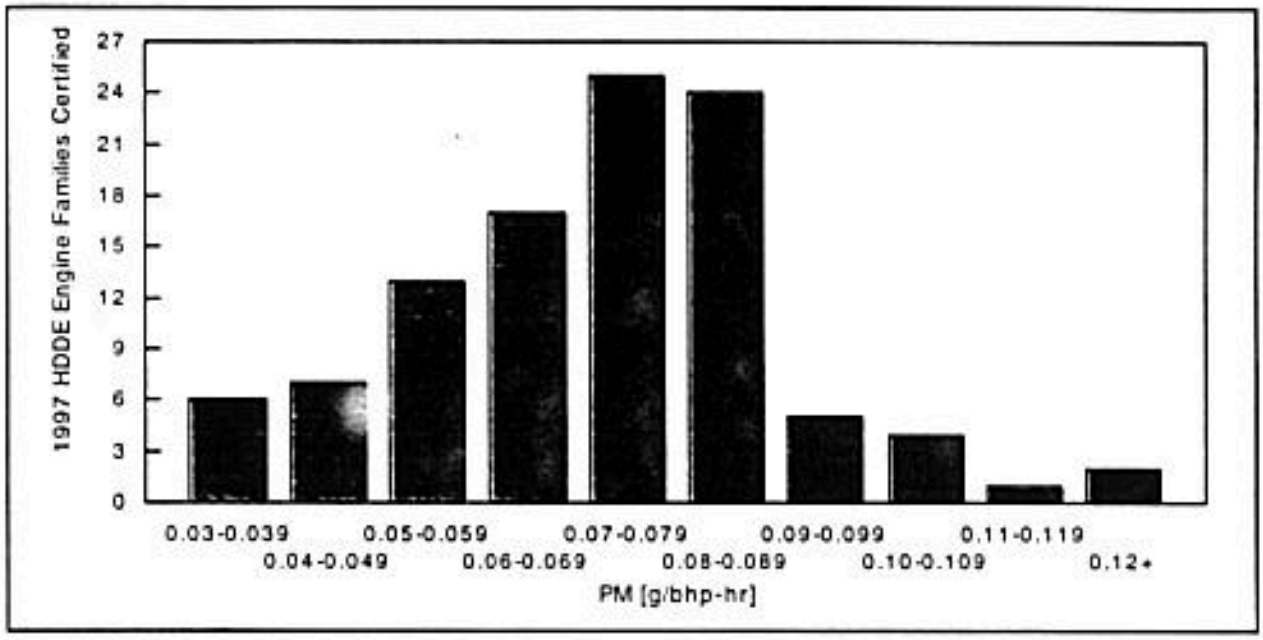


Figure 5: Distribution of 1997 PM HDDE Certification Levels

As is laid out in the technology and cost analyses in the RIA, EPA expects that meeting 2.4 g/bhp-hr NMHC+NOx and 0.10 g/bhp-hr PM will require new technology, heretofore unused in heavy-duty diesel applications. Such technology has potential operating cost and durability implications which may make it prohibitive to meet the standard for every engine family beginning in 2004. Some engine families will represent a more difficult challenge for engine manufacturers than others and manufacturers may need additional time for the more difficult

engine families. Modified ABT provides the manufacturers the design and implementation flexibility and reduces overall compliance costs. Eventually, however, when credits have been consumed, all engines will be required to be equipped with advanced emissions controls (not considering the possible effect of averaging).

EPA believes that adopting the modified program helps to ensure that the 2004 standards are achievable on a fleetwide basis and appropriate under the CAA, beginning in model year 2004. Having the 2.4 g/bhp-hr standard effective beginning in 2004 is more beneficial for the environment than either the same standard in a later model year or a less stringent standard in 2004. For the reasons noted above, EPA does not believe that the ABT program results in a loss of emissions reduction. Nonetheless, to evaluate this issue, the Agency intends to undertake a study of the performance of the ABT program since its inception which will characterize the program's effects in detail. The study will be available after the finalization of this rule and before the 1999 Rulemaking Review.

Several commenters expressed concern about EPA's proposal to provide a modified ABT program for PM even though the PM standard is not proposed to change for 2004. As discussed below in subsection e., EPA's decision is based on the well accepted principle that for most in-cylinder control strategies, decreasing NOx emissions will put upward pressure on engine-out particulate levels.[6] This is true for EGR, the most likely technology for 2004. EPA expects that other improvements and technologies will be needed to address this concern, and the design and implementation flexibility offered by ABT will help ensure that the needed combination of NOx and PM control technologies are technologically feasible and cost effective.

c. Credit Life

Summary/Description of the Issue

EPA proposed that credits earned under the modified program have an unlimited credit life. This change would allow manufacturers to begin earning credits as early as the 1998 model year to be used to comply with the 2004 standards. Under the current ABT program, credits have a credit life of three years, after which they expire and cannot be used. EPA thought the need for unlimited credit life to enhance the feasibility of the proposed standards would be greatly diminished after 2006, so the Agency proposed that unlimited life be available only for credits generated in model years 1998 through 2006. The Agency sought comment on what expiration date, if any, would be appropriate for the proposed credit life modification.

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[6] The reader is directed to Chapter 4 of the RIA for more information regarding the NOx-PM trade-off.

Comments

Engine manufacturers strongly supported infinite credit life, and suggested that the change be permanent rather than applied only to credits generated from 1998 through 2006. EMA commented that a credit life limit only creates an incentive to use credits before they expire. Rather than waste credits, manufacturers would have an incentive to defer lower emitting technologies in order to use up the credits. EMA commented that EPA should encourage the saving of credits by allowing unlimited credit life on a permanent basis.

EPA also received comments that unlimited credit life was inappropriate. Health and environmental groups recommended that the modified program expire in 2004 and that all credits generated under the modified program be transferred back to the current program at that time, be subject to a three year credit life limit, and expire in 2007. Their rationale is that liberalized credits accrued prior to 2004 would aid manufacturers in the transition to model year 2004 standards but should not be available in later years to unduly delay the introduction of engines meeting the new standard levels. They raised the concern that a longer credit life would curtail the program's ability to force improvements in technology and generate reliable emissions reductions. Health and environmental groups also suggested the modified ABT program should end because it would cause uncertainty for state planning organizations. Supporting rationale and information regarding the scope of the problem were not provided. Further, the commenters recommended that EPA set a cut-point of 3.5 g/bhp-hr and that engines certified above the cut-point not be eligible for enhanced credits, including unlimited life. EPA received comment from other commenters opposing unlimited credit life credits but they did not provide supporting rationale.

Analysis/Response

EPA agrees with the rationale presented by the engine manufacturers for unlimited credit life. There would be an environmental benefit associated with limiting credit life if manufacturers allowed credits to expire. However, credits are not generated without a cost to the manufacturer and/or the consumer and thus they have value to a manufacturer. If faced with credit expiration, manufacturers would likely use the credits if at all possible. Manufacturers have not been inclined to allow credits to expire in the past.[7] Future credits are even more valuable due to the more stringent standards.

For the highway heavy-duty engine program, EPA believes that an unlimited credit life is appropriate and beneficial for several reasons. There is no advantage environmentally to forcing or encouraging credits to be used because credit use results in a higher emitting engines. EPA does not agree that allowing an unlimited credit life unduly delays the introduction of technology.

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[7] Based on EPA heavy-duty engine compliance records in which manufacturers report to EPA on their credit generation and use. Engine Programs and Compliance Division of the Office of Mobile Sources, 401 M St. SW, Washington DC, 20460.

While unlimited credit life would create the potential for technology delay on a few families, limiting credit life would encourage technology delay in the near term since it would be "use or lose" for the credits. Allowing for holding of credits delays the incentive to use dirtier technology rather than delaying cleaner technology. Furthermore, EPA believes some manufacturers are likely to exercise the option of retaining credits for future use. It is of value to the manufacturers to hold a portion of their credits as a back stop against future uncertainty in production line testing or Selective Enforcement Audits. Credits that are not used, but kept in an account, represent a benefit to the environment.

EPA believes that a limit on credit life would in this case to some degree stifle the development and introduction of new technology. The stringency of the 1998 and later model year standards is not likely to allow for credits to be generated without the application of additional emissions controls. Manufacturers will likely expend significant resources to generate credits. Regulatory provisions which limit manufacturer flexibility in credit use have the effect of reducing credit value and thus also reduce the incentive to invest in the development and introduction of new technology. With limits on credit life, a manufacturer would plan carefully and would not generate credits that are not needed in the time frame before they would expire.

EPA recognizes that this is a departure from the current ABT program for heavy-duty engines but believes that it is warranted given the stringency of the standards being finalized for 2004 and later model years. Initially, the Agency adopted the banking and trading program with standards already established and with a lack of experience with credit programs. These factors lead the Agency to adopt conservative measures such as limited credit life to limit the program's scope. However, providing the manufacturers with the degree of freedom represented by unlimited credit life may aid them in meeting the 2004 and later model year standards. As discussed above, EPA does not believe that the provision has negative environmental consequences.

Another long-term consideration is the possibility that a large bank of credits could be accumulated for use to be used against a future standard. EPA expects that credits generated before 2004 will be used substantially to meet the new 2004 standard. Given the stringent level of the new standard, EPA does not expect significant generation of credits immediately after 2004. However, over several years significant credits could be generated. EPA believes that the generation of credits would be beneficial for the environment, as they would represent a significant step in emissions reduction beyond the stringent 2004 standards. Given that there may not be another new standard in place for a number of years after 2004, unlimited credit life could be essential in providing incentive for credit generation. Once credits are generated, it is likely that manufacturers will hold some credits for emergencies, which could result in a benefit for the environment. Unlimited credit life after 2004 would be a significant incentive in the ABT program for the pull ahead of technology in the post 2004 time frame, which can provide significant information regarding the viability and reliability of such technologies. Also, the generation of such credits after 2004 would be considered in any revision of the standard in the future.

For all of the reasons stated above, EPA also does not believe that a cut-point should be implemented for determining whether or not an engine is eligible for generating unlimited life credits. All of the credits earned prior to 2004 are likely to be very valuable to manufacturers in meeting the 2004 standards. Applying a credit life limit to a portion of the credits is unnecessary and could render those credits useless in meeting the 2004 standards, thus negatively impacting the feasibility of the standards. The concepts of a cut-point is discussed in detail in the following section, "Credit Discounting and Cut Points". In summary, EPA is adopting unlimited credit life for credits generated under the modified ABT program during the 1998 model year and thereafter.

With regard to the effects of ABT on state planning, EPA assumes that the source of uncertainty would be that planners will not know in advance when credits will be earned and when they will be used. The commenter did not provide details and State organizations did not provide similar comment to the Agency regarding the effect of ABT on planning. In response, the impact of the program on fleet make-up is not expected to be significant enough to cause modeling problems. Family-to-family and engine-to-engine variability within any given year is expected to be greater than the variability of the fleet from year to year. Also, the ABT program will essentially average out over time so as not have an overall impact on the environment (beyond the significant benefit of allowing the earlier introduction of a more stringent standard). This is especially true because the overall in-use fleet at any one time is made up of vehicles with engines certified over many years and to different emission levels. Annual reductions or offsetting increases relative to the standard will be dwarfed when compared to the magnitude of the overall emissions reductions from the standards. Figure 3, provides an illustration of these points. It should be noted also, that the scenario modeled for Figure 3 represents an aggressive use of the ABT program for credit generation and use. Actual use of the program is expected to be much more moderate. Therefore, state planning should provide the same level of certainty regardless of the effect of ABT.

d. Credit Discounting and Cut Points

Summary/Description of the Issue

EPA proposed not to discount credits earned under the modified ABT program for use in meeting the model year 2004 standards. The current program requires a one-time 20 percent discount on all credits banked for future use. Although the discount provides a benefit for the environment, EPA proposed to remove the discount because undiscounted credits would enhance the feasibility of the proposed standard for the 2004 model year by increasing the flexibility available to the manufacturer. EPA believed that the modification was justified by the technological challenge faced by manufacturers in meeting the new standard. The benefits of implementing the standard in 2004, as compared to a later model year, would far outweigh the small environmental benefit of the discount. EPA proposed that the opportunity to bank credits without a discount would expire at the end of model year 2006, at which point the 20 percent

discount would return. The Agency sought comment on what expiration date, if any, would be appropriate for the proposed program modification on credit discounting.

Comments

EMA commented that credit discounting should be eliminated permanently. EMA stated that with the existing 20 percent discount, there will not be enough incentive for manufacturers to invest the resources necessary to implement the technology needed to generate credits. Without undiscounted credits, there is little likelihood that lower emitting engines, new technologies, or other innovations will be commercialized in the marketplace.

EMA noted in their comments that engine manufacturers were willing to acquiesce to the imposition of a cut-point five percent below the standard because of EPA's interest in ensuring that credits are generated by engines that provide true emissions benefits, rather than by engines with emissions "marginally" less than the standard.[8] EMA viewed the cut-point as a trigger and engines would be required to be certified below the trigger level before credits could be earned. Once certified below the trigger, engines could earn credits from the level where the manufacturer chose to set its FEL all the way up to the standard. EMA also noted that they did not believe that such a trigger was necessary.

Health and environmental groups and others commented that the proposed enhancements of unlimited credit life (previously addressed) and no discounting should not be available for engine performing only marginally better than the applicable standard. The commenters recommended that only engines certified below 3.5 g/bhp-hr NOx be allowed the proposed enhancements. Commenters believe strongly that only engines reflecting an early introduction of technology should be allowed credits without a discount or credit life limit. Some commenters questioned the proposed program's potential for encouraging the pull ahead of cleaner technology, noting that the more likely result will be minor calibration changes.

Health and environmental groups also recommended that the program enhancements end with the 2004 model year and that credits be transferred back to the original program. Credits earned in 2004 and later model years should be subject to the current program provisions. They suggest that this scheme would aide manufacturers in the transition but not unduly delay the introduction of HDEs meeting the proposed standards.

EPA also received comments from the Interstate Clean Transportation Corridor (ICTC) project which included a proposal for an alternative approach for ABT. ICTC is interested in providing additional incentives for the introduction of substantially lower emitting engines as early as possible. ICTC suggested that undiscounted, unlimited credit life credits be allowed only for engines meeting the proposed standards early, in order to provide such an incentive.

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[8] It should be noted that this concept of a trigger is significantly different than the compliance margin proposed by EPA, which is discussed below.

Alternatively, ICTC recommended that bonus credits be given on a 1.5 to 1 ratio to manufacturers certifying a 2.0 g/bhp-hr (NOx only) engine family prior to the 2002 model year. Although not clear, it appears that ICTC recommends that the manufacturers then be required to continue to sell the 2.0 g/bhp-hr (NOx only) engines in 2002 and 2003 but not earn any credits for the early reductions in those years. The reductions in 2003 and 2004 would offset the bonus credits awarded such that the effect of the program would be to provide the desired incentive and would otherwise be, at worst, environmentally neutral.

Analysis/Response

EPA's primary goal in proposing the changes to the ABT program was to enhance the feasibility of the new standards, a central aspect of which is the pull-ahead of technology which is beneficial for providing information that can be used to help ensure the reliability and durability of such technology for a manufacturer's entire heavy-duty product line, and that can be used in connection with other regulatory programs. EPA recognizes the merit in using a cut point to encourage the use of new technologies to earn credits. Without a cut point, credits could be earned solely through smaller incremental changes to the engine such as calibration changes. While EPA believes these reductions are real, they represent minor engine changes rather than a step forward in technology. EPA agrees that an appropriate NOx only cut point for the purpose of encouraging new technology would be 3.5 g/bhp-hr. EPA believes that this is a level that would ensure the use of new emissions control technologies.

EPA, however, also believes that even if credits are earned above 3.5 g/bhp-hr NOx they still represent an incremental emission reduction relative to what is required by the 4.0 g/bhp-hr standard in effect for model years 1998 through 2003. The credits may be critical to manufacturers' efforts for meeting the 2004 standards and should be allowed to be generated under the modified ABT program. EPA believes discounting credits for engines above the 3.5 g/bhp-hr cut point offers an appropriate way to provide an additional incentive to certify to below the cut point, while still allowing generation above the cut-point.

EPA believes that a discount of 10 percent would balance the need to provide an incentive to introduce new technology and also provide for additional flexibility to meet the proposed standards in model year 2004. The current banking and trading program was established with standards already in place. It contained a 20 percent discount to ensure a benefit to the environment from the program and to address possible windfall credit issues. However, with the standards being implemented in 2004, the ABT program has matured and has become an integral part of the enabling the 2004 standards to be feasible. Therefore, its benefit to the environment is linked to the benefit provided by the new standards.

Each mobile source credits program is designed specifically for the source being controlled and may or may not contain a discount. For example, the National Low Emission Vehicle Program contains a credits program with a 10 percent discount designed to address windfall

credits issues.[9] EPA's proposal for Open Market Trading program, which is being turned into guidance to states, also contained a ten percent discount.[10] Other engine regulatory programs, such as the nonroad above 50 horsepower Phase I diesel engine program and the marine engine program, do not contain discounts because the ABT programs were established during the standards setting process and were linked to the feasibility of the standards. [11]

Since EPA, as discussed above, does not believe that there is any automatic environmental disbenefit associated with the ABT concept as it applies in this instance, a discount is not needed as a means to protect the environment. A discount can, however, be useful as a means of encouraging the pull-ahead of significantly cleaner engines/technology. EPA believes that the discount of 10 percent for engine generating credits under the modified ABT program at FELs above 3.5 g/bhp-hr serves this purpose in this context thus promoting the ability of the manufacturers to meet the standards.

In response to ICTC suggestions, EPA is concerned that implementing either of ICTC recommendations would severely restrict the ability of the manufacturers to earn credits. EPA believes that currently manufacturers are not in a position to produce diesel-fueled engines able to meet a NOx level of 2.0 g/bhp-hr in a manner that would be marketable or cost effective. Several years of development of 2.0 g/bhp-hr engines are expected before the engines would be marketable on a widespread basis. Although EPA appreciates the benefits of and shares an interest in the early introduction of 2.0 g/bhp-hr engines, EPA believes that the ICTC recommendations are too aggressive and would jeopardize the feasibility of the 2004 standard by restricting credit generation. EPA believes that the 3.5 g/bhp-hr cut point described above is a more appropriate means for encouraging the pull-ahead of technology.

With regard to reverting back to the current program's 20 percent discount for banked credits (credit life has been addressed above) in 2004, EPA believes that valid points have been made on both sides of the issue. Due to the stringency of the standard, manufacturers generating credits in 2004 and thereafter will do so only through significant extra effort. Discounting diminishes the manufacturers incentive to pull ahead technology in the post 2004 time frame. Conversely, EPA also recognizes that the need for earning credits in this time frame is diminished compared to before the 2004 model year because there are no new, more stringent, post 2004 standards in place. Also, a discount does provide an additional benefit to the environment in exchange for the flexibility gained by the manufacturer.

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[9] 62 FR 31192 (June 6, 1997).

[10] 60 FR 39668 (August 3, 1995) and 60 FR 44290 (August 25, 1995).

[11] The nonroad Phase I rule was published June 17, 1994 (59 FR 31306) and the regulations are contained in 40 CFR Part 89, Subpart C. The marine rule was published Friday, October 4, 1996 (61 FR 52088).

If a discount is to be established for 2004 and later years, extending beyond the time needed for the transition to the 2004 standard, it should be based on creating an incentive for the introduction of even cleaner technology. Such a goal is consistent with the concepts supporting ABT and the research goals of the SOP.[12] Since credits under the 2004 ABT program will be based on NMHC+NOx, the trigger should be based on NMHC+NOx. And, while at this time there is little data to ascertain what emission level will distinguish truly cleaner technology in the 2004 and later time frame, EPA expects that some level less than 2.0 g/bhp-hr NMHC+NOx is likely to reflect such a technology shift. To be consistent with the 1998 trigger, EPA believes a 0.5 g/bhp-hr delta below the standard (i.e. 1.9 g/bhp-hr NMHC+NOx) is appropriate. Beginning in 2004, engine families seeking to generate credits for banking must be certified to 1.9 g/bhp-hr NMHC+NOx to avoid a discount. Those certified above 1.9 g/bhp-hr but below 2.4 g/bhp-hr would be discounted 10 percent as was the case for pre-2004 credits under the modified ABT program.

However, engines certified prior to 2004 with FELs below the 2004 standard should be allowed to continue to earn undiscounted credits for a limited period after 2004 if the families are carried over to 2004 and later model years. This provides additional incentive to pull-ahead engines meeting the new standards before 2004. Certifying an engine below the 2004 standards prior to 2004 represents a very significant pull-ahead of technology. To allow the engine to generate undiscounted credits in 2003 but then begin applying a discount in 2004 (assuming the engine is at a level greater than 1.9 g/bhp-hr NMHC+NOx) could substantially truncate the incentive to introduce the engine family prior to 2004. EPA believes the years immediately following the implementation of the new standard offer the most challenges to manufacturers in terms of technology and cost and thus that engines certified to less than 2.4 g/bhp-hr NMHC+NOx before 2004 should be permitted to generate undiscounted credits for three model years (2004-2006). The three year period allows manufacturers the full benefit of introducing a new engine family with an FEL below the 2004 standards prior to 2004.

In summary, EPA is adopting a NOx-only cut point of 3.5 g/bhp-hr for 1998-2003 model years. Banked credits earned by engines with certification levels above the cut point would be discounted by 10 percent. For 2004 and later model years, EPA is establishing a NOx plus NMHC cut point of 1.9 g/bhp-hr. Banked credits from engine certified to a level above the cut-point shall be discounted by 10 percent, unless the engine family has been carried over from the 2003 model year. For such carry-over engines, credits shall not be discounted until model year 2007. Engines with certification levels at or below the cut-points shall earn undiscounted credits. The cut-points and discounting methodology apply to both NOx and PM credits (see discussion on particulate matter below).

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[12] In summary, the SOP's research goals call a joint industry/government research program to develop an engine with NOx levels of 1.0 g/bhp-hr and PM levels of 0.05 g/bhp-hr while maintaining performance, durability, safety, and efficiency.

e. Particulate Matter

Summary/Description of the Issue

EPA proposed to apply the modified ABT program to credits generated for particulate matter (PM) reductions as well as NOx reductions. While the PM standard as proposed would not change in 2004, the credits generated in the modified ABT program would be available only for meeting the PM standard in 2004 and later model years.

Comments

Health and environmental groups opposed including PM in the modified ABT program, stating that since EPA proposed no change to the PM standard in 2004, there is no reason that manufacturers should be permitted to qualify for undiscounted, unlimited life PM credits to be used toward the 2004 standards. The commenters argue that liberalized ABT for PM will allow manufacturers to reduce NOx at the expense of PM, yet that strategy will not help manufacturers transition to the final 2004 emission limits which seek NOx reduction without any change in PM levels. The comments also note that "permitting higher PM is inconsistent with EPA's goals for liberalized ABT, which is designed to help manufacturers make progress toward the 2004 standards".

Engine manufacturer comments on ABT did not differentiate between NOx and PM emissions. EMA, for example, supported unlimited credit life and undiscounted credits for all credits. Manufacturers did not make separate arguments for NOx and PM. Their comments are addressed elsewhere in this document.

Analysis/Response

EPA believes that it is appropriate to include PM in the modified ABT program. For most in-cylinder control technologies, there is a strong inverse relationship between NOx and PM which makes it difficult to control both pollutants at the same time. The control technologies expected to be used to reduce NOx to model year 2004 levels are likely to increase PM. These PM increases must be addressed by the manufacturer which means that one of the effects of the new NOx standard will be to require manufacturers to implement technology which achieves both NOx and PM reductions. The technology is available to accomplish PM reductions, but at this point it is not certain how effective or costly it will be in each family. Therefore, EPA believes that applying the ABT modifications to PM as well as NOx allows the manufacturer more flexibility in addressing the technology issues involved with reducing NOx emissions to the NOx plus NMHC standard being finalized in this rule, while maintaining PM emissions at 0.10 g/bhp-hr. EPA does not agree with commenters' concern that liberalized ABT for PM will encourage manufacturers to pursue NOx reduction technologies that tend to increase PM. EPA expects manufacturers to pursue technologies that initially reduce NOx and tend to increase PM, regardless of ABT for PM because they are the only type of technology on the horizon that are

expected to make the 2.4 g/bhp-hr standard feasible. The modified ABT for PM will allow manufacturers to then transition quickly to the 2004 standards for NMHC+NOx and PM. Modified ABT for PM offers manufacturers necessary flexibility to help make the model year 2004 standards as a whole, PM as well as NOx plus NMHC, feasible.

As discussed in previous sections, EPA does not believe the ABT program results in an increase in overall emissions levels relative to the standard. EPA believes that the supporting rationales above apply to PM as well as NOx. Currently, the 0.10 g/bhp-hr standard is a stringent technology forcing standard. Certifying engines below the standard to earn credits will require the use of additional emissions controls incremental to those needed to meet 0.10 g/bhp-hr and therefore there are no windfall PM credits available for manufacturers. In addition, the ABT could provide some near term PM reductions beyond those required by the standard through early banking of credits.

Therefore, EPA is finalizing the modifications to the ABT program to apply to PM in the same manner as they apply to NOx emissions, as described in section c., above. Engines meeting the NOx requirements to earn undiscounted credits would be eligible for undiscounted PM credits. Otherwise, banked PM credits would be discounted by 10 percent. The program applies to both pre-2004 engines and 2004 and later engines.

f. Compliance Margins/In-use Compliance

Summary of Issue

EPA proposed to require a minimum compliance margin at certification (the difference between the family emissions limit set by the manufacturer and the engine family certification level) of 5 percent in order to generate credits under the modified ABT program. EPA proposed the requirement due to concerns that manufacturers would otherwise have an incentive to shave or eliminate their margins to earn additional credits. The margins are needed to address engine emissions variability and the smaller the margin the more risk there is of engines failing to meet the standard at SEA or in-use. To provide additional flexibility, it was also proposed that the manufacturers be permitted to use a margin of less than 5 percent if they have test data which demonstrates that a lower margin is sufficient.

Comments

Several commenters found margin shaving to be a serious issue that severely undermines the credibility of the current ABT program for highway HDEs, as well as any modification of that program. Health and environmental groups noted that EPA correctly identified a key problem and commented that allowing manufacturers to generate credits by margin shaving provides manufacturers with windfall credits. The American Lung Association provided a detailed analysis of data demonstrating manufacturer practices of reducing compliance margins during a model year. According to ALA, the data showed that more than one manufacturer reduced

margins after the threat of selective enforcement audits (SEA) was reduced or had passed. The commenter noted that without the threat of a viable recall program, the ABT program provides an opportunity for manufacturers to avoid introducing advanced emissions controls.

The Northeast States for Coordinated Air Use Management (NESCAUM) also commented that without a recall threat, there is little incentive to set FELs at appropriate levels even in the current ABT program. Their primary concern was that manufacturers have little incentive to set FELs at appropriate levels, considering in-use deterioration, because there is no credible enforcement programs to identify engines which are not achieving FELs in-use. NESCAUM recommended that the quick and proper way to resolve the issue is with a firm commitment to routinely test and enforce in-use emissions standards.

Several commenters recommended compliance margins of greater than 5 percent. These commenters preferred compliance margins in the 10 to 1[illegible]ercent range. They noted that a compliance margin of 5 percent may not ensure that the [illegible]quality benefits being sought are achieved and that a higher margin would more reliably ensure emission reductions.

Engine manufacturers also submitted comments regarding the appropriateness of requiring a compliance margin. EMA commented that EPA must eliminate the compliance margin requirement. EMA noted manufacturers have historically established compliance margins to protect against audit failures. EMA attributes the shrinking compliance margins not to shaving but to the improved systems adopted by manufacturers to support the accuracy of their compliance capability. The compliance margin is represented not only in the size of the margin but also in the quality assurance and statistical accuracy that ensures engines will comply with the standard. EMA also commented that EPA failed to recognize that manufacturers use their production line data to better determine the size of the compliance margin needed and also that manufacturers may make running changes to an engine family in order to improve the margin.

EMA believes that by requiring a larger margin than an engine manufacturer would otherwise set on their own, EPA is essentially discounting credits. The discount can be very substantial in cases where an engine family FEL is relatively close to the standard. For example, an engine certified to 3.6 g/bhp-hr and subject to this requirement could only have an FEL of 3.8 g/bhp-hr, which represents a 50 percent discount on the amount of credits that can be earned. EMA commented that removing one discount and replacing it with another discount is not acceptable given that the availability of credits is critical to manufacturers' assessment of the feasibility of the proposed standards in 2004.

Cummins Engine Company commented that Cummins always sets appropriate margins and that the threat of compliance audits provides sufficient safeguards against margin shaving. Cummins provided EPA with an analysis of the way in which improvements to production and measurement variability can bring the population mean closer to the standard. Cummins also noted that it is possible for the certification engine to turn out to be several standard deviations

from the population mean. Based on such data, an FEL not only equal to but below the certification level could be justified, and should be allowed by EPA.

Detroit Diesel Corporation also commented that any reduction in compliance margins is due to improvements in quality control. Detroit Diesel asserted that the threat of SEA failure is a tremendous deterrent to margin shaving. Detroit Diesel stated that they have never engaged in margin shaving and believes that manufacturers are not engaging in margin shaving even on an isolated basis. Detroit Diesel recommends that EPA address its concerns by focusing SEA audits on engine families they feel have inadequate margins. Other manufacturers provided similar comments.

Analysis/Response

EPA remains very concerned about the potential for margin shaving. Engine manufacturer statements that an SEA audit is a substantial deterrent to margin shaving do not address the critical issue of FEL changes after EPA has conducted much of its SEA testing for the model year. Clearly, there is at least the appearance of gaming in this practice. In a few instances, FELs are being set initially with larger compliance margins and then with a decreased compliance margin later in the model year when the threat of SEA is diminished. The comments submitted by ALA provided data as examples of this practice. Available data demonstrates that in a few cases compliance margins were reduced over the course of the model year with no apparent change to the engines themselves. If these changes are the result of reduced SEA audit threat rather than improved manufacturing methods or manufacturer audit data, the changes could result in unearned credits being generated. The changes noted in the examples provided by ALA may have been based on audit data, but that is not clear.

While the Agency concern regarding this issue continues, EPA now recognizes that requiring a compliance margin is not the best way to address the issue. Quality assurance and improved variability control are valid ways to reduce compliance margins and, according to engine manufacturers, explain all instances where compliance margins are reduced. Although the engine manufacturers commented that a compliance margin requirement acts as a discount, EPA does not consider this so. If EPA had finalized the compliance margin as proposed, manufacturers who expended resources to reduce variability to the point where they would otherwise have a smaller margin than 5 percent would have been able to submit data to certify to a smaller margin according to the proposal.

On balance, the Agency believes that the issue of margin shaving is best addressed through Agency compliance activities and is therefore not finalizing a compliance margin requirement. As recommended by one commenter, EPA believes that, by far, the most appropriate means of addressing this issue is through a viable in-use testing program. Additionally, taking further steps to target suspect engine families in the SEA program is also a valid recommendation. Furthermore, additional efforts on the part of EPA to review data supporting running changes to FELs would also be useful. All of these items and other approaches shall be considered by EPA

as possible ways to address Agency concerns. Also, addressing the margin shaving issue through EPA's compliance authority can be applied to the current ABT program as well as the modified program. After considering all of the comments, EPA does not believe finalizing a requirement for a specific compliance margin is appropriate at this time. The reader is directed to Section IV.C. of the preamble for EPA's summary and response to comments regarding the general need for in-use compliance programs and revised SEA procedures.

g. Buy high/sell low

Summary/Description of the Issue

EPA proposed to allow both credit generation and credit use on a sales-weighted average horsepower basis in lieu of the "buy high/sell low" provisions of the current ABT program, as found in 40 CFR §86.094-15 (c)(2). Buy high/sell low provisions require manufacturers to calculate credits generated based on the lowest horsepower rating within an engine family and credits used based on the highest horsepower rating within an engine family. This results in a penalty to the manufacturer because calculations using lower horsepowers result in fewer credits than with higher horsepowers. Based on EPA's experience of running the ABT program, the Agency believed that there is less need for the provision and found that it could be removed without environmental loss. As with the other proposed modifications to the ABT program, the proposed removal of the buy high/sell low provision was meant to enhance the feasibility of the new standards.

Comments

EMA requested clarification on EPA's intent with regard to the buy-high, sell-low provision, which EMA regards as another form of a discount. EMA believed it to be a discount because credit generation and use was not equivalent to the sales weighted emissions for the engine family. EMA believed it was EPA's intent to remove the discount permanently but the proposed regulations did not make it clear. EMA also believes that the provision should be removed from the current program upon publication of the final rule.

Analysis/Response

EPA proposed to remove the buy-high/sell-low provision and replace it with a methodology of calculating credits based on the sales-weighted average horsepower of an engine family. It was and continues to be EPA's intent to remove the discount permanently, but for modified ABT only. The provision is revised for credits generated and used to meet the 2004 and later model year standards. EPA did not propose and is not finalizing any change in the current ABT program for credits generated and used to meet the model year 1998 4.0 g/bhp-hr NOx standard.

h. Cross-cycle, Cross-subclass, Cross-category Trading

Summary/Description of the Issue

EPA invited comments on the appropriateness of, at some later date, proposing to allow credits trading between cycles (i.e., diesel-cycle and Otto-cycle), between subclasses (e.g., light, medium, heavy heavy-duty), and between categories (e.g., highway and nonroad engines). EPA did not propose to consider any such changes for this rulemaking. Cross-fuel trading within a cycle is currently permitted by EPA and was not part of the NPRM.

Comments

EPA received a variety of comments regarding cross trading of credits. Some engine manufacturers support allowing such trading. GM suggested trying a 3 year trial program so that the Agency could better examine the benefits/disbenefits to manufacturers. GM noted that the program would allow greater flexibility for manufacturers in managing their product lines. Detroit Diesel Corporation (DDC) also commented in support of cross trading programs. DDC argued that these programs do not introduce competitive disadvantages for manufacturers with limited product lines. Instead, the programs aid these small volume manufacturers by allowing them access to credits from other product lines of companies that they do not compete with directly. Thus, the smaller manufacturers would also benefit from improved flexibility.

Mack Trucks presented concerns that opening the program to cross trading would put Mack at an enormous competitive disadvantage because their product line is limited to a single fuel and subclass. Mack presented numerous arguments for why they believe that such programs would threaten their existence as a truck company. To summarize their rationale, Mack noted that windfall credits would be available in some markets. Mack used as an example of windfall credits, gasoline engine credits, which would be easier to earn due to the inherent nature of gasoline technology. Mack also noted that for some engine categories, regulations are in their infancy and additional emissions reductions for credits may cost much less than for the latest incremental change to highway heavy-duty engine standards. Manufacturers with access to those inexpensive credits could use them to avoid making the changes to their highway diesel engines that the standards would otherwise require. Mack commented that they see no incentive for competitors to sell credits to one another.

NRDC commented that cross-subclass, cross-category and cross-source trading are inappropriate and unnecessary. NRDC did not believe that the necessary preconditions for effectiveness, enforceability, and efficiency were yet established by the Agency and therefore that such trading schemes would seriously hinder the development of better technologies and the creation of a clean and effective vehicle fleet. NRDC further commented that EPA had provided sufficient evaluation of the economic and environmental impact of such approaches.

Some commenters expressed interest in ensuring that ABT restrictions did not impede in any way the flow of credits between alternative-fuel engine and diesel-fueled engines. Commenters

believe alternative fuels are a valuable strategy for complying with the proposed rules. Further, comments suggested that transfer from spark-ignited alternative fuel engines to diesel cycle engine should be allowed because they emphasize the role that alternative fuels can and should play in achieving emission reductions. Further, EPA should initiate a rulemaking to permit the full range of alternative fuels, which currently exclude ethanol, to be certified for use in HDEs and hence generate credits.

Analysis/Response

EPA remains interested in the possibility of broadening credit exchanges due to the potential it represents for increased cost effectiveness of mobile source regulations. However, EPA understands the concerns presented by Mack and does not believe that cross-class or cross-cycle exchange can be proposed until the potential for marketplace competitive disadvantages has been adequately addressed. Clearly, companies would have unequal access to credits due to variations in product lines. While it is true that there may be expanded opportunity for trading among manufacturers, there is no assurance that a manufacturer with a narrow product line would have access to enough credits and at a price that would allow them to remain competitive. Also, EPA understands the concerns raised by NRDC and agrees that more analysis would be needed on the full scope of the ramifications of such programs before they could be further pursued. Therefore, the Agency is not taking any action to broaden the ABT program along the lines suggested in the NPRM.

In response to concerns regarding alternatively fueled engines, EPA believes that manufacturers currently have sufficient flexibility to allow them to take full advantage of credits earned from selling alternatively fueled engines. Cross-fuel credit exchanges are permitted among engine families of the same cycle and subclass under current regulations. Manufacturers are provided with significant leeway when they categorize engines into subclasses which allows them to consider the fuel-usage of the engine as well as the cycle of the engine. EPA would undertake a rulemaking to establish ethanol standards and test procedures if the Agency believed them to be needed. However, currently EPA does not know of any manufacturer planning to certify an ethanol-fueled heavy-duty engine and therefore believes its resources are better utilized on higher priorities.

i. Urban Bus Issues

Summary/Description of the Issue

EPA proposed the same modified ABT provisions for urban bus engine families as it did for the rest of the highway engines. EPA did not propose changes to other aspects of the current ABT program that relate specifically to urban buses. In the current program, urban buses may trade NOx credits with other engine families in their primary intended service class (LHDD, MHDD, or HDDD), but may only trade PM credits with other urban buses.

Comments

Detroit Diesel Corporation (DDC) provided comments recommending that the current ABT program be changed to allow both NOx and PM credits to be traded between urban bus engine families and other engines in its primary intended service class. This practice is currently only allowed for NOx emissions credits where the standards for the two engine groups are the same. DDC argues that though the two engine groups have different PM standards, the air quality benefit remains the same. DDC also noted that unless allowed to exchange credits with other engine families, PM averaging, banking, and trading is not a meaningful option for urban buses due to the very small number of engine families and their low sales volumes. DDC commented that the absence of a meaningful program will have a negative impact on the technical feasibility of the 2004 standards.

DDC also recommended that urban bus PM credits be calculated against the 0.07 g/bhp.-hr in-use standard rather than the certification standard of 0.05 g/bhp-hr. Currently the regulations do not make it clear which standard should be used for credits calculations, the certification standard or in-use standard. DDC believes using the in-use standard is most appropriate since the credits are meant to reflect reductions or excesses in in-use emissions.

Analysis/Response

EPA believes that allowing urban bus engine families to use PM credits from non urban bus families to meet the urban bus PM standard is contrary to the intent of the Clean Air Act (CAA). The CAA set forth a more stringent, technology-forcing PM standard for urban buses (42 U.S.C. 7554). Allowing use of non urban bus credits could result in urban bus families never having to meet the more stringent standard. Therefore, EPA does not believe that allowing such trading of PM credits is appropriate. In addition, the feasibility of the urban bus standards is discussed later in this document.

The preamble to the final rule establishing the urban bus standards made clear that the credits should be calculated against the certification standard (58 FR 15790, March 24,1993). The final rule also stated that during in-use testing 0.02 g/bhp-hr would be added to the FEL to establish the level to which manufacturers would be held accountable. EPA believes that credits must be calculated against the certification standard otherwise the certification standard is meaningless. For example, an engine with an FEL of 0.06 g/bhp-hr would be above the certification standard. Yet, it would be earning credits if calculated against the in-use standard. There would no longer be a requirement to meet the certification standard. The purpose of allowing a somewhat higher in-use standard is to address in-use deterioration uncertainties associated with technology used to meet the more stringent urban bus PM standard. Allowing manufacturers to earn credits against the in-use standard defeats its purpose.

j. Effect of Useful Life on Credit Generation

Summary/Description of the Issue

Credit generation and credit use calculations under the ABT program involve the useful life value. The current useful life for heavy-heavy duty diesel engines (HHDDEs) is 290,000 miles and was proposed to increase to 435,000 miles in 2004. This change in useful life creates a potential complication for the modified ABT program during years 1998-2003 since credits needed by a 2004 HHDDEs would be 50 percent more than those generated by pre 2004 engine (assuming the same emissions increment). The average period to retirement or rebuild for HHDDEs is at least 435,000 miles now, so these engines are already operating and emitting over this longer period. Based on this fact, and the expected NOx and PM deterioration characteristics of HHDDEs, EPA proposed several options to address this issue.

1. Require that manufacturers who want to generate credits in model years 1998-2003 under the modified ABT program accept a useful life of 435,000 miles for both credit calculation and in-use liability. Manufacturers may petition for an alternative useful life period under the existing ABT regulations.
2. Alternatively, since NOx deterioration is negligible in current technology engines, permit manufacturers to extend the NOx deterioration factor used in certifying the engine family to the 435,000 mile life for the purpose of credit calculation only. The extension would not impose additional certification durability requirements or extended in-use liability.
3. Since PM deterioration has much less confidence in the reliability of projections from the current 290,000 mile useful life, allow manufacturers to generate credits for the longer period only if the manufacturer accepts in-use liability for the longer period.

EPA sought comment on the alternative approaches to NOx credit generation.

Comments

Engine manufacturers commented that both NOx and PM credits should be allowed to be generated from 1998 through 2003 using 435,000 miles without incurring liability beyond 290,000 miles. NGVC stated that PM deterioration is inherently low for gaseous fueled engines, so PM credit generation should be automatic to the full useful life of 435,000 miles without incurring additional in-use liability.

Health and environmental groups strongly objected to any credit allowance for longer lives without the assurance of in-use benefits. As a general principle, in order to receive credit for emission reductions over the useful life of an engine, manufacturers must also be liable for those reductions.

Analysis/Response

The manufacturers' desire for NOx and PM credits is understandable given the current useful life periods and standards being finalized today. However, it is reasonable that emission credits must be tied to certification or in-use liability. If the manufacturer has a strong technical argument that NOx or PM deterioration is inherently low over the longer useful life then the manufacturer should accept responsibility for that argument. Relying solely on option one above requires no action since it is now available in the regulations and implementing no other options forces this approach for the manufacturer who wants to maximize credits. EPA believes that it is only appropriate to allow NOx and PM credits to be generated for a longer useful life period if the manufacturer accepts liability for the longer useful life.

k. Calculating Credits Based on NMOG Rather than NMHC for Alternatively Fueled Vehicles

Summary/Description of the Issue

EPA proposed a modified ABT program for 1998-2003 for compliance with the 2004 NMHC + NOx standard. Under this proposal, credits were limited to NOx only due to the very low HC levels of most heavy-duty engines (HDEs) relative to the level of the standard. Beginning in 2004, NMHC + NOx credits were proposed to be generated to meet the standard. EPA did not propose any special provisions for alternatively fueled vehicles.

Comments

NGVC requested that certifiers of alternative fuel engines be permitted to speciate NMOG and substitute reactivity-adjusted NMOG for measured NMHC for determining compliance and ABT credits. It was suggested that the ethane portion of the NMHC is quite large in the exhaust from alternative fueled engines as compared to the exhaust from petroleum-based engines. It was further asserted that ethane is non-reactive in the formation of ozone.

Analysis/Response

The request from the NGVC is based on the assertion that the non-methane portion of their hydrocarbons emissions is less photochemically reactive than the non-methane portion of diesel or gasoline exhaust.

While there is not very much data available, it is generally true that the emissions of alternative fueled engines have a higher proportion of less reactive constituents than do their petroleum-fueled counterparts. However, while there may be some differences based on the fuel used for any given combustion cycle, NMHC emissions of essentially all HDEs are less than 0.5 g/BHP-hr, making the potential difference caused by a reactivity adjustment less significant.

The standard was proposed as NMHC + NOx, not NMOG + NOx. A change of the form of the standard at this time would require a reproposal without any accompanying environmental benefit.

Maintaining the form of the standard as NMHC + NOx and allowing for correction for ethane at the manufacturer's option is a second alternative. However, this was not proposed nor was a test procedure for measuring ethane. Furthermore, neither the California ARB LEV program nor the CAA Clean Fuel Fleet program treats ethane as non-reactive as compared to methane. Thus, some form of a correction for ethane reactivity might be necessary. The reactivity adjustment factor for methane is 0.0148, but 0.25 for ethane, a factor of 17 difference.

Since the pre-2004 ABT credits were proposed to be based solely on NOx, the value of this potential change would not be realized until 2004. Given that a reproposal would be needed to either change the form of the standard and address related issues or to allow an ethane correction, EPA will defer any action until the need for such a change and the benefit thereof can be better established.

I. Marketable Credit Levels

Summary of the Issue

The proposal requested comment regarding whether HDV purchasers could be allowed to own credits generated under the HDE ABT program for use in other credit programs but did not provide specific regulatory language on how this should be implemented. EPA asked for comment what revisions or clarifications would be needed to the ABT program to allow for this flexibility while providing assurance that the credits would not be used by both the engine manufacturer and HDV user (double counting).

Comments

Commenters generally supported this proposal. NGVC suggested that manufacturers be allowed to certify to multiple FELs within a given engine family as a means to specify credit apportionment in various situations. This was supported as a means to avoid double-counting of credits and to minimize administrative paper work and costs. Manufacturers requested clarification that the credits could be traded between all 50 states.

Detroit Diesel Corporation (DDC) suggested that the Agency should follow three simple principles in establishing a credits exchange policy: (1) the engine manufacturer owns the credits in the first instance, (2) the manufacturer is allowed to transfer ownership to another party, which would effectively "consume" the credits for purposes of ABT and, (3) the manufacturer's liability for the in-use legitimacy of the credits would remain unchanged. Engine usage or other variables which would impact the value of the credits in any other program would be the responsibility of the party that obtained the credits.

Analysis/Response

The comments of NGVC and DDC have merit. The idea of having different pre-identified emission levels for credit apportionment allows credits to be used by either the manufacturer or the engine purchaser without a loss to the environment. These emission levels and projected sales could be pre-identified in the certification application (and changed as needed during the year). Manufacturers would project and report the number sold at each level for the purposes of credit apportionment. For engine sales reported at the FEL, the manufacturer would get all the credits generated between the FEL and the standard. For sales reported at the level of the standard by the manufacturer, the engine purchaser would get all the credits in-between the FEL and the standard. Of course, for purposes of certification and enforcement, the manufacturer would always be held accountable to the FEL. Only manufacturer owned credits could be used for purposes of certification ABT programs.

EPA is including in the ABT provisions of the final rule an allowance for manufacturers to specify marketable credit levels (MCLs), and includes appropriate regulatory language to specify the details of this program. Because the standard applies equally to all 50 states, consistent with EPA's intent in the NPRM, the program will be applied to all states (nationwide).

The transfer of credits under this provision does not imply the validity of use of these credits in other emission programs. Credits purchased under this provision for use in other programs must meet the use requirements of the emissions programs for which they are purchased. For example, local emissions programs will likely have limits on the geographic scope of emissions reductions that are used for trading out of other emissions programs (i.e. the credits may need to be tied to emissions reductions in the same nonattainment area or the same urban airshed modeling domain). Also, credits purchased under this provision may need to be converted to units of emissions (e.g. tons) used under the emissions programs for which the credits are purchased.

EPA believes that this provision is consistent with the statutory goal of promoting the achievement of the greatest degree of emission reduction for heavy duty engines, taking into account costs, energy, and safety. The impact of the ABT program, including this provision, on the standards has been evaluated in connection with the setting of the appropriate standards. This provision will not result in any increase in generated emission credits, except as a result of actual reductions in emissions from certified engines. The incentives created by the programs could in fact promote the development and use of improved emission control technologies.

m. Labeling

EPA did not propose any new labeling requirements for this rulemaking. EPA received comment that the Agency should require all engines to be labeled with their emissions level in order for equipment builders, end users, and air quality officials to easily identify the emissions performance of the engines. In response, EPA regulations currently require that engines certified

to an FEL, rather than the standard, be labeled with the FEL.[13] Otherwise, the label must state that the engine is certified to the applicable standards.

n. Trading Between ABT Programs

EPA received comment that manufacturers should not be allowed to use credits generated in the current program prior to 1998 for one pollutant while generating credits on the same engine for another pollutant in the modified program. This concern was due to the relationship between NOx and PM which allows one pollutant to be decreased at the expense of the other. In response, EPA proposed two separate programs and engine families would not be allowed to participate in both simultaneously. The modified program only allowed credit generation prior to 2004 and not credit use. A credit-using engine would have to participate in the current ABT program only. Credits could be transferred to the original program but would be subject to the discount and life limit contained in the current program. The program being finalized continues to keep the programs separate.

3. Technology

a. Feasibility of Standard for Diesel Engines

Summary/Description of the Issue

EPA proposed standards that it believed would establish the most stringent emission levels in 2004 for heavy-duty on-highway diesel engines achievable through the application of technology, giving appropriate consideration to cost, energy, and safety factors associated with such technology [see 42 U.S.C. 7521(a)(3)(A)]. EPA described and analyzed potential technologies in the NPRM and accompanying RIA.

Comments

Manufacturers commented that the proposal represents a reasonable projection of the most stringent emission reductions possible in the 2004 time frame, stating there is still uncertainty and that substantial research and development will be necessary. They provided input on the likely technologies to be used to meet the standard which include upgrades to the combustion chamber, cooled and uncooled EGR, more sophisticated fuel and air delivery systems, and possibly oxidation catalysts. One manufacturer has already developed a prototype diesel engine, using the above listed technology, that is nearly capable of meeting the proposed standards and is fully capable of meeting the proposed standards when operated on a two percent oxygenated fuel. Another technology that was mentioned by one commenter was a cerium based diesel fuel additive/particulate filter system which the commenter stated would be developed by 2004 and would have better results than EGR.

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[13] 40 CFR 86.094-35(a)(3)(iii)(L) and (M).

Two commenters expressed concern with the feasibility assessment in the proposal. A trucking association commented that future technology such as EGR would likely cause a significant fuel economy penalty. On the other hand, health and environmental groups commented that the proposal ignores the potential of PM control technologies, such as particulate traps, to mature given the long lead time. Some stated that the application of the urban bus particulate standard to all highway heavy-duty engines would be feasible given the capabilities of existing and expected control technologies, but did not identify any specific technologies. NESCAUM stated that a tighter 0.05 g/bhp-hr PM standard for all highway heavy-duty engines, while technology-forcing, is a reasonable design goal. They commented that the NPRM seemed to ignore the potential for aftertreatment (oxidation catalysts, lean-NOx catalysts, and particulate trap/filters) to lower PM without adversely affecting NOx.

Analysis/Response

The comments from manufacturers basically agreed with the sort of technology packages that EPA assessed in its draft Regulatory Impact Analysis. The prototype engine that is already close to the emission target using these technologies offers additional support that the standards are technologically achievable. EPA does not expect a fuel economy penalty associated with the new technology packages since, with an eight year lead time, future technologies should be designed to work together to decrease emissions without increasing fuel consumption. Full electronic control of fuel and air intake systems should allow for combustion optimization sufficient to at least maintain fuel economy. Issues regarding the ability to meet more stringent standards and the appropriateness of such standards are addressed in Section 1 of this document and in the Regulatory Impact Analysis. Note that under the 1999 review, issues such as fuel economy, technological feasibility, and environmental need will be revisited.

b. Diesel Fuel Requirements

Summary/Description of the Issue

In the NPRM, EPA explained its basis for believing that the proposed standards are challenging but feasible for diesel cycle heavy-duty engines. EPA also described its on-going effort to evaluate engine/fuel quality interactions and developments, in coordination with the involved industries. The agency indicated that should its effort result in the conclusion that the feasibility of the 2004 standards may depend on modifications to diesel fuel, any potential for diesel fuel changes would be considered within the context of the 1999 review.

Comments

Some engine manufacturers commented that they may need further improvements in fuel quality to meet the proposed standard quickly and cost effectively and that they will work with EPA, ARB and the fuel industry to determine the need. Aftertreatment manufacturers support fuel quality improvements and one commenter cited a case in Europe that showed positive

effects of ultra-low sulfur fuel on diesel aftertreatment. Health and environmental groups stated that fuel changes are appropriate if they are needed to meet the proposed standards but industry had not demonstrated that diesel fuel improvements are likely to be needed. They urged that need for fuel quality improvements should not be used as a reason to relax the standard. NESCAUM also pointed out that fuel changes would provide benefits across the entire fleet of heavy-duty engines, not just from new engines. NESCAUM recommended that EPA actively pursue diesel reformulation even if it is not needed to achieve the proposed standards. Others suggested cleaner diesel fuel might allow the implementation of tighter emission limits and urged EPA to specify that the availability of cleaner fuel in 1999 would trigger tighter emission standards. On the other hand, truckers commented that fuel changes would not be cost-effective since only very small emission benefits would result from significant increases in fuel costs (and therefore operating costs).

Analysis/Response

As set forth in more detail in the RIA, the Agency finds that the 2004 standards are technology-forcing but achievable and appropriate under the Clean Air Act without any change to the composition of diesel fuel. In general, the comments on the need for (and cost-effectiveness of) fuel changes have not been supported by data. Should new information arise in the course of EPA's and others' analysis of engine/fuel quality interactions, this information will be considered in the 1999 review. If in 1999 fuel changes were deemed necessary or appropriate under the Clean Air Act, they would be addressed through rulemaking including opportunity for public comment.

c. Feasibility of Standard for Alternative Fuels

Summary/Description of the Issue

The NPRM proposed the same standards for all heavy-duty on-highway engines regardless of the fuel type used.

Comments

Several commenters stated that natural gas vehicles are available today that meet a 2 g/bhp-hr NOx standard. One of these commenters stated that natural gas engines emit much lower PM than diesels and lower CO than gasoline engines without evaporative, refueling, or running losses. Comment was also received that less greenhouse gases and environmental damage occurs due to fuel production, refining, and transportation of natural gas than either gasoline or diesel fuel. The request was made that EPA help lower the high costs associated with low productions through a carefully developed rule.

Analysis/Response

EPA concurs that alternatively fueled vehicles will have a technical advantage meeting the 2004 standards being finalized today. However, EPA does not believe it is appropriate to promulgate standards for diesel HDEs based on levels that can only be met by alternatively fueled vehicles. The standards are driven by the technological feasibility levels for the most widely used engines currently in the market. EPA does not believe that section 202 requires emissions standards that would effectively eliminate diesel-fueled engines. On the other hand, EPA does not believe it is appropriate at this time to promulgate separate, more stringent standards for alternative-fueled vehicles. Such vehicles remain an important environmentally beneficial alternative to traditional diesel-fueled engines. EPA believes that the best method for encouraging these engines at this time, given their newness and customer questions regarding such engines, is to continue to treat them equally to diesel-fueled engines. This will encourage further use of these clean engines rather than penalize manufacturers and consumers for investing in these clean technologies. EPA will, however, review the appropriateness of the level of the standards in the 1999 review.

4. In-Use Emission Control Elements

a. Introduction

The NPRM contained several proposals related to ensuring the control of emissions in-use over the life of the heavy-duty vehicle. As noted in the proposal, advanced emissions controls such as EGR and catalysts may be necessary control strategies for meeting the new standards. EPA proposed several provisions to help ensure that such controls, if used, do not result in a higher rate of emissions deterioration than has been experienced with current and previous emissions control strategies. Current and previous strategies have, for the most part, involved advances in fuel control, intake air controls, and combustion chamber design. Such systems are central to engine operation and therefore not likely to be subject to uncorrected deterioration. However, add-on controls such as EGR systems or catalysts may be less likely to be addressed if they fail to operate properly because such failures may not adversely affect on-road performance.

Several proposals pertaining to in-use emissions control involved modifications to existing regulations, including regulations regarding the useful life of the engine, emissions performance and defect warranties, and maintenance requirements. These proposals would update the existing requirements, which were established several years ago, to better align them with current industry experience of longer lasting engines. EPA also proposed some elementary provisions regarding engine rebuilding to help ensure that rebuilding does not result in the removal of emissions control equipment or the reconfiguring of the engine in a way that would result in a significant increase in emissions. This section reviews each proposal for in-use emissions control, the comments EPA received, and offers EPA's response to the comments. The reader is directed to the NPRM preamble for background on each of the program elements and the full rationale supporting the proposals.

b. Revisions to Current Regulations

i. Useful Life

Summary/Description of the Issue

Currently, for the heavy HDDE service class, the useful life limit is 290,000 miles or 10 years (8 years for some pollutants), whichever occurs first. For heavy HDDEs, EPA proposed to lengthen the useful life mileage interval from 290,000 miles to 435,000 miles. Due to concerns that 435,000 miles would be inappropriately long for urban vehicles such as urban buses, which have a much lower average speed than line-haul trucks, EPA proposed to add an hours interval to the useful life of 13,000 hours. The 13,000 hours interval was based on other miles/hours equivalents used by the Agency in existing regulations regarding heavy-duty engines.[14] However, due to concerns that the new hours interval could result in a shorter useful life than the one in place currently, EPA also proposed that the useful life be at least 290,000 miles. Finally, for all service classes and all pollutants, EPA proposed to set the useful life years interval at 10 years. In summary, EPA proposed a useful life for heavy HDDEs of 435,000 miles, 13,000 hours, or 10 years, whichever occurs first, but in no case less than 290,000 miles.

EPA sought comments on two alternative approaches for the useful life. The first option was to not have an hours interval and retain a 290,000 mile useful life mileage interval for the urban bus engine category. The second option was to establish the hours interval equivalent to the hours it would take an urban bus to travel 290,000 miles on average, about 22,300 hours. Further, EPA requested comments on the appropriateness of requiring a 290,000 mile minimum useful life.

Comments

EPA received only supportive comments on lengthening the useful life mileage interval to 435,000 miles for heavy HDDEs. For the hours interval and the 290,000 minimum mileage interval, EPA received several comments recommending revisions. EMA and some engine manufacturers recommended retaining an hours interval and eliminating the 290,000 mile floor. The main rationale of the commenters is that a 290,000 mile useful life is not appropriate for urban buses and other slow moving urban vehicles and that 290,000 miles represents a difficult challenge to the engine manufacturers. With an average speed of 13 miles per hour[15], urban buses and other urban vehicles would reach 13,000 hours well before 290,000 miles and therefore the 13,000 hours has little, if any, effect on the length of the useful life. For urban bus engines, the 290,000 mile interval is nearly 50 percent greater that the typical life to rebuild for urban buses. Commenters stated that 290,000 miles was unrealistic and inconsistent with useful

[14] Source: 40 CFR 86.094-25.

[15] Cite 61 FR 33447 (June 27, 1996).

life definitions for other engine categories. Some manufacturers suggested that the proposed standards may not be feasible if the useful life remains at 290,000 miles for urban buses.

To support the claim that 290,000 miles is too long, the commenters referred to an EPA rulemaking for retrofitting pre-1993 model year urban buses at time of rebuild. In the previous rulemaking, EPA estimated that urban buses typically travel between 150,000 and 250,000 before being rebuilt.[16] Detroit Diesel Corporation recommended that the Agency establish an urban bus useful life of 200,000 miles/15,000 hours/10 years, whichever occurs first. The recommendation is based on an average life to rebuild of 200,000 miles and the average speed of 13 miles per hour. The commenter did not believe that a minimum mileage interval requirement was necessary, but recommended 150,000 miles if one is to be specified.

EPA also received comment that the Agency should review the useful life intervals for the other engine service classes (i.e., light and medium heavy-duty diesels and Otto-cycle engines) and adjust the useful lives where appropriate.

Analysis/Response

Prior to adopting the current useful life intervals, EPA required manufacturers to establish a useful life based on the manufacturer's estimate of the typical life to rebuild or retirement for the particular engine family.[17] Due to manufacturer concerns regarding the practicality and workability of this approach, EPA replaced the useful life requirements with the useful life intervals approach. The intervals were intended to represent the average mileage/years to rebuild or retirement for each engine service class. At the time the intervals were established, EPA recognized that for some engine families, the intervals may not be appropriate due to the duty cycle over which they were used. EPA stated that the Agency was mindful that for certain applications, particularly heavy-duty engine applications, the odometer mileage may not accurately reflect the actual amount of use that an engine has seen and will take that into consideration in selecting engines for recall.[18] In the past, EPA has also stated that the Agency does not intend to include rebuilt engines in any recall testing, again recognizing that the useful life intervals may not precisely represent every application.[19]

For the proposal, EPA recognized that if the useful life for heavy HDDEs were to be increased from 290,000 miles to 435,000 miles based on the increased life of line-haul trucks,

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[16]Retrofit/Rebuild Requirements for 1993 and earlier Model Year Urban Buses; Fuel Quality Regulations for Certification Diesel Test Fuel, 58 FR 21360 (April 21, 1993).

[17] 40 CFR §86.084-2.

[18] 48 FR 1409, January 12, 1983.

[19] 48 FR 52179, November 16, 1983.

special provisions would be needed to address urban vehicles powered by heavy HDDEs, especially urban buses. There is a very significant difference in the usage patterns of the two types of vehicles. Urban buses cannot be expected to reach the same mileages before engine rebuilding due to their slow mileage accumulation rates. To address this issue, EPA proposed a 13,000 hour useful life limit and a 290,000 mile minimum useful life and requested comment on other approaches. Having an hours interval is now practical with the wide use of electronic controls which can track the engine hours of use. EPA received no critical comments regarding the concept of treating urban buses and other urban vehicles differently than line-haul trucks with respect to the useful life interval. Also, except for engine manufacturers, commenters did not comment on the method of differentiating between the two categories though the Agency requested comment on different options.

Manufacturers objected to the 290,000 minimum mileage interval and based their comments regarding the interval on an EPA rulemaking which focused on urban bus industry engine rebuilding experience with 1970s and 1980s vintage engines. EPA believes that it is more appropriate to focus on current industry engine life expectations and experiences with more recent model year engines. As with engines used in line-haul applications, the latest generation of urban bus engines is expected to be more durable than previous generations. Engine manufacturers currently project a life to rebuild for average current model year urban bus engines of at least 290,000 miles.[20] Based on the average life-to-rebuild expectations of the manufacturers for current urban bus engines, a useful life equivalent to 290,000 miles is appropriate. Although manufacturer projections for some families are as high as 375,000 miles, EPA recognizes that the projections are based on expectations rather than actual in-use experience of a large fleet and therefore believes that basing the useful life on the low end of the projections is prudent.

Engine manufacturers recommended strongly that the Agency remove the minimum mileage interval from the useful life requirements and keep the hours interval. EPA believes it is reasonable to drop the minimum mileage interval of 290,000 miles if the hours interval is revised upward to an hours interval equivalent to 290,000 miles for an average urban bus. EPA recognizes that there are a small number of urban vehicles that have average speeds that are significantly below the average speed of urban buses (13 miles per hour) and therefore accumulate mileage more slowly than typical urban buses. For such vehicles, an hours of operation interval would better represent their life to rebuild than would the 290,000 mile useful life interval. For example, solid waste haulers are likely to accumulate mileage more slowly than urban buses and would therefore reach the rebuild point earlier than 290,000 miles.

Using the methodology suggested by one commenter of dividing the average expected miles to rebuild by the average urban bus speed, and using the estimates of 13 miles per hour and

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[20] "Telephone Conversations with representatives from Cummins and Detroit Diesel Corporation Regarding Expected Engine Life for Urban Bus Engines", Memorandum from Chris Lieske to Docket A-95-27.

290,000 miles, the resulting hours interval would be 22,000 hours. This is essentially the same methodology and hours interval on which EPA requested comment. This approach allows the same level of stringency relative to the 290,000 mile interval for urban buses and helps address vehicles which move even more slowly. A 22,000 hour useful life interval may result in a useful life shorter than 290,000 miles for a small number of vehicles. However, it will more closely approximate life to rebuild for engines in applications which accumulate mileage more slowly than urban buses.

Commenters suggested that meeting the new standards over a useful life limit of (or equivalent to) 290,000 miles may not be feasible for urban bus engines. EPA believes it is unlikely that the new standards would affect durability so dramatically that the engines' average time to rebuild would drop to below the useful life levels that were proposed. Durability is a primary consideration for purchasers of large heavy-duty diesel engines and such a drop in durability would not be tolerated in the market place. Considering urban bus engines are currently expected to last at least 290,000 miles, EPA believes that the useful life should not be relaxed for these vehicles.

EPA established all of the useful life intervals to approximate the point of either engine retirement or engine rebuild in the case of the larger engines.[21] EPA noted in the ANPRM, its concern that the 290,000 mile interval no longer adequately reflects the expected mileage to rebuild of line-haul trucks. These trucks accumulate mileage very rapidly and engine manufacturers had made significant strides in improving the durability of these engines especially. It became clear from comments received on the ANPRM that the interval of 290,000 miles for heavy heavy-duty engines was substantially shorter than the engine life to rebuild expectations of industry. Commenters on the ANPRM provided specific comment that the 290,000 mile interval for line-haul trucks was inadequate and recommended revisions, noting that manufacturers of these engines had themselves indicated through their advertising that engine life was greater than indicated by EPA's regulations. EPA, however, did not receive the same type of comments on the ANPRM regarding the useful life intervals for other engine categories. The need for an adjustment in useful life for the other intended service classes (i.e., Otto cycle engines and light and medium heavy-duty diesels) was not considered in the proposal. Also, no commenters provided EPA with data supporting the need for a change to the intervals. Therefore, EPA is not finalizing any change to the useful life for other engine classes in this final rule. EPA does however agree with the commenter that the Agency should further investigate the need for adjustments to the useful lives for the other engine categories.

In summary, EPA is adopting a 22,000 hour interval and dropping the proposed minimum mileage interval provision such that the useful life for heavy heavy-duty diesel engines would be

[21] 48 FR 52170 (November 16, 1983).

435,000 miles, 22,000 hours, or 10 years, whichever occurs first.[22] EPA is also finalizing a useful life years interval of 10 years for all engine classes and for all pollutants as proposed. These useful life provisions are effective with the 2004 model year.

ii. Emission Related Maintenance

Summary/Description of the Issue

EPA proposed new minimum maintenance intervals for some key emission related components, as summarized in Table 1. The intervals are in miles or hours, whichever occurs first. The manufacturer may not perform maintenance more frequently than is specified by the intervals during durability testing for engine certification. Also, manufacturers may not specify maintenance intervals in the maintenance instructions provided to the engine purchaser which are shorter than the maintenance intervals established by EPA. EPA proposed to define add-on emissions-related component as a component whose sole or primary purpose is to reduce emissions or whose failure will significantly degrade emissions control and whose function is not integral to the design and performance of the engine. EPA did not propose to change the interval for EGR filters and coolers from its current interval of 50,000 miles (1,500 hours).

[22]Note that for an individual engine, if the useful life hours interval is reached before the engine reaches 10 year or 100,000 miles, the useful life shall become 10 years/100,000 miles, whichever occurs first, as required under Clean Air Act section 202(d). EPA believes that this provision will be used only very rarely given the usage patterns of affected vehicles.

Table 1
Proposed Minimum Emission-Related Maintenance Intervals

Intended Service Class	Component or System	Proposed change to minimum maintenance interval
Otto-cycle Engines	EGR system (except filters and coolers)	Increase from 50,000 miles (1,500 hours) to 100,000 miles (3,000 hours)
Light HDDEs	EGR system (except filters and coolers)	Increase from 50,000 miles (1,500 hours) to 100,000 miles (3,000 hours)
	* Add-on emission-related components * Catalytic converter	Establish 100,000 mile (3,000 hour) interval
Medium and Heavy HDDEs	EGR system (except filters and coolers)	Increase from 50,000 miles (1,500 hours) to 150,000 miles (4,500 hours)
	* Add-on emission-related components * Catalytic converter	Establish 150,000 mile (4,500 hour) interval

Comments

Although EPA did not propose to change the maintenance interval for EGR filters, the maintenance interval for EGR filters is a significant area of concern for several engine manufacturers. EMA commented that because of manufacturers' limited experience with EGR systems, engine manufacturers do not know how long the systems will function and whether replacement of the EGR filter will need to become a part of the operator's routine maintenance. EMA recommends that EPA shorten or eliminate the requirement, or at least reconsider the allowable maintenance interval during the 1999 review.

For light HDDEs, manufacturers believe that it is not appropriate to extend any of the maintenance intervals beyond 50,000 miles. The rationale presented by the commenters is that maintenance is performed for vehicles in which light HDDEs are used in intervals far shorter than 100,000 miles. EMA also noted that the useful life for the light HDDE category is only 110,000 miles and is not proposed to increase.

Manufacturers of gasoline-fueled engines recommended that EPA retain the current maintenance interval for EGR system filters and coolers of 50,000 miles (1,500 hours). The commenters noted that it appeared that EPA was proposing to increase the interval for these

components to 100,000 miles. (Note: EPA did not propose to increase this interval, as noted in the analysis/response section below.)

EPA also received comments on the need for and appropriateness of setting maintenance intervals in general. One engine manufacturer suggested that it is unnecessary to both set a minimum maintenance interval and require the manufacturer to show evidence that the maintenance has a reasonable likelihood of being performed by the owner. With such evidence, there is no need to set a minimum interval. Additionally, the commenter stated that it defies logic to set a single maintenance interval for a wide variety of technologies for which there is little or no real world experience on which to base the intervals. As an example, the commenter noted that the maintenance interval for particulate traps was set at 150,000 miles and experience has since shown that much more frequent maintenance is needed. The commenter further stated that the maintenance intervals serve no useful purpose and should be eliminated, suggesting that market forces will ensure that the most durable technologies are used.

EPA received comments from the American Trucking Association supporting EPA maintenance-related proposals and cautioning EPA against allowing EGR maintenance intervals that are too short.

Finally, EPA received comments that the structure and wording of the regulations regarding maintenance intervals is confusing and should be revised. For example, one commenter noted that the proposed minimum allowable maintenance intervals for heavy-duty Otto-cycle engines could not be easily found.

Analysis/Response

EPA currently has no basis for recommending a change in the EGR filter maintenance interval from its current level of 50,000 miles (1,500 hours). As is the case for all of the maintenance intervals, the interval serves as a design target during the development of EGR systems for diesel engines. An EGR filter is a critical emissions related component which if not maintained properly could have a significant adverse impact on emissions. At this critical time in the development of emissions controls, EPA does not wish to encourage the design of an EGR system that may need more maintenance and have a higher potential rate of failure by lowering the maintenance interval.

In response to comments regarding light HDDEs, EPA believes that 100,000 mile interval is appropriate given that a 150,000 mile interval is being adopted for the same components used on medium and heavy HDDEs. There is nothing to indicate that there are inherent differences in the technologies as applied to the different size engines which would require a substantially shorter maintenance interval for the light heavy-duty category. The maintenance intervals for other types of vehicle or engine maintenance not related to emissions components is not generally useful as a guide due to the wide variety of maintenance performed on vehicles and engines. Furthermore, EPA is concerned that owners would not find it acceptable to replace their

catalyst or EGR system at 50,000 miles. EPA would prefer to have the components designed to last as close to the full life of the vehicle as possible in order to ensure emissions control. For example, similarly, the current maintenance interval for catalysts and EGR systems for light-duty vehicles and light-duty trucks is 100,000 miles/3,000 hours which is essentially equivalent to their regulatory useful lives.

The recommendation of commenters regarding Otto-cycle engine EGR filters and coolers is in-line with EPA's proposal. EPA did not propose any changes to the maintenance interval for EGR filters and coolers. EPA proposed changing the interval for the remaining EGR system parts and components. Although EPA is not finalizing new standards for Otto-cycle engines, EGR systems are commonly used on these engines today, and therefore the provision continues to be appropriate.

With regard to the overall need for maintenance intervals, EPA believes that there is a connection between the amount and frequency of maintenance that is called for by the manufacturer and the owner's willingness to perform the maintenance. This is especially true when the maintenance is not connected in a noticeable way to on-road vehicle performance such as could be the case with emissions controls such as catalysts or EGR systems. As noted by ATA, too frequent maintenance intervals would be unreasonable for truck owners. EPA therefore continues to believe that specifying minimum maintenance intervals in the regulations is important in balancing the responsibilities of the owner and the manufacturer.

In response to comments regarding the appropriateness of the length of the intervals and setting a single interval for several technologies, EPA believes it is important to set minimum durability targets for emissions related components. The regulations do not call for maintenance to be performed at the intervals but only prevents the manufacturer from specifying a maintenance interval shorter than the interval established in the regulations. The purpose of the maintenance interval requirement is to ensure a minimum level of emissions-related component durability and to limit the maintenance costs associated with emissions controls.

In summary, EPA is finalizing the maintenance intervals be finalized as proposed. EPA is also adding regulatory test further specifying which maintenance intervals apply to heavy-duty Otto-cycle and diesel-cycle engines in order to improve the clarity the regulations.

iii. Emissions Defect and Performance Warranties

Summary/Description of the Issue

Emissions warranties are provided by manufacturers as required under Section 207 of the Clean Air Act. The performance warranty provides that if a properly maintained vehicle or engine fails to conform to the test established under section 207(b)(2) at anytime during the warranty period, and such nonconformity causes the owner to have to bear a penalty or other sanction, then the engine manufacturer is responsible for remedying the nonconformity at its own

cost. The defect warranty provides that manufacturers are responsible for defects in materials and workmanship which cause an engine not to conform with applicable regulations.

EPA regulations currently provide that the emissions defect and emissions performance warranty periods shall be 5 years/50,000 miles, whichever occurs first, for heavy-duty Otto-cycle engines and light heavy-duty diesel engines and 5 years/100,000 miles, whichever occurs first, for all other heavy-duty diesel engines. However, in no case, may the warranty period be less than the basic mechanical warranty period for the engine family. The actual mechanical warranty period for an engine often differs from the published warranty for the engine family, in cases where the purchaser negotiates or is provided a longer basic mechanical warranty period. Therefore, EPA proposed to revise the emission defect and performance warranties to clarify that the warranty periods shall not be shorter than the basic mechanical warranty of the engine that the manufacturer actually provides to the vehicle owner.[23]

Comments

The American Trucking Association (ATA) provided comments in support of the proposed revision to the warranty regulations. ATA noted that negotiated mechanical warranties that exceed the published basic warranties for an engine family are fairly prevalent for heavy-duty engines.

EMA recommended that EPA revise the proposed regulatory language to ensure that (i) an extended warranty on select parts does not require the manufacturer to extend the emissions warranty on the entire engine, (ii) a shared customer responsibility for extended commercial warranty does not extend the manufacturer's sole emissions warranty responsibility; and (iii) an extended commercial warranty does not extend manufacturers' liability for recall.

F[illegible] opposes making the warranty period equivalent to the mechanical warranty offered by the m[illegible]facturer. Ford commented that it is not clear under what authority EPA would be acting on to establish the warranty provisions. Ford also commented that there has been no showing that engine parts and emissions parts have the same durability. Ford continued to comment that EPA interference in the contractual obligations between it and its customers will likely increase the price of the warranty or deter manufacturers from offering the warranty and therefore any benefit from the provision will be lost.

NRDC suggested that the warranty period should be equivalent to the useful life period. NRDC believes that since manufacturers are already liable for emissions performance over the useful life period, they should incur no additional cost or regulatory burden by extending the

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[23] While EPA is finalizing revisions to the performance warranty period as discussed below, in accordance with Section 207(i) of the Clean Air Act, EPA has not prescribed regulations under Section 207(b)(2) of the Act which require heavy-duty engine manufacturers to provide performance warranties.

warranties to consumers for the useful life period. Such a warranty would help ensure emissions control by removing any disincentive for repair of emission related controls which fail between the end of the basic mechanical warranty period and the end of the useful life.

Analysis/Response

EPA agrees with EMA's recommendations and believe the recommendations ensure that the emissions warranty requirements would be consistent with the mechanical warranty provided to the owner. The emissions warranty responsibilities of the manufacturer would be required only to match the manufacturer's mechanical warranty responsibilities in terms of duration, cost sharing, or parts coverage, except where the mechanical warranty is shorter than the minimum emissions warranty requirements contained in the regulations. EPA views the changes as clarifications to the regulations and not a change from the intent of the proposal. EPA did not intend to change the emissions warranty provisions to require that they go beyond the mechanical warranty of the engine in scope but only match the mechanical warranty. Also, the warranty provisions are currently not connected to recall and EPA did not propose to change this aspect of the regulations. Thus, an extended commercial warranty would not extend a manufacturer's liability for recall. Similarly, should the warranty period exceed the regulatory useful life, the warranty would not become invalid merely because the engine has reached the end of the useful life period.

In response to Ford's comments, the Agency has long required that the emissions warranty period for an engine family be equivalent to the basic mechanical warranty of the engine family. The authority for setting the warranty period is provided to the Agency by section 207(i) of the Clean Air Act. EPA only proposed a modification to this requirement so that it would better reflect common industry practice, as noted by ATA. The proposed change reflects the long established principle that the emissions control be warranted along with the engine's mechanical operation. EPA did not receive any comments that the established regulations have been problematic or have caused engine manufacturers to restrict their basic mechanical warranties. EPA does not believe that the proposed changes to the regulations (revised to incorporate EMA comments) will affect basic mechanical warranty coverage negatively. EPA believes the changes to the warranty provisions continue to be appropriate for both diesel and Otto-cycle engines.

EPA does not believe that warranty and useful life should be directly linked as recommended by NRDC for highway heavy-duty engines. Useful life defines the period over which a new engine is subject to emissions standards and is linked to durability requirements during certification and to recall liability. The warranty period offers protection to the owner against an isolated component failure that the owner could otherwise be responsible for repairing. It is not designed to require manufacturers to pay for the replacement of all parts of an engine that do not last the entire useful life without maintenance or replacement. In the case of a recall, the manufacturer would be required to pay for repairs regardless of the terms of the warranty. The final rule aligns EPA warranty regulations with industry practices. It provides continued assurance that engines are durable without requiring that manufacturers pay for parts to last

throughout the useful life of the engines without repair or replacement, which could result in considerable increase in up-front cost.

In summary, EPA is revising the regulations regarding the warranty period such that the warranty period shall not be less than the basic mechanical warranty of the engine. Thus, the warranty would be longer than that published for the engine family in cases where a manufacturer provides to the customer a longer basic mechanical warranty for a particular engine. Extended warranties on select parts do not extend the emissions warranty requirements for the entire engine but only for those parts. Also, in cases where responsibility for an extended warranty is shared between the owner and the manufacturer, the emissions warranty would also be shared in the same manner as specified in the warranty agreement.

c. Maintenance and Repair of Emissions Controls After the End of the Useful Life

Heavy-duty engines are often used well beyond their regulatory useful life, in large part due to the practice of engine rebuilding, which restores the engine and allows its continued use for many years. EPA proposed several provisions to help ensure proper maintenance and repair of emissions related components after the end of the regulatory useful life. This section is divided into manufacturer requirements and engine rebuild provisions.

i. Manufacturer Requirements

EPA proposed several requirements for engine manufacturers to ensure that service manuals contain information needed to properly repair emissions related components after the end of the regulatory useful life period. In addition, EPA proposed that emissions-related on-board diagnostic system signals be designed not to stop operating beyond the useful life period. EPA received comments only in support of these provisions with no suggestions for revisions and is therefore finalizing without revision. These provisions are being finalized for both diesel and Otto-cycle HDEs. The reader is directed to the final rule preamble or section III.B. of the final rule preamble for the detailed provisions.

ii. Provisions Pertaining to Engine Rebuilding Practices

Summary/Description of the Issue

Engine rebuilding is common for large heavy-duty engines and rebuilding extends the life of the engine for several years. The original manufacturer's liability ends at the end of the useful life which is set to approximate the retirement of the vehicle (for smaller vehicles) or the engine rebuild point (for larger vehicles). Engine rebuild practices have been found to generally have no impact on emissions in past studies. EPA, however, is concerned that more sophisticated engines and emissions controls used to meet the new standards will be more prone to tampering at time of engine rebuild, in violation of Clean Air Act (CAA) section 203. For example, engines originally equipped with EGR could be rebuilt without the EGR systems being reinstalled on the

engine. Therefore, EPA proposed some basic provisions for engine rebuilding under CAA section 203 which will help engine rebuilders understand their responsibilities and ensure that rebuilding continues to be a point at which emissions control is restored along with the engine itself.

EPA proposed that parties involved in the process of rebuilding or remanufacturing heavy-duty engines (which may include the removal of the engine, rebuilding, assembly, reinstallation and other acts associated with engine rebuilding) must follow the provisions described below to avoid tampering with the engine and its emissions controls.

(1) During engine rebuilding, parties involved must have a reasonable technical basis for knowing that the rebuilt engine is equivalent, from an emissions standpoint, to a certified configuration (i.e., tolerances, calibrations, specifications) of the same or newer model year as the engine being rebuilt. A reasonable basis would exist if:

(a) Parts used when rebuilding an engine, whether the part is new, used, or rebuilt, is such that a person familiar with the design and function of motor vehicle engines would reasonably believe that the part performs the same function with respect to emissions control as the original part, and

(b) Any parameter adjustment or design element change is made only (i) in accordance with the original engine manufacturer's instructions or (ii) where data or other reasonable technical basis exists that such parameter adjustment or design element change, when performed on the engine or similar engines, is not expected to adversely affect in-use emissions.

(2) A replacement engine must be of (or rebuilt to) a configuration of the same or later model year as the original engine. Thus, in addition, under the proposed regulations a party supplying a rebuilt engine would be prohibited from supplying a replacement engine that is not rebuilt to a configuration of the same or later model year as the trade-in engine.

(3) At the time of rebuild, emissions-related codes or signals from on-board monitoring systems may not be erased or reset without diagnosing and responding appropriately to the diagnostic codes, regardless of whether the systems are installed to satisfy EPA requirements under 40 CFR 86.094-25 or for other reasons and regardless of form or interface. Diagnostic systems must be free of all such codes when the rebuilt engines are returned to service. Further, such signals may not be rendered inoperative during the rebuilding process.

(4) When conducting an in-frame rebuild or the installation of a rebuilt engine, all emissions-related components not otherwise addressed by the above provisions must be checked and cleaned, repaired, or replaced where necessary, following manufacturer recommended practices.

EPA proposed that any person or entity engaged in the process, in whole or in part, of rebuilding engines who fails to comply with the above provisions will be liable for tampering in violation of CAA Section 203(a)(3). Parties would be responsible for the activities over which they have control and as such there may be more than one responsible party for a single engine in cases where different parties perform different tasks during the engine rebuilding process (e.g., engine rebuild, full engine assembly, installation). EPA did not propose certification, record keeping, or other requirements of the rebuilder or engine owner and there would be no in-use emissions requirements.

Comments

Several industry commenters supported the proposed engine rebuild provisions including the American Trucking Association, the Automotive Engine Rebuilders Association (who represents independent engine rebuilders), and the American Truck Dealers Division of the National Automobile Dealers Association. Their comments supported EPA's position that the proposed provisions represent current industry practices and their comments did not note any negative consequences for their member companies due to the proposals.

EMA raised two concerns regarding the provisions as they relate to engine remanufacturers[24] and a few individual engine manufacturers recommended that engine remanufacturers not be covered by the rebuild provisions. First, EMA is concerned with the provision that the rebuilder replace the original engine with one of the same or later model year. The reason for concern is that an engine remanufacturer cannot reasonably ensure that an engine is replaced with one of the correct model year because the remanufacturer never deals with the owner directly, and is not involved with switching engines. EMA recommends that only the party performing the engine switch be responsible for ensuring that the appropriate engine model is used.

Second, EMA is concerned that the provisions regarding the rebuilding of engines to the same or later model year would be very burdensome for remanufacturers. Remanufacturers receive many trade-in engines which are then disassembled down to the basic engine core. The engine core can then be rebuilt to a variety of engine models and model years because the basic core often does not change from model year to model year. EMA commented that the engines are rebuilt to a certified level of emissions performance and are labeled to identify the set of standards which they will meet. However, the engine is not necessarily rebuilt to be of the same model year as it was when traded-in. It would be very disruptive and costly to the remanufacturer if the remanufacturer had to track each engine and was limited in the use of engine cores. EMA recommended removing the provision concerning rebuilding to the same or newer configuration and commented that it was not needed considering that there is another

[24] Remanufacturers is a term used by industry to note rebuilders who rebuild a large volume of engines using production style assembly-line methods. Engine cores from trade-ins are shipped to the remanufacturing facility where they are completely disassembled for rebuild on the assembly line.

provision in the proposal prohibiting switching an engine with one of an earlier model year configuration.

EPA also received comments regarding the use of aftermarket parts and the need for certification testing of aftermarket parts. EPA received comments from EMA that the provisions pertaining to the use of replacement parts are vague and should be clarified. In addition, one manufacturer recommended that EPA establish a certification program for aftermarket replacement parts. The commenter believes that aftermarket parts suppliers should be required to conduct emissions testing to prove the emissions performance of the part and that the certification of parts would be no more complex or stringent than the new engine certification program. The commenter noted that there are very subtle design tolerances that will make it very difficult for a rebuilder to judge whether or not an aftermarket replacement part is equivalent to an original part.

NRDC recommended that EPA place liability on the rebuilders for the in-use emissions performance of the rebuilt engines. EPA should then test these rebuilt engines as part of a larger comprehensive in-use compliance program which the commenter suggests should be based on a simple loaded chassis-based test developed by the Agency. The commenter noted that if good rebuild practices are followed by the rebuilders, the rebuilder would not incur any additional costs due to the liability. The commenter also stated that without strong post-rebuild emissions standards EPA is undercutting the potential emissions benefits of the rule.

Analysis/Response

EPA recognizes EMA's concerns regarding the effect of the proposed provisions on remanufacturers and agrees with EMA's recommendations for revisions. Engine remanufacturers must be given special consideration because they run assembly-line style operations and do not interface directly with customers. Other types of rebuilders are custom rebuilders (where each engine is rebuilt individually) and interface directly with the vehicle owner and therefore do not share the concerns raised by EMA. Because engine remanufacturers do not interface with the end user of their products and are not involved with engine installation, they cannot easily control the use of the remanufactured engines they produce. Therefore, it is much more practical to require that when an engine is replaced, it be replaced with the appropriate engine, than it is to require the remanufacturer to supply the appropriate engine. EPA also understands that a remanufacturer would have tremendous difficulty tracking each engine core that arrives to be remanufactured in order to ensure that it is rebuilt to the same or newer model year. Also, such a requirement would not provide an air quality benefit, given that what matters most is that the appropriate engine be installed in the vehicle. Therefore, the most critical aspect of remanufacturing would be to ensure that engines are rebuilt to a certified configuration and that they are properly identified in terms of model year and configuration so that the appropriate engine is installed. Both of these practices are standard remanufacturing practices, and are retained in the final rule.

EPA is revising its proposal (provision 2) to require the following; when an engine is being rebuilt and remains installed or is reinstalled in the same vehicle, it must be rebuilt to a configuration of the same or later model year as the original engine. When an engine is being replaced, the engine must be replaced with an engine of (or rebuilt to) a configuration of the same or later model year as the original engine. Also, EPA is revising provision 1 to remove the requirement to rebuild to the same or later model year configuration. EPA believes that these changes do not substantively change the effect of the program, continue to reflect the intent of the proposal, and address EMA's concerns. Also, therefore, EPA does not believe that it is necessary to exempt remanufacturers, as requested by some of the commenters.

With regard to aftermarket parts, while certification testing of parts might be the most precise way to determine that aftermarket parts provide the same emissions control as the original parts, EPA believes that such testing would be very costly and is not warranted based on available data regarding aftermarket parts. EPA's engine rebuilding study indicated that use of aftermarket parts does not appear to be a significant source of loss of emissions control.[25] Therefore, EPA proposed to codify its existing policies regarding the use of aftermarket parts rather than more stringent measures. These policies allow for the use of engineering judgement rather than emissions testing in determining if an aftermarket part is likely to affect emissions. Many times the aftermarket parts are exact duplicates of the original part, such as when the manufacturer of the part supplies that part to the engine manufacturer, and the analysis is quite simple. Where there are design changes, a more in depth engineering analysis may be needed depending on the nature of the changes. EPA understands, however, that components are becoming more sophisticated, often in response to tighter emissions standards. Further requirements in the future may be appropriate if there is evidence indicating a significant loss of emissions control due to the use of aftermarket parts.

EPA has the authority to adopt emissions standards and related programs for rebuilt HDEs under section 202(a)(3)(D) if such rebuild requirements are warranted. Establishing a standard or emissions performance liability based on the existing testing method is also not appropriate at this time. The vast majority of rebuilders do not have reasonable access to this type of testing due to its high cost and emissions performance liability was not proposed for rebuilders due to the significant burden it would potentially represent. The costs of establishing a standard and in-use performance liability cannot be justified based on information currently available to the Agency, which indicates that rebuilding is not a source of emissions degradation.

Because EPA believes that the above provisions represent sound engine rebuilding practices and are being finalized to help prevent tampering and loss of emissions control in general, EPA continues to believe that the provisions are applicable for Otto-cycle engines as well as diesel engines. Organizations representing the vast majority of engine rebuilders commented in support of the proposals and did not raise concerns regarding the effect of the provisions on their

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[25]"Heavy-duty Engine Rebuilding Practices," EPA Final Report by Tom Stricker and Karl Simon, March 21, 1995. Docket A-95-27.

rebuilding operations. EPA has modified the provisions in response to large engine remanufacturer concerns to ensure that the provisions do not cause unintended and unnecessary changes to their industry practices.

iii. Engine Rebuild Record Keeping Requirements

Summary/Description of the Issue

EPA requested comments on adopting minor record keeping requirements which EPA believed would be in-line with customary business practices. The Agency would then have assurance that records would be available for inspection to determine compliance with the proposed rebuild provisions. As described in the NPRM, the records would be required to be kept by persons involved in the process of heavy-duty engine rebuilding or remanufacturing and would have to include the mileage and/or hours at time of rebuild and a list of the work performed on the engine and related emission control systems including a list of replacement parts used, engine parameter adjustments, design element changes, emissions related codes and signals that are responded to and reset and the response to the signals and codes, and work performed as described in item (4) of the rebuild provisions above. EPA also noted that if it is customary practice to keep records for groups of engines where the engines are being rebuilt or remanufactured to an identical configuration, such record keeping practices would satisfy these requirements. EPA would require such records to be kept for two years after the engine is rebuilt.

Comments

EPA received comments from the American Trucking Association, the Automotive Engine Rebuilders Association, and the American Truck Dealers Division of the National Automobile Dealers Association indicating that the record keeping requirements would not impose a burden as long as records could be kept in their current form and EPA did not require a duplicate set of records specifically for compliance with the regulations.

EMA and some member companies submitted comments opposing formal record keeping requirements as unnecessary and burdensome. The commenters noted that remanufacturers do not keep information on each individual engine that goes through the assembly line remanufacturing process. Also, remanufacturers receive loose engines (already removed from the vehicle) and do not have access to the vehicle to determine vehicle mileage or hours of use. EMA suggested that EPA must have relied on records during its study of rebuilding practices and that such records should be sufficient for the Agency in the future. One commenter suggested that a distinction be made between rebuilders and remanufacturers if any record keeping requirement is adopted.

The Automotive Engine Rebuilders Association requested clarification to ensure that records did not have to be kept on work performed by other parties. For example, an engine rebuilder often will send the fuel system to a fuel system specialist for rebuild.

Analysis/Response

EPA believes that simple record keeping requirements are needed in order to ensure an adequate means of enforcement. Without a record keeping requirement, the Agency would have great difficulty holding those not complying with the regulations accountable for their actions. Those not complying would not be likely to keep records. EPA believes that all of the concerns of the commenters can be addressed such that the normal records kept as part of customary business practices will be sufficient to satisfy EPA needs.

In response to the comments, EPA agrees that rebuilders should be allowed to keep the information in whatever format they choose, but only as long as it can be provided to an EPA enforcement officer in a way that is understandable to the officer. Engine remanufacturers can use records such as build lists, parts lists, and engineering parameters that they keep for the engine families being remanufactured rather than on individual engines. Also, remanufacturers would not be required to keep information on each individual emissions related diagnostic code that might be reset but only information on the process by which possible codes are addressed as part of the remanufacturing process. For example, if an engine is equipped with a sensor that monitors the EGR flow rate, the remanufacturer could state that such a code would always be addressed during the remanufacturing process, say, because the EGR system is always rebuilt in a certain way which ensures proper operation. EPA expects that remanufacturers currently keep these types of records in order to control the quality of their products.

Finally, EPA agrees that remanufacturers or rebuilders should not be required to keep records on information that they do not have access to as part of normal business practices. For example, remanufacturers should not be required to keep vehicle specific information such as mileage information.

In response to the Automotive Engine Rebuilders Association (AERA) request for clarification to ensure that records did not have to be kept on work performed by other parties, it is the intent of the regulation to hold parties responsible only for work they perform and not the activities of others. EPA expects that customary business practice in the example noted by AERA would be for the rebuilder to note from whom the rebuilt fuel system was attained and such a note would be sufficient for EPA purposes.

In summary, EPA is establishing record keeping requirements for those participating in the rebuilding of engines and that records be required to be kept only on work performed by the given party. Records shall include the mileage and/or hours at time of rebuild and a list of the work performed on the engine and related emission control systems including a list of replacement parts used, engine parameter adjustments, design element changes, emissions related

codes and signals that are responded to and reset and the response to the signals and codes, and work performed as described in item (4) of the rebuild provisions above. However, remanufacturers and rebuilders will not be required to keep records on information that they do not have access to as part of normal business practices. Rebuilders shall be allowed to keep the information in whatever format they choose, as long as it can be provided to an EPA enforcement officer in a way that is understandable to the officer. Further, records may be kept on an engine family basis rather than on an engine-by-engine basis in cases where each engine is rebuilt in the same way to the same specifications, as is the case in assembly line rebuilding processes.

5. Economic Incentives

a. Voluntary Labeling

Summary/Description of the Issue

EPA requested comments on but did not propose voluntary environmental labeling or "green" labeling of heavy-duty engines (and vehicles equipped with those engines) that meet certain criteria. There were three separate criteria discussed in the proposal for which a label could be issued: engines certified to the proposed standards earlier than required, engines certified to an intermediate emissions level between the proposed standards and the standards currently in effect for the model year, and engines powered by an alternative fuel. An incentive for engine manufacturers would be that they would be able to market their product as "green". Another main incentive for participation cited by EPA would be that engine manufacturers and trucking companies would benefit from the public good will demonstrated by displaying the label.

Comments

Commenters' reactions to the concept of green labeling for heavy-duty vehicles varied widely. Commenters in support of the basic concept of labeling also expressed some reservations and had several suggestions for EPA's consideration.

Commenters supporting the concept of labeling had specific recommendations regarding what engines should be eligible for labels. Commenters from the natural gas industry support a labeling program for engines able to meet the proposed standard ahead of schedule. One commenter noted that labels should be limited to engines already meeting the proposed standards since such engines are already available. Another commenter believes that the program's effectiveness would be diminished if engines which are only slightly cleaner than the 1998 standards are given green labels. Similarly, NRDC also recommended that only engines meeting the new standard early or low emitting alternative-fueled engines be eligible for labels, noting that engines below the 1998 standard but above the proposed 2004 standard would already be given special consideration under the averaging, banking, and trading program. The Natural Gas

Vehicle Coalition suggested that a gold label be established for engines certified to half the proposed standard.

Detroit Diesel Corporation also supported the labeling concept. Detroit Diesel Corporation suggested that, to keep the program simple, EPA establish a single criterion by which labels would be issued. Detroit Diesel recommended that engines 20 percent below the NOx, NOx plus NMHC, or PM standard during the first year of a new standard be eligible to receive a label and that the percentage increase by 5 percent each year until the percentage reaches 40 percent in the fifth year of the standard. After the fifth year of the standard, engines 40 percent or more below the standard would qualify for a label. Detroit Diesel noted that labeling alone provides only a small incentive and is unlikely to be sufficient to generate wide interest in the program. Detroit Diesel recommends that EPA consider other incentives such as exemptions from in-use testing such as recall testing for the manufacturers of the engines and, for the truckers, exemptions from state inspection and maintenance programs.

Some commenters supporting the concept of labeling also cautioned EPA that care must be taken to ensure that engines receiving a label be well maintained in-use. Commenters noted that labeled vehicles powered by poorly maintained smoking diesel engines would severely undermine the credibility of the program. Some commenters recommended that label designation be limited to the regulatory useful life of the engines.

The American Trucking Association, while supporting the concept of market-based incentives, commented that the large majority of truck fleets would likely not be interested in a labeling program, unless it were connected to other economic incentives, due to the highly competitive nature of the industry. Truck fleets would likely view it as an additional burden that outweighs the benefits of participating.

EMA does not support engine labeling due largely to concerns regarding the potential for significant administrative burdens for engine manufacturers. EMA is also concerned about the program interfering with the ABT program. EMA recommends that, if EPA pursues a labeling program, the vehicle manufacturers be able to participate without assistance from the engine manufacturers.

Analysis/Response

EPA continues to be interested in the potential of market-based programs. However, due to comments received by the Agency, EPA is not further pursuing the labeling concept in this rule. Key participants including the engine makers and trucking industry did not support the concept in its current form and their support would be necessary for a successful program. Other commenters raised significant issues regarding enforcement and program safeguards. More program development and discussion with stakeholders would be needed to fully assess if a labeling program can be fashioned which will provide a significant incentive for the sale and use

of cleaner engines. Several issues have been raised by commenters that must be considered before a labeling program can be successfully implemented.

b. Voluntary Standards/Incentives

Summary/Description of the Issue

EPA requested comment on the need for and desirability of voluntary NOx and PM standards in the period from 1998-2003 to encourage technical innovation. The ultimate purchasers of the heavy-duty engines would be able to market the emissions credits generated provided there was no double-counting. EPA also asked for comment on optional early certification for Otto-cycle engines as a means to delay compliance with alternative, more stringent NMHC +NOx standards in 2004.

Comments

In general commenters supported a voluntary program with appropriate incentives as a vehicle to bring in advanced technology early and to support alternative fuel use. Examples of incentives supplied by commenters were tax breaks and bonus credits. One commenter expressed concern that credit programs don't actually exist since states do not have established programs to recognize and reward open market credits. An Otto-cycle engine manufacturer commented that voluntary certification would not be appropriate for gasoline engines. Finally, the American Trucking Association invited EPA to join them and Western Highway Institute in their evaluations of appropriate market-based incentives such as scrappage, retrofitting, and exporting older trucks.

Analysis/Response

EPA believes that a good target for voluntary standards in the 1998-2003 period would be the proposed standards for 2004. After 2004, EPA believes that an appropriate target would be 1 g/bhp-hr NOx and 0.05 g/bhp-hr PM since these are the targets in the SOP for reductions beyond 2004. At this time, EPA has no definite ideas for appropriate incentives for the certification of engines to lower voluntary emission standards. Tax breaks are probably not feasible and bonus credits for early introduction of cleaner technology could lead to a net loss to the environment.

EPA will continue to communicate with interested parties with the hope of determining the appropriateness of any incentives in the future. However, EPA is not finalizing voluntary standards at this time.

6. Economic Impact

Summary/Description of the Issue

To assist EPA in its estimate of the economic impact of the proposed rule, Acurex Environmental, Inc. prepared a report detailing the costs of adopting or improving several different technologies for improved control of emissions. EPA then made an assessment of a likely scenario of technology packages for the different classes of heavy-duty vehicles. Applying the costs developed by Acurex to these technology packages resulted in estimated per-vehicle costs for complying with the 2004 standards. Additionally, EPA applied a learning curve that substantially reduces the cost of compliance over time to reflect manufacturers' cost savings over time as they gain experience in producing the low-emitting engines.

Comments

Manufacturers generally considered EPA's cost estimates for diesel engines to be too low. Commenters made several specific suggestions:

1. The expenditures to develop engines that comply with the 2004 standards could have been used for technologies that would otherwise improve the engine. These foregone opportunities are not included as a cost of the program. Similarly, EPA ignored the potential for a learning curve to reduce the cost of complying with the 1998 standards over the years leading up to the change to 2004 standards, especially with respect to potential reductions in fuel consumption rates.
2. Suggested adjustments to the total cost per engine ranged from three to six times EPA's estimate.
3. EPA developed a single cost estimate for each vehicle category. One commenter thought the analysis should include best-case and worst-case estimates for a range of likely costs.
4. A manufacturer also requested that EPA include a separate cost analysis for urban buses, rather than lumping them into the larger category of heavy heavy-duty vehicles.
5. EPA projected that most engines will use EGR without extra cooling of the recirculated gases, whereas information from the industry indicates that cool EGR will be needed for engines to meet the 2004 emission standards.
6. One manufacturer noted that EPA omitted the cost for increased warranty obligations resulting from new emission-reduction technologies. Experience would indicate a need to increase anticipated overall costs between 4 and 10 percent to account for warranty costs.
7. Commenters expressed a concern that operating costs would increase, either from an increase in fuel consumption or from increased fuel costs (should fuel reformulation be considered necessary for engines to meet emission standards). Also, EPA's analysis depends on developments such as improved lubricating oil to avoid durability problems, but does not include a cost increment for the upgraded materials.
8. The cost reductions attributed to the learning curve were generally validated by commenters. There was, however, a concern that such learning would not come without some cost. A

suggestion was to consider the cost of improving designs and manufacturing processes from R&D, retooling, etc. to be equivalent to one year's savings.

Analysis/Response

1. EPA's cost estimates in the proposed rule and in this final rule take into account the fact that expenditures to develop model year 2004 engines could have been used for techniques that would otherwise improve the engines. The cost analysis accounts for the foregone opportunity cost of R&D and other capital expenditures with an annual discount rate of 7 percent. The discount rate reflects the time value of money and quantifies the cost of displacing capital for other investments.

The cost of complying with the 2004 standards is based on the incremental change from engines that meet the previous standards for 1998 and later model year vehicles. EPA conducted the analysis by identifying those technological changes that would be needed to meet the more stringent standard. The incremental costs of these individual improvements were then summed for a total cost. Since the cost of compliance for the 1998 standard does not affect the cost calculation, any savings from a learning curve between 1998 and 2003 would not affect the cost calculation for 2004 vehicles. Potential gains in fuel economy were not considered since they would be merely speculative. Similarly, EPA chose not to project a decrease in the deployment of catalysts during periods of stable standards, even though manufacturers attempt to do so by further developing the effectiveness of in-cylinder emission controls.

2. EPA's cost analysis depends on a bottom-up cost analysis. The expected technological changes were identified and then investigated to determine the cost of compliance. Costs for individual technologies were developed by making a detailed assessment of the required hardware, R&D time, retooling, etc. These commenters provided only broad estimates of compliance costs rather than specific critiques of EPA's analysis. EPA is not able to assess the validity of the very broad estimates of compliance costs from manufacturers other than to repeat the previous analysis with an emphasis on the detailed construction of those estimates.

3. EPA's analysis for the proposal acknowledged that a single cost quote for a category of vehicles does not adequately reflect (a) the uncertainty of future developments, (b) varying approaches that will be taken by different manufacturers (c) the flexibility provided by the averaging, banking and trading program. The cost analysis in the RIA states at the outset that these factors will lead to multiple technology solutions across the industry, some or all of which will be different than we project in the analysis. Nevertheless, EPA expects that the projected estimates fairly represents the range of likely technology scenarios.

EPA's responsibility in the impact analysis is to demonstrate the feasibility of meeting the new standards and estimate the cost of compliance. Toward that end, EPA's approach of simplifying the assessment to focus on a single cost for a uniform package of technologies for each category of vehicles is appropriate. To ensure that the cost estimate is not too dependent on

specific projections. EPA includes multiple additional calculations to test the sensitivity of the analysis.

4. In the proposed rule, EPA made a full assessment of costs for urban buses, but did not use those costs to make a separate calculation of cost-effectiveness. EPA has in the past used a single cost-effectiveness estimate to characterize the whole range of heavy-duty engines. The cost-effectiveness analysis performed for the proposed rule did include an extra level of precision by developing separate cost-effectiveness estimates for light, medium, and heavy heavy-duty diesel engines

In response to this comment, EPA has used information developed for previous urban bus rulemakings to make an estimate of the cost-effectiveness of the new standards for urban buses. In order to estimate the cost-effectiveness, it is necessary to determine the NOx and NMHC emission reductions attributable to the new standards. For this analysis, EPA assumed urban bus engines would emit at the same emission levels (in g/bhp-hr) as for other heavy-duty diesel engines. EPA used conversion factors developed specifically for urban buses for converting from g/bhp-hr levels to g/mi levels.[26] For NOx, the urban bus conversion factor is 4.3 hp-hr/mi. For HC, the urban bus conversion factor is 2.3 hp-hr/mi. Table 2 contains the mileage accumulation rates for a typical urban bus used in this analysis which were developed for past EPA urban bus rules.[27]

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[26] "Development of Conversion Factors for Heavy-duty Bus Engines," EPA Technical Report, EPA-AA-EVRB-92-01, July 1992.

[27] "Final Regulatory Support Document and Summary and Analysis of Comments on the NPRM (for Urban Bus Programs)," U.S. EPA, OAR, OMS, February 1993.

Table 2
Urban Bus Mileage Accumulation Rates

Age	Mileage	Age	Mileage
1	45,000	9	33,000
2	45,000	10	29,000
3	44,000	11	25,000
4	42,000	12	25,000
5	41,000	13	25,000
6	38,000	14	25,000
7	36,000	15	25,000
8	35,000	-	-

Table 3 contains the projected emission reductions due to the new engine standard, the estimated cost of complying with the new standard (including both increased engine and operating costs), and the resulting discounted, lifetime cost-effectiveness for urban buses under the same two scenarios presented in the RIA. Compared to the cost-effectiveness of the new NOx plus NMHC standard for heavy heavy-duty diesel engines, the most similar engine category, the projected cost-effectiveness for urban buses shows a slightly lower cost per ton of emission reduction.

Table 3
Cost-Effectiveness for Urban Buses of the NOx plus NMHC Standard

Model Year Grouping	Total NPV Costs per Vehicle	Discounted Lifetime Reduction (tons)		Discounted Per-Vehicle Cost-Effectiveness ($/ton)	
		NOx	NMHC	Nationwide Scenario	Regional Strategy Scenario
2004-05	$533	3.768	0.028	$100	$200
2006-08	$488			$100	$100
2009+	$270			$100	$100
30 Year Fleet	—	—	—	$100	$100

5. In developing its draft report, Acurex estimated the cost of using a cool EGR system. The system as presented included a new heat exchanger to cool the recirculated exhaust gases. At the time of the proposal, EPA expected that manufacturers would make an extra effort to avoid adopting such a complex system and would look to other simpler technological approaches to meet the new emission standards.

Since completion of the draft analyses, it has become clear that a simpler form of cool EGR has emerged. Specifically, manufacturers are pursuing an EGR system that uses the existing jacket water cooler to cool the recirculated exhaust gases. This provides less cooling than a dedicated air-to-air EGR heat exchanger, but nevertheless provides substantial cooling for a much lower cost. Less extensive cooling also has the advantage of avoiding condensation of material from the exhaust stream. Acurex has revised its report to include this technology scenario and EPA has incorporated these numbers into the analysis with a projection that all heavy-duty vehicles will use cool EGR.

6. EPA agrees that manufacturers will face increased costs for warranty of new parts resulting from the new emission standards. Except for EGR, however, all the expected technology developments depend on developmental changes to existing hardware and onboard software. While it is not clear that these changes will necessarily be completely free from increased warranty claims, it is difficult to justify or quantify an expectation that a change in the frequency of claims will result. EGR is the one technology that will clearly require manufacturers to develop and manufacture new parts. To reflect the increased expense from

warranties, EPA will adjust the analysis to add 10 percent to the manufacturer's marked up variable cost.

7. EPA's analysis includes no cost increase for fuel because the rulemaking requires no changes to in-use fuels. If the Agency makes a subsequent determination that fuel changes are appropriate, an analysis of an increase in fuel costs due to fuel reformulation will be conducted at that time.

Engines designed to meet the new emission standards may indeed have higher fuel consumption than current engines. Historically, however, manufacturers have consistently reduced fuel consumption while improving control of emissions. EPA acknowledges the challenge facing manufacturers in this area; however, EPA believes that the overwhelming demand for steady or improving fuel economy will prompt manufacturers to focus ongoing R&D efforts on reducing or overcoming any potential negative effect that EGR or other technologies may have on fuel consumption. An EGR cooler, for example, greatly reduces the pressure on increased fuel consumption from recirculating the exhaust gases. The analysis therefore shifts the cost of increased fuel consumption to relatively large R&D expenditures. A sensitivity analysis compares this approach with a direct calculation of the cost of increased fuel consumption.

EPA agrees that the projection of R&D efforts to overcome any negative on durability effects should recognize a cost for more expensive materials resulting from that research. Specifically, focusing here on heavy heavy-duty vehicles, Acurex estimated a lifetime cost (net present value) of $210 for increasing oil sump volumes (or oil change frequencies) by 10 percent. EPA's reasoning, similar to that for fuel economy, was that an R&D investment of $25 per engine would allow for a very extensive effort to find a simpler, less expensive solution. For the final rule, the analysis will incorporate the same R&D expenditure and will add 2 percent to the cost of lubricating oil to account for improved wear-resistant formulations.

8. EPA estimated a 20 percent reduction in variable costs with each doubling of production volume. This estimate was derived from economic research from several different manufacturing sectors. Those conducting the research presented the learning curve as a net cost savings, taking into account all the fixed and variable costs incurred to manufacture the product. Since the learning curve already represents a net cost savings, it would be inappropriate to assume an additional cost for implementing the changes that lead to more efficient production.

7. EPA's Air Quality Justification for the Proposed Program

In the NPRM, EPA expressed its belief that improvements in air quality in many parts of the country will continue to be necessary in the future. Specifically, the Agency presented the results of analyses indicating that the emissions of NOx, VOC, and PM can be expected to increase without further controls and that air quality (in the case of both ozone and particulate matter) is

likely to worsen as a result. In proposing new standards for highway HDEs, the Agency relied on these projections in concluding that it should proceed with regulatory action as soon as possible.

Some commenters questioned this conclusion, disputing whether the available information in fact justifies establishing new standards for highway HDEs. Others argued the opposite --that immediate action is indeed justified on the basis of available modeling information. As discussed in detail below, comments on the ANPRM and the NPRM have helped to sharpen the picture, but they have not changed EPA's basic conclusions about the need for new HDE standards.

a. Quality of Modeling of Emission Inventories and Air Quality

Comments

Some commenters, including the American Petroleum Institute, the National Petroleum Refiners Association, the Western Highway Institute, 76 Products, Detroit Diesel Corporation, and General Motors, argued that currently available computer modeling is not of sufficient quality to draw conclusions about the future need NOx control or that available modeling indicates that the proposed controls are not needed. Several other commenters, including the American Lung Association, the Natural Resources Defense Council, and representatives of state air pollution control agencies (STAPPA/ALAPCO and NESCAUM), were generally satisfied with the quality of the available modeling and expressed support for EPA's air quality conclusions.

Analysis/Response

In responding to comments about EPA's modeling and the policy decisions based on that modeling, some background may be helpful. In the case of ozone, the modeling to which commenters referred falls into two related categories that are generally performed sequentially. The first major step is to develop emission inventories estimating the atmospheric loading of ozone precursors currently and projecting emissions out to future years. These inventories are useful for projecting trends in emissions over time and for understanding the relative importance of various emission sources. The second major step is to input specially prepared inventories into a complex grid-based air quality model which simulates the photochemistry of ozone formation over a geographic area for the same future years. Modelers have gradually improved the quality of both of these types of modeling over many years, and improvements continue. The following is a summary of the "state of the art" for emission inventory and air quality modeling.

Emission Inventories

In the case of the modeling of emissions inventories performed in support of the proposed HDE rule, EPA at the time of the ANPRM and NPRM used the most currently available data and

widely accepted assumptions about stationary, area, and mobile source emissions and growth rates. EPA and other modeling institutions, most prominently those collaborating in the work of the Ozone Transport Assessment Group (OTAG), have made and continue to make incremental improvements in the quality of data inputs and modeling assumptions for the Eastern half of the U.S.

Several further improvements in the modeling of emission inventories are planned by EPA and/or OTAG. One set of changes involves EPA's plans to improve its mobile source emission factor modeling capability in several ways. Emission factor modeling simulates changes in vehicle fleets over time and estimates average emissions in grams per mile traveled for different types of vehicles and engines. Version 5 of the MOBILE model ("MOBILE5") is the current "state of the art" emission factor model for estimating nationwide emissions (except particulate matter) from on-highway mobile sources. The similar model PART5 is used for projecting mobile source particulate matter emissions). The recently released MOBILE5b improves upon MOBILE5a. While improvements continue in both MOBILE5 and PART5, EPA is confident that the use of these models in projecting mobile source emissions in general, and highway heavy-duty vehicle emissions in particular, is sufficiently accurate for drawing general air quality policy conclusions.

EPA currently has plans underway which will result in several improvements in the modeling of heavy-duty engine emissions. Improvements EPA is considering include reassessing the factors that convert grams per brake horsepower (the units of work used for engine testing) to grams per mile (relating emissions to vehicle miles traveled) and incorporating any newer data that is available relating to in-use emissions from highway HDEs. Several commenters stated that the MOBILE5 model may underestimate actual highway HDE emissions. These commenters believe that the engine emission testing on which HDE modeling is based has too little highway-type operation (which can generate higher NOx levels) and may miss the effects of electronic sensors in some newer engines that change engine parameters during some highway operation. These issue will also be addressed as a part of the development of improvements to the MOBILE model. The Agency also plans to make improvements to PART5 and is developing an improved model for nonroad engines.

These emission factor model improvements and expansions will enhance the ability of EPA, states, and others to accurately estimate mobile source emissions for various scenarios of future emission controls. Although the overall effect of these modeling improvements is not possible to anticipate with accuracy, EPA believes that it is likely that these improvements, taken together, will tend to increase the Agency's estimates of the contribution of highway HDEs to overall emissions as compared to current estimates. In any event, it is very unlikely that changes in emissions estimates that result from these incremental improvements would be so large as to affect the general conclusions of the Agency about the need for NOx control.

OTAG has also initiated changes in inventory modeling that are becoming broadly accepted. These improvements include the choice of which emission control programs are assumed to be in

place in future years in modeling projections. Some commenters raised questions about the assumptions of future programs EPA made in the ANPRM and NPRM. Historically, EPA and others have tended to take the approach of incorporating only those programs that have actually been promulgated at the time of the analysis. Increasingly, it has been possible to evaluate scenarios which include programs that are currently under consideration and are considered likely to be adopted, although they are not yet in place. OTAG and EPA have begun to follow this approach for some modeling scenarios, adding new perspectives to projections of future emissions as various mixes of reasonably likely future programs are assumed.

Taken together, the emerging improvements in emission inventory modeling discussed in this section will help modelers fine-tune estimates of absolute levels of emissions in projection years. What will not change, EPA believes, is the general conclusion that, in the absence of new controls, levels of NOx will level off at levels still too high to resolve the problem of exceedances of the current ozone NAAQS and then begin to rise again. EPA assumes that national economic growth will continue more or less steadily for the foreseeable future, and that increasing numbers of mobile and stationary emission sources will enter that economy. Once current emission control programs are fully phased into the fleet, the downward pressure they provide on emissions would end and total inventories would inevitably begin to turn upward due to the increasing numbers of sources. The potential impact of such a reversal in NOx emissions trends on ozone attainment problems is the subject of the next section.

Ozone Air Quality Modeling

In addition to concerns about projected emission inventories, some commenters also challenged the quality of air quality modeling cited in the ANPRM and NPRM as part of the Agency's justification for proposing new HDE standards. EPA cited several separate studies involving runs of the Regional Oxidant Model (ROM) in different parts of the country, reporting these studies' conclusions that large regional-scale NOx reductions would be necessary for areas in the Northeast, Southeast, Lake Michigan area, and California to attain the ozone air quality standard.

Several commenters pointed out that a newer air quality model, UAM-V, is increasingly used,[28] and they questioned the validity of drawing conclusions based on the earlier modeling. However, recent projections performed by the "modeling centers" involved with OTAG using the UAM-V model have confirmed the general patterns in ozone formation and the potential for ozone reduction projected by the earlier ROM studies. While the newer modeling provides a more detailed view of the behavior of ozone and its precursors in a local area, EPA believes that both models provide a clear picture of ozone as a regional problem which can be expected to respond to regional-scale NOx controls. (As described below, the recent UAM-V modeling has

[28]The UAM-V model uses smaller grid sizes than ROM and allows more layers of the atmosphere to be evaluated, so it has better resolution in predicting localized phenomena.

also confirmed EPA's understanding about the degree to which limited areas under some conditions may experience increased ozone levels when NOx is reduced).

b. Ability of NOx Reductions to Increase Ozone

Comments

Several commenters argued that EPA had not fully recognized that NOx reductions can cause increases in ozone, and they concluded that the proposed action to reduce NOx emissions was therefore unwise or premature. Another commenter, Ventura County, California, expressed an opposing view. In their comments, the Ventura County Air Pollution Control District stated, "If locations are identified where NOx reductions would exacerbate the ozone problem, compensating actions could easily be taken to optimize NOx levels in those areas."

Analysis/Response

In the ANPRM and NPRM, EPA discussed the well known phenomenon that reducing NOx emissions in a local area may in certain circumstances result in an increase in ozone in limited parts of the area. In the proposal, EPA stated its belief that this phenomenon must be considered in the context of the broad need for ozone reduction in nonattainment areas. The Agency also stated its belief that the large expected benefits of NOx control over broad areas within and downwind of many nonattainment areas should be pursued even if these NOx reductions have a neutral or negative effect in localized portions of a limited number of nonattainment areas. Ventura County's comments specifically reinforced this view.

After consideration of all comments received on this subject, EPA believes that nothing in these comments warrants a different course of action by the Agency. Rather, the staff's interpretation of air quality modeling work done since the analysis presented in the NPRM is that the Agency's justification for pursuing the proposed program has grown stronger. Specifically, the joint modeling work done by OTAG in the past year again demonstrates the very limited significance of the "NOx disbenefit" phenomenon. OTAG UAM-V modeling, like earlier ROM modeling, has confirmed that NOx reductions can result in localized areas of ozone increase at the same time that much larger areas experience ozone decreases. One set of OTAG modeling runs, designed to simulate large region-wide NOx reductions, indicated that all ozone problem areas analyzed (covering the eastern half of the U.S.) would experience large ozone reductions with only occasional instances of ozone increases. For only one area did modeled ozone increases of over 5 parts per billion occur more than 5 percent of the time (for the Lake Michigan area such occurrences occurred 7 percent of the time). For most areas, ozone increases occurred one percent or less of the time. In all areas, ozone decreases occurred much more frequently than ozone increases. As some commenters observed, the areas of increased ozone are often in populated areas, and EPA agrees that this is cause for concern. Additional local VOC controls may be needed for some areas to offset part or all of the increased ozone effect. However, the modeling shows that the areas that would experience a reduction in ozone include all or large

portions of each current ozone nonattainment area as well as attainment areas upwind of these the nonattainment areas.

Another important result of the recent and ongoing OTAG modeling is that the phenomenon of NOx reductions increasing ozone levels appears to occur primarily on days and in areas where ozone levels are low. This means that in many cases, even if such an increase in ozone occurs when local NOx levels are reduced, ozone levels may not exceed the NAAQS. In addition, many areas showing increased ozone on some days also show decreased ozone on other days in the modeled episode. Again, any increase in ozone is cause for concern, but clearly most efforts by states and EPA to address ozone problems are and should be directed at situations ozone in excess of the NAAQS occurs frequently.

The Agency has concluded that the overall ozone benefit of large regional reductions in NOx, like those that would occur with the HDE standards finalized today, warrant such controls even where localized ozone increases may occur.[29]

c. Trends in Ozone Levels

Comments

One commenter presented an analysis of ozone monitors concluding that the number of national ozone exceedances has been steadily decreasing over time (when adjusted for ambient temperatures) (Sonoma Technologies, Inc., under contract with the American Petroleum Institute (API)). API stated that this data raises questions about the need for new NOx control programs in order for areas to reach attainment.

Analysis/Response

EPA draws a different conclusion from the Sonoma data than does API. EPA believes that the decreases in numbers and levels of ozone exceedance are not surprising and can be assumed to be the result of the success of past NOx and VOC control programs. Since, as described above, the Agency concludes that NOx levels will continue downward for several years but then level off and begin to rise, the welcome downward trend in ozone cannot be expected to continue without new emission reductions. The data from Sonoma does not contradict this conclusion.

In general, based on consideration of comments relating to modeling, NOx disbenefits, and ozone trends, EPA has concluded that the air quality rationale for proceeding with new HDE emission standards remains strong and that such a program is very much needed. HDE NOx reductions, in particular, are increasingly being shown to be the kind of major program with regional scope that can have a significant effect on ozone levels in many areas of the country that

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[29]"EPA Staff Observations from Recent Air Quality Modeling," Memorandum from Norm Possiel to Tad Wysor, August, 1997.

continue to face unhealthy air quality (See the preamble for this final rule, Section II.A.). EPA is therefore not making changes to its proposed program or the timetable for its implementation.

8. Test Procedures

a. Exhaust Test

Summary/Description of the Issue

The proposed standards are based on the Heavy-Duty Federal Test Procedure (HD-FTP) which is a transient, dynamometer based test procedure developed in the 1970s.

Comments

Several SOP signatories commented that continuity of the test procedures is important for their support of the standards. However, other commenters expressed concern that the test procedure is not representative of real-world operation with some comments that the HD-FTP is being gamed. Therefore, it was suggested that EPA evaluate the HD-FTP under the technology review and develop a supplemental test, if necessary, that would cover real world operation that is not covered by the HD-FTP. Commenters also suggested that a supplemental chassis based short test should be developed and included in certification which could also be used for in-use compliance programs.

Analysis/Response

EPA recognizes that there is concern with the representativeness of the HD-FTP with respect to real-world operation. To address this and other concerns and guarantee in-use emission reductions, EPA has begun an in-use initiative to assess the effectiveness of the current certification and enforcement programs (See preamble section IV.C.). EPA did not propose any changes in its test procedure and does not yet have sufficient information to revise the test procedure. Therefore, EPA will not address the test procedure in this final rule. However, EPA will continue to review the effectiveness of the current certification test, including whether it adequately addresses all cycles of driving behavior. EPA is committed to reviewing this important component of the heavy-duty program and revising the program if such changes are necessary.

b. Measurement of NMHC for Diesels

Summary/Description of the Issue

A method for the measurement of NMHC for diesel exhaust was not proposed. Current Federal emission standards do not require the measurement of NMHC from heavy-duty diesel engines.

Comments

Some commenters made note that there were no proposed test procedures specifically for measuring NMHC from diesel engines.

Analysis/Response

Beginning in 2004, the Federal standards for diesel vehicles will be changed from a total hydrocarbon measurement to a non-methane hydrocarbon standard. However, there is no standardized method for the measurement of methane from diesel exhaust. In the absence of such a procedure, EPA has three options - 1) allow a THC value in place of an NMHC value; 2) allow manufacturers to use their own procedure to analyze methane in diesel exhaust pending prior approval from the EPA; or 3) allow manufacturers to subtract 2% from the mass of the total hydrocarbon value in place of methane measurement. This assumed methane fraction is based on data from a previous EPA study.[30] In the interim, it would incumbent upon industry to develop a standardized methane measurement procedure at which point EPA could put into the regulations. EPA will allow all three options in the regulations.

c. Measurement of NMHC for CNG Vehicles

Summary/Description of the Issue

EPA test procedures currently determine NMHC by measuring THC and methane and taking the difference.

Comments

The Natural Gas Vehicle Coalition commented that the NMHC method defined in EPA's current regulations does not produce accurate results for NGVs because it measures total hydrocarbons by a flame ionization detector (FID) and measures methane separately using a methane analyzer. NMHC is then determined by subtracting methane from the THC FID results.

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[30] Springer, Kari J. (1979), "Characterization of Sulfates, Odor, Smoke, POM and Particulates from Light and Heavy-Duty Engines -- Part IX," Ann Arbor, Michigan: U.S. Environmental Protection Agency, Office of Mobile Sources. Publication no. EPA-460/3-79-007.

This results in an unacceptably high level of error in the calculated NMHC value. Direct NMHC measurement by gas chromatograph (GC) is more accurate than the subtraction method.

Analysis/Response

The Natural Gas Vehicle Coalition is correct that a more accurate value would be obtained using gas chromatography rather than the current subtraction method. In fact, GC is the required method for determination of NMHC in California and is widely used in industry for development purposes. EPA will revise the current emission measurement method to allow CNG vehicles to use GC to determine NMHC emissions.

9. Rulemaking Process

a. SOP Process

Summary/Description of the Issue

In July of 1995, EPA, the California Air Resources Board, and engine manufacturers representing over 90 percent of annual engine sales signed a Statement of Principles (SOP). The SOP describes various understandings and intentions of the signatories. The central focus is EPA's intention to propose significantly more stringent emissions standards for NOx. The SOP contains an outline of many of the important elements of the intended proposal. The SOP also contains the agreement of the other signatories to the intended proposal.

In the SOP the signatories recognize the air quality concerns for high ambient levels of ozone, the importance of moving toward the goal of in-use NOx emissions levels of approximately 2.0 g/bhp-hr, and the feasibility and appropriateness of this goal. The understanding of the signatories on the feasibility and appropriateness of the standards described in the SOP is premised on various factors such as (1) no changes at this time in the PM or CO standard and the test procedures, and (2) increased flexibility in the ABT program. The signatories recognize that EPA is required and fully intends to meet all applicable substantive and procedural rulemaking requirements under the Clean Air Act.

Subsequent to signing the SOP, EPA issued an ANPRM inviting comment on its contents and inviting the views of all concerned in the contents of a proposal. EPA issued a proposal in June 1996 (61 FR 33421 June 27, 1996).

Comments

EPA received comment from several parties supporting the SOP and rulemaking effort. The manufacturers supported the rule and the process used by the Agency. State organizations including STAPPA/ALAPCO and NESCAUM noted their strong support for the rule and commended the Agency and industry on the SOP in their comments. The American Lung

Association also commended EPA and industry on the cooperative effort and the proposal. ATA, in the oral testimony at the public hearing, noted concern that the trucking industry was not part of the SOP discussions, nor were invited to be signatories. However, ATA also noted that EPA staff had made a reasonably good effort to discuss the rule prior to the NPRM and incorporate some of ATA's views into the proposal. While expressing general support for the rule and the new NMHC+NOx standards, the commenters also raised several concerns and provided recommendations in areas where they thought the rule should be improved.

The Union for Concerned Scientists and NRDC, commenting on behalf of health and environmental groups, raised concerns over what they believe to be a lack of public participation in developing the SOP. They questioned whether the requirements of the Administrative Procedures Act have been met and whether EPA can be legally directed or constrained by an agreement reached with a regulated industry without public participation. The commenters found it to be a particularly dangerous precedent to exclude items from a rulemaking that are of critical public interest, such as the particulate standard. The commenters stated that EPA must clarify the role that the SOP played in guiding the rulemaking and re-evaluate the appropriateness of such private agreements in developing future rules.

Analysis/Response

EPA believes the SOP process and the public rulemaking procedures that followed it have been a constructive and productive way to develop the final rule issued today, which will significantly reduce in-use emissions of NOx for diesel cycle HDEs. EPA has adopted many provisions in the final rule that are consistent with the SOP, where the rulemaking record indicates this is the most appropriate course. The final rule differs from the outline in the SOP in certain important aspects where EPA made changes to reflect the development of the facts and issues subsequent to the SOP, stemming in large part from the extensive public rulemaking process leading to this final rule. The result is a comprehensive, well supported final rule that will provide important benefits in the control of NOx emissions from HDEs.

The SOP was the initial step in this process. In the past, a rulemaking proposal was often developed with relatively limited involvement of outside parties. Public input was obtained in the public rulemaking process, with the final rule often leading to important changes from the proposal. In recent years EPA has sought in many cases to increase the involvement of interested parties prior to issuance of a proposal. This often provides EPA with the kind of information needed to develop a more comprehensive and robust proposal.

In this case, EPA obtained important pre-proposal input by holding discussions with the parties who eventually became signatories to the SOP, as well as with various other interested parties who were not signatories. The SOP which resulted reflects the significant input received by EPA from a wide number of interested parties. Based on discussions with both signatories and non-signatories, EPA's view at that time was that the SOP outlined an appropriate and feasible proposal for more stringent NOx standards.

The SOP did not constrain EPA, or limit its discretion in any way, legally or otherwise. In essence it is a public statement of EPA's intentions concerning the contents of an upcoming proposal, with the understandings of various parties who agree with EPA's intention. It recognizes EPA's obligation and intention to follow the SOP discussions with a public rulemaking process.

Instead of directly issuing a proposal, EPA issued an ANPRM to seek more public input on the contents of the NPRM. Based on this, EPA developed a proposal that fleshed out many of the details of the SOP and sought comment on a variety of options and issues, including ones not discussed in the SOP. The final rule contains EPA's detailed responses to public comments. While EPA has adopted the approach of the SOP in many ways, there are certain important changes from the SOP. EPA's decision to change or not change from the NPRM is based on EPA's reasoned evaluation of the record before it, including information and ideas provided by commenters. One of the most important changes made by EPA was not taking action at this time on the NMHC+NOx standard for otto-cycle engines. Significant changes were also made in the kind of flexibility added to the current ABT program.

The ANPRM, NPRM, and now this final rule reflect a process of continuing refinements and development of the substance and details of the revised standards and related provisions. The SOP was a critical initial step in this process, and the final result is a major step forward in the control of NOx emissions from diesel cycle HDEs.

b. 1999 Rulemaking Review

Summary/Description of the Issue

EPA included a provision in the NPRM proposing to review the final standards in 1999 to reassess the appropriateness of the standards under the Clean Air Act, including the need for and the technological and economic feasibility of the standards at that time. EPA stated that before making a final decision in this review regarding the appropriateness of these standards, EPA intended to issue a proposal regarding the issue and provide an opportunity for comment. Following any comment, EPA would issue a final agency decision.

Comments

EPA received a comment from environmental groups saying that the 1999 review adds uncertainty to the proposed rulemaking and jeopardized the program by weakening signals to industry. The comment stated that EPA should explicitly state that the burden of proof for any upward change to the emission standards lies with the regulated industry. The comment stated that EPA should develop specific criteria for any determination to modify the standard, and that EPA should emphasize that the 1999 review could result in a lowering of standards. The comment also urged EPA to engage public participation in the 1999 review.

Analysis/Response

EPA does not believe that the existence of the 1999 review adds substantial uncertainty to the rulemaking or the standards. Manufacturers are put on notice by this final rule that they will be expected to meet the new standards by the 2004 model year. Any manufacturer that fails to take steps as soon as needed to meet these requirements does so at the manufacturer's own peril. Though the decision to have a formal review in 1999 is somewhat different from past EPA practice, EPA has always had the ability and duty to review whether its promulgated standards continue to be consistent with the mandate of the Clean Air Act.

Regarding the burdens and criteria for the 1999 review, any EPA decision will be based on the mandates of the Clean Air Act, particularly section 202. The 1999 review does not provide EPA with the authority to modify its statutory criteria. The NPRM and the preamble to this final rule make clear that the 1999 review will be a public process and that the result of the review could be a strengthening of standards.