controls emissions from an individual enclosed storage bin, stack emissions which exhibit greater than 7 percent opacity.

(g) Owners or operators of multiple storage bins with combined stack emissions shall comply with the emission limits in paragraph (a) of this section.

5. It is proposed to amend § 60.675 by revising paragraph (d) and adding paragraph (g) to read as follows:

§ 60.675 Test methods and procedures.

* * * * *

(d) When determining compliance with the fugitive emissions standard for any affected facility described under § 60.672(b) and where there are no individual readings greater than 10% opacity and where there are no more than 3 readings of 10% opacity for the first hour of testing of this affected facility and the opacity of stack emissions from any baghouse that only controls emissions from an individual, enclosed storage bin under § 60.672(f), using Method 9, the duration of the Method 9 observations shall be 1 hour (10 6-minute averages).

* * * * *

(g) If, after 30 days notice for an initially scheduled performance test, there is a delay (due to operational problems, etc.) in conducting any rescheduled performance test required in this section, the owner or operator of an affected facility shall submit to the Administrator at least 7 days prior notice of any rescheduled performance test.

6. Section 60.676 is amended by removing and reserving paragraph (b), revising paragraph (f), redesignating paragraph (g) as paragraph (j) and revising newly designated (j), and adding new paragraphs (g), (h), and (i) to read as follows:

§ 60.676 Reporting and recordkeeping.

* * * * *

(b) [reserved]

* * * * *

(f) The owner or operator of any affected facility shall submit written reports of the results of all performance tests conducted to demonstrate compliance with the standards set forth in § 60.672, including reports of opacity observations made using Method 9 to demonstrate compliance with § 60.672 (b), (c), and (f), and reports of observations using Method 22 to demonstrate compliance with § 60.672(e).

(g) The owner or operator of any wet screening operation and associated conveyor shall keep a record describing the location of these operations and shall submit an initial report describing the location of these operations within 30 days. If, subsequent to the initial report, any screening operation ceases to operate as wet screening, the owner or operator shall submit a report of this change and shall immediately comply with all of the requirements of the regulation for an affected facility. These reports shall be submitted within 30 days following such change.

(h) The Subpart A requirement under § 60.7(a)(2) for notification of the anticipated date of initial startup of an affected facility shall be waived for owners or operators of affected facilities regulated under this subpart.

(i) A notification of the actual date of initial startup of each affected facility shall be submitted to the Administrator. For a combination of affected facilities in a production line that begin actual initial startup on the same day, a single notification of startup may be submitted by the owner or operator to the Administrator. The notification shall be postmarked within 15 days after such date and shall include a description of each affected facility, equipment manufacturer, and serial number of the equipment, if available.

(j) The requirements of this section remain in force until and unless the Agency, in delegating enforcement authority to a State under section 111 of the Act, approves reporting requirements or an alternative means of compliance surveillance adopted by such States. In that event, affected facilities within the State will be relieved of the obligation to comply with the reporting requirements of this section, provided that they comply with requirements established by the State.

[FR Doc. 96–16012 Filed 6–26–96; 8:45 am]
BILLING CODE 6560–50–P

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40 CFR Part 86

[AMS-FRL–5526–9]

Control of Emissions of Air Pollution from Highway Heavy-Duty Engines

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of proposed rulemaking.

SUMMARY: In this action, EPA proposes new emission standards and related provisions for heavy-duty engines intended for highway operation, beginning in the 2004 model year. The proposed provisions represent a large reduction (approximately 50 percent) in emission of oxides of nitrogen (NO_X), as well as reductions in hydrocarbons (HC) and nitrate particulate matter (PM) from trucks and buses. If the proposed standards are implemented, the resulting emission reductions would translate into significant, long-term improvements in air quality in many areas of the U.S. This would provide much-needed assistance to a range of states and regions facing ozone and particulate air quality problems that are causing a range of adverse health effects for their citizens, especially in terms of respiratory impairment and related illnesses.

EPA is also proposing several provisions to increase the durability of emission controls and to provide flexibility for manufacturers in complying with the stringent new standards. The Agency previously published an Advance Notice of Proposed Rulemaking relating to this action and addresses here a number of the comments received on the Advance Notice. EPA believes the proposed program would result in significant progress throughout the country in protecting public health and the environment.

DATES: EPA requests comment on the proposal rulemaking no later than August 26, 1996.

EPA will hold a public hearing on this proposal on July 25, 1996.

EPA will also hold a public meeting on July 19, 1996, to discuss the proposed HDE regulations and receive informal public input on them, and to discuss other potential mobile source controls identified in the California Ozone State Implementation Plan for the South Coast (the greater Los Angeles area).

More information about commenting on this action and on the public hearing and meeting may be found under Public Participation, in Section II of **SUPPLEMENARY INFORMATION.**

ADDRESSES: Materials relevant to this proposal including the draft regulatory text and Regulatory Impact Analysis (RIA) are contained in Public Docket A–95–27, located at room M–1500, Waterside Mall (ground floor), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, DC 20460. The docket may be inspected from 8:00 a.m. until 5:30 p.m., Monday through Friday. A reasonable fee may be charged by EPA for copying docket materials.

Comments on this proposal should be sent to Public Docket A–95–27 at the above address. EPA requests that a copy of comments also be sent to Chris Lieske, U.S. EPA, Engine Programs and Compliance Division, 2565 Plymouth Road, Ann Arbor, MI 48105.

The hearing on this proposal will be held at the Marriott Hotel and

Conference Center, 1275 South Huron Street, Ypsilanti, MI, (313) 487–2000, from 9:00 am until all testimony has been presented.

The public meeting to discuss the proposed HDE regulations will be held Downtown Los Angeles Hyatt Regency, 711 South Hope Street, Los Angeles, California. The public meeting will be conducted in two sessions beginning at 2:00 p.m. and 7:00 p.m., with a dinner recess before the 7:00 p.m. sessions.

This proposal, the draft regulatory text, and the draft Regulatory Impact Analysis (RIA) are available electronically and can be obtained on the Technology Transfer Network (TTN), which is an electronic bulletin board system (BBS) operated by EPA's Office of Air Quality Planning and Standards and via the internet. Details on how to access TTNBBS and the internet are included in Section XIII of **SUPPLEMENTARY INFORMATION.**

FOR FURTHER INFORMATION CONTACT: Chris Lieske, U.S. EPA, Engine Programs and Compliance Division, (313) 668–4584.

SUPPLEMENTARY INFORMATION:

I. Introduction

Air pollution continues to represent a serious threat to the health and well-being of millions of Americans and a large burden to the U.S. economy. This threat exists despite the fact that, over the past two decades, great progress has been made at the local, state and national levels in controlling emissions from many sources of air pollution. As a result of this progress, many individual emission sources, both stationary and mobile, pollute at only a fraction of their precontrol rates. However, continued industrial growth and expansion of motor vehicle usage threaten to reverse these past achievements. Today, more than five years after passage of major amendments to the Clean Air Act (CAA or the Act), many states are still finding it difficult to meet the ozone and PM National Ambient Air Quality Standards (NAAQSs) by the deadlines established in the Act.[1] Furthermore, other states which are approaching or have reached attainment of the ozone and PM NAAQSs will likely see those gains lost if current trends persist.

In recent years, significant efforts have been made on both a national and state level to reduce air quality problems associated with ground-level ozone, with a focus on its main precursors, oxides of nitrogen (NO_X) and volatile organic compounds (VOCs).[2] In addition, airborne particulate matter (PM) has been a major air quality concern in many regions. As discussed below, NO_X, ozone, and PM have all been linked to a range of serious respiratory health problems and a variety of adverse environmental effects.

NO_X control is now seen as a critical strategy to control ozone levels, which remain unacceptably high in many areas across the country. For many years, control of VOCs was the main strategy employed in efforts to reduce ground-level ozone. VOC reductions were deemed more cost effective (on a per-ton basis) and more readily achievable than NO_X reductions. In addition, it was generally believed that greater ozone benefits could be achieved through VOC reductions. More recently, it has become clear that NO_X controls are often an effective strategy for reducing ozone where its levels are high over a large region (as in the Midwest and Northeast). As a result, attention has turned to controlling NO_X emissions as a key to improving air quality in many areas of the country.

Current projections show total NO_X emissions decreasing slightly during the next few years as stationary and mobile source control programs promulgated under the 1990 CAA amendments are phased in. However, the downward trends in NO_X pollution will begin to reverse and NO_X emission inventories will begin to rise by the early or middle part of the next decade due to growth in stationary and mobile source activity. In this timeframe, emissions from mobile sources will account for about half of all NO_X emissions and heavy-duty vehicles are projected to represent about one quarter of mobile source NO_X emissions. In most areas, a significant increase in ground-level ozone is expected to accompany the rise in NO_X emissions. Levels of PM are also expected to rise, both because of the expected increase in numbers of PM sources and because NO_X is transformed in the atmosphere into fine nitrate particles that account for a substantial fraction of the airborne particulate in some areas of the country (a process called "secondary particulate formation"). Given these expected trends and the absence of new emission control initiatives, the Agency believes that some of the nation's hard-won air quality improvements will begin to be seriously threatened early in the next decade.

Over the past decade, ambient air measurements and computer modeling studies have repeatedly demonstrated that ozone is a regional-scale issue, not just a local issue, in part because ozone and its precursors, NO_X and VOC, are often transported across large distances. Thus, there is a role for all levels of government to address these issues. EPA's state and local partners generally agree that only with new initiatives at the regional and national level can long-term clean air goals be achieved.

The states have jurisdiction to implement a variety of stationary source emission controls. In most regions of the country, states are implementing significant stationary source NO_X controls (as well as stationary source VOC controls) for controlling acid rain, ozone, or both. In many areas, however, these controls will not be sufficient to reach and maintain the ozone standard without significant additional NO_X reductions from mobile sources. Generally, the Clean Air Act specifies that standards for controlling NO_X, HC, and PM emissions from new motor vehicles must be established at the federal level.[3] Thus, the states look to the national mobile source emission control program as a complement to their efforts to meet air quality goals. The concept of common emission standards for mobile sources across the nation is strongly supported by manufacturers, which often face serious production inefficiencies when different requirements apply to engines or vehicles sold in different states or areas.

Motor vehicle emission control programs have a history of technological success that, in the past, has largely offset the pressure from constantly growing numbers of vehicles and miles traveled in the U.S. The per-vehicle rate of emissions from new passenger cars and light trucks has been reduced to very low levels. As a result, increasing attention is now focused on heavy-duty trucks (ranging from large pickups to tractor-trailers), buses, and nonroad equipment.

Since the 1970s, manufacturers of heavy-duty engines for highway use have developed new technological approaches in response to periodic increases in the stringency of emission standards.[4] However, the technological characteristics of heavy-duty engines, particularly diesel engines, have so far prevented achievement of emission levels comparable to today's light-duty

[1] See 42 U.S.C. 7401 *et seq.*

[2] VOCs consist mostly of hydrocarbons (HC).

[3] The CAA limits the role states may play in regulating emissions from new motor vehicles. California is permitted to establish emission control standards for new motor vehicles, and other states may adopt California's programs (Sections 209 and 177 of the Act).

[4] Highway heavy-duty engines, sometimes referred to as highway HDEs in this proposal, are used in heavy-duty vehicles, which EPA defines as highway vehicles with a gross vehicle weight rating over 8,500 pounds.

gasoline vehicles. While diesel engines provide advantages in terms of fuel efficiency, reliability, and durability, controlling NO_X emissions is a greater challenge for diesel engines than for gasoline engines. Similarly, control of PM emissions, which are very low for gasoline engines, represents a substantial challenge for diesel engines. Part of this challenge is that most traditional NO_X control approaches tend to increase PM, and vice versa.

Despite these technological challenges, there is substantial evidence of the ability for heavy-duty highway engines to achieve significant additional emission reductions. In their successful efforts to reach lower NO_X and PM levels over the past 20 years, heavy-duty highway diesel engine manufacturers have identified new technologies and approaches that offer promise for significant new reductions. New technological options are available to manufacturers of heavy-duty gasoline engines as well. The emerging technological potential for much cleaner heavy-duty vehicles is discussed further in Section IV of this proposal and in the associated Regulatory Impact Analysis (RIA).

Recognizing the need for additional NO_X and PM control measures to address air quality concerns in several parts of the country and the growing contribution of the heavy-duty engine sector to ozone and PM problems, EPA issued an Advance Notice of Proposed Rulemaking (ANPRM) on August 31, 1995. In the ANPRM, the Agency sought early comment on the general framework of a program to reduce emissions from the heavy-duty engine category. The Agency has been pleased that a broad range of interested parties have responded to the ANPRM with their comments. To the extent possible, EPA has considered and addressed these comments in the preparation of this Notice of Proposed Rulemaking (NPRM). EPA continues to encourage comment on all aspects of the proposed program; where ANPRM commenters may believe that this action fails to address their comments, EPA encourages them to resubmit those comments in the context of this formal proposal.

This preamble is organized as follows: Section II.A. summarizes the public health and environmental concerns from ozone, PM and their precursors; Section II.B. discusses the connection of these emissions to air quality trends and the regional nature of the ozone and PM problems; Section II.C. presents trends in overall nationwide NO_X, VOC, and PM emissions; Section II.D. presents the current and projected future contribution of heavy-duty vehicles to overall emissions; Section II.E. summarizes the overall rationale for the action being proposed; Section III. then describes in detail the standards and other provisions being proposed as well as background on the regulation of highway heavy-duty engines; Section IV. summarizes the technological feasibility of the proposed program; Section V. reviews the results of EPA's economic and environmental analyses; Section VI. discusses the potential role of several incentive-based programs; and Section VII. provides information about the formal public comment process, including a public hearing. The actual proposed regulatory language is available in the public docket and electronically (see **ADDRESSES** above and Section XIII. for further information).

II. Need for New NO_X and VOC Emission Control

A. Health and Environmental Impacts of Ambient NO_X and VOC: Ozone, Particulate Matter, and Other Effects

Oxides of nitrogen (NO_X) comprise a family of highly reactive gaseous compounds that contribute to air pollution in both urban and rural environments. NO_X emissions are produced during the combustion of fuels at high temperatures. The primary sources of atmospheric NO_X include both stationary sources (such as power plants and industrial boilers), highway sources (such as light-duty and heavy-duty vehicles) and nonroad sources (such as construction and agricultural equipment). Ambient levels of NO_X can be directly harmful to human health and the environment. More importantly from an overall health and welfare perspective, NO_X contributes to the production of secondary chemical products that in turn cause additional health and welfare effects. Prominent among these are ozone and secondary PM formation. Each of these phenomena is briefly discussed in this proposal and in more detail in the Regulatory Impact Analysis.

Much of the evaluation of the health and environmental effects related to NO_X found in this section and in the Regulatory Impact Analysis (RIA) were also discussed in the August 31, 1995 ANPRM.[5] EPA encourages comment on the Agency beliefs expressed in this proposal and in the RIA.

1. Direct Health Effects of NO_X

The component of NO_X that is of most concern from a health standpoint is nitrogen dioxide, NO_2. EPA has set a primary (health-related) NAAQS for NO_2 of 100 micrograms per cubic meter, or 0.053 parts per million. Direct exposure to NO_2 can reduce breathing efficiency and increase lung and airway irritation in healthy people, as well as in the elderly and in people with pre-existing pulmonary conditions. Exposure to NO_2 at or near the level of the ambient standard appears to increase symptoms of respiratory illness, lung congestion, wheeze, and increased bronchitis in children.[6]

2. Indirect Health and Welfare Effects of NO_X and VOC

In addition to the direct effects of NO_X, the chemical transformation products of NO_X also contribute to adverse health and environmental impacts. These secondary impacts of NO_X include ground-level ozone, nitrate particulate matter, acid deposition, eutrophication (plant overgrowth) of coastal waters, and transformation of other pollutants into more dangerous chemical forms. Each of these is discussed below and in the Regulatory Impact Analysis. Also, volatile organic compounds (VOCs), composed of a very large number of different hydrocarbons (HC) and other organic compounds, are primary precursors to ozone. The health and environmental effects of these compounds as a class are generally considered in terms of their effect on ozone and are discussed below and in the RIA. Health or other effects of individual toxic compounds are not separately addressed in this proposal.

a. Ozone

NO_X and VOCs are primary precursors to ground level ozone (O_3). As discussed later in this proposal, ozone tends to be a regional phenomenon in which elevated levels of ozone can develop over wide areas.

Ozone is a highly reactive chemical compound that can affect both biological tissues and man-made materials. Ozone exposure causes a range of human pulmonary and respiratory health effects. While ozone's effects on the pulmonary function of sensitive individuals or populations (e.g., asthmatics) are of primary concern, evidence indicates that high ambient levels of ozone can cause respiratory symptoms in healthy adults and

[5] Information cited in this section and other related information on health and environmental effects related to NO_X and VOC are available from the Regulatory Impact Analysis and other documents found in Docket A–95–27.

[6] Air Quality Criteria Document for Oxides of Nitrogen, EPA–600/8–91/049aF–cF, August 1993 (NTIS #: PB92–17–6361/REB, –6379/REB, –6387/REB).

children as well. For example, exposure to ozone for several hours at moderate concentrations, especially during outdoor work and exercise, has been found to decrease lung function, increase airway inflammation, increase sensitivity to other irritants, and impair lung defenses against infections in otherwise healthy adults and children. Other symptoms include chest pain, coughing, and shortness of breath.[7]

Recent studies focusing on chronic lung effects are also being evaluated as part of EPA's review of the current ozone NAAQS. Repeated exposures in laboratory animals suggest a cumulative impact, potentially causing permanent structural changes to respiratory tissues.[8] Extrapolation of these results to humans raises concern that individuals who have been exposed to ambient air containing high levels of ozone each summer of their lives may experience a reduced quality of life in their later years.[9]

As described in more detail in the RIA, the presence of elevated levels of ozone is of concern in rural areas as well. Because of its high chemical reactivity, ozone causes injury to vegetation. This injury has been observed at ozone levels above and also below the current ozone NAAQS; EPA in is the process of reconsidering the appropriate level of the ozone NAAQS in light of such evidence. Although the action proposed is not being proposed for the purpose of reducing crop damage from ozone, it is of interest to note that estimates based on experimental studies of the major commercial crops in the U.S. suggest that ozone may be responsible for significant agricultural crop yield losses. In addition, ozone causes noticeable leaf injury in many crops, which reduces their marketability and value. Finally, there is evidence that exposure to ambient levels of ozone existing in many parts of the country may be responsible for forest and ecosystem damage. Such damage may be exhibited as leaf damage, reduced growth rate, and increased susceptibility to insects, disease, and other environmental stresses.

b. Nitrate Particulate Matter

The conversion of NO_X into fine particulate matter (such as ammonium nitrate) is of significant human health and environmental concern. In general, air pollutants collectively called particulate matter (PM) are divided into primary and secondary sources. Primary sources include dust, dirt, soot, smoke, and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, trucks, woodstoves/fireplaces, construction activity, forest fires, agricultural activities such as tillage, and natural windblown dust. Particles formed secondarily in the atmosphere by condensation or the transformation of emitted gases such as SO_2, NO_X, and VOCs are also considered particulate matter. Ambient PM is related to several adverse health and environmental effects.

At the present time, data is not available to precisely partition PM–10 into its primary and secondary PM components. Most of the well developed nationwide PM–10 inventories are based only on primary sources, but inventories for some PM–10 nonattainment areas have identified the primary and secondary PM. From the available data, it is clear that the roles of primary and secondary PM vary geographically. For example, ammonium nitrate is a significant portion of the PM–10 inventory in cities in the western states (e.g., Denver, Salt Lake City, Los Angeles) and a smaller portion of total PM in cities in the eastern states (e.g., Philadelphia, New York). As discussed in the RIA, EPA estimates that the NO_X to Nitrate conversion rate varies from near zero to about 20 percent, with a U.S. average in the order of about 5 percent. While there is not data available on this at the present time, it is reasonable to assume that NO_X emissions from heavy-duty engines are converted to nitrate at the same rate as NO_X from other sources.

The existing NAAQS for particulate matter were set in 1987. The primary standards, intended to protect human health, are an average concentration of 150 micrograms per cubic meter ($\mu g/m^3$) over a 24-hour period and an average concentration of 50 $\mu g/m^3$ annually. PM–10 was selected as the indicator for particle pollution based on lung deposition studies. PM–10 includes all particles in the size range of 10 micrometers or less. Particles smaller than 2.5 micrometers are capable of penetrating deeper into the lungs and air sacs. The secondary standards, intended to protect against damage to the environment, were set identical to the primary standards.

Since the last review of the PM–10 NAAQS in 1987, many epidemiological studies of PM–10 exposure at levels below the existing 24-hour and annual standards have associated higher levels of particle pollution with increased occurrence of illness and death (e.g., increased hospital admissions, aggravation of bronchitis and asthma, and premature deaths). Based on studies of human populations exposed to high concentrations of particles and on laboratory studies of animals and humans, there are major human health concerns associated with PM. These include deleterious effects on breathing and the respiratory system, aggravation of existing respiratory and cardiovascular disease, alterations in the body's defense mechanisms against foreign materials, direct and indirect damage to lung tissue resulting in fibrosis, carcinogenesis, and premature death. The major subgroups of the population that appear to be most sensitive to the effects of particulate matter include individuals with emphysema-like conditions or cardiovascular diseases, chronic obstructive pulmonary disease, those with influenza, asthmatics, the elderly, and children. PM–10 also soils and damages materials, and fine particles are a major cause of visibility impairment in the United States.[10]

All particles in the atmosphere scatter light and, hence, reduce visibility. However, light is scattered most efficiently by particles with a diameter of 0.5–1.0 micrometers. Secondary particles such as nitrates are in this size range. As discussed in the RIA, in locations such as the western U.S., where the ambient levels of SO_2 tend to be low, EPA believes nitrate particles are major contributors to visibility attenuation.

c. Other Secondary Effects of NO_X

NO_X is a major contributor to acid deposition. The damage caused by acid deposition continues to be documented and includes acidification of surface waters and soil, reduction in fish populations, damage to forests and associated wildlife, soil degradation, damage to materials, monuments, buildings, etc., and reduced visibility.[11]

[7] Air Quality Criteria Document for Ozone and Related Photochemical Oxidants (External Review Draft), EPA/600/P–93/004aF-cF, 1996.

[8] Gross, K.B., White, H.J. (1987) ''Functional and pathologic consequences of a 52-week exposure to 0.5 PPM ozone followed by a clean air recovery period,'' Lung 165:283–295.; Huang, Y, Chang, L.-Y, Miller, F.J., Crapo, J.D. (1988) ''Lung injury caused by ambient levels of ozone,'' J. Aerosol Med. 1:180–183; Tyler, W.S., Tyler, N.K., Last, J.A., Gillespie, M.J., Barstow, T.J. (1988) ''Comparison of daily and seasonal exposures of young monkeys to ozone,'' Toxicology 50:131–144.

[9] See, for example, Euler, G.L.; Abbey, D.E.; Hodgkin, J.E.; Magie, A.R. (1988) ''COPD symptom effects of long-term cumulative exposure to ambient levels of total oxidants and nitrogen dioxide in California Seventh-Day Adventist residents,'' Arch. Environ. Health 43:279–285.

[10] Air Quality Criteria for Particulate Matter (External Review Draft), EPA–600/AP–95/001a–a, April 1995.

Effects of acid deposition are most pronounced during springtime snowmelts, when ''pulses'' of highly acidic water, often containing high concentrations of toxic aluminum, enter lakes and streams. In addition, nitrogen compounds deposited on ecosystems can transport acids already contained in the soils and thus contribute to the acidification of those ecosystems. Although one commenter on the ANPRM, API, challenged the importance of NO_X control in reducing acid deposition, EPA believes that geographically broad controls like those proposed in this action represent a cost-effective method of reducing overall levels of deposited acid.[12]

Another secondary effect of NO_X emissions is their role in the overgrowth of algae and other plants and oxygen depletion (eutrophication) in coastal estuaries in the eastern part of the country, including the Chesapeake Bay, as well as other estuaries and coastal waters.[13] Airborne nitrogen compounds act as fertilizers for plant growth, contributing an estimated 25 percent of nitrogen loading in some coastal waters. In waters where nitrogen compounds are the limiting factor, eutrophication is resulting in the reduction or loss of commercially valuable aquatic/marine species as well as diminution of water-related recreational activities. EPA addressed this effect on estuaries in the ANPRM and received no comments counter to the Agency's assessment; comment on this issue is encouraged.

EPA encourages comment on all aspects of its review of the human health and environmental impacts of ozone, NO_X, and PM (especially secondary nitrate PM), both in this preamble and in the Regulatory Impact Analysis.

B. Need for NO_X and VOC Control To Address Ozone and PM Issues

1. Regional NO_X Control as a Strategy for Addressing Regional Ozone Problems

The precursors to ozone and ozone itself are transported long distances under some commonly occurring meteorological conditions. Specifically, concentrations of ozone and its precursors in a region and the transport of ozone and precursor pollutants into, out of, and within a region are very significant factors in the accumulation of ozone in any given area. Regional-scale transport, as it is discussed in this proposal, may occur within a state or across one or more state boundaries. Local source NO_X and VOC controls are key parts of the overall attainment strategy for nonattainment areas. However, the ability of an area to achieve ozone attainment and thereby reduce ozone-related health and environmental effects is often heavily influenced by the ozone and precursor emission levels of upwind areas. Thus, for many of these areas, EPA believes that attainment of the ozone NAAQS will require control programs much broader than strictly locally focused controls to take into account the effect of emissions and ozone far beyond the boundaries of any individual nonattainment area.

EPA therefore believes that effective ozone control requires an integrated strategy that combines cost-effective reductions in emissions from both mobile and stationary sources. EPA's current initiatives, including the national highway heavy-duty engine standards proposed in this action, are components of the Agency's integrated ozone reduction strategy.

By the time the 1990 amendments to the Clean Air Act were passed, the understanding that many areas face regional-scale ozone problems was well established. Before 1990, the Act required states to address the contribution of their pollution to other areas' attainment of the ozone standard. Then, in the 1990 amendments, Congress included additional provisions for states to address regional ozone transport in their efforts to reach attainment by the statutory deadlines (the Northeast Ozone Transport Region and Commission resulted from these provisions). Since 1990, the understanding of regional transport of ozone precursors and ozone itself has continued to expand.

The problem of regional transport of ozone and its precursors is widely recognized by the states. In response to concerns about this problem raised by state environmental commissioners comprising the Environmental Council of the States (ECOS), EPA has worked closely with states in the Ozone Transport Assessment Group (OTAG) to develop various recommended control measures intended to address the regional nature of ozone. Similarly, state and local air administrators, under the auspices of STAPPA and ALAPCO, recently passed a unanimous resolution endorsing national NO_X emission regulations.[14]

As the understanding of the photochemical phenomena related to ozone has developed, NO_X control options have received increasing attention. Especially in addressing regional-scale ozone problems, control of NO_X has emerged as the primary strategy. VOC control, by comparison, is seen as most effective in addressing localized ozone peak concentrations found in or near major urban areas. As discussed further below, EPA has conducted modeling studies in recent years covering the eastern half of the U.S., which have reinforced the understanding that regional-scale control of NO_X emissions will be essential to reducing the levels of transported ozone in large areas of the Northeast, Southeast, and Midwest. EPA believes that ozone problems in California also represent regional problems that would be susceptible to regional NO_X control. Thus, the extent of local controls that will be needed to attain and maintain the ozone NAAQS in and near seriously polluted cities is sensitive both to the amount of ozone and precursors transported into the local area and to the specific photochemistry of the area. In some cases (e.g., portions of the Northeast Corridor, the Lake Michigan area, Atlanta, and California) preliminary local modeling performed by the states indicates that it will likely not be feasible to find sufficient local control measures for individual nonattainment areas unless transport into the areas is reduced in some manner. EPA has carefully considered this important relationship between local and regional NO_X controls for individual areas and regions and for the country as a whole, as summarized in the next sections. EPA requests comment on these issues as well as general comments on the need for regional-scale NO_X controls.

a. Action by States and EPA To Achieve CAA Air Quality Goals

Title I of the 1990 Clean Air Act amendments (Sections 181–185(b), generally) established an aggressive strategy for ozone nonattainment areas to come into compliance with the ozone NAAQS. (The case of attainment of the PM NAAQS is discussed in section B.3. below.) The Act's strategy provides the framework for action by states and EPA for national, regional, and local controls. Under these provisions, states are expected to submit State Implementation Plans (SIPs)

[11] ''Acid Deposition Standard Feasibility Study, A Report to Congress,'' prepared for the U.S. Environmental Protection Agency by the Cadmus Group, Inc., under Contract Number 68–D2–0168, February 1995.

[12] More information about EPA's position on the relationship between NO_X and acid deposition may be found as item II–A–13 in Docket A–95–28, titled *Draft Report: Adverse Effects of Nitrogen Oxides and Benefits of Reductions.*

[13] Deposition of Air Pollutants Into the Great Waters: First Report to Congress, EPA–453/r–93–055, May 1994.

[14] See comments from STAPPA/ALAPCO in Docket A–95–27.

demonstrating how each nonattainment area will reach attainment of the ozone NAAQS. Based on the degree that ozone concentrations in an area exceed the standard, the Act spells out specific requirements that states must incorporate into their attainment plans and sets specific dates by which nonattainment areas must reach attainment.

For nonattainment areas designated as serious, severe, or extreme, state attainment demonstrations involve the use of photochemical grid modeling (e.g., Urban Airshed Modeling, or UAM) for each nonattainment area. Although these attainment demonstrations were due November 15, 1994, the magnitude of this modeling task, especially for areas that are significantly affected by transport of ozone and precursors generated outside of the nonattainment area, has delayed many states in submitting complete modeling results.

Recognizing these challenges, EPA recently issued guidance on ozone demonstrations, based on a two-phase approach for the submittal of ozone SIP attainment demonstrations.[15] Under Phase I, the state is required to conduct limited UAM modeling and submit a plan implementing a set of specific local control measures to achieve major reductions in ozone precursors. Phase II involves a two-year process during which EPA, the states, regional associations, and other interested parties can improve emission inventories and modeling and identify regional measures that may be needed to supplement the local controls of Phase I. These improved analyses are then to be considered by states in identifying additional local control measures that may be needed to attain the NAAQS by the statutory dates. Currently, under Phase I of the process, states are submitting plans and EPA is taking action to approve or disapprove them.

As part of these Phase I submittals, some states have indicated that on the basis of preliminary information, locally based stationary source NO_X controls in those nonattainment areas would not be helpful—or, in a few cases, would be detrimental—to attainment of the ozone NAAQS. These states have petitioned EPA under Section 182(f) of the Act for exemptions from local NO_X stationary source controls they would otherwise be required to implement under Reasonably Available Control Technology (RACT) and New Source Review (NSR) regulations. In general, Section 182(f) provides that waivers must be granted if states show that reducing NO_X within a nonattainment area would not contribute to attainment of the ozone NAAQS within the same nonattainment area.[16] This section of the Act was added in 1990 in recognition of the fact that NO_X reductions within some nonattainment areas can increase ozone concentrations.

Section 182(f) of the Act also requires EPA to limit the assessment of state petitions to the effect that NO_X reductions within a nonattainment area are likely to have on that local area's ability to meet the NAAQS (i.e., this section of the Act does not permit an assessment of pollutant transport into and out of the area). However, in their modeling supporting their overall attainment demonstrations under Phase II, states will need to project the levels of ozone and precursors that are transported into the area (these assumptions are called ''boundary conditions''). In many areas, the boundary conditions used in Phase II modeling will need to assume that significant reductions in ozone and NO_X will be accomplished upwind. Thus, in Phase II of the current process, it will be necessary for states and EPA to consider the impacts of NO_X controls at both the local and regional levels in assessing how attainment can be achieved. As described below, in most cases, EPA believes that broad, regional ozone and NO_X control in upwind areas will be necessary for Phase II demonstrations even where Phase I modeling results currently indicate that local NO_X controls may be unnecessary or detrimental.

b. Local NO_X Exemptions' Relation to Regional NO_X Control Needs

The state petitions for exemption from local RACT and NSR requirements so far granted by EPA fall into three categories: (1) EPA approved four state petitions for areas (Dallas and El Paso, TX, Birmingham, AL, and northern Maine) for which Phase I modeling shows that the areas will attain the ozone NAAQS without additional NO_X controls (there is no analysis for these areas showing NO_X controls are either beneficial or detrimental); (2) EPA granted exemptions for five areas (Baton Rouge, LA, Beaumont, TX, Houston, TX, the Lake Michigan area, and Phoenix, AZ) after Phase I modeling showed that local NO_X controls could worsen peak ozone concentrations in the nonattainment areas; (3) EPA approved ten other petitions based on monitoring data that shows the areas attained the ozone NAAQS without additional NO_X controls (there is no analysis for these areas showing NO_X controls are either beneficial or detrimental). It is important to note that only five exemptions that have been granted assert that NO_X controls would be detrimental to attainment plans.

It is very important to view EPA's granting of exemptions from local NO_X controls in some areas under Phase I of the attainment process in the broader context of the ultimate Phase II determinations. Although EPA believes that it is reasonable to initiate new control programs to address regional ozone problems on the strength of information already available (see Section II.E. below), a better overall picture of regional and local air quality phenomena for each area will exist once Phase II demonstrations are completed. Some commenters on the ANPRM have argued that EPA's granting of local NO_X exemptions for some areas during Phase I of the process should be interpreted as a conclusion by the Agency that no further NO_X controls—local, regional, or national—will be necessary for these areas to reach and maintain attainment or that such controls would be harmful. API commented that EPA ''has failed to reconcile [the] two incongruous policies,'' referring to the initiation of new regionally based controls in a period when local NO_X exemptions are being granted in some areas. Similarly, the National Petroleum Refiners Association (NPRA) stated that they view such simultaneous action to be ''contradictory and arbitrary.'' For several reasons, EPA believes that such characterizations fail to recognize the limited role of local NO_X exemptions within the broader Phase II attainment demonstration process.

First, because most of the NO_X waiver petitions contain no modeling analyses and many of those that contain modeling analyses are being supplemented with improved Phase II modeling, EPA's approval of each NO_X exemption has been granted on a contingent basis.[17] That is, a monitoring-based exemption lasts for only as long as the area's monitoring data continue to demonstrate attainment. Thus, if a violation is monitored (prior to the area being redesignated as being in attainment) the exemption would be revoked and the

[15] Memorandum from Mary D. Nichols, Assistant Administrator for Air and Radiation, to EPA Regional Administrators, re Ozone Attainment Demonstrations, March 2, 1995.

[16] ''Section 182(f) Nitrogen Oxides (NO_X) Exemptions—Revised Process and Criteria,'' EPA Memo from John S. Seitz, Director, OAQPS, to Regional Air Directors, February 8, 1995.

[17] ''Section 182(f) Nitrogen Oxides (NO_X) Exemptions—Revised Process and Criteria,'' EPA Memo from John S. Seitz, Director, OAQPS, to Regional Air Directors, May 27, 1994.

requirement to adopt NO_X controls would again apply. Similarly, any modeling-based exemption may need to be withdrawn if updated modeling analyses for Phase II reach a different conclusion than the Phase I modeling on which the exemption was based.[18]

Second, as discussed above, Section 182(f) of the Act does not permit EPA to consider regional-scale NO_X issues when acting on state petitions for exemptions from local NO_X controls. Because NO_X has been shown to be effective in reducing regionally transported ozone, the broader modeling under Phase II is expected to show that many areas will need regional NO_X controls to counter expected growth and maintain or reach attainment. Where this occurs, it might also lead to withdrawal of exemptions from local NO_X controls.

Third, EPA has separate authority under the CAA (Section 110(a)(2)(D)) to require a state to reduce emissions from sources where there is evidence showing that transport of such emissions would contribute significantly to nonattainment or interfere with maintenance of attainment in other states. For example, local NO_X controls may need to be reinstated if Phase II modeling shows that additional reductions in that area are needed for attainment and maintenance in downwind areas, superseding any NO_X exemption that may have been granted under Phase I. If this need arises, Section 110(a)(2)(D) would provide EPA the authority to require such additional reductions.

EPA therefore believes that decisions about initiating new NO_X control programs that have a regional-scale effect are appropriately made based on the best understanding available at that time of the broad attainment needs of all areas. As is discussed below for several regions of the country, there is strong evidence that regional-scale controls will be needed to achieve and maintain attainment. As a part of the Phase II assessments, the impact of and need for NO_X control and the continuation or withdrawal of local NO_X exemptions would be taken fully into account. Thus, in assessing EPA's overall NO_X policy, it is important to understand the limited and perhaps temporary nature of exemptions from NO_X controls in some areas within the context of the anticipated implementation of broader, regional NO_X control strategies upon completion of the Phase II modeling.

An important issue that states and EPA will consider during the Phase II process is the interaction between prospective regional control programs and local air quality conditions. For nonattainment areas that are granted local NO_X exemptions based on the lack of need for additional NO_X controls (this covers the great majority of current and pending exemptions, as shown above), introducing regional controls that have an effect both inside and outside the nonattainment area is generally not expected to harm air quality within the area. In the few areas where Phase I modeling indicates that reduction of NO_X in the area could increase ozone in some locations, a balancing of all relevant factors will be necessary if Phase II modeling reinforces that a significant potential problem exists. For example, if ozone and NO_X transported into the area would be significantly reduced by regional-scale controls, the absolute level of ozone within the area would drop, changing the photochemistry of the area and potentially offsetting any localized detriment to air quality that might still be introduced by the regional controls (e.g., cleaner trucks within the area).

In its comments on the ANPRM, API referred to recent modeling studies performed by the Modeling Ozone Cooperative, which API says challenge EPA's earlier conclusions about the need for NO_X control in the Northeast. EPA is aware of and is reviewing the results of these modeling studies. Based on EPA's evaluation of these studies to date, the Agency finds that these studies in fact support EPA's previous conclusions that broad regional-scale controls will be necessary for the Northeast and other areas to attain and maintain the ozone NAAQS. As API observes, these studies also predict that NO_X reductions may increase ozone levels in several areas. API also cites modeling performed by the Lake Michigan Air Directors Consortium (LADCO), which appears to predict similar results for the Lake Michigan area. As described below, the LADCO studies do however, suggest that reductions in regional ozone at the boundary of their modeling domain will likely play a key role in determining whether the NAAQS can be attained with local VOC-oriented control measures.

EPA is concerned about these results and is interested in additional modeling to further explore the degree to which NO_X control programs may increase ozone in some areas. Questions not answered by current modeling include (1) how the results change if additional stationary and mobile source NO_X and VOC control programs are assumed to be implemented by the time the heavy-duty engine emission standards proposed in this action would be in place and (2) whether urban-scale modeling of higher resolution can shed more light on how widespread potential areas of increased ozone might be.

EPA expects that on balance it will continue to be preferable to achieve regional-scale NO_X and ozone reductions whenever possible, even where current modeling indicates that increases in ozone may occur in parts of some areas. EPA requests comments on this general assessment, as well as on the discussions of individual regions below; comments including additional data and modeling results that challenge or reinforce EPA's views will be particularly valuable.

2. Role of Regional-Scale NO_X Control in Addressing Ozone Problems in Several Regions of the U.S.

EPA believes that the best data and modeling available show that NO_X in several large geographic areas of the country will continue to contribute greatly to ozone problems in nonattainment areas well into the future. Together, these areas account for about 87 percent of nationwide NO_X emissions from heavy-duty vehicles (see Chapter 7 of the RIA). Several of these regions are discussed individually below. Where there are existing or pending exemptions from local NO_X controls in the region, their relationship to regional-scale NO_X controls is also discussed.

a. Eastern United States

There is a growing body of evidence that reducing regional ozone levels holds the key to the ability of a number of the most seriously polluted nonattainment areas in the Eastern United States, in both the Southeast and the Northeast, to attain and maintain the ozone NAAQS. Regional Oxidant Modeling (ROM) studies conducted by EPA (called the ROMNET and Matrix studies) reinforce that reducing NO_X emissions in large geographical regions is the most effective approach for reducing ozone levels in those large regions.[19] At the same time, these studies, as well as ongoing UAM modeling by states, suggest that reductions in VOC emissions may be

[18] NO_X Supplement to the General Preamble, 57 FR 55628 (Nov. 25, 1992).

[19] See Regional Ozone Modeling for Northeast Transport (ROMNET), EPA Doc. EPA–450/4–91–002a (June 1991), and Chu, S.H., E.L. Meyer, W.M. Cox, R.D. Scheffe, ''The Response of Regional Ozone to VOC and NO_X Emissions Reductions: An Analysis for the Eastern United States Based on Regional Oxidant Modeling,'' Proceedings of U.S. EPA/AWMA International Specialty Conference on Tropospheric Ozone: Nonattainment and Design Value Issues, AWMA TR–23, 1993.

key to reducing locally generated peak ozone concentrations.[20]

In its analysis supporting the approval of a Low Emission Vehicle program in the mid-Atlantic and Northeast states comprising the Ozone Transport Region (OTR), EPA reviewed existing work and performed new analyses to evaluate in detail the degree to which NO_X controls are needed.[21] [22] These studies showed that NO_X emissions must be reduced by 50 to 75 percent from 1990 levels throughout the OTR. These studies showed that VOC emissions must also be reduced by 50 to 75 percent in and near the Northeast urban corridor. The studies also concluded that transport of ozone and precursors from upwind areas both inside and outside the OTR contributes significantly to ozone predictions in much of the OTR.

More recently, three studies have become available confirming the conclusions of the earlier studies. In one of these, the Agency performed new ROM analyses evaluating the eastern third of the U.S. and southern Canada.[23] Taken together, these studies strongly support the view that NO_X emissions must be reduced in the range of 50 to 75 percent throughout the OTR and that VOC emissions must be reduced by the same amount in and near the Northeast urban corridor to reach and maintain attainment.

Among the Northeast states, only Maine, based on unique air trajectory patterns, has sought an exemption from local NO_X control; this exemption is granted for the northern part of the state.

b. The Southeast

A recent Southern Oxidant Study report describes the results of research showing that, in the South, relatively high concentrations of ozone are measured in both rural and urban areas.[24] These pervasive levels of ozone, while for the most part not in excess of the current ozone NAAQS, form a background into which individual urban plumes are interspersed. Preliminary modeling analyses performed by the State of Georgia Department of Natural Resources suggests that it will be very difficult to meet the NAAQS in Atlanta during episodes similar to those modeled episodes, given the high background levels of ozone that appear to prevail in the South. Further analyses of monitored data by Southern Oxidant Study investigators suggest that the background ozone levels are likely to be more responsive to reductions in NO_X emissions than in VOC emissions. There are no petitions at this time for local NO_X exemptions in this region.

c. The Lake Michigan Area

Modeling studies performed to date for the states surrounding Lake Michigan (Wisconsin, Illinois, Indiana, and Michigan) under Phase I of their attainment demonstrations clearly indicate that reducing ozone and precursors transported into the nonattainment areas would have a significant effect on the number and stringency of local control measures needed to meet the ozone NAAQS.[25] These studies suggest that without such region-wide reductions, the necessary degree of local control will be very difficult to achieve, even with very stringent local controls. The EPA Matrix study referenced above reinforces that regional NO_X control will be effective in reducing ozone across the Midwest region. Taken together, the information available to date suggests that additional reductions in regional NO_X emissions will probably be necessary in meeting the NAAQS in the Chicago/Gary/Milwaukee area and downwind (including western Michigan), even though currently available modeling shows that there may be a detrimental effect from applying NO_X controls locally in and near the major nonattainment areas, in the absence of regional controls.

EPA has granted an exemption from local NO_X controls for several areas in the Lake Michigan region based on Phase I modeling. Phase II modeling is underway by these states, which the Agency is hopeful will clarify the conditions under which NO_X controls might cause an increase in ozone in the future, the magnitude of such an increase, and the parts of the nonattainment areas in this region in which this may occur.

d. Eastern Texas

There has been only limited modeling work focusing on the air quality characteristics of the eastern Texas region to date. The State of Texas has requested and been granted exemptions for the Houston and Beaumont/Port Arthur nonattainment areas, based on Phase I modeling that predicted that additional local NO_X controls could worsen the ozone problem. New modeling is underway by the state, but there is not yet enough data to draw conclusions about the potential effect of transport of ozone and its precursors on these areas. This uncertainty has led the state to request that the exemptions from local NO_X controls in these areas be granted on a temporary basis while more sophisticated modeling is conducted.

e. California

The State of California has submitted their ozone SIP to EPA for approval, relying on both NO_X and VOC reductions for most California nonattainment areas, comprising most of the populated portion of the state, to demonstrate compliance with the NAAQS. Specifically, the revised SIP projects that the following NO_X reductions are as follows: South Coast, 59 percent; Sacramento, 40 percent; Ventura, 51 percent; San Diego, 26 percent; and San Joaquin Valley, 49 percent. For VOC, the required reductions will be the following: South Coast, 79 percent; Sacramento, 38 percent; Ventura, 48 percent; San Diego, 26 percent; and San Joaquin Valley, 40 percent.

EPA has granted exemptions from local NO_X controls within three California nonattainment areas; EPA believes that these actions do not affect the broader need for regional NO_X controls in large parts of the state for ozone and PM NAAQS attainment and maintenance.

3. Secondary PM Formation as a Regional Issue

Measurements of ambient PM in some western U.S. urban areas that are having difficulty meeting the current NAAQS for PM–10 have indicated that secondary PM is a very important component of the problem. Nitrates

[20] Because of the significant role that NO_X plays in atmospheric chemistry, additional regional NO_X control can also be very helpful in addressing the problems of year-round NO_X deposition in the Chesapeake Bay and other nitrogen-limited lakes and estuaries and acid deposition and visibility degradation in the eastern U.S. (as well as parts of the West).

[21] The Northeast Ozone Transport Region (OTR) is comprised of the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, and the Consolidated Metropolitan Statistical Area that includes the District of Columbia and northern Virginia.

[22] Environmental Protection Agency, Low Emission Vehicle Program for Northeast Ozone Transport Region; Final Rule, 60 FR 48673, January 24, 1995.

[23] Environmental Protection Agency, ''Summary of EPA Regional Oxidant Model Analyses of Various Regional Ozone Control Strategies,'' November 28, 1994; Kuruville, John et al., ''Modeling Analyses of Ozone Problem in the Northeast,'' prepared for EPA, EPA Document No. EPA–230–R–94–108, 1994; Cox, William M. and Chu, Shao-Hung, ''Meteorologically Adjusted Ozone Trends in Urban Areas: A Probabilistic Approach,'' Atmospheric Environment, Vol. 27B, No. 4, pp 425–434, 1993.

[24] ''The State of the Southern Oxidant Study (SOS): Policy-Relevant Findings in Ozone Pollution Research,'' 1988–1994. North Carolina State University, April 1995. See this reference for all statements in this paragraph.

[25] Lake Michigan Ozone Study; Lake Michigan Ozone Control Program: Project Report, December 1995.

(e.g., ammonium nitrate) are a primary constituent of this secondary PM. For example, on days when PM–10 is high in Denver, about 25 percent of the measured particulate is ammonium nitrate. In the Provo/Salt Lake City area, secondary PM accounts for approximately 50 percent of the measured PM, with nitrates being an important component of the secondary particulate. Secondary nitrate PM levels as high as 40 percent of the 24-hour PM–10 NAAQS standard have been measured in the Los Angeles Basin and concentrations of nitrate PM about one third of the NAAQS have been measured in the San Joaquin Valley.[26]

NO_X is a critical reactant in the complex chemical reactions which eventually result in the formation of atmospheric nitrates. Thus, control of NO_X emissions from heavy-duty vehicles will have a positive effect in reducing atmospheric ammonium nitrate. Because the atmospheric chemistry of secondary PM formation has common attributes to that of ozone, secondary PM also tends to be a regional, rather than a strictly local phenomenon. For this reason, EPA believes that, as is the case for ozone, regional NO_X controls can be very effective in reducing secondary PM over a significant area. For example, California's revised SIP concludes that secondary formation of nitrate particulate (primarily ammonium nitrate) contributes to the particulate problem in the South Coast Air Basin and the San Joaquin Valley. The Agency requests comment on the role of secondary particulate in PM–10 nonattainment in specific areas and the effect of regional NO_X controls on such emission; comments that include additional data will be particularly valuable.

The sources that contribute to PM levels can vary significantly from area to area. In many areas in the western U.S., re-entrained fugitive dust emissions dominate the overall PM emissions inventory. In large urban areas, however, direct PM emissions from heavy-duty diesel vehicles, as well as the secondary PM from NO_X produced by all heavy-duty vehicles, are believed to contribute significantly to elevated PM levels.

As can be seen from the discussion above, NO_X emissions have a number of different fates in the atmosphere. In some situations, such as the formation of atmospheric ozone, NO_X is used as a catalyst but not consumed. A single NO_X molecule can potentially be involved in many photochemical reactions producing several ozone molecules. In other cases, such as the formation of nitrate particulate and acid precipitation, NO_X is consumed. All NO_X eventually leaves the atmosphere in dry gas, particulate deposition, or in wet deposition. NO_X has a mean residence time in the atmosphere on the order of several days.

It is clear that heavy-duty vehicle NO_X emissions have a role in the formation of ozone, nitrate particulates, and acid precipitation. The relative partitioning varies across the country depending on factors such as geography, meteorology, and the concentration of other atmospheric pollutants. This preamble and the RIA contain information and analyses describing the positive impact of this proposal on ozone, PM, and other environmental effects, which EPA believes form a strong basis for this proposal. EPA is conducting additional studies to further refine our understanding of the role of NO_X in the formation of ozone and nitrate PM. EPA requests comment and data regarding the relative partitioning of NO_X emissions.

C. National Emission Trends Related to Ozone and PM

1. National NO_X and VOC Emissions Trends

Figure 1 displays projected total NO_X emissions over the time period 1990 to 2020, including a breakdown between stationary and mobile source components over the same period.[27] Figure 2 presents similar data for VOC emissions for the period 1990 to 2010 (later-year projections for VOC are under development).[28] As the figures show, a similar pattern is projected for both of these ozone precursor emissions. Initially, the projections indicate that national inventories will decrease over the next few years as a result of continued implementation of finalized CAA stationary and mobile source NO_X control programs. After the year 2000, however, when implementation of these CAA programs is largely completed and the pressure of growth continues, these downward trends are expected to reverse, resulting in rising national VOC and NO_X emissions.

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[26] Summary of Local-Scale Source Characterization Studies, EPA–230–F–95–002, July, 1994.

[27] A discussion of the data used for projecting emissions from various sources is found in the Regulatory Impact Analysis.

[28] The data in these and the succeeding figures in this proposal are discussed in the RIA, and take into account the expected effects of various CAA control programs that have been promulgated at the time of the modeling. These include Tier I tailpipe standards, new evaporative emission test procedures, enhanced inspection and maintenance requirements, reformulated gasoline, oxygenated fuels, and California LEV (Low Emission Vehicle) requirements. Nonroad NO_X emission projections also reflect the future effects of existing nonroad emission regulations. The potential effects of contemplated National LEV requirements or other programs are not reflected in the data. In these figures, nonroad emission data includes emissions from a broad range of nonroad sources including locomotives, aircraft, and marine vessels.

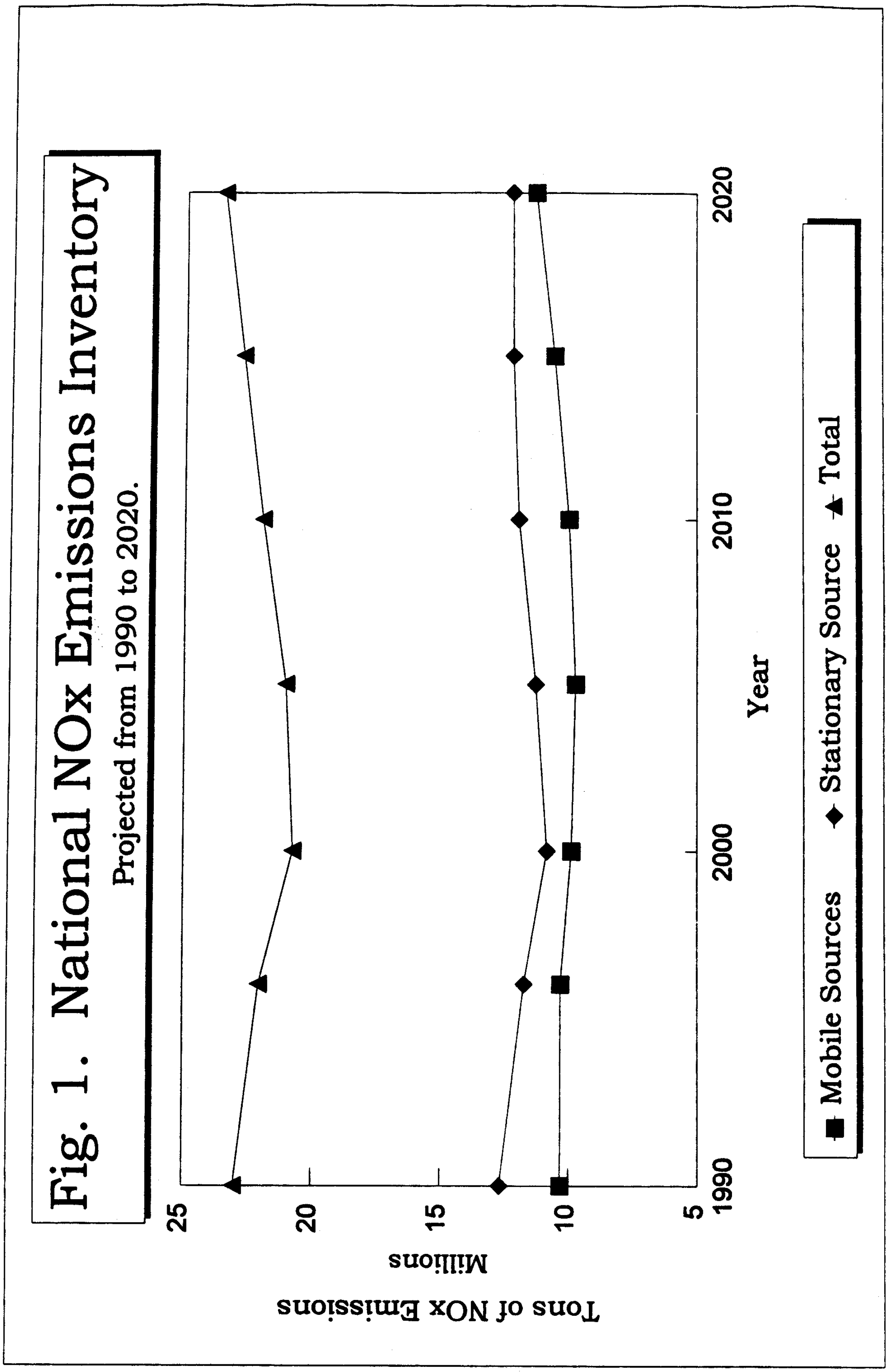
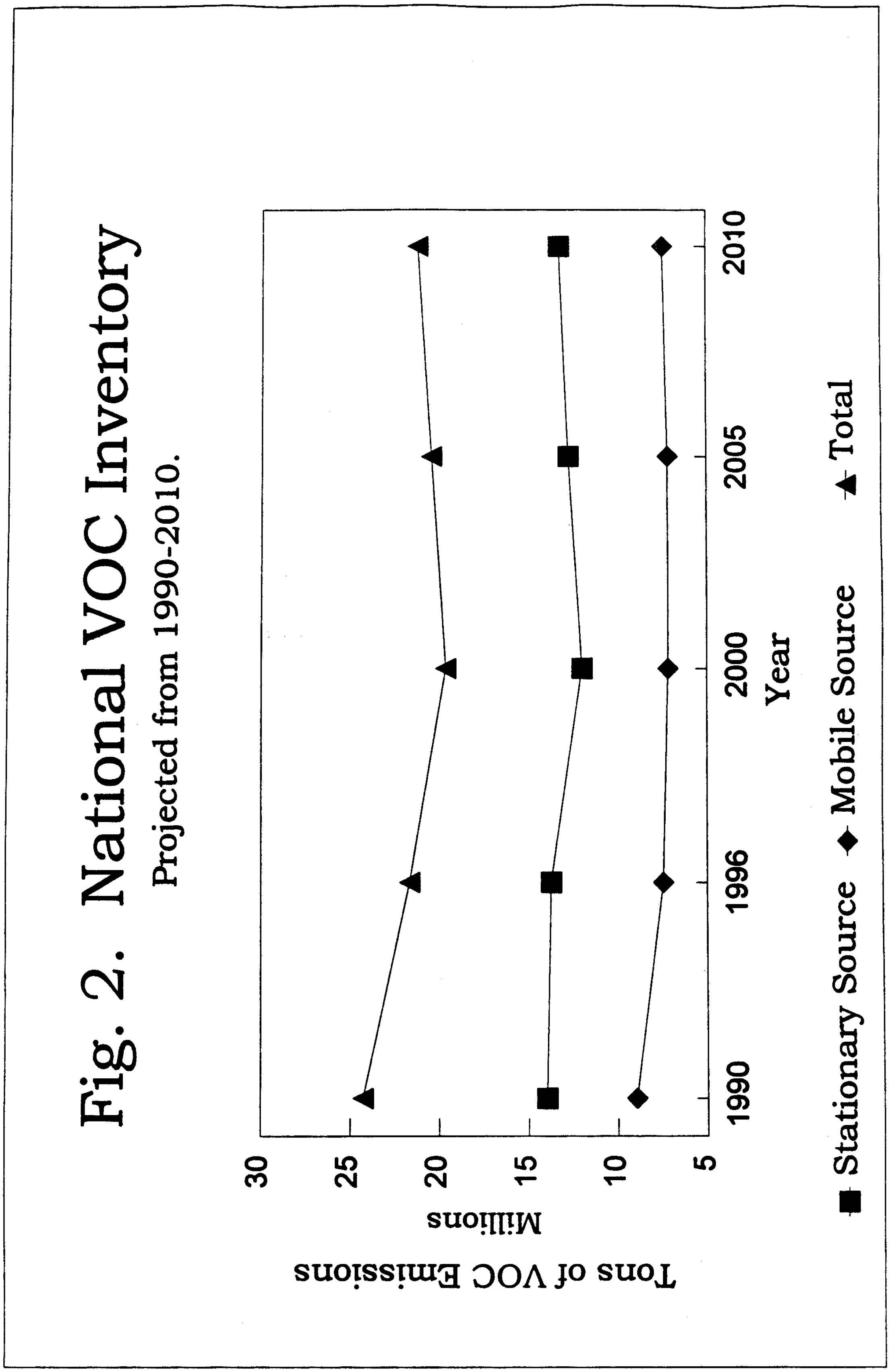


Fig. 1. National NOx Emissions Inventory
Projected from 1990 to 2020.
Tons of NOx Emissions
Millions
25
20
15
10
5
1990
2000
2010
2020
Year
Mobile Sources
Stationary Source
Total



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In its comments on the ANPRM, API observed that monitoring data from some areas show progress in reducing ozone. EPA agrees that this progress appears to be occurring and the Agency believes that this progress may continue for the next few years in many areas as current NO_X and VOC programs are implemented. As shown in Figures 1 and 2 above, however, EPA believes that, in the absence of significant new control efforts, the current downward trends in ozone precursor emissions will be reversed in the middle of the next decade. The Agency also believes that the projected increase in emissions will again increase ozone levels in urban areas. EPA continues to examine this issue and welcomes new modeling analyses that relate NO_X and VOC emission trends to ozone levels.

2. PM Air Quality Issues and Emission Trends

The overwhelming proportion of PM–10 emissions is created by wind erosion, accidental fires, fugitive dust emissions (from road surfaces, agricultural tilling, construction sites, etc.), and other miscellaneous sources. As much as 85 percent of PM–10 in nonattainment areas can be composed of these ''crustal'' and miscellaneous materials. Since these sources are not readily amenable to regulatory standards and controls, it is appropriate to focus on the ''controllable'' portion of the particulate pollution problem when considering the need for PM controls. The result is shown in Figure 3, which displays national trends in PM–10 levels from stationary and mobile sources, including secondary nitrate PM, projected for the twenty-year period 1990 to 2010. Similar to the pattern discussed above for VOC and NO_X emissions, the figure shows that total PM from these sources will decline slightly as the beneficial effects of the 1990 CAA Amendments continue to be felt. However, in the absence of additional controls, including NO_X controls, mobile source and industrial source PM emissions are expected to rise after 2000.

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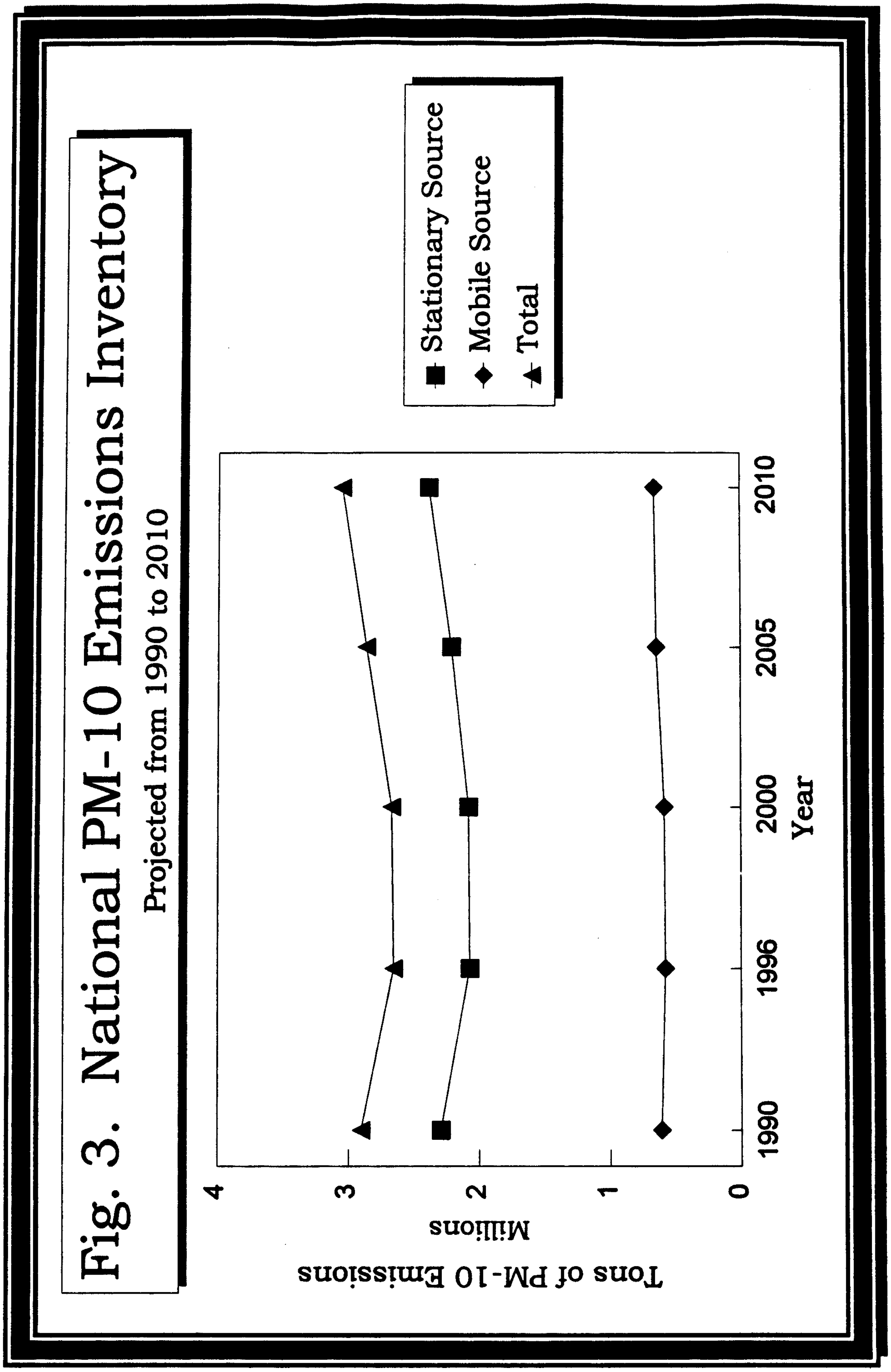

Fig. 3. National PM-10 Emissions Inventory
Projected from 1990 to 2010

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Currently, there are 82 PM–10 nonattainment areas across the U.S. As discussed in section II.B.3. above, in some areas of the West, nitrate particulate represents between 15 and 40 percent of total particulate matter. The level of nitrate PM is a function of the availability of NO_X. It is appropriate to expect that the relative proportions of nitrate particulate caused by stationary and mobile sources are similar to the relative contributions of NO_X by these source categories. Thus, based on the NO_X projections of Figure 1, which EPA believes are generally typical of NO_X projections in the West, EPA estimates that about half of total nitrate PM is caused by mobile sources, or about one tenth of total PM–10 in the western part of the country. In the eastern part of the country, peak fine particulate matter levels occur in the summer, primarily because photochemical processes involving SO_2 and NO_X driven by strong sunshine accelerate the formation of sulfate and nitrate particulate matter. Thus, reducing NO_X over a broad area is one strategy for reducing the net fine particle formation in the East. EPA requests comment, including applicable data whenever possible, on its assessment of the relationship of NO_X to ambient nitrate PM.

D. Contribution of Heavy-Duty Vehicles to Mobile Source Emissions

Heavy-duty vehicles represent about 12 percent of nationwide NO_X emissions and are also an important source of VOC (as a result of HC emissions) and PM throughout the country. This section reviews EPA's current estimates of the contribution of heavy-duty vehicles to the nation's ozone, PM, and NO_X air pollution problems now and into the future. The projections presented here incorporate the emission reductions from all national mobile source emission control programs for which final regulations were in place at the time of the modeling and are discussed further in the RIA.

1. National Mobile Source NO_X Emissions Trends

Figure 4 shows the total mobile source NO_X inventory by emission source (light-duty vehicles, heavy-duty vehicles, and nonroad engines) projected over the next 25 years. For light- and heavy-duty vehicles, the figure shows a decline in emissions over the next decade as current programs phase in. The figure also shows, however, that this current downward trend is projected to end, resulting in a return to current NO_X levels in the absence of further controls. Nonroad emissions are projected to rise throughout the period.

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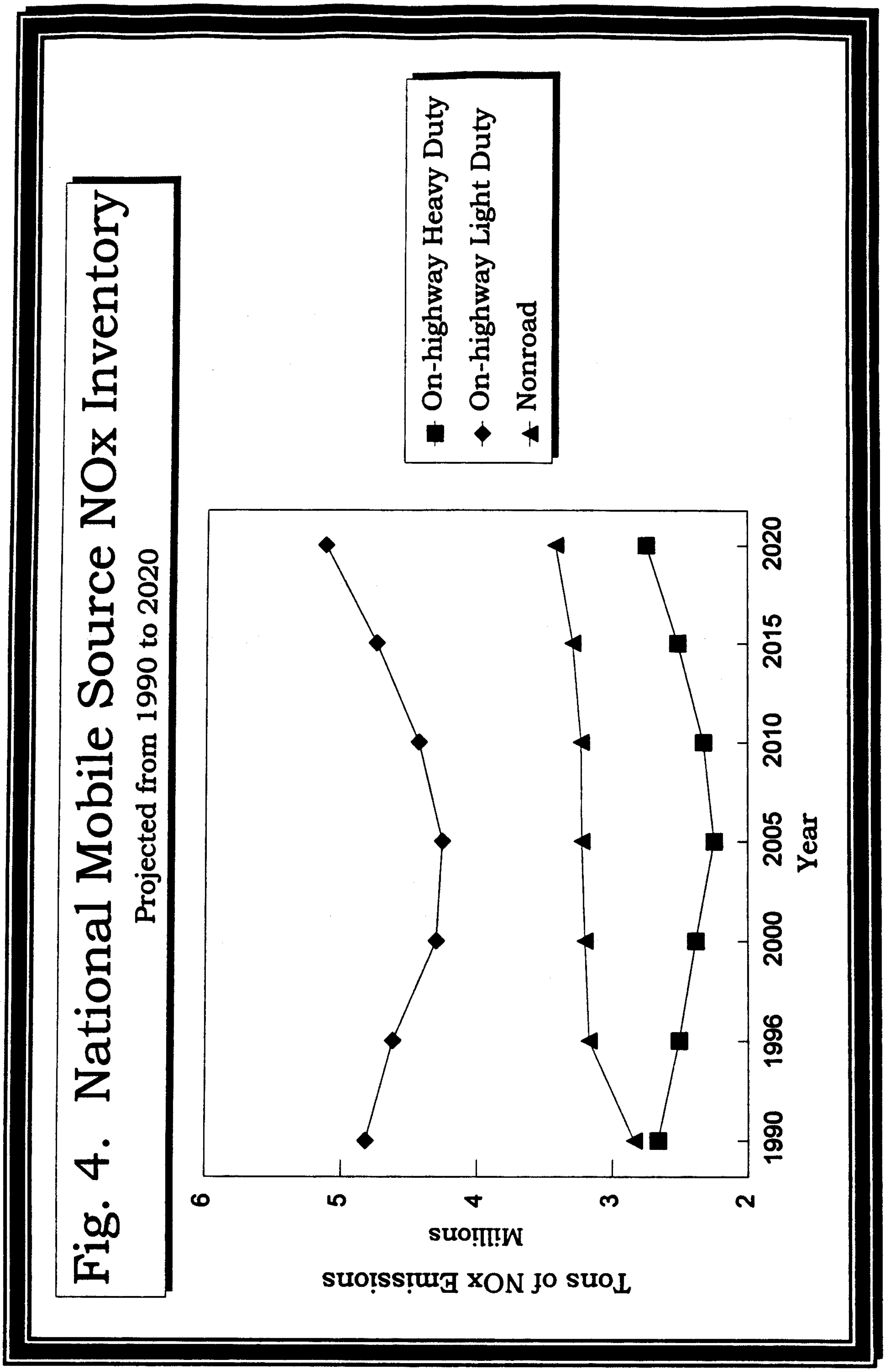

Fig. 4. National Mobile Source NOx Inventory

Projected from 1990 to 2020

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2. National Mobile Source VOC Emissions Trends

Figure 5 shows the total national mobile source VOC inventory by emission source. As with the NO_X emission projections in Figure 4, this figure shows that light-duty vehicle emissions can be expected to decline for some years, but then begin rising in the 2005 time frame. VOC emissions from heavy-duty vehicles and nonroad engines are projected to rise gradually throughout this period.

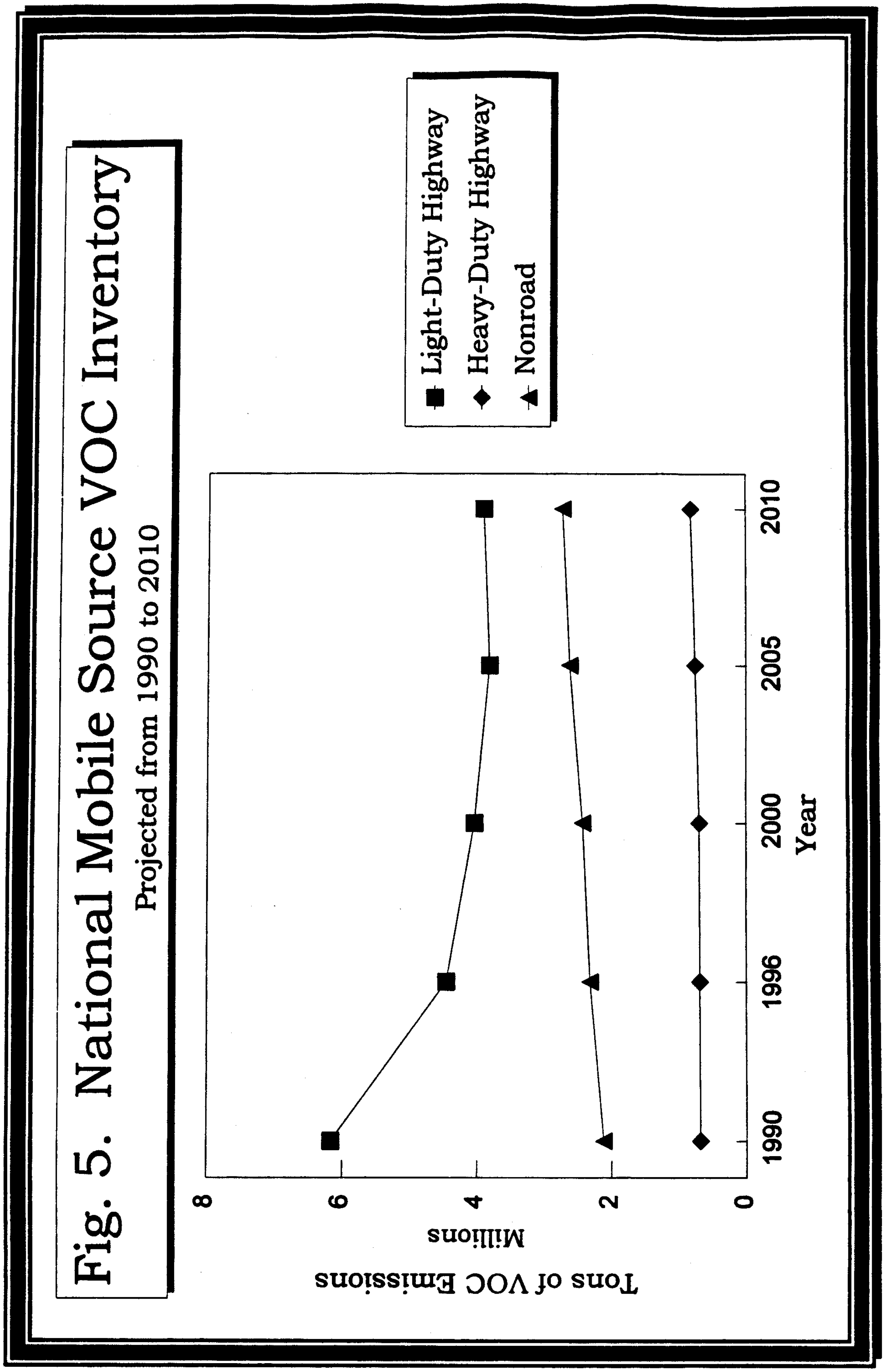

Fig. 5. National Mobile Source VOC Inventory
Projected from 1990 to 2010

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3. National Mobile Source PM Emissions Trends

EPA's latest projected trends for directly emitted mobile source emissions of PM–10 are shown in Figure 6. The figure shows that over the next 15 years the contribution of heavy-duty vehicles and other highway sources to PM–10 pollution are expected to decrease significantly and then remain relatively constant well into the next decade.

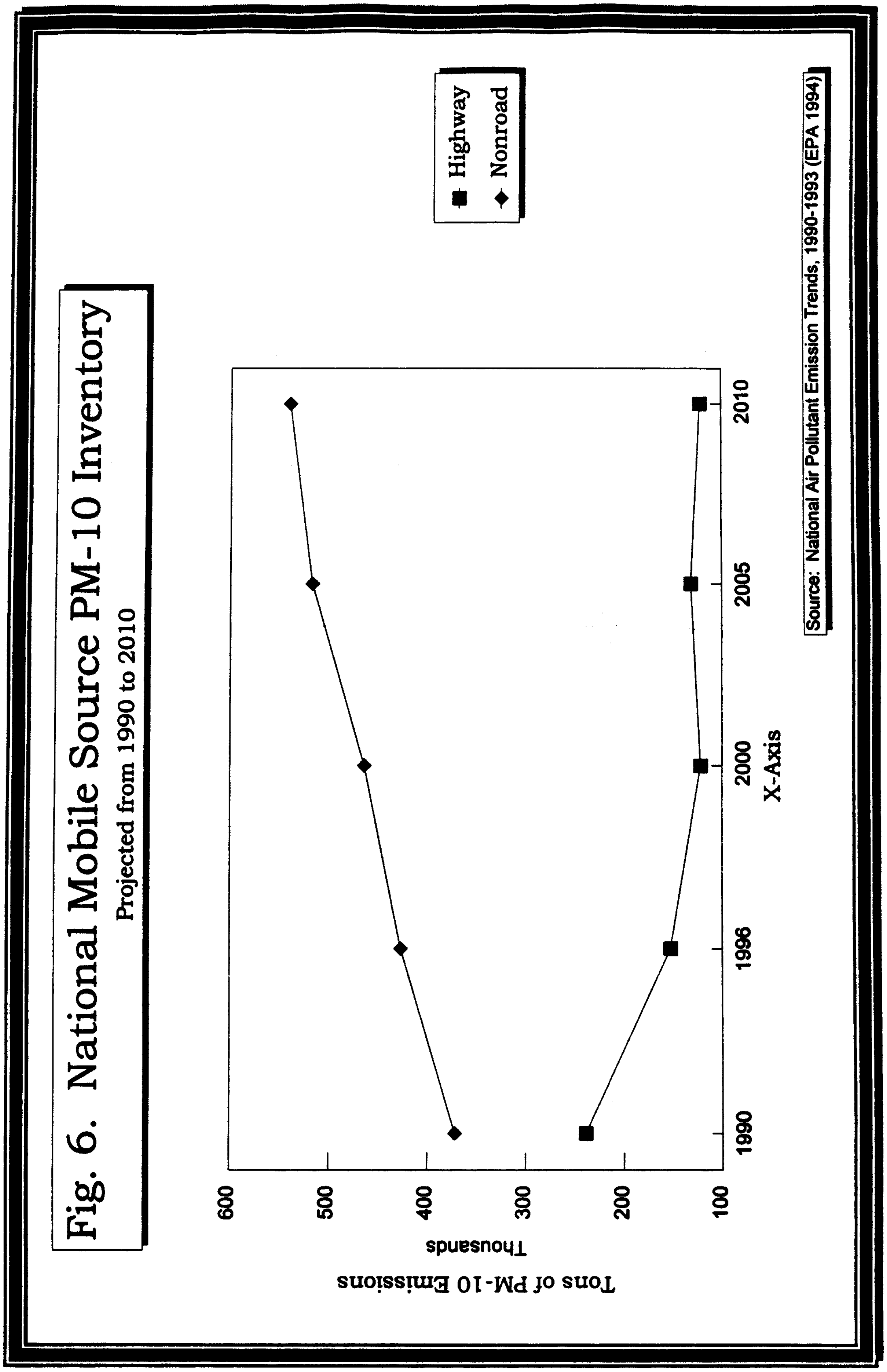

Fig. 6. National Mobile Source PM-10 Inventory

Projected from 1990 to 2010

The emission data on which Figure 6 is based do not include secondary nitrate PM–10 produced by the transformation of NO_X in the atmosphere. EPA believes that for those areas where secondary PM formed from NO_X is a problem, the proportions of total secondary PM that may be attributed to different emission source categories mirror the proportions of total NO_X emissions from those sources in those areas. Thus, based on the trends for NO_X emissions shown in Figures 1 and 4 above and assuming that the availability of ammonia in the atmosphere remains roughly constant, the contribution of heavy-duty vehicles to secondary PM problems can be expected to decline slightly in the next few years and then to begin to increase again, likely reaching and exceeding current levels after about 2020. Also based on Figures 1 and 4, EPA believes that on average the proportion of total nitrate PM that may be attributed to heavy-duty vehicles is in the same range as the proportion of total NO_X contributed by these vehicles, or roughly 10 percent.

As discussed earlier in this proposal, EPA has not completed its assessment of the relative importance of fine PM to health and welfare concerns as compared with PM–10. As a result, EPA has not yet developed specific projections showing the contribution of heavy-duty vehicles to total fine particulate emissions. However, since nearly all mobile source related PM, both directly emitted PM and secondary nitrate PM formed from NO_X emissions, falls in the fine particulate category, it follows that the relative contribution of heavy-duty vehicles to total fine particulate is greater than their contribution to total PM–10.

E. Conclusions

1. The Rationale for Controlling Heavy-Duty Vehicle Emissions

EPA believes that immediate proposal of new emission standards for highway heavy-duty engines is appropriate. The decision to issue this NPRM is based on thorough consideration of a range of relevant factors, as described above. Section II.A. presented the serious effects to human health and the environment of elevated levels of ozone and other chemical products of NO_X emissions, including secondary PM . That section describes a range of serious respiratory health effects that have been closely connected to exposure to ozone levels exceeding the NAAQS, which exist in many areas of the country. In light of the many years of research by many parties into the health effects of ozone, the Agency believes that a clear picture has emerged that, not only those with existing respiratory conditions, but also healthy adults and children are in danger of experiencing medical problems and a reduced quality of life when exposed to elevated levels of ozone. Also discussed were the variety of health concerns that have been associated with exposure to PM at levels above the current NAAQS. Beyond these and other serious health concerns, Section II.A. also discussed major impacts on vegetation, crops, coastal estuaries, visibility, and other effects that result from the transformation of NO_X into ozone, acid deposition, and nitrate PM formed from NO_X. The current NAAQS levels reflect the need to address exposure to ozone and PM wherever the NAAQS standards are exceeded.

Section II.B. discussed EPA's belief that the widespread exposure of people to elevated ozone levels will continue and worsen in the absence of major regional-scale reductions in NO_X. This section discussed the regional characteristic of the ozone problem and how various large areas of the country are projected to require regional-scale NO_X controls to reach and maintain attainment of the ozone standard. EPA believes this remains true even where local NO_X control waivers must be granted under the CAA. This section also noted that regional-scale control of NO_X would be beneficial in reducing the formation of secondary PM in some areas of the western U.S. and would thereby assist these areas in reaching and attaining the PM NAAQS.

Section II.B. also presented projections of emissions over the next 20 to 30 years to help assess the likelihood of continued air quality problems in the future. In general, EPA's most recently developed emission inventories show that national levels of ozone precursors will tend to drop slightly, but only temporarily, after which they will return to current levels. The link of these projected future emissions to the formation of ozone was reinforced by recent air quality modeling projecting continued ozone problems in major areas of the country in the absence of new controls. The information assembled in this section leads EPA to believe that a strong need exists for new regional-scale NO_X control programs over large areas of the country if the negative trends are to be arrested and reversed. Similarly, the data on PM suggests that secondary PM reductions will be helpful in reversing a national trend of increasing PM emissions, especially in the western states.

Section II.C. presented national mobile source emission inventories over the next 20 to 30 years, divided into the key mobile source categories. These presentations showed that heavy-duty vehicles contribute significantly to mobile source NO_X , VOC, and PM emissions and to the overall trends in mobile source emissions into the future. In its comments on the ANPRM, API gave several reasons why projections of future emission inventories may be in error and questioned the future contribution of heavy-duty vehicle emissions. Although EPA believes that the projections presented in this proposal can be improved and will continue to take actions to improve them, the Agency believes that they represent the highest quality estimates available today. As such, they clearly indicate that heavy-duty vehicles will remain significant contributors to these emissions well into the future.

After consideration of all the available information, including comments received on the ANPRM, EPA believes that heavy-duty vehicles contribute significantly to air pollution, which has a serious impact on health and the environment. The Agency believes that this body of information on balance supports taking action to revise heavy-duty engine emission standards, which will reduce NO_X, HC, and secondary PM from this segment of mobile sources.

2. Appropriateness of a National Heavy-Duty Vehicle Program

EPA further believes that the mobile source emission control program proposed in this action is most appropriately national in scope, for several reasons. First, as summarized above, the regional character of both ozone and secondary PM formation leads EPA to believe that major new NO_X controls over large regions of the country are needed to achieve the regional-scale ozone and PM reduction many areas require. Control of NO_X from heavy-duty vehicles and other mobile sources are effective approaches to such regional control since the resulting control covers a wide area. Second, heavy-duty vehicles, like other mobile sources, represent an emissions source that itself crosses boundaries of nonattainment areas, states, and regions. A mobile source control program that covers only certain parts of the country has the disadvantage of allowing high-emitting vehicles to travel regularly into areas with more stringent requirements, compromising the effectiveness of the program. Finally, the structure and marketing patterns of the engine and vehicle manufacturing industries would make it impractical and inefficient for a patchwork of different emission standards to be enacted in various parts of the country. Rather, for engine manufacturers to achieve economies of scale and to concentrate research and development resources most effectively, EPA believes it is most practical to establish a single set of emission requirements applying to engines in trucks and buses used anywhere in the country. A key reason why EPA, CARB, and engine manufacturers agreed to a Statement of Principles was the potential for nationally harmonized requirements for heavy-duty vehicles.

3. Issues of Timing

EPA also believes that for the anticipated benefits of new highway heavy-duty engine emission standards to be available when they are needed, it is best to finalize such a program in the near future. There are several reasons for and positive consequences of expeditious promulgation of new emission requirements for heavy-duty engines. The primary reason to begin the process now is that the current emission and air quality projections discussed above project a need in many areas of the country for significant additional emission reductions in the post-2000 period to reach and maintain attainment.

In addition, the highway heavy-duty engine manufacturers have communicated to EPA that to meet the stringent standards proposed in this action for model year 2004 and later, they need to have the precise emission requirements affecting them in place and begin work toward those goals very soon. The industry's perspective is based on its expectation that the standards proposed here would represent a very significant technological challenge requiring large investments by the members of the industry. EPA's technology assessment is consistent with the industry view. If new standards are established by approximately the end of 1996, about two years will be available before the proposed 1999 technology review for manufacturers to marshall appropriate resources to achieve significant technological progress. Then, if such progress is confirmed at that time, about four years will remain for additional resources to be assembled and the new technologies to be developed and incorporated into 2004 model year engines. Based on the Agency's technology assessment as of the time of this proposal, EPA agrees that it is best to set the process in motion now to achieve the full benefits of cleaner heavy-duty vehicles beginning in 2004.

Another compelling reason to initiate the process of enacting new heavy-duty engine emission requirements soon is that the Agency is proposing to encourage voluntary marketing of cleaner engines, especially engines that incorporate new technologies, earlier than 2004 (see Section III.B. below for proposed changes to the Averaging, Banking, and Trading program). An expeditious completion of the rulemaking process would encourage manufacturers to consider such options in the earliest possible model year.

State air quality planners will also benefit if the program proposed in this action can be formally established soon. States must soon finalize ozone SIPs demonstrating attainment in the years ahead, and expeditious EPA action on additional heavy-duty vehicle emission reductions will allow states to know whether to incorporate expected reductions from heavy-duty vehicle controls into their SIPs. At the same time, any significant delay in promulgation might also require a delay in the year of implementation past 2004, postponing the full benefit of the program as an air quality strategy. For this and the other reasons given in this section, EPA plans to finalize the proposed requirements as soon as possible should the Agency reach a final determination that such a program is warranted.

III. Proposed Program for Reducing Highway HDE Emissions

A. Background on Highway HDE Standards

Under EPA's classification system, vehicles with a gross vehicle weight rating (GVWR) over 8,500 pounds are considered heavy-duty vehicles. (The State of California classifies the lighter end of EPA's heavy-duty class as ''medium-duty vehicles.'') Heavy-duty engines (HDEs) are used in a wide range of heavy-duty vehicle categories, from small utility vans to large trucks. Because one type of HDE may be used in many different applications, EPA emission standards for heavy-duty vehicles are based on the emissions performance of the engine (and any associated aftertreatment devices) separate from the vehicle chassis. Testing of an HDE consists of exercising it over a prescribed duty cycle of engine speeds and loads using an engine dynamometer.

Highway HDEs are categorized into diesel and otto-cycle (predominantly gasoline-fueled) engines with each, in some cases, having different standards and program requirements. EPA has further subdivided heavy-duty diesel engines (HDDEs) into three subclassifications or ''primary intended service classes''; light, medium, and heavy HDDEs. HDDEs are categorized into one of the three subclasses depending on the GVWR of the vehicles for which they are intended, the usage of the vehicles, the engine horsepower rating, and other factors [29]. The subclassifications allow EPA to more effectively set requirements that are appropriate for the wide range of sizes and uses of HDDEs. With one exception, emission standards are the same for HDDE in all of the subclasses but other programmatic requirements differ as appropriate. Engines used in ''urban buses'' (large transit buses)[30], which fall mostly in the heavy HDDE subclass, have somewhat different standards and program requirements. The standards and program requirements for the various categories and types of engines are discussed below and in following sections, as appropriate.

Emissions from HDEs are measured in grams of pollutant per brake horsepower-hour (g/bhp-hr) or, in more recent regulations, in grams per kilowatt hour (g/kw-hr). These units for emission rates recognize that the primary purpose of HDEs is to perform work and that there is a large variation in work output among the engines used in heavy-duty applications. This system allows EPA to apply the same standards to a very wide range of engines.

Emission standards have been in place for highway diesel and gasoline-fueled HDEs since the early 1970s. The first regulations focused on control of emissions of smoke. Subsequent regulations broadened emission control requirements to include gaseous and particulate emissions. The 1990 amendments to the Clean Air Act required EPA to set more stringent standards for NO_X emissions from all heavy-duty highway HDEs and for PM from urban buses. 42 U.S.C. 7521(a)(3), 7521(f), and 7554(b).

The current exhaust emission standards for highway heavy-duty diesel and gasoline engines are presented in Table 1. Standards for urban buses, which specify more stringent PM levels than those applying to other HDEs, are displayed separately in the table.

[29] 40 CFR Part 86.090–2.

[30] 40 CFR Part 86.093–2.

TABLE 1.—HIGHWAY HEAVY-DUTY EMISSION STANDARDS

Year	HC (g/bhp-hr)	CO (g/bhp-hr)	NO_X (g/bhp-hr)	Diesel particulate (g/bhp-hr)
Diesel:				
1991–93	1.3	15.5	5.0	0.25
1994–97	1.3	15.5	5.0	0.10
1998	1.3	15.5	4.0	0.10
Urban Buses:				
1991–92	1.3	15.5	5.0	0.25
1993	1.3	15.5	5.0	0.10
1994–95	1.3	15.5	5.0	0.07
1996–97	1.3	15.5	5.0	*0.05
1998	1.3	15.5	4.0	*0.05
Otto-cycle	HC (g/bhp-hr)	CO (g/bhp-hr)	NO_X (g/bhp-hr)	Evaporative HC (g/test)
1991–97:				
(A)	1.1	14.4	5.0	3.0
(B)	1.9	37.1	5.0	4.0
1998 (A)	1.1	14.4	4.0	3.0
(B)	1.9	37.1	4.0	4.0

Note:
‘‘(A)’’ denotes the standard for engines in trucks ≤14,000 lbs. Gross Vehicle Weight Rating (GVWR).
‘‘(B)’’ denotes the standard for engines in trucks ≥14,000 lbs. GVWR.
*.07 g/bhp-hr in-use.
This table does not contain all applicable standards. A complete set of standards may be found in 40 CFR Part 86.

Under section 202(a)(3), emission standards for highway HDEs are set at the ‘‘greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology’’ (42 U.S.C. 7521(a)(3)(A)). In addition, section 202(a)(3) provides that highway HDE manufacturers will have four model years of lead time before any new emission standards may be implemented (42 U.S.C. 7521(a)(3)(C)). The Act also provides that standards for HDEs apply for at least three model years to provide stability to any heavy-duty standards. *Id.* Finally, the Act precludes new NO_X emission standards for highway HDEs before the model year 2004. 42 U.S.C. 7521(b)(1)(C).

B. Description of Today's Proposal

In this action, EPA proposes a comprehensive program to address the significant contribution of highway HDEs to ambient pollutant concentrations and the resultant air quality problems around the country. The proposed program consists of stringent new emission standards, changes to maintain the durability of HDE emissions in use, and changes to the current Averaging, Banking, and Trading regulations to encourage the early introduction of cleaner engines and new technology.

1. Emission Standards

a. Standards Proposed in Today's Action. EPA proposes new emission standards for model years 2004 and later. These standards are in the form of combined non-methane hydrocarbons plus nitrogen oxides (NMHC + NO_X) and are presented in units of g/bhp-hr. They would apply to otto and diesel cycle engines fueled by gasoline, diesel, methanol, and gaseous fuels and their blends. Manufacturers would have the choice of certifying their engines to either of two optional sets of standards:

2.4 g/bhp-hr NMHC + NO_X
or
2.5 g/bhp-hr NMHC + NO_X with a limit of 0.5 g/bhp-hr on NMHC

EPA proposes that all other emission standards and other requirements applying to model year 1998 and later model years remain unchanged.

For the most part, EPA expects that either of these standards will result in the essentially the same NO_X and NMHC emission rates in-use. As is discussed elsewhere in the proposal and in the supporting RIA, EPA expects that the proposed standards will generally result in NMHC levels of about 0.4 g/bhp-hr and NO_X levels of about 2.0 g/bhp-hr. Most, but not all, HDEs now have HC certification levels of 0.5 g/bhp-hr or less. The standards will result in modest NMHC reductions for the HDE class taken as a whole and will serve as a cap against increases in NMHC emissions as manufacturers implement NO_X control strategies. The expected NO_X levels would result in reductions of 50 percent as compared to the 1998 standard. For administrative simplicity, EPA would prefer only one standard and based on current HC certification levels the 2.4 g/bhp-hr standard seems most appropriate. However, the manufacturers would prefer the flexibility of the alternate standard and EPA sees no environmental harm from offering this option. EPA asks comment on whether two standards are appropriate and why.

The form of the proposed standards differs in some aspects from the current and 1998 model year standards for HDEs presented in Table 1. First, EPA is proposing a combined standard (NMHC+NO_X) instead of separate standards. EPA is using this approach because for in-cylinder control strategies there is a tradeoff between HC and NO_X control. Thus, expressing the requirements as a combined standard provides the manufacturers some small amount of additional flexibility. Further, EPA sees no environmental harm from providing this flexibility. While there is not a direct one to one trade-off in every area of the country, both pollutants are generally considered key ingredients in the formation of ozone. Thus a little more control of one pollutant at the expense of the other should provide essentially the same air quality benefits as if the engines were meeting separate standards for NO_X and NMHC at comparable levels (nominally 2.0 g/bhp-hr NO_X and 0.4 g/bhp-hr NMHC). Second, EPA is proposing an NMHC standard instead of a total HC standard. This approach is being proposed primarily because methane is largely unreactive in the formation of ozone and thus its control would not help to achieve the ozone air quality objectives of this proposal. This is not intended to suggest that the control of methane is not valuable in the context of other environmental objectives EPA may consider in the future, but methane emissions from these engines are only a small fraction of their total HC and thus foregoing control at this time is reasonable. Both the use of an NMHC standard and the use of a combined standard is also consistent with the current California LEV program requirements for medium-duty vehicles and the requirements for HDEs prescribed in section 245 of the 1990 amendments to the Clean Air Act.

The proposed standards (rooted in the California Federal Implementation Plan and identified in the SOP) represent a reduction of more than 50 percent in NO_X and NMHC/HC over current requirements. Reductions of this magnitude are a significant challenge, especially for diesel HDEs, and will require a major research and development effort to achieve. At this time there is not one firm set of technologies to be applied to all diesel HDEs to achieve the proposed standards. Diesel HDEs will need to consider approaches from a number of different technological strategies and control hardware which have been identified and assessed in a few laboratory programs and then apply their choices to their 2004 models. In many cases these strategies and hardware have not been used on production diesel engines and there are substantial development challenges ahead to apply this technology cost effectively with due consideration to impacts on operating and maintenance costs as well as engine durability. Regulatory enhancements such as the proposed revisions to the Averaging, Banking, and Trading program (as discussed below) will also help to enhance overall feasibility of the standards for all engine models. As is discussed elsewhere in proposal and in the supporting RIA, EPA believes the proposed standards while very challenging are technically feasible and otherwise appropriate in the context of section 202(a)(3). With about eight years remaining before the 2004 model year, manufacturers have an unprecedented amount of leadtime to fully assess, develop, and optimize the various control approaches and to integrate them into their 2004 model year products in a manner which minimizes engine costs and fuel impacts and does not raise safety concerns. Indeed the widespread support of the HDE industry for the SOP tends to support EPA's conclusion.

While there are promising technologies and aftertreatment control strategies which otto cycle (gasoline) HDEs may employ to achieve the proposed standards, these still require development if they are to be applied to all different otto-cycle engine models and the standards are to be met in use. EPA believes it will be easier technologically for otto-cycle (gasoline) HDEs to achieve the proposed standards but proposes the same standards for otto and diesel cycle HDEs for two reasons. First, work is required to apply these technologies/aftertreatment control strategies to all otto cycle engines. EPA expects that much of this progress will be made in response to the 1998 HDE NO_X standard and others in response to market competitive pressures. Nonetheless, EPA still expects that some models will need to develop and employ technology/aftertreatment control upgrades to meet a 2.4 g/bhp-hr NMHC + NO_X standard. This may especially be the case for the few otto-cycle HDE families which may not employ closed loop control, fuel injection systems with catalysts before 2004. Second, because otto and diesel cycle HDEs compete in the market place, there is a degree to which for market equity reasons it is appropriate to apply standards of equivalent stringency to both classes of engines. This approach reduces the possibility that emission standards could have disruptive effect on the HDE market. Both EPA and the California Air Resources Board have set HC and NO_X standards of equivalent stringency for otto-cycle and diesel HDEs in the past.

b. 1999 Rulemaking Review

EPA proposes to conduct a special review in 1999 to reassess the appropriateness of the standards under the CAA including the need for and the technological and economic feasibility of the standards at that time. Before making a final decision in this review regarding the appropriateness of these standards under the CAA, EPA intends to issue a proposal regarding this issue and offer an opportunity for public comment on whether the standards continue to be technologically feasible for implementation in 2004 and consistent with the CAA. Following the close of the comment period, EPA would issue a final agency decision under section 307 of the CAA.

If in 1999 EPA finds the standards to not be feasible for model year 2004 or otherwise not in accordance with the Act, EPA will propose adjusted standards which do not exceed the following:

2.9 g/bhp-hr NMHC + NO_X
or
3.0 g/bhp-hr NMHC + NO_X with a limit of 0.6 g/bhp-hr on NMHC.

However, if EPA determines that the feasibility of the standards requires diesel fuel changes and EPA does not engage in rulemaking to require such changes, EPA will propose adjusted standards which do not exceed the following:

3.4 g/bhp-hr NMHC + NO_X
or
3.5 g/bhp-hr NMHC + NO_X with a limit of 0.7 g/bhp-hr on NMHC.

The standards finalized in the rulemaking initiated by today's proposal would stay in effect unless revised by this subsequent rulemaking procedure. EPA has included language in the proposed regulatory text regarding the 1999 review.

Over the next several years EPA will be actively engaged in programs to evaluate technology (engine/fuel quality) interactions/developments and progress toward meeting the proposed standards through in-house programs and coordination with the involved industries. To aid in this process EPA has established a working group under its Mobile Sources Technical Advisory Sub-Committee to the CAA Advisory Committee to solicit technical advice and input from engine, fuel, and related experts from around the country. If as a result of this evaluation, EPA reaches the view that the available information is sufficient to indicate that the feasibility of the standards may depend on modifications to diesel fuel, any potential for diesel fuel changes could then be considered within the context of the 1999 Review. EPA recognizes that any consideration of potential fuel diesel modifications must be appropriate under section 211(c) of the CAA (including considerations of cost, cost effectiveness, and other relevant cost considerations), and is especially sensitive to the substantial leadtime requirements that may be associated with fuel modifications.

Based on the information presented in the RIA and in section IV of this proposal, EPA believes the proposed standards are technologically feasible and otherwise appropriate under the CAA. Nonetheless, especially for diesel engines, it is clear that a significant amount of research and development will be needed to comply. The alternate standards discussed above are designed to serve as a backstop in the event that the 1999 review leads to the conclusion that a revision is appropriate. Based on the technical analysis in the RIA, these levels represent upper limits for these potential revisions. If during the course of the review EPA concludes that a revision is appropriate, a rulemaking will be conducted to determine the appropriate level for the model year 2004 and later standards.

c. Other Issues Related to HDE Emission Standards. Several commenters to the ANPRM expressed concern with the levels of the emission standards EPA is proposing today. Representatives of environmental organizations and several states argued that EPA should propose more stringent standards for one or more pollutants. While EPA believes at this time that today's proposed program represents the best combination of standards that are achievable given our current understanding of technological constraints, as explained below, and the other criteria set forth in CAA section 202(a)(3), EPA remains open to additional information and will consider finalizing more stringent standards in this action or proposing more stringent standards by separate action if such standards are warranted.

In comments the Agency has received thus far, commenters generally address potential standards for NO_X and PM separately and somewhat independently. These comments urge the Agency to propose an NMHC + NO_X standard low enough to assure that NO_X levels of 2.0 g/bhp-hr are reached by all diesels, expressing concern that a 2.4 or 2.5 g/bhp-hr NMHC + NO_X standard will actually translate into 2.2–2.3 g/bhp-hr NO_X, not the 2.0 g/bhp-hr level applied in the California Federal Implementation Plan (FIP) to model year 2002 engines. These commenters also suggest that a PM standard of 0.05 g/bhp-hr be proposed, equal to the level which currently applies to urban buses.

The Agency believes that because of the close interaction among NO_X, NMHC, and PM emissions from diesel engines, decisions about proposed emission standards cannot be made independently from one another. As described below in section IV, EPA believes that reaching all the standards proposed today simultaneously will require a very large technological effort on the part of diesel HDE manufacturers. Based on the information available today, the Agency believes that the scale of the effort which will be required is such that if NO_X, NMHC, or PM standards lower than those proposed here were to be required, the feasibility of implementing the program for the 2004 model year would be threatened. That is, while manufacturers may be able to achieve lower emission levels for some engine models, at this time EPA does not believe that this would be feasible, on average, for the full line of engines manufacturers will likely be offering in 2004. (The technological assessment on which EPA based a 2.0 g/bhp-hr NO_X emission standard in the California Federal Implementation Plans assumed that only engines sold in California, not all engines nationally, would be affected.) Regarding a specific comment that a combined NO_X + NMHC standard allows NO_X emissions significantly higher than the 2.0 g/bhp-hr NO_X goal, the Agency accepts the intention of the engine industry to reach levels very close to 2.0 g/bhp-hr. This also seems likely from a technical perspective since at best modest NMHC reductions can be achieved over current levels. By combining the NO_X standard with NMHC, EPA proposes to allow a small degree of flexibility to manufacturers which succeed in achieving very low NMHC levels in conjunction with the proposed NO_X and PM standards. However, the Agency does not expect that the opportunity to take advantage of that flexibility will be frequently used and expects that on average in-use NO_X levels would be approximately 2 g/BHP-hr.

As is the case for NMHC, for many in-cylinder control strategies there is a trade-off between NO_X and PM emission rates. In-cylinder techniques which reduce NO_X may increase PM and vice-versa. For HDDEs, EPA expects that most manufacturers will rely on in-cylinder NO_X control techniques as opposed to aftertreatment devices. Some of these techniques are likely to put upward pressure on PM levels, and thus will require special optimization to ensure that PM levels are not increased. A simultaneous reduction in the PM standard could have an adverse effect on the feasibility of the NMHC + NO_X standard. Nonetheless, EPA recognizes the need for and value of additional reductions in PM emission rates and asks for comments on this matter.

EPA encourages further, detailed comment on the appropriateness of the proposed levels for NMHC + NO_X and PM in light of the technological interactions of their formation and control. EPA will consider finalizing standards different than those proposed today to the degree that comments and analysis support such action. However, the interactions among the pollutants would require a reassessment of all pollutants if a more stringent standard is to be considered for any one pollutant.

One commenter requested that EPA propose voluntary low emission standards for NO_X and PM which would apply between 1998 and 2003 at levels below the 4.0 g/bhp-hr NO_X and 0.10 g/bhp-hr PM which would be required in 2004. The ultimate purchasers of HDEs certified to meet the voluntary low emission standards would be able to market the emission credits generated. EPA asks for comment on the need for and desirability of lower voluntary NO_X and PM standards as a means to encourage technological innovation and the value of such a program given that manufacturers can already elect to certify to lower standards (family emission limits) under the Averaging, Banking, and Trading (A,B,&T) program. These extra emission reductions from these HDEs could be sold for marketable credits provided there is not double counting between the A,B,&T program and a user program.

Commenters also raised the issue of whether standards for otto-cycle HDEs (gasoline-fueled) should be different, and more stringent, than those for diesel-cycle HDEs. As commenters observe, the technological challenge of achieving lower NO_X levels simultaneously with low NMHC levels has been less for otto- than diesel-cycle HDEs in the past and current data suggests this may be the case for the proposed 2004 standards. In 1996 there were seven otto-cycle HDE families that certified to the existing standards with combined NMHC+NO_X levels below the level of the proposed NMHC+NO_X standard. However, of these seven, only about half had actual test data to demonstrate emission levels which could allow them to certify to the level of the proposed standards. Durability test data on others indicates that they would be unable to meet a 2.4 g/BHP-hr NMHC+NO_X standard at the end of their useful life period.

Lower certification levels for some families does not necessarily lead to the conclusion that levels significantly less than the proposed standards are achievable by all families in the near term. Indeed, the industry has raised concern that even if the level of the proposed standard can be achieved on laboratory prototypes in the near term, some engine models will require additional work to gain the additional emission reductions needed to account for the effects of production and test variability and the deterioration in the efficiency of emission controls in use. Industry has suggested that a prototype engine emission rate about 1 g/BHP-hr less than the proposed standard is needed to be assured of compliance by production engines.

Nonetheless, the recent engine and emission control system improvements and the resultant reduction in the NMHC+NO_X emission levels of many of the current otto-cycle families clearly indicate that the proposed standards are feasible by the 2004 model year. Some concern has been expressed that the proposed standard may be more difficult for otto-cycle engines used in heavier vehicles (>14,000 lbs GVWR). If not formulated properly, the efficiency of their catalysts may be reduced by heat stress which occurs during the longer periods of high load operation which are characteristic of some of these vehicles. However, the fact that otto-cycle HDEs with these lower emission rates are used in vehicles of all weight classes suggests that vehicle design and use patterns do not govern the feasibility of low NO_X catalyst technology. EPA believes that any technological feasibility concerns for otto-cycle HDE families required to meet the proposed standard can be resolved within the next eight years.

Given the relatively low NMHC+NO_X certification levels of some current otto-cycle engines and the available leadtime, EPA requests comment on setting the NMHC+NO_X standard for otto-cycle engines in the range of 1.5–2.0 g/BHP-hr. In addition to comments on technological feasibility, EPA requests comment on the appropriateness of a lower standard in the context of emission inventory benefits, environmental need, costs of compliance (purchase and operating), energy impact, safety, and market equity concerns. Comments regarding market equity should address how different levels of NMHC+NO_X standards for otto- and diesel-cycle engines would affect the market relationship between these technologies. EPA also requests comment on whether implementing a separate standard for otto-cycle engines (which are largely gasoline-fueled engines) would be an appropriate change from the historical ''fuel neutral'' nature of EPA's emission standards for NMHC and NO_X emissions from HDEs, and whether such a change could adversely affect the development of and use of clean alternative fuels.

EPA also requests comment on another alternative approach for otto-cycle engines. Under this approach, manufacturers could voluntarily elect to certify these engines to the proposed standard significantly earlier (i.e., model year 1999, 2000, or 2001 instead of 2004) as an alternative to meeting the more stringent standard discussed above (1.5–2.0 g/bhp-hr) in 2004. In this concept, the more stringent 2004 standard for otto-cycle engines either would not apply or would apply to a model year after 2004 to a manufacturer that elected to meet the proposed standard early. This approach would have the benefit of providing early emission reductions and, to the extent that manufacturers choose the proposed standard early, would help reduce the potential market equity impacts mentioned above since the same standard would apply to both otto- and diesel-cycle engines. While EPA may not impose on highway heavy-duty engines NO_X standards more stringent than 4.0 g/bhp-hr for any model year before 2004 (CAA sections 202(b)(1)(C) and (a)(3)(B)(ii)), EPA believes it retains authority to offer manufacturers the voluntary option of complying with a NO_X plus NMHC standard of 2.4 g/bhp-hr beginning before model year 2004. EPA requests comment on the appropriateness of finalizing this concept. Should a commenter favor this concept, they should specify the version they prefer (i.e., implementation date of the 2.4 g/BHP-hr standard or implementation date and numerical value of a later more stringent standard. EPA seeks comment on the technical feasibility and appropriateness in the context of environmental need, costs of compliance, energy impact, safety and market equity for the option supported. The public docket contains a memo further discussing each of the alternative approaches to otto-cycle HDE standards as laid out above.

Finally, several commenters encouraged EPA to reconsider the role of alternative fuel technologies in reaching low emission levels. EPA believes HDE technologies using alternative fuels can reach or exceed the emission standards proposed today. For this reason, EPA has for many years supported, and continues to support, expanded use of optimized alternative fuel engines. The Agency is pleased that development of HDEs which use alternative fuels is continuing and that some of these engines have been marketed, usually for specialized purposes. However, it does not appear that a major shift in the market toward alternative fuel HDEs is underway, and EPA does not believe at this time that the HDE manufacturing industry is in a position to shift a significant amount of its production toward non-petroleum fuels by the year 2004. Thus, EPA believes it is likely that petroleum-fueled HDEs will continue to dominate the HDE industry well into the next century, and the Agency does not believe that EPA action that could theoretically force a faster shift toward alternative fuel technologies (e.g., extremely low emission requirements for all engines) would be effective in the absence of a strong market demand for such engines.

Therefore, the Agency believes that it is appropriate to base new proposed HDE emission standards on the projected capabilities of petroleum-fueled engines rather than on the current or projected capabilities of alternative fuel engine technologies. If the stringent standards proposed today, while achievable by petroleum-fueled engines, are indeed relatively easy for some alternative fueled engines to meet, the result may be the introduction of alternative fueled HDEs that are both acceptable to the market and priced competitively. From the Agency's perspective, such a market-based promotion of alternative fuel technologies would be a positive result of today's proposed action.

d. Non-conformance Penalties. Section 206(g) of the Clean Air Act requires EPA to allow an HDE manufacturer to receive a certificate of compliance for an engine family which exceeds the applicable standard (but does not exceed an upper limit) if the manufacturer pays a non-conformance penalty established by EPA through rulemaking. The NCP program established through rulemaking is codified in Subpart L of 40 CFR 86. EPA plans to address provisions related to NCPs for the proposed 2004 model year standards in conjunction with the 1999 review discussed above.

2. In-use Emissions Control Elements

a. Introduction. Historically, EPA has viewed in-use emissions deterioration as a problem associated more with gasoline engines than with diesel engines. For NO_X emissions, EPA has tended to be less concerned with diesel engine emissions deterioration because diesels are currently equipped with fewer aftertreatment or other emission control devices susceptible to in-use degradation. Diesel engine emissions standards have historically been met mainly through overall improvements to the engine and fuel system. These improvements have resulted in improved performance, fuel economy, and durability as well.

As described below in Section IV. A., as standards are reduced diesel HDE manufacturers will likely continue to strive to meet the standards through engine, air intake, and fuel systems redesign. However, they may find it necessary to introduce new technologies, such as exhaust gas recirculation (EGR), which function solely to reduce emissions. Long-term emissions performance becomes a greater concern with the addition of such emissions control technologies. The controls may not function as long as the engines and there may be little incentive for vehicle owners to conduct the repairs on these items needed to ensure emissions control during the very long life of the engines. This is of particular concern because the heavy-duty engine market has demanded longer-lasting engines, and manufacturers have been successful in increasing engine life. It is EPA's understanding that some current large engines accumulate in excess of 500,000 miles before being rebuilt and are used for several hundred thousand more miles after rebuild. Thus, failure of emissions controls early in the engine's life could offset a significant portion of the expected benefit associated with the more stringent standards proposed today.

As described below, EPA is proposing revisions to its current regulations regarding in-use emissions control including changes to useful life, emissions related maintenance and warranty provisions. These changes are intended as updates to current requirements which will further encourage engine manufacturers to use emissions controls that will have a high degree of durability, and that perform well in use without an unreasonable degree of owner involvement. EPA is also proposing other basic provisions to help encourage the maintenance and repair of emissions controls after the regulatory useful life is reached, and especially during engine rebuild. The proposals would be effective beginning with 2004 model year engines. EPA believes that the industry is fully capable of responding to the challenge of achieving the benefits of low emissions standards, not just in the early years of engine life, but throughout the time that the engine is in-use. EPA requests detailed comments, with as much supporting rationale as possible, on all of the following proposals.

b. Revisions to Current Regulations

To help ensure the durability of new emissions related technology used to meet the new standards, EPA is proposing revisions to its current regulations in the areas of ''useful life'', ''emissions related maintenance'', and ''emission defect and performance warranties''.

i. Useful life

As provided in section 202 of the Clean Air Act, EPA specifies the ''useful life'' periods for the various heavy-duty engine types. The regulatory useful life is the period of time or operation during which manufacturers are liable for emissions compliance. Manufacturers are responsible for making sure their engines meet emissions standards not just at the time of certification and production but also for the regulatory useful life of the engines. EPA has the authority to test engines selected from the production line and from the in-use fleet to determine compliance with this requirement. EPA can require manufacturers to recall and repair engines in an engine family if testing of properly maintained and used engines or other information indicates that a substantial number of engines in the engine family do not meet emissions standards during the useful life. EPA's ongoing programs for production-line auditing (Selective Enforcement Auditing) and in-use recall are two primary EPA enforcement mechanisms for engine emissions standards. The statutory authority for these programs is found in Sections 206 and 207 of the Clean Air Act.

Currently for heavy-duty on-highway engines, the useful life is generally defined as eight years or 110,000 miles for light heavy-duty diesel engines (HDDEs) and gasoline heavy-duty engines, eight years or 185,000 miles for medium HDDEs, and eight years or 290,000 miles for heavy HDDEs, whichever comes first.[31] These mileage values were originally chosen to roughly correspond to the prevailing average engine lives before retirement (for smaller engines) or major engine rebuilds (for larger engines). Since the middle 1980s, manufacturers have increased very significantly the mechanical durability of heavy-duty diesel engines, allowing the engines to go many more miles before rebuild. Also, the annual vehicle miles travelled (VMT) for newer line-haul trucks has increased which results in the trucks reaching the end of their defined useful life more quickly. It is not uncommon for line haul trucks to reach their current maximum useful life of 290,000 miles well before the years useful life interval.

The first part of the following discussion concerns the mileage portion of the useful life. The years useful life interval is much less critical because it is not generally the limiting interval. EPA is proposing to make the years portion consistent at ten years for all heavy-duty engines and standards beginning with the 2004 model year. The discussion of the years interval proposal follows the proposals and discussion regarding mileage.

The engines of greatest concern to EPA are those in the heavy heavy-duty diesel engine category because they, for the most part, are the engines that tend to reach the end of the useful life quickly and then continue to accumulate many more miles than the current useful life before needing to be rebuilt. Published warranty information indicates that the major engine components of heavy HDDEs are warranted for 500,000 miles in most cases and extended base engine coverage is often available for up to 5 years/500,000 miles. Since the repair or replacement of some of the components covered by the warranties due to wear is fundamental to rebuilding, the warranties are one good indication that some engines greatly exceed EPA's current useful life miles limit of 290,000 miles. Also, it is commonly accepted in the trucking industry that, with sound maintenance practices, today's heavy HDDEs last much longer than 290,000 miles before rebuild.[32]

Although EPA could perhaps justify proposing an increase of the heavy HDDE useful life requirement to 500,000 miles or more based on how long engines are lasting today before rebuild, EPA believes that a somewhat lower value is appropriate. Engine manufacturers have stated that they will be challenged to meet the proposed new standards and an extremely long useful life could affect the feasibility of the 2004 standards. EPA acknowledges that the length of the useful life can affect the feasibility of the standards. EPA believes that the program goal of ensuring durable emissions control designs would be achieved through a 50 percent increase in the useful life up to 435,000 miles. This value represents a meaningful increase in the useful life without potentially compromising the feasibility or cost effectiveness of the 2004 standards. Additionally, other programs, as described below, can help ensure emissions controls continue to operate properly after the end of the useful life. The end of the useful life does not necessarily mean the end of good in-use emissions performance.

Not all heavy HDDEs are used in line-haul trucks which accumulate miles very quickly. A small minority of heavy

[31] 40 CFR 86.096–2. The Clean Air Act Amendments of 1990 specify a minimum useful life years limit of ten years for heavy-duty engines with respect to any standard that first becomes applicable after the 1990 amendments were enacted. 42 U.S.C. 7521 (d)(2). Standards adopted after the Amendments such as the urban bus particulate standard and the 1998 and later model year NO_X standard have a useful life years limit of ten years (e.g., 40 CFR 86.098–2). Standards adopted before the Clean Air Act Amendments of 1990 have a useful life years limit of eight years.

[32] Comments of American Trucking Association, Inc., October 17, 1995, Docket A–95–27, II–D–40.

HDDEs are used in urban (transit) buses and other urban vehicles that accumulate miles much more slowly. For example, urban buses average about 13 miles per hour (including idle time)[33] and about 40,000 miles per year.[34] For urban vehicles such as urban buses, a useful life of 435,000 miles would be excessive because of their slow mileage accumulation rates. EPA has addressed such concerns in other regulations by adopting an hours limit that is equivalent to a miles limit which is set to reflect typical operation of heavy-duty engines. Vehicles that accumulate mileage more slowly than typical for heavy-duty vehicles would reach the hours interval before the mileage interval. In keeping with this approach, EPA proposes to add an hours limit of 13,000 hours to the useful life for heavy HDDEs. The 13,000 hours limit is based on other hours and miles equivalents used in existing EPA regulations regarding heavy-duty engines.[35]

EPA, however, is concerned that the hours interval being proposed could, in effect, relax the useful life from its current level, as would be the case in instances when vehicles would reach 13,000 hours before reaching 290,000 miles. Given the average speed for urban buses of 13 miles per hour, this would be likely to occur frequently. To ensure that the addition of an hours limit does not result in a useful life less than the current useful life in any instance, EPA proposes not to allow the hours limit to be effective until after an engine reaches 290,000 miles. In summary, EPA proposes a useful life for heavy HDDEs of 435,000 miles, 13,000 hours, or ten years, whichever occurs first, but in no case less than 290,000 miles.

EPA requests comments on two alternative approaches to adopting an hours limit of 13,000 hours. The first option is to not have an hours interval and retain the useful life mileage interval of 290,000 miles for urban bus engines with an increase of the mileage interval to 435,000 miles for all other heavy HDDEs. This would simplify regulations but could disadvantage engine manufacturers where engines are used in slow moving urban vehicles other than urban buses, such as solid waste haulers. The second option is to set the hours interval to be equivalent to the number of hours it takes an urban bus, on average, to accumulate 290,000 miles. Using the 13 miles per hour estimate from above, the hours interval would be 22,300 hours. With this second option, EPA also requests comments on whether or not a minimum useful life of 290,000 miles is appropriate. These two alternatives may work well for urban buses but may not be as appropriate for other urban heavy-duty vehicles.

Currently the years component of the useful life is eight years for some standards and ten years for others depending on whether the standards were adopted before or after the Clean Air Act Amendments of 1990. Standards promulgated after the Clean Air Act Amendments, such as the 1998 4.0 g/bhp-hr NO_X standard, are required to have a useful life years limit of 10 years. EPA proposes to make the useful life years limits consistent for all pollutants and for all heavy-duty engines by raising the years component of the useful life so that it is ten years in all cases. The change affects the carbon monoxide and particulate matter standards (except the urban bus particulate standards which are already at ten years). EPA regards this change as a simplification of the regulations with very little or no impact on the stringency of the standards because EPA believes that vehicles will reach the mileage limits before the years limits in almost all cases.

EPA requests comments on the appropriateness of the useful life proposals described above. In particular, EPA seeks comments on the appropriateness of the 435,000 mileage limit, the appropriateness of treating engines used in urban vehicles differently from other heavy HDDEs, and the appropriateness of the proposed 13,000 hour limit.

ii. Emissions-Related Maintenance

The frequency of emission-related maintenance actions that manufacturers require owners to perform as a condition of their emissions warranties is another issue that affects the actual in-use emission performance of engines. If such required maintenance is more than the vehicle owner is likely to perform due to cost or inconvenience, then in-use emissions deterioration can result. Therefore, EPA currently imposes limits on the frequency of maintenance that can be required of HDE owners for emissions related items. These limits also apply to the engine manufacturer during engine certification and durability testing. The requirements currently apply for the useful life of the engine. Table 2 summarizes current regulations regarding the mileage interval limitations for the maintenance manufacturers may specify on certain emissions-related items for heavy-duty diesel engines (HDDEs). Engine manufacturers cannot require maintenance to be performed any more often than is noted in the table but may specify longer periods. The intervals are in miles or hours, whichever occurs first.

TABLE 2.—CURRENT INTERVALS FOR EMISSION-RELATED MAINTENANCE [1]

50,000 miles or 1,500 hours for all heavy duty diesel engines (HDDEs).	100,000 miles or 3,000 hours for Light HDDEs.	150,000 miles or 4,500 hours for Medium and Heavy HDDEs.	None listed.
EGR systems including all related filters and control valves [2].	Turbocharger	Turbocharger	Catalytic converter.[2]
PCV valve [2]	Fuel injectors	Fuel injectors	
Fuel injector tip cleaning	Electronic engine control unit, sensors, and actuators [2].	Electronic engine control unit, sensors, and actuators [2].	
	Particulate trap [2]	Particulate trap [2]	

[1] Source 40 CFR 86.094–25.
[2] Critical emissions-related components.

Table 2 notes components that EPA considers ''critical emissions-related components'' and EPA has additional requirements for these components (see 40 CFR 86.094–25 (b) (6)). Specifically, manufacturers must show that

[33] ''National Transit Summaries and Trends For the 1993 National Transit Database Section 15 Report'', Federal Transit Administration, May 1995.

[34] ''Data Tables For the National Transit Database Section 15 Report Year'', Federal Transit Administration, December 1994.

[35] 40 CFR 86.094–25 (b)(4) contains several hours and miles equivalents for HDDEs all of which are based on the ratio of one hour to 33.3 miles of operation.

maintenance which the manufacturer requires for a critical emission-related component has a reasonable likelihood of being performed by the operator in use. The engine manufacturer has a variety of options for making such a demonstration such as showing that component degradation will also cause vehicle performance to degrade or by using visual displays to notify the driver that maintenance is needed.

EPA believes that revising the maintenance intervals for certain technologies is appropriate in order to adequately cover the technologies which manufacturers may use to meet the proposed 2004 and later model year standards. The new standards may prompt the use of EGR on heavy-duty diesel engines and an increased interval for EGR valves and tubing will help ensure adequate system durability. Similarly, EPA believes that catalytic converters should be added to the list of emission-related components for HDDEs for which a minimum interval is specified, also to ensure adequate durability. Except for the recent use of catalytic converters for particulate control, neither technology has been used significantly for HDDEs in the past. Accordingly, EPA proposes for EGR valves and tubing and catalytic converters that manufacturers specify maintenance no more often than the intervals shown in Table 2 for other technologies; 100,000 miles or 3,000 hours, whichever occurs first, for light HDDEs and 150,000 miles or 4,500 hours for medium and heavy HDDEs. For EGR system filters and coolers, EPA proposes that the maintenance interval would remain 50,000 miles/1,500 hours due to manufacturer concerns that a longer interval for these components may not be feasible.

In addition, there is the possibility that new technologies not listed in Table 2 could be used to meet the proposed standards. Therefore, EPA proposes to apply the same maintenance intervals as listed above for most components, 100,000 miles or 3,000 hours, whichever occurs first, for light HDDEs and 150,000 miles or 4,500 hours for medium and heavy HDDE, to any additional add-on emissions-related components that manufacturers introduce in the future. EPA proposes to define add-on emission-related components for this purpose as components 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 or performance of the engine. EPA would also consider such components critical emission-related components for purposes of 40 CFR 86.094–25(b)(6). EPA believes that this proposal is necessary to provide the same minimum level of durability for all emissions-related components (except EGR filters and coolers) used to meet the standards. The minimum requirement will also be helpful in the development of future technologies as it will provide a clear minimum design target for technology development.

Maintenance requirements for gasoline-fueled heavy-duty engines and light heavy-duty diesel engines are currently the same for EGR and several other components due to the similarity in their duty cycles. EPA believes that it is appropriate for the maintenance intervals for EGR for light heavy-duty diesel engines and heavy-duty gasoline engine to remain consistent with each other given this similarity. Therefore, for otto-cycle (i.e., gasoline-fueled) heavy-duty engines, EPA proposes that the maintenance interval for EGR valves and tubing be increased to 100,000 miles or 3,000 hours from the current 50,000 mile or 1,500 hour interval. Because gasoline-fueled engines emit less particulate (which can cause deterioration of the EGR system) than do diesel engines, EPA does not believe that the change represents a particular challenge for gasoline-fueled engines.

EPA requests comments on the proposed changes to the maintenance intervals described above including comments on the length of the intervals and the technologies for which intervals are being proposed. Also, EPA requests comment on the definition of ''add-on emission-related component'' offered here.

iii. Emissions Defect and Performance Warranties

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 EPA emissions requirements 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.[36] 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 currently requires that the emission defect and emission performance warranties for heavy-duty gasoline engines and light HDDEs last 5 years/50,000 miles and for medium and heavy HDDEs last 5 years/100,000 miles, whichever occurs first, but in no case may the warranty period be less than the manufacturer's basic mechanical warranty period for the engine family.[37]

EPA proposes to clarify that the period of the warranty is to be in no case less than the basic mechanical warranty period that the manufacturer provides to the purchaser with the engine rather than the general warranty period for the engine family. It is common for manufacturers to provide negotiated mechanical warranties that are longer than the published base warranties for the engine family. EPA believes that this modification is appropriate because negotiated warranties are prevalent and therefore the published warranty is not reflective of the true mechanical warranty period in many cases. EPA requests comments on this proposal.

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

As discussed above, EPA regulates maintenance and repairs of emissions control components that manufacturers may specify during the useful life of the engines. However, these provisions will not ensure emissions control for the full operating life of all heavy-duty engines. Large diesel engines have an extremely long life that is extended through rebuilding. If the vehicle owner and engine rebuilder were to not properly maintain or repair emissions control components, the controls could degrade and cause an unacceptable increase in emissions. Because there may be no effect on engine performance, the degraded components may otherwise go unnoticed for a significant portion of the total life of the engine. Since HDEs are typically rebuilt, EPA also believes it is appropriate to take steps to ensure that emissions-related components used to meet the new standards receive all needed maintenance and repair beyond the useful life period. The proposals described below fall into two categories: manufacturer requirements and engine rebuilding requirements. The proposals are intended to help enhance the focus on emissions-related components and the Agency does not believe that the proposals will result in significant costs above those that would be incurred for

[36] While EPA is proposing to revise 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.

[37] Useful life definition paragraph (6), 40 CFR Part 86.096–2.

the proper maintenance/repair of emissions-related components. As with the related provisions proposed above, EPA believes that these basic provisions are necessary beginning with the 2004 model year because new add-on emissions-related components which may require occasional maintenance and repair may be used to meet the 2004 and later model year standards.

i. Provisions Affecting Manufacturers

Manufacturers currently provide owners with comprehensive service/maintenance manuals covering the maintenance necessary to keep engines operating properly. If a manufacturer required maintenance on any emissions-related components during the useful life, as described above in 2.b.ii. of this section, maintenance procedures would be detailed in this manual. EPA proposes to require that manufacturers, in addition, include in the manual maintenance needed for emissions related components after the end of the regulatory useful life, including mileage/hours intervals and procedures to determine whether maintenance or repair is needed. The recommended practices must also include instructions for accessing and responding to any emissions-related diagnostic codes that may be stored in on-board monitoring systems. The recommended maintenance practices would be based on engineering analysis or other sound technical rationale. In the event that an emission-related component is designed not to need maintenance during the full life of the vehicle, the manual would need to contain at a minimum a description of the component noting its purpose and a statement that the component is expected to last the life of the vehicle without maintenance or repair. In addition, manufacturers would be required to highlight in the manual any rebuild provisions adopted by the Agency, as described in 2.c.ii. below, to ensure that owners and rebuilders are aware of the requirements.

As described above in 2.b.ii. of this section, manufacturers must ensure that critical emissions-related scheduled maintenance has a reasonable likelihood of being performed in-use. Manufacturers may elect to provide such assurance by using some form of on-board driver notification when maintenance is needed on a critical emission related component.[38] The signal may be triggered either based on mileage intervals or component failure. It is currently considered a violation of the Clean Air Act's prohibition on tampering (Section 203(a)(3)) to disable or reset the signal without also performing the indicated maintenance procedure.[39]

EPA proposes to require that manufacturers electing to use such signal systems to ensure that critical emissions-related maintenance has a reasonable likelihood of being performed must design the systems so that they do not cease to function at or beyond the end of the regulatory useful life. For example, if the signal is designed to be actuated based on mileage intervals, it would have to be designed to continue to signal the driver at the same intervals after the end of the useful life. EPA does not propose, however, to hold the manufacturer responsible or liable for recall due to signal failure in instances where the signal fails to function as designed beyond the end of the useful life. Manufacturer recall liability is limited to failures during the regulatory useful life under Section 207 of the Clean Air Act. (The manufacturer is also not responsible for repairs when the signal does function after the end of the useful life unless such repairs are covered by the emission warranty provided as described above in 2.b.ii.)

EPA believes these proposals will help ensure that information necessary to care for critical emission related components through the engines' entire life on the road will be widely available to owners, rebuilders and others maintaining and repairing heavy-duty engines. EPA requests comments on the proposals.

ii. Provisions Pertaining to Engine Rebuilding Practices

EPA has two concerns regarding the rebuilding of 2004 and later model year engines, both related to new emissions related components that may be added to the engine to meet the new standards. First, EPA is concerned that during engine rebuilding, there may not be an incentive to check and repair emissions controls that do not affect engine performance. Second, EPA is concerned that there may be an incentive to rebuild engines to a pre-2004 model year configuration due to real or perceived performance penalties associated with 2004 and later model year technologies. Such practices would likely result in a loss of emissions control.

EPA currently does not have regulations concerning engine rebuilding practices for heavy-duty engines other than requirements for engines used in 1993 and earlier model year urban buses.[40] Clean Air Act Section 202(a)(3)(D) directed EPA to study heavy-duty engine rebuild practices and the impact rebuilding has on engine emissions. Based on the study and other information, EPA may prescribe requirements to control rebuilding practices (whether or not the engine is past its useful life), which in the Administrator's judgement cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare taking costs into account. 42 U.S.C. 7521 (a)(3)(D). EPA conducted a study of engine rebuilding and determined that current-technology engines, when rebuilt, generally emit at levels near or below the certification standards that applied to the engine when new and that regulations to control rebuild practices did not appear to be warranted at that time.[41]

In the ANPRM, EPA requested comments on establishing rebuild requirements to promote continued in-use compliance for 2004 and later model year engines. The Automotive Engine Rebuilders Association (AERA) and other related associations stated in their comments on the ANPRM that it is extremely unlikely that engine rebuilders would rebuild to non-original specifications because such a product would not be acceptable to the purchaser.[42] AERA further commented that a rebuild program where the rebuilder would be required to conduct certification testing and be held liable for emissions performance in-use would be unreasonable for the many rebuilders that are small businesses. AERA commented that, given what is known about the rebuilding industry, EPA has no basis for rebuild regulations.

EPA does not believe that a major program placing substantial new requirements on the rebuilding industry needs to be proposed at this time to adequately address the Agency's concerns described above, based on comments received and EPA's findings regarding current industry practices. Therefore, EPA does not propose regulations at this time under the authority of Clean Air Act Section 202(a)(3)(D). However, EPA does believe that establishing basic regulatory provisions regarding engine rebuilding under Section 203 of the Clean Air Act (''Prohibited Acts'') would help the rebuilding industry understand what is needed to ensure that rebuilt 2004 and

[38] 40 CFR 86.094–25(b)(6)(ii)(C)

[39] 40 CFR 86.094–25(b)(6)(iii)

[40] 40 CFR Part 85, Subpart O, Urban Bus Rebuild Requirements.

[41] ''Heavy-duty Engine Rebuilding Practices,'' EPA Final Report by Tom Stricker and Karl Simon, March 21, 1995.

[42] EPA Docket A–95–27, Docket II-D–41.

later model year engines closely approximate original emissions performance when they are rebuilt.

Clean Air Act Section 203(a)(3) states that it is prohibited for ''any person to remove or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine'' in compliance with regulations, either before or after its sale and delivery to the ultimate purchaser. 42 U.S.C. 7522 (a)(3)(A). EPA commonly refers to violations of this provision of the Clean Air Act as tampering. Engine rebuilding practices are currently addressed in general terms under EPA policies established under Clean Air Act Section 203(a)(3) regarding tampering. The Agency has established a policy that when switching heavy-duty engines the new engine must be ''identical to a certified configuration of a heavy-duty engine of the same or newer model year''.[43] EPA has also established policies regarding the use of aftermarket parts during rebuild.[44]

EPA is proposing to codify these policies as they apply to rebuilding and to propose new measures. The Agency believes that rebuilding is currently a time when emissions control is restored, along with the engine itself, and that the proposed provisions described below will help ensure that this continues for the 2004 and later model year engines. Currently, the engine and all emissions related components are treated as a package for purposes of engine certification and other programs and EPA believes it is important to maintain this view at time of engine rebuild. The provisions proposed below would specify what minimum action is necessary at time of rebuild under Clean Air Act Section 203(a)(3) to ensure continued emissions control.[45] These provisions reflect what EPA believes will be common practice for rebuilding engines, but also will help to focus attention on new emission-related components used to meet the 2004 standards.

EPA proposes that parties involved in the process of rebuilding or remanufacturing 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 proposes 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 may 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 is proposing no certification, recordkeeping, or other requirements of the rebuilder or engine owner and there would be no in-use emissions requirements.

Because the above proposal represents what EPA believes would be sound rebuilding practices for 2004 and later model year engines, EPA does not believe that there are costs associated with the above proposed requirements. Items 1 and 2 of the proposal closely reflect established EPA policy regarding tampering (discussed above). Any changes to rebuild practices will be due to the industry adjusting to the use of new technologies. EPA believes that any added cost to the rebuilding of the engines will be due to the technology used to meet the standards and not due to the rebuilding provisions being proposed. Additionally, EPA continues to have the authority to regulate rebuilding if future studies or other information were to provide the basis for such regulations. EPA views the proposal above as preventative, in that it will help ensure that the rebuild industry is aware of the new technologies and that rebuilding of engines with 2004 and later technology will not impact emissions negatively. EPA requests comments on all aspects of the above proposal.

To ensure that engine rebuilders and others involved in engine rebuilding are complying with the requirements and to maintain a level playing field between those who follow the rules and those who do not, EPA's enforcement office intends to take action against violations of the rebuild provisions. EPA is concerned, however, that proving violations will be difficult without some form of records available for inspection.

EPA is considering the adoption of minor recordkeeping requirements which EPA believes would be in line with customary business practices. The Agency would then be able to inspect such records to determine compliance with the rebuild provisions. 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

[43] Engine Switching Fact Sheet, April 2, 1991. Docket A–95–27, II–B–6.

[44] ''Interim Tampering Enforcement Policy'', Mobile Source Enforcement Memorandum No. 1A., June 25, 1974. Docket A–95–27, II–B–5.

[45] Note that other actions not specified may also be prohibited under Clean Air Act Section 203.

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. 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 recordkeeping practices would satisfy these requirements. EPA would require such records to be kept for two years after the engine is rebuilt.

EPA's intention with such record keeping requirements would be to make basic records available to the Agency such that enforcement officials would be able to understand what work was performed on an engine during the rebuild process. EPA believes that those in the rebuilding industry already keep detailed records on work performed on engines as part of good business practices and therefore, EPA believes that the above recordkeeping requirements would impose no additional burden on affected businesses. Moreover, EPA has always had the authority to request such records pursuant to section 208 of the Clean Air Act and the above requirements would only standardize the records available for EPA inspection. EPA requests comments on the above record keeping requirements.

d. State Inspection/Maintenance Programs

Many states are currently in various stages of planning or implementing inspection/maintenance (I/M) programs for trucks. The programs are mostly focused on identifying trucks with high smoke emissions, which usually result from tampering or poor maintenance, and requiring their repair. EPA has received requests from several sources including the American Trucking Association, the Engine Manufacturers Association, and state organizations to become involved in the development of truck I/M programs, with the hope that state programs can be standardized under EPA guidance. Currently, programs may differ widely from state-to-state causing a variety of problems for the parties affected.

In response, EPA has begun an effort in this area with the goal of developing a guidance document that states can use to establish programs. EPA intends to address issues regarding testing procedures and standards or pass/fail cut points for heavy-duty engine I/M programs in coordination with interested parties. Although the guidance document would not preclude states from designing programs differently, it should help decrease program differences from state-to-state.

3. Revised Averaging, Banking, and Trading Provisions

Today's proposal makes changes to the heavy-duty engine averaging, banking and trading (ABT) provisions. They are intended to enhance the flexibility offered to manufacturers in meeting the stringent standards being proposed and to encourage the early introduction of cleaner engines, thus securing emissions benefits earlier than would otherwise be the case. Further, the proposed ABT changes also allow EPA to propose more stringent emission standards than it otherwise might, since the flexibility provided by ABT lowers the costs to manufacturers and makes it easier to meet the technical challenges of lower standards.

Under a modified program proposed to be available to manufacturers between 1998 and 2006 inclusive, credits could be earned without the current ABT credit discounting or limited life provisions. These credits could be used beginning in model year 2004 to ease the impact of the new standards in their initial years of applicability. With the exception of a minor adjustment in how credit exchanges are conducted between families, other provisions of the existing ABT program would remain essentially unchanged, including prohibitions on cross subclass and cross combustion cycle ABT. A further description of the proposed changes, including provisions designed to safeguard against any potential adverse air quality impacts, is provided later in this section.

a. Overview of the Current Averaging, Banking and Trading Program

The proposed changes come in the context of the existing ABT program, the bulk of which was adopted in 1990. The existing program includes otto and diesel cycle HDEs fueled by petroleum (gasoline and diesel), gaseous fuels, and methanol (see 55 FR 30584, July 28, 1990 and 59 FR 43472, September 21, 1994), and is available for meeting applicable NO_X and particulate matter (PM) standards. The three aspects of ABT: averaging, banking and trading, are briefly described in the following paragraphs.

Within a given manufacturer's product line, averaging allows certification of one or more engine families at levels above the applicable emission standard (but below a set upper limit), provided their increased emissions are offset by those from one or more families certified below the same emission standard, such that the average emissions from all the manufacturer's families (weighted by horsepower and production) are at or below the level of the emission standard. Averaging results are calculated for each specific model year. The mechanism by which this is accomplished is certification of the engine family to a ''family emission limit'' (FEL) set by the manufacturer, which may be above or below the standard (an FEL above the standard may not exceed a prescribed upper limit specified in the ABT regulations). Once an engine family is certified to an FEL, that FEL becomes the enforceable limit used to determine compliance during assembly line and in-use compliance testing.

The second element of the current ABT program is banking. Banking gives the manufacturer generating the credits in one model year the option to defer their use until a later model year for averaging or trading. Under the current program, credits are discounted by 20 percent when banked and have a three year life. EPA believes banking promotes the development and early introduction of advanced emission control technology, which provides emission reduction benefits to the environment sooner than would otherwise occur. An incentive for early introduction arises because the banked credits can subsequently be used by the manufacturer to ease the compliance burden of new, more stringent, standards. For the same reasons, banking can promote the introduction and use of clean alternative-fueled engines.

The final element of the ABT program is trading. Since averaging is limited to a given manufacturer's own product line, the manufacturer must have two or more engine families within a given averaging set to participate in the program. This could limit the opportunities for smaller HDE manufacturers with more limited product lines to optimize their costs. Trading resolves this concern by allowing credit exchanges between manufacturers. Thus, averaging benefits can be extended to manufacturers who might not otherwise be able to participate due to their limited product lines. Trading can also be advantageous to larger manufacturers because extending the effective averaging set through trading can allow for overall optimization of cost across manufacturers.

Due to manufacturer equity and environmental impact concerns there are some limitations on credit exchanges in the existing ABT program. First, for diesel cycle engines, NO_X and PM credit exchanges are prohibited across the various subclasses (LHDDE, MHDDE, HHDDE). Second, no credit exchanges are permitted between diesel-cycle and otto-cycle engines. Finally, cross fuel credit exchanges are permitted only within engines of the same basic combustion cycle and subclass. Details on these credit exchange restrictions, including the reasons for their existence, are discussed in the previously cited Federal Register notices.

b. Description of Proposed ABT Program Changes

As noted at the outset of this section, EPA is proposing two principal changes to the existing ABT program designed to temporarily remove the discounting and limited life of credits generated under current provisions. Behind these changes is the recognition that the proposed standards represent a major technological challenge to the industry. ABT provisions can ease the need to bring all engines into compliance in MY 2004 by allowing accumulated credits to be used, for example, to temporarily offset emissions from some particularly difficult to control engine line. Thus, the Agency can adopt new standards without the need to show that they can be met by all engines when first implemented. While the current ABT provisions were designed with these same general goals in mind, EPA believes that the nature of the challenge presented by today's proposed standards justifies efforts to increase the flexibility of the ABT program. The Agency wishes to maximize the flexibility and incentives for early introduction of technology which ABT offers. This will help insure that the proposed new standards will, in fact, be attainable for the manufacturers, and will be met at the lowest cost. It is also the case that the Agency has gained experience with the operation of its ABT program which gives it more confidence in being able to successfully modify the program in the face of this need.

The proposal being made today would establish a second, parallel, ABT program targeted specifically at helping manufacturers meet the proposed more stringent standards in MY 2004 through 2006, the first three model years to which the new standards would apply. Credits could be earned under this program beginning in 1998 and would not be discounted, nor would they expire after 3 years as do current ABT credits. These credits could only be used to comply with the 2004 standards. If a manufacturer wished to apply them to its compliance program for earlier model years they could be transferred into the original ABT program, but would at the same time become subject to the 20 percent discount and three year life of the original program. EPA is also proposing that this alternate program would be in effect only for the years immediately surrounding the transition to the new standards. The ability to generate credits under the proposed new program would be eliminated in 2007 (the current ABT program would be available for 2007 and later model years). EPA thinks the need for unlimited life and no credit discounting to enhance the technological feasibility of the standards would be greatly diminished after the first three years of the model year 2004 standards. EPA believes it is appropriate to remove the discounting and limited life restrictions in the modified ABT program and still keep them in the current ABT program because these modifications have been considered in developing the proposed standards, but not prior standards subject to the ABT program. The Agency seeks comment on what expiration date, if any, would be appropriate for the proposed program modifications and why.

As in the current ABT program, only NO_X and PM credits could be earned under the modified program. NMHC credits would not be included because of the potential for windfall credit generation from the very low NMHC levels of many current engines. NO_X-only credit generation also allows the credits to be transferred back to the current program if deemed necessary by the manufacturer. The NO_X credits would be applied against the NO_X + NMHC standards beginning in 2004 (but not the NMHC cap associated with the 2.5 g/bhp-hr optional standard).

EPA proposes that the upper limits for engine families certified above the 2004 standard and using offsetting ABT credits would be 4.5 g/bhp-hr, NO_X + NMHC and 0.25 g/bhp-hr for PM. The 0.25 g/bhp-hr upper limit proposed here for PM is a reduction from the 0.60 g/bhp-hr which now applies. EPA believes a reduction in this value is appropriate even though the stringency of the PM standard is not being changed. Unless other factors dictate, normal practice has been to set the upper limit for FELs at the level of the previous standard. An exception to this practice was made in 1990 when the full current ABT program was promulgated. At that time engines were only meeting a 0.60 g/bhp-hr PM standard, and it was not clear that a 0.25 g/bhp-hr upper limit would provide adequate flexibility for 1994 and later model years. At that time the PM standard was set to drop from 0.60 g/bhp-hr to 0.25 g/bhp-hr in 1991. The 0.25 g/bhp-hr standard was to be in place for only three model years (1991–1993) before dropping to 0.10 g/bhp-hr and as part of their compliance strategy some manufacturers indicated plans to use credits to meet the 0.25 g/bhp-hr standard and desired that flexibility to continue after the standard dropped to 0.10 g/bhp-hr. By 2004, the 0.10 g/bhp-hr standard will have been in place for ten years, and the need for flexibility to certify above 0.25 g/bhp-hr should have disappeared by that time. In fact, in 1996 only three diesel engine families out of about 90 certified above the 0.25 g/bhp-hr level.

One of the potential problems with ABT programs is the possibility that manufacturers will reduce their compliance margins relative to the standards, or associated FELs, in order to maximize the generation of credits for low emitting engines and minimize the need for credit use for high emitting engines. Compliance margins are used to protect against unexpected failure of emission standards due to the variability inherent in both producing and emission testing of engines. To avoid having engines exceed their FEL, the manufacturer includes a safety factor and certifies with emission levels somewhat below the FEL. As the manufacturer reduces these compliance margins, it increases its odds of experiencing an unexpected failure of the FEL, either during assembly line testing or in-use. However, the ability to generate and use credits encourages the manufacturer to set its FELs as low as possible. To the extent that a manufacturer reduces its compliance margins under the proposed new ABT provisions, there is a risk that such a manufacturer's engines would not meet the FELs.

The Agency is unsure to what extent such ‘‘margin shaving’’ might occur as a result of the modified ABT program being proposed today. However, to protect against such a possibility, EPA is proposing to require a minimum margin in order to participate in the modified ABT program. Based on current certification data, compliance margins vary from essentially zero to about 18 percent, with the average being about 10 percent. To help ensure that a manufacturer's engines do in fact meet their FELs without unduly constraining how margins are used, today's proposal requires a minimum margin of at least five percent to participate in the modified ABT program. Even though some manufacturers have higher margins, EPA believes that a five percent value provides reasonable protection against margin shaving. The larger margins found in some engine families may exist for other reasons. To provide reasonable flexibility, it is also proposed that manufacturers be permitted to use a margin of less than five percent if they have test data which demonstrates that a lower margin is sufficient. Comments are requested on the validity of the Agency's concern as well as on the proposed use of a minimum required margin. Commenters supporting this approach should also comment on the appropriate size of the margin.

Since the useful life for heavy heavy-duty diesels (HHDDEs) is being proposed to increase in 2004 along with the change in emission standards, the question arises of how to determine appropriate credits under the modified ABT program for those HHDDEs engines being certified to the shorter useful life provisions prior to 2004. In-use emissions generally increase, or ''deteriorate,'' with increasing mileage. Thus, if those engines had been certified to the longer useful life, they normally would have had to account for more deterioration than for the shorter life. This would have produced a higher FEL, and less credit, than would the shorter life.

For NO_X, dealing with the issue of the amount of credits is fairly straightforward. NO_X emissions from HHDDEs show little deterioration, and in some cases can actually decline with age. Therefore, the Agency believes an appropriate adjustment for useful life can be made by simply extending the NO_X deterioration factor used in certifying the engine family to the proposed 435,000 mile life. This should give a conservative estimate of likely deterioration over the longer life period. Under this approach the extension would be performed only for the purposes of calculating credits for the modified ABT program, and would not impose added certification durability requirements or extended recall testing limits as the useful life (and corresponding obligation to comply with the emission standards) would not be extended. If a manufacturer felt that a projection of its deterioration factor was inappropriate, it could exercise the existing option under 40 CFR 86.090–21(f) to petition the administrator for a longer useful life for its engine, and determine a new deterioration factor for that new useful life.

Under the approach just described for extending NO_X deterioration factors, the manufacturer incurs no added liability for the mileage extension from 290,000 miles to 435,000 miles. The above approach seems appropriate to the Agency for purposes of quantifying the amount of credits given the transitional nature of the useful life issue and the general stability and predictability of NO_X emissions. However, in various credit and trading programs EPA has set policy that credit generation should be based on an enforceable obligation to achieve the expected emission reductions. See, e.g., Interim Guidelines on the Generation of Mobile Source Emission Reduction Credits, 58 FR 11134 (February 23, 1993). If deemed appropriate, this could be accomplished by requiring the manufacturer to certify using the same extended NO_X deterioration factor it used for credit calculations. This would establish in-use liability for the extended mileage period. If this were done, it would apply only for the NO_X standard. EPA believes this extended useful life could be accomplished without imposing additional certification burdens or requirements, given the current flexibility in certification regulations and the expected deterioration associated with NO_X emissions over time. EPA invites comments on this alternate approach as well as the proposal to calculate the amount of NO_X credits without extending the useful life. Comments should address which of these approaches should be adopted in the final rule.

In the case of particulate matter (PM) emissions, the Agency has much less confidence in the reliability of projections from the current 290,000 mile life. In this case there is a greater possibility of unexpected changes in emissions later in the engine life which would not be consistently captured with such an approach. Therefore, EPA is proposing to allow credits to be generated only for the applicable engine family's certified useful life period. In most cases this would be 290,000 miles. However, as with NO_X, if a manufacturer wished to generate credits for a longer period, it could petition the Administrator under the provisions of 40 CFR 86.090–21(f) for a longer useful life for its engine. It would then be able to generate credits for that entire useful life period.

Finally, it should be noted that EPA is proposing to revise the technique used to calculate credit exchange (generation and use) amounts. In the current ABT system, credits are generated based on the lowest horsepower configuration in a family and credit use is calculated based on the highest horsepower configuration. Credit generation is calculated based on the configuration which generates the least benefit within the family while credit use is based on the configuration which requires the most credits to comply. In some cases this can result in large offsets (i.e., credits are generated at the lowest rate and credits required at the highest rate). Based on EPA's experience with ABT programs, we find this offset to be unnecessary. Over the past five years the ABT program has been implemented smoothly, leaving less need for the safeguards this provision brought to the original program. Furthermore, this provision tends to introduce a penalty for credit generating engines, thus reducing the incentive to introduce clean technology. Therefore, EPA proposes to base such calculations on sales-weighted average horsepower values within each family. EPA believes use of an average horsepower for generating and using engines is sufficient to ensure no environmental loss from the credit transaction.

EPA received comments on the ANPRM requesting clarification on whether or not, and if so, how credits from engines certified below the applicable standard can be used by entities other than the engine manufacturers (e.g., engine purchasers). EPA believes that in some circumstances this could well be appropriate and consistent with the intent of the ABT regulations. EPA asks comment on what revisions or clarifications may be needed to the ABT program to facilitate this possibility. For example, EPA is interested in comment on how we can assure that credits not be counted by both the engine manufacturer and the vehicle/engine user (double counted).

The interim modifications to relax the credit discounting and lifetime restrictions for model years 1998–2006 are being included primarily to assist in compliance with the proposed standards beginning in 2004. As was discussed earlier in this section, the technological challenge of meeting the proposed standards is much less for otto-cycle engines as compared to diesel cycle engines. In fact many models already have certification levels near or below the level of the proposed standard. While the revised ABT program could provide an incentive to produce even cleaner otto-cycle engines before 2004, EPA is concerned that the discount and lifetime revisions would provide ''windfall credits'' to the otto-cycle industry. A similar concern does not exist for diesel cycle engines, because their current $NMHC+NO_X$ emission rates are well above the level of the proposed standard. EPA asks comment on this issue including whether or not and why these two program changes should be extended to otto-cycle engines or just the current A, B,& T program should be available.

In its comments on the ANPRM submitted on behalf of a consortium of environmental groups, NRDC raised several objections to the possible ABT program changes discussed in that document and in the SOP. Among these, NRDC opposed removal of the discounting and limited life provisions of the current program. NRDC argued that these changes could lead to unnecessary delays in compliance with the proposed new standards and could result in increased emissions. Commenting specifically on the removal of discounting, NRDC argued that in the absence of discounting, the public ''relinquishes all of the benefits of unanticipated advances in technology.'' The Agency does not agree with these comments. As described above, existence of the ABT program allows the Agency to propose and finalize a standard that might not be otherwise appropriate under the CAA, since ABT reduces the cost and improves the technological feasibility of achieving the standard. Furthermore, the generation of credits means that emission reductions have been realized earlier than required by the standards, which EPA believes is a benefit to the public. The fact that the use of credits would allow some specific engine families to delay compliance with the proposed new standards has no inherent air quality impact since the credits represent offsetting emission reductions below the applicable standard from other engines. EPA encourages further comment on the appropriateness of the Agency's proposal to impose no discount or life limit on credits generated and used under the modified ABT program.

In their comments NRDC also opposed expansion of the trading provisions to include cross-cycle, cross sub-class or cross-source trading. None of those changes are included in today's proposal. Comments are invited on the appropriateness of EPA at some later date proposing to allow cross-cycle, cross-cycle with the same fuel, cross-subclass or cross-category (e.g., highway and non-road) credit exchanges as part of the modified ABT program.

In their comments on the ANPRM, NRDC stated that only engines meeting the proposed standards early should be able to get the benefits of the temporary changes to discount and lifetime provisions. EPA explored this concept, but for two reasons chose not to include it in the NPRM. First, such a restriction would reduce the value of ABT programs in assisting transition to the 2004 standards. A manufacturer would have no incentive to introduce improved technology early unless the engine made it all the way to the level of the proposed standards. Second, since early additional emission reductions have equal value whether the engine is above or below the proposed standards it would be inconsistent with air quality goals to create a disincentive for early additional emission reductions. However, this view is premised on the design criterion discussed above, i.e., no cross-cycle credit exchanges. If cross-cycle exchanges are permitted without some form of a trigger level for eligibility, an unusual situation could be created where gasoline-fueled otto cycle engines could generate credits for use by petroleum-fueled diesel cycle engines. This in turn would create a disincentive for technology innovation for diesels which is one of the key goals for the ABT program.

Readers are encouraged to review the draft regulations for a fuller understanding of how the proposed ABT program would operate. The Agency solicits comments on all aspects of the ABT changes being proposed, including comments on the benefit of these changes to manufacturers in meeting the proposed emission standards and any potential air quality impacts which might be associated with them.

IV. Technological Feasibility

This section discusses the emission control technologies that EPA believes would be available for engine manufacturers to meet the proposed 2004 standards. Included in this discussion are estimates of emission reductions associated with these technologies and their potential to impact performance. Because of the significant differences between the operation, emissions, and likely control strategies for diesel and gasoline heavy-duty engines, each engine type will be treated separately. Further information on the basic characteristics of diesel and gasoline heavy-duty engines may be found in Docket A–95–27.[46]

Following is a summary of the key technologies discussed in the Regulatory Impact Analysis (RIA). For more detail on the emission control technology described in this section, see Chapter 4 of the RIA. This chapter of the RIA also describes many of the technologies that are still under development that could allow heavy-duty highway engines to meet or exceed the reduced emission standards proposed in this action. Several technologies described in the RIA are not included in this section because EPA believes they are less likely to be used by engine manufacturers in 2004 than those strategies, techniques, and technologies described here.[47]

The following discussion of technologies includes a wide range of alternatives from which manufacturers may choose to comply with the proposed emission standards. Not all of these technologies will be needed to reduce NO_X or HC emissions to comply with the proposed emission standards. Manufacturers may develop and use technologies to improve fuel economy or performance or to control particulate emissions at a lower cost. The analysis of economic impacts in Section V.B. reflects this by assessing the incremental cost of adopting a limited package of technological changes to heavy-duty engines.

As will be discussed further below, EPA believes that the goals set by this proposal are challenging but feasible. They clearly represent major reductions compared to current engine emission levels. At the same time, heavy-duty engine technology is in a period of rapid development, and EPA does not see any reason to expect that such development will be slowed in the foreseeable future. Published work shows that research engines are already beginning to approach the levels required by the new standards. There are certainly many significant technical challenges to translating research work into acceptable products for the marketplace. However, the emission targets are set in the framework of a long lead time, substantially longer than has been the case in many previous heavy-duty engine rules. Also, except for the use of EGR on heavy-duty diesel engines, each of the technologies anticipated for complying with the proposed emission standards, as described below, have already been applied to and proven on recent model year heavy-duty engines. Thus, on balance, the Agency believes that the proposed standards are feasible for the heavy-duty industry.

Through comments on the ANPRM, some concern has been expressed to EPA that lower standards may be more appropriate for heavy-duty engines. One suggestion was that heavy-duty diesel engines should be required to meet a 0.05 g/bhp-hr PM standard since urban buses are now held to this level. In addition, commenters recommended that separate, lower HC plus NO_X and CO standards should be set into place for heavy-duty gasoline engines. Based on the information discussed further

[46] Memo from Tad Wysor (EPA) to Air Docket A–95–27, ''Summary of Heavy-Duty Engine Emission Control Technologies,'' II–B–4, August 24, 1995.

[47] The technological feasibility of meeting the proposed standards using alternative fuels is discussed in Chapter 4 of the RIA.

below and in the RIA, EPA believes that the proposed standards represent the lowest levels consistent with the constraints of section 202 (a)(3)(A)(i) of the Clean Air Act. That section requires EPA to establish the ''greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.''

Given the uncertainty associated with the long lead time, this analysis would be re-evaluated in the proposed 1999 review of the feasibility of the standards discussed in section III.B above. EPA requests comment on the availability and effectiveness of emission control technologies that may be applied to heavy-duty on-highway engines to meet the proposed standards. EPA also requests specific comment on the appropriateness of a separate, lower standard for heavy-duty gasoline engines.

A. Diesel Engines

Highway heavy-duty diesel engine manufacturers have historically been very successful in lowering both NO_X and PM levels to meet EPA emission standards. EPA standards have required a reduction in NO_X emissions of over 50 percent and PM reduction of over 80 percent largely within the past 5 years. Engine manufacturers have been able to achieve the majority of these reductions using changes in engine hardware with minimal reliance on exhaust aftertreatment devices. Today's heavy-duty diesel engines are also well below the standards for HC and CO. Over this same period, engine manufacturers have been able to provide their customers with increased power, improved fuel economy and improved engine durability.

Indications are that HC, NO_X and PM control technologies have not yet reached their full potential. A broad range of current published research, referenced in the RIA, shows that HC + NO_X levels of 2.5 g/bhp-hr with a PM level of 0.10 are already being approached in laboratory diesel engines. One example, discussed in the RIA, is a turbocharged and aftercooled engine that uses optimized swirl and cooled EGR to achieve emission levels of 2.0 g/bhp-hr HC + NO_X and 0.13 g/bhp-hr PM (average of three operating modes). Engine manufacturers and other companies have conducted extensive research that is still confidential or is not yet published for other reasons. EPA believes that the unpublished work in the field of diesel engine emission control represents progress in research and development that goes well beyond that described in the published literature. The Agency recognizes that such results do not, of themselves, demonstrate the feasibility of reaching such levels in production engines. However, as discussed below, EPA believes that for the 2004 time frame, technologies will be optimized to meet—and in some cases possibly exceed—future emission-control targets.

Under the proposal, the engine manufacturers will have an effective leadtime of eight years. This is twice that available in previous heavy-duty engine rules. This long leadtime is valuable to heavy-duty diesel engine manufacturers for several reasons. Due to the stringency of the proposed standards, it is likely that manufacturers will need to make fundamental changes in engine technology. History has shown that emissions can be reduced more cost-effectively when the engine manufacturers are given a reasonable amount of time for research and development (R&D). The relatively long lead time available for this rule provides adequate time for a strong, orderly, and comprehensive R&D program which focuses not only on emission reduction, but also on addressing fuel consumption, durability and maintenance concerns. EPA anticipates that heavy-duty diesel engine manufacturers would focus primarily on NO_X control strategies to meet the proposed 2004 standards rather than NMHC control. EPA also expects that manufacturers will focus on in-cylinder control strategies as opposed to aftertreatment approaches. Combustion optimization through improved air and fuel controls are expected to be at the center of the strategy for reducing NO_X emissions (and HC where possible), while holding the line on PM emission rates. Such strategies also hold promise for positive impacts on fuel consumption. Combustion optimization can be achieved through a combination of strategies related to combustion chamber design improvements, upgrades in fuel system controls, and modifications of intake air distribution approaches and characteristics. The R&D associated with the assessment and optimization of such strategies and the application of the results of this work to the various heavy-duty diesel engine models will need to be conducted during the available leadtime.

Individual technologies may have different effects on NO_X, PM, and HC emissions, though manufacturers can balance these to produce an engine that effectively controls all emissions. NO_X emissions are controlled primarily by lowering peak combustion chamber temperatures. However, simply lowering combustion temperatures can lead to an increase in PM or HC formation because PM and HC are more likely to form at lower temperatures. NO_X control strategies such as retarding fuel injection timing by themselves are limited because they cause an increase in PM or HC. Engine manufacturers have had to devise more sophisticated emission control strategies that allow them to simultaneously control NO_X, and PM, and HC. Manufacturers have used a variety of technologies, often balancing their effects and optimizing among them to comply with the emission standards. EPA therefore believes that manufacturers will need some, but certainly not all, of the technologies that are primarily for controlling PM or HC emissions to meet the standards proposed in this action.

Combustion chamber design is a key area for improvements to reduce emissions and increase performance. Manufacturers are continuously working to improve the combustion chamber geometries of their engines to maximize efficiency and reduce emissions. Design variables include such things as the shape of the combustion chamber, the location of the fuel injector, valve timing, and air intake geometry. Efforts to redesign the shape of the combustion chamber and the location of the fuel injector have been directed primarily at optimizing the relative motion of the air and injected fuel. Increasing the turbulence of the intake air (such as through inducing swirl) can reduce NO_X and PM emissions from diesel engines by improving the mixing of air and fuel in the combustion chamber. Increasing the compression ratio of the engine will generally reduce fuel consumption and PM, but tends to increase NO_X emissions. Moving from 2 to 4 valves per cylinder can be used to improve engine breathing and will allow the fuel injector to be placed in the center of the cylinder bore, improving combustion. Finally, higher precision in the bore honing and the matching of the piston and rings can reduce the amount of oil that passes from the crankcase into the cylinder. This will result in a reduction in PM.

Emission control and diesel engine performance may also be improved through advances in fuel injector design. Design variables for fuel injectors include injection pressure, spray pattern, and control of the rate of fuel injection over the course of the injection event. The combination of reduced droplet size and improved mixing leads to decreased HC and PM. This improved fuel injection can simultaneously lower NO_X emissions by reducing the time between the initial injection and ensuing ignition of the fuel, which minimizes the level of premixed combustion.

Varying the rate at which fuel is injected into the cylinder is another strategy that may be used to reduce HC, NO_X, and PM emissions. This ''rate shaping'' is especially effective when combined with electronic controls. A low rate pilot injection may be used at the beginning of combustion to shorten the ignition delay, therefore shortening the pre-mixed burning phase of combustion, which is most conducive to NO_X formation. At low loads, improved fuel injection can reduce NO_X, the soluble organic fraction of PM, and fuel consumption, with some possible penalty in smoke. One experimental study, referenced in the RIA, showed that rate shaping and fuel injection parameters could be used to achieve 3.5 g/bhp-hr NO_X and 0.10 g/bhp-hr PM from a diesel engine operating at 75 percent load, without the use of EGR (HC levels were not reported).

Engine manufacturers may reduce emissions from their engines through optimization of charge air pressures and response rates for all types of engine operation (speed and load). Charge air compression is used in almost all current heavy-duty diesel engines. For four-stroke diesels, turbocharging is the most common method of increasing boost air pressure into the cylinder. With an increase of air moved into the cylinder, more fuel may be injected resulting in higher power. One limitation of a turbocharger is that it has an inertial lag time associated with its response to changing operating conditions. As a result, during transient operation, too little intake air compression may occur at the beginning of an acceleration, while an excessive boost may remain at the start of the next steady-state operation. In addition, a given turbocharger optimized for high loads may have compromised efficiency at low loads. A variable geometry turbocharger may be used to increase the boost response rate and provide appropriate air/fuel ratios for varying loads and speeds. This control of the air/fuel ratio can often lead to decreased emissions. In one study, referenced in the RIA, electronic controls combined with a variable geometry turbocharger achieved a 37 percent reduction in HC and a 34 percent reduction in NO_X without an increase in PM over a portion of the HD-FTP.

Exhaust gas recirculation (EGR) is probably the most important in-cylinder diesel engine control technology for obtaining significant NO_X reductions to meet the 2004 proposed standard. Under this approach, a portion of the exhaust gas is routed back into the intake manifold. This has the effect of reducing peak temperatures, and thus reducing NO_X formation in the cylinder. This strategy will be focused on low and medium load conditions due to possible PM and fuel consumption increases at high loads. EPA expects that the effectiveness of the EGR system will be optimized and its potential adverse affects minimized by integrating its control into the overall electronic controls used for other engine systems. One method for controlling the PM emissions attributed to EGR, which may be used on some designs, is to cool the exhaust gas recirculated to the intake manifold. By cooling the recirculated gas, more exhaust gas can be added to the intake charge without reducing the supply of fresh air into the cylinder. Another concern associated with EGR is that, by being recirculated, the particulate or other contaminants in the exhaust may find its way into the oil and degrade the oil's performance, resulting in a durability concern. This durability concern may be alleviated by keeping the EGR fraction of the intake charge below 10 or 15 percent, modifying lubricating oil additive packages, improving oil filtration, and/or more frequent oil changes. In the worst case, some manufacturers may consider some form of an in-line particulate removal device such as a filter in the stream of recirculated exhaust gas.

Engine manufacturers have started to use oxidation catalysts in some cases where engines have needed help meeting particulate standards. Efforts are also being made to develop a durable and cost effective NO_X reduction catalyst that will operate on the lean exhaust which is produced by diesel engines. However, due to projected engine design improvements, EPA expects the engine manufacturers to focus on meeting the proposed standard without the use of aftertreatment. Alternatives to aftertreatment are generally preferable because of high costs, space requirements, backpressure effects, and possible durability concerns (with respect to long life of diesel engines) associated with aftertreatment devices.

In summary, EPA believes that combustion optimization through strategies such as air and fuel control and EGR would be the primary NO_X control strategy for meeting the proposed standards. However, as NO_X emissions are reduced through engine controls, there is often a tradeoff resulting in an increase in PM emissions. Strategies that would be expected to be used to control PM emissions include further optimization of combustion chamber geometry, advances in fuel injection, fuel rate shaping, and advances in turbocharger design. These PM control technologies may also be used to increase power from the engine and reduce fuel consumption. EPA believes that manufacturers would make use of the PM control technologies, regardless of further emission control, to achieve benefits in power and fuel consumption. All of the technologies described in this section have been applied to and proven in on-highway diesel engine applications. Further, all of the technologies, with the exception of EGR, have been proven in heavy-duty diesel applications. Even EGR is used on at least one 1996 light heavy-duty diesel engine model. By combining these strategies in various ways, EPA believes it is technologically feasible to meet the proposed standards for model year 2004. Together these strategies should allow heavy-duty diesel engines to achieve the proposed NO_X + NMHC reductions without increasing PM or other emissions.

Most of the results discussed above are based on research using conventional on-highway diesel fuel. Another parameter which affects emissions from diesel engines is the composition of the fuel being used. While much can be said about the effect of current fuels on current engines, the degree of sensitivity of future, low emitting, engines to fuel parameters is not as well understood. The Agency's current view is that fuel changes could reduce the amount of emission control necessary for the engine, but fuel changes are probably not necessary to meet the proposed standards. However, this remains an area of uncertainty and is one of the issues which would be addressed further in the proposed 1999 review of the feasibility of the standard, as discussed in section III.B above.

B. Gasoline Engines

Gasoline engine manufacturers are producing heavy-duty engines that exceed the level of emission control required by current standards. Some 1996 model year heavy-duty gasoline engine families have certified emission levels below the standards proposed for 2004. Thus, the Agency believes that complying with the proposed standards will be fairly straightforward for gasoline engines. EPA requests comment on the appropriateness and effectiveness of the technologies described below.

Current heavy-duty gasoline engine emission levels are achieved mainly through the use of EGR and either air-assisted oxidation catalysts or three-way catalysts. Many of these engines have used open-loop engine controls and electronic fuel injection for years. However, the three-way catalysts require precise control of the exhaust air-fuel ratio for maximum performance. By including a feedback loop in the control system, the precision of the air-fuel ratio in the exhaust is greatly increased, especially during transient operation. Therefore, EPA believes that, through the use of closed-loop electronic control and the upgrades to system management available with that approach, manufacturers can significantly improve their emission-control capability. These reductions may be further assisted by improvements in fuel injection technology or EGR.

Improving fuel injection has been proven to be an effective and durable strategy for controlling emissions and reducing fuel consumption from gasoline engines. Improved fuel injection will result in better fuel atomization and a more homogeneous charge with less cylinder-to-cylinder and cycle-to-cycle variation of the air-fuel ratio. These engine performance benefits will increase as technology advances allow fuel to be injected with better atomization. Increased atomization of fuel promotes more rapid evaporation by increasing the surface area to mass ratio of the injected fuel. This results in a more homogeneous charge to the combustion chamber and more complete combustion. EPA believes that multi-port fuel injection will be used in most, if not all, applications under the proposed standards because of its proven effectiveness. Because of the performance and fuel consumption improvements associated with multi-port fuel injection, it is likely that most engine models would incorporate this technology by 2004 anyway.

Exhaust gas recirculation is currently used on heavy-duty gasoline engines as a NO_X control strategy. Recirculated gases reduce the peak flame temperature, thus reducing NO_X. Because the recirculated gases limit the amount of oxygen available for combustion, there can be some penalty in fuel economy if too much gas is recirculated. One method of increasing the engine's tolerance for EGR is to stratify the recirculated gases in the cylinder. This stratification allows high amounts of dilution near the spark plug for NO_X reduction while making undiluted air available to the crevices, oil films, and deposit areas so that HC emissions may be reduced. Stratification may be induced radially or laterally through control of air and mixture motion determined by the geometry of the inlet ports. One study of this strategy is referenced in the RIA.

EPA believes that the most promising overall emission control strategy for heavy-duty gasoline engines is the combination of a three-way catalyst and closed loop electronic control of the air-fuel ratio. Control of the air-fuel ratio is important because the three-way catalyst is only effective if the air-fuel ratio is at a narrow band near stoichiometry. For example, for an 80 percent conversion efficiency of HC, CO, and NO_X with a typical three-way catalyst, the air-fuel ratio must be maintained within a fraction of one percent of stoichiometry. During transient operation, this minimal variation cannot be maintained with open-loop control. For closed-loop control, the air-fuel ratio in the exhaust is measured by an oxygen sensor and used in a feedback loop. The throttle position, fuel injection, and spark timing can then be adjusted for given operating conditions to result in the proper air-fuel ratio in the exhaust. In addition, electronic control can be used to adjust the air-fuel ratio and spark timing to adapt to lower engine temperatures, therefore controlling HC emissions during cold start operation.

A three-way catalyst may be a single converter or have two converters in series. A converter is constructed of a substrate, washcoat, and catalytic material. The substrate may be metallic or ceramic with a flow-through design similar to a honeycomb. A high surface area coating, or washcoat, is used to provide a suitable surface for the catalytic material. Under high temperatures, the catalytic material will increase the rate of chemical reaction of the exhaust gas constituents. In a typical three-way catalyst design with two converters, the first converter will be a reduction catalyst which converts NO_X to nitrogen and water. Palladium is often used as the NO_X reduction catalytic material with rhodium added to control ammonia formation. Ammonia, which may be converted back to NO_X in the second converter, can also be controlled through the use of tight air-fuel ratio control. The second converter is an oxidation catalyst and typically uses platinum and rhodium to convert HC and CO to CO_2 and water. Three-way catalytic converters using a single monolith generally use one or more of the metals mentioned above (platinum, rhodium, and palladium) to catalyze the desired reactions. These designs may be preferable since less materials are used and less space is required.

In summary, EPA believes that gasoline engine manufacturers, to the extent they need to make improvements, can meet the proposed standards by refining those technologies already employed on their engines. The use of more powerful electronics to better control combustion and aftertreatment will likely be the most important focus of technology upgrades enabling manufacturers to reduce emissions. EPA therefore believes it is technologically feasible for heavy-duty gasoline engines to meet the proposed standards for model year 2004.

C. Safety and Energy

One of the factors considered by EPA in assessing the feasibility of its proposed standards is safety. Section 202(a)(3) of the Clean Air Act requires that EPA set emission standards for heavy-duty engines that reflect the "greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology." [48] EPA has considered the safety implications of the standards in today's proposal. In the course of this consideration, the Agency has consulted with the Department of Transportation, to make use of that Department's expertise in assessing vehicle safety.

EPA does not believe that there are any significant safety concerns associated with the technologies described in this section. In general, they all represent the progressive development of technology already in use. Except for the use of EGR on heavy-duty diesel engines, all of the technologies anticipated for use in 2004 have already been applied to and proven on recent model year heavy-duty engines. As for the use of EGR, EPA is not aware of any safety problems where EGR has been used on light-duty diesel vehicles or on heavy-duty gasoline engines. EPA sees no reason why the use of EGR on heavy-duty diesels would create any new safety problems. EPA welcomes comment on any safety issues that commenters believe might be associated with today's proposal.

EPA believes that there will not be significant energy concerns associated

[48] 42 U.S.C. 7521(a)(3)(A)(i).

with the control strategies which would be available to meet the proposed standards. EPA expects that manufacturers will focus on maintaining or decreasing the fuel consumption of their engines in the development of engines that will meet the proposed standards. For heavy-duty diesel engines, many of the technologies that would likely be used to control PM emissions would also be used to offset the negative effects of EGR on fuel economy. For heavy-duty gasoline engines, the combination of fuel injection advances and closed-loop control used to control emissions could actually result in a fuel economy benefit.

V. Impacts of Proposed Program

A. Environmental Impacts

1. Heavy-Duty NO_X Emissions Impacts

The NO_X inventories used for this rulemaking were based on a detailed analysis of NO_X emissions that was prepared for EPA by E.H. Pechan and Associates, as described in Section II. To calculate the impact of this proposal, it is necessary to estimate average NO_X and average NMHC emission levels resulting from the combined NO_X + NMHC standard. The NO_X emission level was determined by analyzing the relative cost effectiveness of NO_X and NMHC emissions reduction technologies; NO_X-reduction technologies are expected to be much more cost-effective than NMHC-reduction technologies, which are only practical for a small number of engine families that have relatively high NMHC emissions. As a result, NMHC emissions are expected to be only slightly less than current levels, (see following section for additional discussion), and NO_X emissions are expected to be reduced to below 2.0 g/BHP-hr to provide a sufficient compliance margin. Thus, the effect of the combined standards on NO_X was modeled as being equivalent to a 2.0 g/BHP-hr NO_X-only standard. Full details of the air quality impacts can be found in the RIA. The following paragraphs summarize the key results. The public is encouraged to read the full analysis, and to comment on all aspects of the work.

Figure 7 shows projections of total NO_X emissions, with and without the proposed controls, for the entire nation. The emissions are projected to decline over the next several years, due to the implementation of previously promulgated controls, but then begin to increase due to growth in the number of vehicles and other sources. By the year 2020, without additional control, total national NO_X emissions are projected to actually exceed current levels. Even with the implementation of the proposed standards, total NO_X emissions are expected to grow in the future. Figure 8, which presents the projections of NO_X emissions from heavy-duty engines, with and without the proposed controls, shows that the proposed standards are expected to prevent the contribution of heavy-duty engines from increasing before the year 2020.

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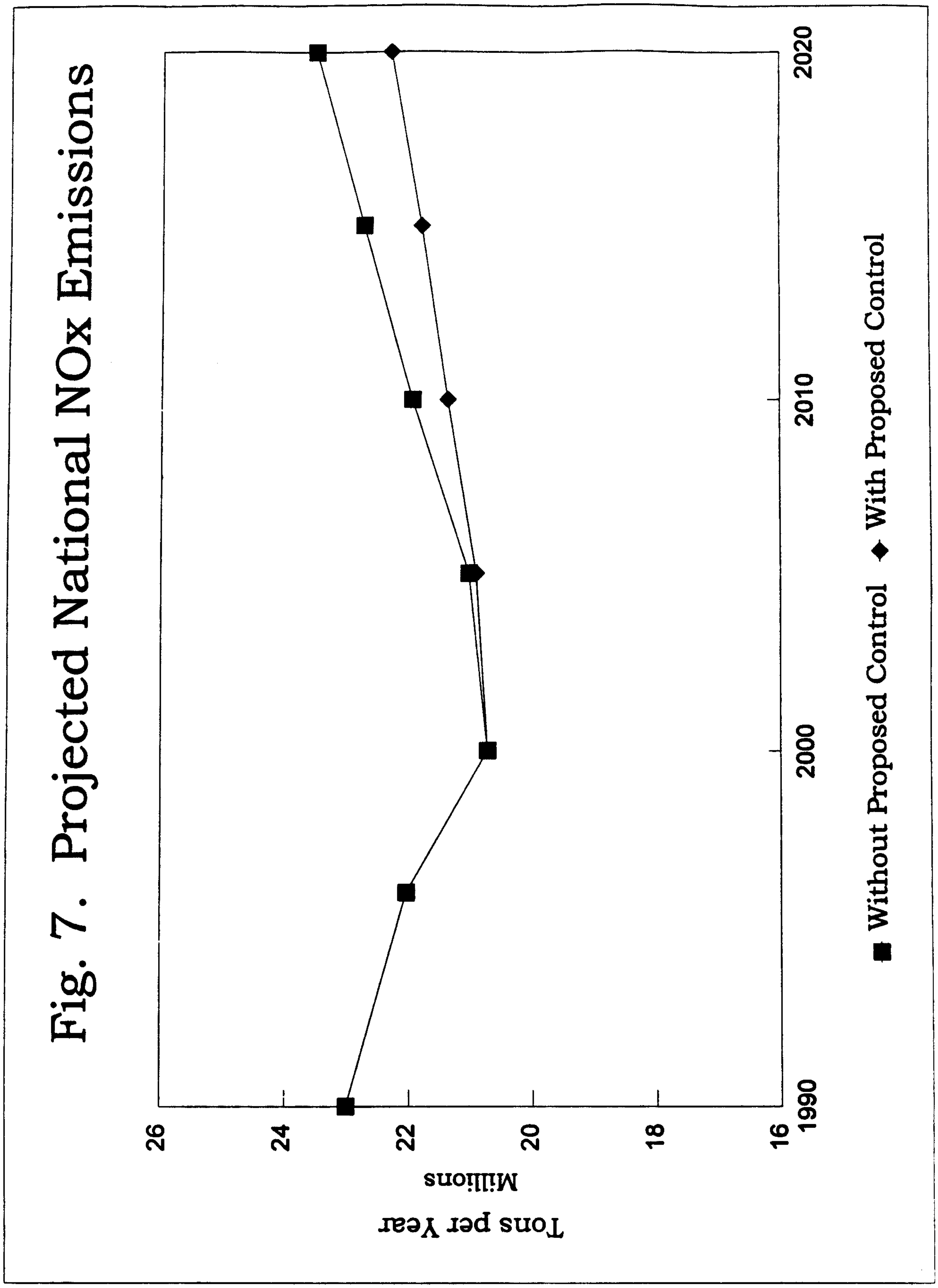
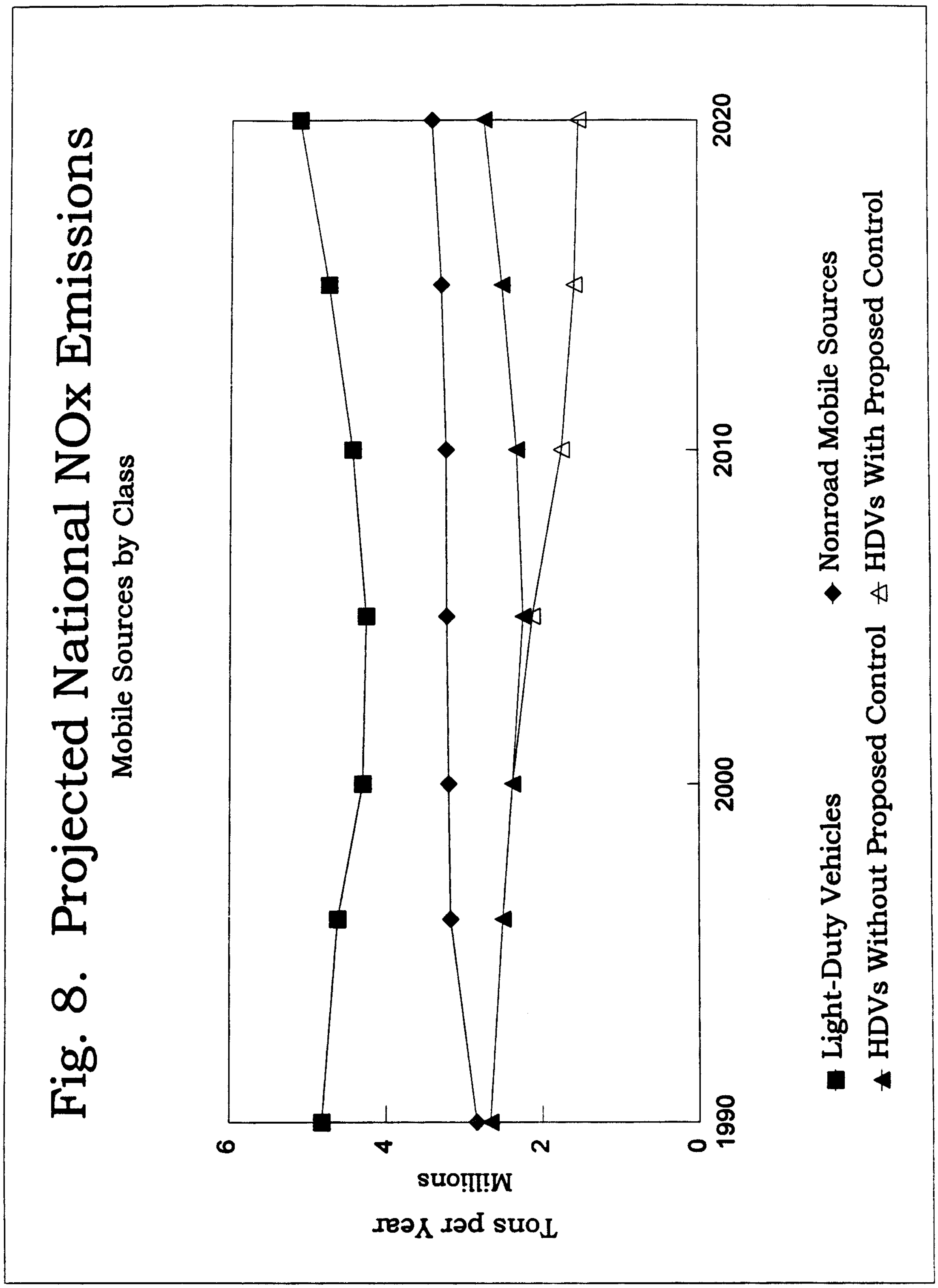


Fig. 7. Projected National NOx Emissions



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The estimates of the total NO_X reductions are shown in Table 3. Almost half of the reductions would occur in nonattainment areas, and nearly 90 percent of the reductions would occur in regions where NO_X emissions are reasonably expected to have a significant effect on nonattainment areas.[49]

TABLE 3.—ESTIMATED NATIONAL NO_X Emissions Reductions From Proposed Standards for Heavy-Duty Engines

[Thousand Tons per Year]

Year	Diesel emissions reductions	Gasoline emissions reductions	Total emissions reductions
2005	106	12	118
2010	518	59	577
2015	832	102	934
2020	1,066	149	1,215

2. Heavy-Duty NMHC Emissions Impacts

Estimates of the impact of this action on NMHC emissions were developed by assuming that the combined NMHC plus NO_X standards are equivalent to that of 0.4 g/BHP-hr NMHC-only standards; this discussion briefly summarizes the detailed analysis in the RIA. This is consistent with the previous assumption that the combined standards are equivalent to that of 2.0 g/BHP-hr NO_X-only standards It was also assumed that, without the proposed NMHC control, average NMHC emissions from 2004 and later model year heavy-duty engines would be the same as 1994 model year heavy-duty engines (based on certification data), since there are no new PM or HC standards after 1994. Using these assumptions, the expected exhaust NMHC reductions for 2004 and later model year engines would be 9 percent for diesels and 24 percent for gasoline. The effect of these reductions on nationwide emissions was modeled using MOBILE5a, using the VMT estimates from Pechan. The results are shown in Table 4. The reason why these reductions are small relative to the decrease in the numerical level of the standards is that many heavy-duty engines are currently being certified well below their applicable hydrocarbon standards. As is discussed in the RIA, however, the lowering of the NO_X standard in 1998 may cause some increases in NMHC emissions from diesel engines (even if the emissions remained below the current HC standard), such that the actual benefit of this standard may be greater. Moreover, it is worth noting that the inclusion of NMHC emissions in the proposed standards also serves to prevent increases in NMHC emissions that may otherwise have occurred as a result of lowering the NO_X standard, given the tradeoff between NO_X reductions and HC/PM reductions that is often observed with diesel engines.

TABLE 4.—ESTIMATED NATIONAL NMHC EMISSIONS REDUCTIONS FROM PROPOSED STANDARDS FOR HEAVY-DUTY ENGINES

[Thousand Tons per Year]

Year	Diesel emissions reductions	Gasoline emissions reductions	Total emissions reductions
2005	2.2	0.5	2.7
2010	6.8	2.9	9.7
2015	12.1	5.2	17.3
2020	16.4	8.4	24.8

3. Particulate Emissions Impacts

The action being proposed should not have any effect on direct particulate emissions from heavy-duty engines, since it does not change the particulate standard. Manufacturers are expected to continue to produce engines with particulate levels slightly below the standard. The NO_X reductions discussed above, however, are expected to reduce the concentrations of secondary nitrate particulates. As discussed previously, NO_X can react with ammonia in the atmosphere to form ammonium nitrate particulates. In some areas in the western states, ammonium nitrate particulates can represent more than one quarter of the fine particulate in the air. The California Air Resources Board has preliminarily estimated that, in California, there are typically 4 to 19 (with an average of about 7) tons of nitrate particulate in the air for every 100 tons of NO_X in the air.[50] Unfortunately, such information is not available for the rest of the nation. As was described in the RIA, the national average for the years of interest was estimated as 4.3:100, assuming that the ratio would be 7.0 for the western part of the nation, and 3.5 for the eastern part. This estimate was used to determine the equivalent fine particulate emissions reductions caused by the NO_X emissions reductions, as is shown in Table 5. Future year estimates are extrapolations based on the NO_X reduction estimates for those years. The Agency recognizes the limited precision of these estimates, and requests comments on the potential for developing better estimates of the expected relationship between NO_X emissions and nitrate particulate formation during and after the year 2004.

TABLE 5.—ESTIMATED EQUIVALENT NATIONAL PARTICULATE EMISSIONS REDUCTIONS FROM PROPOSED STANDARDS FOR HEAVY-DUTY ENGINES

[Thousand Tons per Year]

Year	Total NO_X emissions reductions	Equivalent particulate emissions reductions
2005	118	5
2010	577	25
2015	934	40
2020	1215	52

4. Effect on Ozone

The effect of these NO_X emissions reductions on ozone concentrations is expected to vary geographically. In general, when fully phased-in, the effect of this action in most nonattainment areas should be a reduction in ozone concentrations on the order of a few percent. It should be noted, however, that the potential exists for a few localized areas to actually experience slight increases in ozone concentrations as a result of NO_X emissions reductions. The Agency is attempting to develop a more precise analysis of the effect of these reductions on ozone, including an analysis of the extent to which potential localized ozone increases could be mitigated through other emissions control programs.

5. Other Effects

Reducing NO_X emissions has a positive effect on visibility, since both NO_2 and nitrate particulates absorb visible light. As noted in the RIA, NO_2 and nitrate particulates can be responsible for 20 to 40 percent of the visible haze in some urban areas. The effect of this action on visibility should be small but potentially significant, given that it is expected to reduce overall NO_X emissions by several percent. For example, the proposed controls are expected to result in about 5 percent less total NO_X in the year 2020, and therefore would be expected

[49] These regions include all counties in ozone nonattainment, as well as all counties in attainment in: California, Texas, all states east of the Mississippi River, and all states on the western border of the Mississippi River.

[50] ''Conversion Factors for Secondary Formation of PM Nitrate from NO_X Emissions for California'', Draft, June 6, 1996, Leon J. Dolislager, Nehzat Motallebi, Bart E. Croes, California Air Resources Board.

to result in a decrease in haze of about 1 percent in an area where NO_2 and nitrate particulates cause 20 percent of the haze. NO_2 and nitrate particulates also contribute to decreased visibility in scenic rural areas in southern California, so these areas would similarly benefit from reduced NO_X emissions.

The standards being proposed here are also expected to provide benefits with respect to nitrogen deposition. The 1.2 million-ton per year reduction in NO_X emissions expected in 2020 as a result of this action is greater than the 400,000-ton per year reduction expected from Phase I of the Agency's acid rain NO_X control rule (59 FR 13538), which was considered to be a significant step toward controlling the ecological damage caused by acid deposition. This action should also lead to a reduction in the nitrogen loading of estuaries. This is significant since high nitrogen loadings can lead to eutrophication of the estuary, which causes disruption in the ecological balance. The effect should be most significant in areas heavily affected by atmospheric NO_X emissions. One such estuary is Chesapeake Bay, where as much as 40 percent of the nitrogen loading may be caused by atmospheric deposition. In addition to these benefits, the NO_X reductions from the proposed new engine standards are expected to have beneficial impacts with respect to crop and forest damage.

B. Economic Impact and Cost-Effectiveness

This rulemaking does not follow the normal pattern of allowing four years following the conclusion of the rule before requiring production of the new low-emitting engines. The engine manufacturers, by signing the Statement of Principles, have committed themselves to challenging, long-term design targets. This provides manufacturers fully eight years to allocate resources and conduct planning for a very thorough long-term R&D program. Manufacturers have expressed a confidence that several years of research will provide them opportunity to develop a complying engine that they can market with full confidence.

The above presentation of the range of technologies shows a good deal of promise for controlling emissions, but also makes clear that much effort remains to optimize the technologies for maximum emission-control effectiveness with minimum negative impacts on engine performance, durability, and fuel consumption. On the other hand, it has become clear that manufacturers have a great potential to advance beyond the current state of understanding by identifying aspects of the key technologies that contribute most to hardware or operational costs or other drawbacks and pursuing improvements, simplifications, or alternatives to limit those burdens. To reflect this improvement and long-term cost saving potential, the cost analysis includes an estimated $230 million (net present value in 1996) in R&D outlays for heavy-duty engine emission control over several years. The cost analysis accordingly presumes extensive improvements on the current state of technology from these future developments. The 1999 technology review provides a check on EPA's projected costs. EPA will revisit the analysis of the full life-cycle costs as part of the 1999 technology review. EPA and manufacturers will at that time confirm whether or not technology development is progressing as needed to meet the proposed emission standards.

In assessing the economic impact of changing the emission standards, EPA has made a best estimate of the combination of technologies that an engine manufacturer might use to meet the proposed standards at an acceptable cost. Full details of EPA's cost and cost-effectiveness analyses, including information not presented here, can be found in the Regulatory Impact Analysis in the public docket. The Agency invites comments on all aspects of these analyses.

Estimated cost increases are broken into purchase price and total life-cycle costs. The incremental purchase price for new engines is comprised of variable costs (for hardware and assembly time) and fixed costs (for R&D, retooling, and certification). Total life-cycle costs factor in an additional estimate for operating costs attributable to any increased maintenance or fuel consumption. Cost estimates based on these projected technology packages represent an expected incremental cost of engines in the 2004 model year. Costs in subsequent years would be reduced by several factors, as described below. Separate projected costs were derived for engines used in three service classes of heavy-duty diesel engines. Cost estimates are presented for all gasoline heavy-duty vehicles as a single group. All costs are presented in 1996 dollars. Life-cycle costs have been discounted to the year of sale. Diesel engine costs are considered first, followed by gasoline engines.

1. Costs for Diesel Engines

The following discussion provides a description and estimated costs for those technologies EPA believes will be needed to comply with the proposed emission standards. It is difficult to make a distinction between technologies that are needed to reduce NO_X emissions for compliance with 2004 model year standards and those technologies that offer other benefits for improved fuel economy and engine performance or for better control of particulate emissions. EPA believes that manufacturers, in the absence of 2004 model year standards, would continue research on and eventually deploy numerous technological upgrades to improve engine performance or more cost-effectively control emissions. EPA therefore believes that a small set of technologies represent the primary changes manufacturers must make to meet the proposed 2004 model year standards. Other technologies applied to heavy-duty engines, before or after implementation of new emission standards, will make relatively minor positive contributions to controlling NO_X emissions and are therefore considered secondary improvements for this analysis. In this category are design changes such as improved oil control, variable-geometry turbochargers, optimized catalyst designs, and variable-valve timing. Lean NO_X catalysts are also considered here to be secondary technologies, not because NO_X control is an incidental benefit, but rather because it appears unlikely that they will be part of 2004 model year technology packages. Modifications to fuel injection systems will also continue independently of new standards, though some further development with a focus on reducing NO_X emissions would be evaluated.

Several technological improvements are projected for complying with the proposed 2004 model year emission standards. Selecting this package of technologies requires extensive engineering judgment. The fact that manufacturers have nearly a full decade before implementation of the proposed standards virtually ensures that the technologies used to comply with the proposed emission standards will develop significantly before reaching production. This ongoing development will lead to reduced costs in three ways. First, research will lead to enhanced effectiveness for individual technologies, allowing manufacturers to use simpler packages of emission control technologies than we would predict given the current state of development. Similarly, the continuing effort to improve the emission control technologies will include innovations that allow lower-cost production. Finally, manufacturers will focus research efforts on any drawbacks, such as increased fuel consumption or maintenance costs, in an effort to minimize or overcome any potential negative effects.

A combination of primary technology upgrades are anticipated for the 2004 model year. Achieving very low NO_X emissions will require basic research on reducing in-cylinder NO_X and HC. Modifications to basic engine design features can be used to improve intake air characteristics and distribution during combustion. Manufacturers are also expected to utilize upgraded electronics and advanced fuel-injection techniques and hardware to modify various fuel injection parameters, including injection pressure, further rate shaping and some split injection. EPA also expects that many engines will incorporate light-load EGR.

If not developed and implemented properly, EGR has the potential to increase operating costs, either by increasing fuel consumption or requiring additional maintenance to avoid accelerated engine or component wear. While it is possible to develop scenarios and estimate the impact on operating costs of current diesel EGR concepts, this is of minimal value due to the expected continuing development of these technologies. Nevertheless, EPA has assessed the potential for increased operating costs, as described below, first for EGR-related maintenance, then for fuel economy. EPA understands that manufacturers will make a great effort to minimize any potential new maintenance burden for the end user, investing in research to design an engine acceptable to users. The cost to address the durability concern is therefore included not as a maintenance item, but as a fixed cost. The analysis includes a separate maintenance cost for EGR systems—EPA expects engine rebuilding will include preventive maintenance to clean or replace EGR components.

With respect to fuel economy, several of the secondary technologies described below may lead to cost savings, while EGR has the potential to incur a fuel economy penalty. As with potential new maintenance cost burdens, EPA believes manufacturers will focus their research efforts on overcoming any negative impact on fuel economy caused by EGR. In any case, it is not clear at this stage of development that the set of changes resulting from the proposed emission standards will have any net negative impact on fuel economy; additional fuel costs are therefore not included in the cost analysis.

Meeting the proposed NO_X+NMHC standard will somewhat increase the challenge to control particulate emissions. Manufacturers might use a number of different technologies to maintain control of particulate emissions; however, EPA believes that the fuel system improvements described above will be sufficient to prevent any potential particulate-emission increase. In fact, manufacturers are attempting to lessen the cost of meeting current particulate emission standards over the next several years by decreasing their reliance on catalysts. This underscores EPA's belief that 2004 model year engines will be able to control particulate emissions without major technological innovation.

The costs of these new technologies for meeting the proposed standards are itemized in the Regulatory Impact Analysis and summarized in Table 6. For light heavy-duty vehicles, the incremental cost of a new 2004 model year engine is estimated to be $185, with no additional operating costs. For medium heavy duty vehicles the new engine purchase price is estimated to increase by $327, with total life-cycle costs of $371. Similarly, for heavy heavy-duty engines, initial purchase price is expected to increase by $403, while total life-cycle cost estimates reach $499.

For the long term, EPA has identified various factors that would cause cost impacts to decrease over time. First, the analysis incorporates the expectation that manufacturers will apply ongoing research to making emission controls more effective and less costly over time. This expectation is similar to manufacturers' stated goal of decreasing their reliance on catalysts to meet emission standards in the future. Research in the costs of manufacturing has consistently shown that as manufacturers gain experience in production, they are able to apply innovations to simplify machining and assembly operations, use lower cost materials, and reduce the number or complexity of component parts.[51] The analysis incorporates the effects of this learning curve by projecting that the variable costs of producing the low-emitting engines decreases by 20 percent starting with the third year of production (2006 model year) and by reducing variable costs again by 20 percent starting with the sixth year of production. Finally, since fixed costs are assumed to be recovered over a five-year period, these costs disappear from the analysis after the first five model years. Table 6 lists the projected schedule of costs for each category of vehicle over time.

TABLE 6.—PROJECTED DIESEL ENGINE COSTS
[1995 dollars discounted to year of sale]

Vehicle class	Model year	Purchase price	Life-cycle operating cost	Total life-cycle cost
Light heavy-duty	2004	185	0	185
	2009 and later	68	0	68
Medium heavy-duty	2004	327	44	371
	2009 and later	101	44	145
Heavy heavy-duty	2004	403	96	499
	2009 and later	148	96	243

2. Costs for Gasoline Engines

The cost analysis for gasoline engines follows the same methodology as for diesel engines, though with significantly less complexity due to the expectation that the technological development needed to meet the proposed standards will not be so far-reaching as for diesel engines. The same kinds of costs are considered for gasoline engines. Because the technologies require changes to existing technologies without affecting the assembly time, no increase in assembly costs are anticipated. Also, the improvements to gasoline engine technologies will not affect fuel economy or in-use maintenance; therefore, no incremental fuel or maintenance costs are anticipated.

Gasoline engines and vehicles need a much different set of changes to meet the proposed emission standards than do diesel engines. Much of the very extensive development work done for

[51] "Learning Curves in Manufacturing," Linda Argote and Dennis Epple, Science, February 23, 1990, Vol. 247, pp. 920–924.

passenger cars can, with appropriate adaptations, be applied to heavy-duty engines. The technology projections for heavy-duty gasoline engines therefore depend in part on the experience with light-duty trucks, as well as on the current view of technology developments for the heavy-duty applications themselves.

More sophisticated control of EGR flow rates over the various operating modes may allow more aggressive use of EGR to better control NO_X emissions. Ongoing developments show that three-way catalysts can be made with modified washcoats and configured in the vehicle in ways that significantly improve their effectiveness at controlling both NO_X and HC emissions. Some basic engine modifications may also be needed to fine-tune emission control and operating performance.

Since no operating costs for fuel economy or maintenance are expected for gasoline engines, all the costs translate into an increased purchase price of the engine or vehicle. The 2004 model year cost estimate for an average heavy-duty gasoline vehicle is $162. Costs can be reduced with continuing production experience, as described for diesel engines; variable costs are reduced by 20 percent only one time though, because the changes to gasoline engines are considered to be of a smaller magnitude. The resulting cost calculation for 2009 and later model year heavy-duty gasoline vehicles is $101 (Table 7).

TABLE 7.—PROJECTED GASOLINE ENGINE COSTS

[1995 dollars discounted to year of sale]

Model year	Purchase price	Life-cycle operating cost	Total life-cycle cost
2004	162	0	162
2009 and later	101	0	101

3. Aggregate Costs to Society

The above analysis develops per-vehicle cost estimates for each vehicle class. Using current data for the size and characteristics of the heavy-duty vehicle fleet and making projections for the future, these costs can be used to estimate the total cost to the nation for the proposed emission standards in any year. The result of this analysis is a projected total cost starting at $300 million in 2004. Per-vehicle costs savings over time reduce projected costs to a minimum value of $136 million in 2009, after which the growth in truck population leads to increasing costs that reach $186 million in 2020. Total costs for these years are presented by vehicle class in Table 8. The calculated total costs represent a combined estimate of fixed costs as they are allocated over fleet sales, variable costs assessed at the point of sale, and operating costs as they are incurred in each calendar year.

TABLE 8.—ESTIMATED ANNUAL COSTS FOR IMPROVED HEAVY-DUTY VEHICLES

[millions of dollars]

Category	2004	2009	2020
Light Heavy-Duty Diesel	51	23	26
Medium Heavy-Duty Diesel	71	22	34
Heavy Heavy-Duty Diesel	97	37	62
Gasoline	81	55	64
Total	300	136	186

As described in Section X below, EPA expects that complying with the proposed emission standards will not result in a significant impact on a substantial number of small entities.

4. Cost-effectiveness

EPA has estimated the per-vehicle cost-effectiveness (i.e., the cost per ton of emission reduction) of the proposed NO_X plus NMHC standard over the typical lifetime of heavy-duty diesel and heavy-duty gasoline vehicles. The RIA contains a more detailed discussion of the cost-effectiveness analyses. EPA requests comments on all aspects of the cost-effectiveness analyses, including, for example, the appropriateness of the scope of benefits and costs which EPA considered.

EPA has examined the cost-effectiveness by two different methodologies. The first methodology yields a nationwide cost-effectiveness in which the total cost of compliance is divided by the nationwide emission benefits. The second methodology yields a regional ozone strategy cost-effectiveness in which the total cost of compliance is divided by the emission benefits attributable to the regions that impact ozone levels in ozone nonattainment areas.[52] EPA requests comments on the methodologies used to determine cost-effectiveness in this analysis.

In addition to the benefits of reducing ozone within and transported into urban ozone nonattainment areas, the NO_X reductions from the proposed new engine standards are expected to have beneficial impacts with respect to crop damage, secondary particulate, acid deposition, eutrophication, visibility, and forests, as described above. Due to the difficulty in estimating the monetary value of these societal benefits, the cost-effectiveness analysis does not assign any numerical value to these additional benefits. It should be emphasized that the Agency believes that the actual monetary value of the multiple environmental and public health benefits produced by the large NO_X reductions under this proposal is likely to be much higher than the estimated regulatory costs. To the extent possible, EPA plans to take into consideration the value of these additional benefits in analyzing the cost-effectiveness of the standards for the final rulemaking. EPA requests comment on including these benefits in an estimate of the cost-effectiveness of the proposed standards.

As described above in the cost section, the cost of complying with the proposed standards will vary by model year. Therefore, the cost-effectiveness will also vary from model year to model year. For comparison purposes, the discounted costs, emission reductions and cost-effectiveness of the proposed standards are shown in Table 9 for the same model years discussed above in the cost section. The cost-effectiveness results contained in Table 9 present the range in cost-effectiveness resulting from the two cost-effectiveness scenarios described above.

[52] The RIA contains a detailed description of areas included in the regional control strategy.

TABLE 9.—DISCOUNTED PER-VEHICLE COSTS, EMISSION REDUCTIONS AND COST-EFFECTIVENESS OF THE PROPOSED NO_X and NMHC Standards

Vehicle class	Model year	Discounted lifecycle cost	Discounted lifetime reductions (tons)		Discounted cost-effectiveness ($/ton)
			NO_X	NMH	
Heavy-duty diesel vehicles	2004	$333	1.321	0.019	$200–$300
	2009+	143	....	....	100
Heavy-duty gasoline vehicles	2004	162	0.190	0.011	800–900
	2009+	101	....	....	500–600

VI. Potential for Use of Additional Incentive-based Approaches

When considering how to achieve the greatest emission reductions possible, a broad variety of options must be evaluated. On one end of the continuum are mandatory standards, which generally provide the strongest mechanism to produce cleaner engines. At the other end of the continuum are voluntary programs, where engine manufacturers and users are not required to make or use cleaner engines, but are strongly encouraged to do so. The proposed actions described in Section IV above include elements of both mandatory programs (emissions standards and durability-related requirements), as well as voluntary provisions (enhancements to the averaging banking and trading program). Voluntary programs can also be used to allow manufacturers and users maximum flexibility in finding the most cost effective ways to adopt new standards.

In the following sections, EPA describes additional voluntary programs that might facilitate the introduction of cleaner heavy-duty engines. These are voluntary labeling (‘‘green star’’) programs, and emission reduction credit generation under various state-run credit programs (including scrappage buy-back and open market trading). While EPA is not proposing these programs in today’s NPRM, EPA is soliciting comments on their applicability and potential usefulness.

A. Voluntary Labeling

One type of economic incentive program is environmental labeling, or ‘‘green’’ labeling. While ‘‘green’’ labeling is very closely linked to environmental marketing, it most often involves setting voluntary standards and encouraging industry to adopt them based on their intrinsic value to the common good, as well as individual companies. In a voluntary labeling program benefits can be direct or indirect. Some voluntary labeling programs may confer direct economic benefits (savings), for example, in the form of reduced energy costs. An example of this is EPA’s Green Lights and Energy Star programs. Other voluntary labeling programs may confer only indirect benefits on companies that offset emission control costs by providing some other intangible benefit, such as positive publicity, public goodwill, or improved efficiency.

Although EPA is not proposing a voluntary environmental labeling program in this document, EPA is requesting comments on a three-component labeling concept called the Green Star Engines Program. The program would seek to identify cleaner engines and classify products that could be marketed as ‘‘green.’’ This would provide positive publicity and, potentially, economic incentives. These, in turn, could help encourage engine manufacturers to market cleaner engines and encourage truckers and other users to purchase those cleaner engines.

The first part of the program would focus on identifying engines that meet the emission standards contained in today’s proposal earlier than required. The second would also focus on early compliance, but with intermediate standards which are between pre-2004 levels and those being proposed today. The third part of the program would concentrate on identifying engines that can meet or exceed the emissions standard with the use of alternative fuels. Engine manufacturers benefit from the public good will created as they demonstrate a commitment to work cooperatively with other stakeholders to improve air quality. In addition, producers of alternative fuels would have additional opportunities to enter the transportation energy market.

As described further below, engines falling under any of the three parts of the program would be identified with an appropriate engine label. Trucks equipped with such engines would also be labeled. In the case of the truck labels, it might be desirable to include a commitment to advanced maintenance practices on the part of the truck owner as a condition of displaying the label. EPA envisions that this could be a cooperative program between the federal or state government and truck owners/operators. Participants would sign a letter of commitment to establish specified maintenance programs and maintenance technician training programs. They would then be recognized as members of the program and provided with labels to affix to their trucks. The supervising agency, either EPA or some other entity, would be responsible for ascertaining that truck owner/operators have the systems in place to comply with the maintenance requirements. Also, the commitment would have to be renewed periodically to insure that the relevant trucks are performing as required.

EPA solicits comment as to the practicality and potential effectiveness of all aspects of this program, as well as whether and how the three aspects of the program could be used simultaneously, as further discussed below.

EPA anticipates that a broad range of interested stakeholders would wish to participate in the Green Star Programs described in more detail below. Interested stakeholders would participate as either a Partner or Supporter. A Partner would be defined as an individual or entity that either manufactures or uses the Green Star Product and thus has a greater stake in the program outcome. A Supporter would assist in making the program successful through public education efforts and by providing positive publicity.

1. Green Star Engine Program: Early Compliance with Certification Standards

The first labeling program about which EPA is requesting comment would identify those heavy-duty engines which meet the federal heavy-duty certification standards prior to the required implementation date. All such engines would be identified with the Green Star Engine Label. Trucks that are equipped with Green Star engines would also be identified with the Green Star Engine Label.

The identification of heavy-duty engines, trucks, and equipment that meet a more protective standard would serve to visually inform users, states, interested parties, and the general public of the specific heavy-duty engines, and consequently the trucks and other heavy-duty equipment, which meet more protective emission standards. For example, heavy-duty engines which meet the 1998 NO_X standard before 1998 could be labeled with a Green Star Engine label, until those standards become mandatory. After those standards are mandatory, but prior to the implementation to the 2004 heavy-duty standard, heavy-duty engines that meet the 2004 standards could be labeled with the Green Star Engine label. This program would be intended to encourage the early introduction of cleaner heavy-duty engines, the idea being that early users would draw some publicity benefits from using these engines. Engine manufacturers would benefit from being able to use the Green Star Engine label as a sales tool. Comments are invited on whether EPA should propose the early compliance labeling program, and if it should, how the program should be structured.

2. Green Star Engine: Intermediate Standards Program

Engines which might meet a more stringent intermediate standard than what would be required by regulation could be identified with the Green Star Engine intermediate label. The intermediate label would identify engines (and trucks equipped with those engines) as cleaner than the current standard but not as clean as the future standard. For example, such an engine might meet a 2.5–3.0 g/bhp-hr NO_X standard between 1998 and 2004 or meet a 1–1.5 gram NO_X standard after 2004. For the 2004 case, it may be desirable to have a somewhat higher cut point initially, and then lower it over time. Engines certified to meet an intermediate standard would be demonstrating more advanced technology options than other engines.

The Agency would expect that advantages similar to the early certification program would accrue for any potential participants. Of course, the intermediate standards component of the Green Star Engine labeling program would not accrue the same level of potential air quality benefit as the early certification component described above because the emission standards would not be as stringent. EPA requests comments on the feasibility of developing an intermediate standard labeling program. Commenters supporting a proposal are also asked to comment on the appropriateness of using a 3g/bhp-hr NO_X level as a cut-point for the 1998 to 2004 time period, as well as an appropriate cut point, or points, for 2004 and later.

3. Green Star Alternative Fuel Engines

Under this component of the program, all engines which meet or exceed the 1998 or 2004 standards by using alternative fuels would be identified with a Green Star Alternative fuel engine label. Trucks using those engines would also be labeled. The primary purpose would be to encourage the use of alternative fuels by identifying the engines/trucks which meet or exceed the proposed emission standards by utilizing alternative fuels (such as CNG, methanol, or LPG) as their energy source. The use of alternative fuels can bring additional benefits, such as reduced green house gas emissions, not available with conventional fuels. Alternative fuels could be included in the labeling program in conjunction with either of the other two components of the Green Star Engine program. EPA requests that comments be submitted regarding the usefulness and practicality of an alternative fuel engine labeling program. The Agency also asks that comments be submitted on the logistical aspects of a labeling program for such an approach.

B. Emission Reduction Credit Programs

A third type of economic incentive program involves generating and trading emission reduction credits. This type of incentive could be used by those states that have adopted economic incentive programs in their State Implementation Plan, and would be subject to the details of those programs. Where they are available, these programs could provide an incentive for engine manufacturers and truck operators to undertake emission reduction efforts beyond those required since states may allow such emission sources to generate and sell emission reduction credits to other entities such as stationary sources. Alternatively, the generator of the credits could retain them for use or sale in the future. The purchaser of the credits would typically use the credits to offset their own emission reduction requirements and therefore the credits may not of themselves reduce overall emissions. Another option available in credit programs is for the purchaser to retire the credits to benefit the environment instead of using them to offset emission reduction requirements. Retiring credits would result in an overall reduction in emissions. Credits programs could lower the overall cost of emission reductions by allowing for more cost effective emissions controls to be used on some emissions sources instead of less cost effective controls on other sources. Additionally, credits programs may encourage technology advances that may have broad applications, which could help lower overall emissions in the future.

There are two important credit trading programs of this kind: the Economic Incentive Program (EIP) and the proposed Open Market Trading Rule (OMTR) (60 FR 39668, August 3, 1995). Generally, the EIP is more stringent than the proposed OMTR in that it requires state approval for trades before they occur. However, these programs are similar in that they require credits to be surplus (beyond required emissions reductions), quantifiable, and enforceable.

Because credits must be surplus, engines generating credits for use in EPA's averaging, banking, and trading (ABT) program cannot also generate marketable emission reduction credits, based on those same emission reductions, to be used in the credit trading programs. That is, a truck operator cannot generate emission reduction credits based on the difference between the emissions level of the engine and the standard if that engine is generating credits for use by the manufacturer in the ABT program. EPA believes that some manufacturers may choose to pass credit ownership to purchasers of clean engines rather than using the credits themselves under the ABT program. EPA believes that in some circumstances this could well be appropriate and consistent with the intent of the ABT regulations. Further discussion is provided in section III.B.3. above.

Depending on the state program, truck operators may be able to generate credits in ways other than purchasing cleaner-than-required engines. For example, credits might be able to be generated through operational changes, maintenance changes, or changes in activity levels. Credits might also be earned through buy-back programs, commonly known as scrappage programs. Buy-back programs typically involve giving financial incentives to vehicle owners in exchange for the voluntary scrapping of their older-technology, higher-emitting engines or vehicles. Buy-back programs might also be used for helping an area achieve an air quality goal rather than to generate emission reduction credits to be sold in an emission trading program (for example, in the proposed Open Market Trading Rule). Typically, any credits earned in buy-back programs are earned by those purchasing and retiring the old vehicles or engines. As long as the emission benefits that result can be reliably quantified and meet the requirements of the relevant state credit program, such activities could be used to generate emission reduction credits.

VII. Public Participation

As mentioned above, EPA issued an Advance Notice of Proposed Rulemaking (ANPRM) announcing EPA's intent to formally propose regulatory action relating to HDE emissions, including today's action on highway HDEs. During the development of the ANPRM and after its publication, EPA received a wide range of early comments on the basic framework of such a program. By the time of the close of the comment period, the Agency had received more than 60 communications relating to this program and the ANPRM. These comments have been very valuable in developing today's proposal, and the Agency looks forward to additional comment as the formal rulemaking process now begins.

As described in part in the discussions above, comments ranged from those strongly opposing new highway HDE emission standards like those proposed today to those strongly supportive of such new standards or of standards even more stringent. Commenters offered widely varying rationales for their suggestions, including the availability or nonavailability of cost effective engine technology or the degree of need for new NO_X and PM control. To the extent possible, EPA has considered each of the comments relevant to highway HDE emissions and has accommodated them in this proposal. (Comments relating to other potential parts of an overall program that are not proposed today, including regulations affecting fuels or nonroad engines, are under consideration by the Agency as it contemplates what action it may pursue in these areas in the future.) To the extent commenters on the ANPRM believe EPA failed to address their ANPRM comments adequately in this proposal, they should offer them again as comments to this NPRM for consideration in this rulemaking.

A. Comments and the Public Docket

EPA today opens a formal comment period for this NPRM and will accept comments through August 26, 1996. The Agency encourages all parties that have an interest in the program proposed today to offer comment on all aspects of this action. Throughout this proposal are requests for specific comment on various topics. Of particular interest to the Agency are detailed comments in the following areas: The air quality need for national or regional NO_X, PM, and VOC control; the need for control of emissions from highway HDEs; EPA's proposed approaches to encouraging durability and revising the Averaging, Banking, and Trading program; the technological feasibility of the proposed standards; EPA's projections of the environmental and economic impacts of the proposed program; and non-regulatory methods of encouraging early compliance or cleaner-than-required engines.

The most useful comments are those supported by appropriate and detailed rationales, data, and analyses. The Agency also encourages commenters that disagree with the proposed program to suggest and analyze alternate approaches to meeting the air quality goals of this proposed program. All comments, with the exception of proprietary information, should be directed to the EPA Air Docket Section, Docket No. A–95–27 before the date specified above.

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

Information covered by a claim of confidentiality will be disclosed by EPA only to the extent allowed and in accordance with the procedures set forth in 40 CFR part 2. If no claim of confidentiality accompanies the submission when it is received by EPA, it will be made available to the public without further notice to the commenter.

B. Public Hearing

The Agency will hold a public hearing as noted in the DATES section above. Any person desiring to present testimony at the public hearing is asked to notify the contact person listed above at least five business days prior to the date of the hearing. This notification should include an estimate of the time required for the presentation of the testimony and any need for audio/visual equipment. EPA suggests that sufficient copies of the statement or material to be presented be available to the audience. In addition, it is helpful if the contact person receives a copy of the testimony or material prior to the hearing.

The hearing will be conducted informally, and technical rules of evidence will not apply. A sign-up sheet will be available at the hearing for scheduling the order of testimony. A written transcript of the hearing will be prepared. The official record of the hearing will be kept open for 30 days after the hearing to allow submittal of supplementary information.

In addition to the public hearing, EPA will hold a public meeting in Los Angeles to discuss the proposed EPA regulations for HDEs, and receive informal public input on them. Other potential mobile source controls identified in the California Ozone State Implementation Plan for the South Coast (the greater Los Angeles area) will also be discussed.[53] Further details on the public meeting may be found in the DATES section at the beginning of this document. Because this public meeting is intended to be an informal exchange of information, a transcript of the meeting will not be prepared and members of the public who wish to present comments at the Los Angeles meeting should be aware that, in order to be considered for the final promulgation, their comments must also be made either in writing to the rulemaking docket or at the public hearing.

VIII. Statutory Authority

Section 202(a)(3) authorizes EPA to establish emissions standards for new heavy-duty motor vehicle engines. See 42 U.S.C. 7521(a)(3). These standards are to reflect the greatest reduction achievable through the application of technology which the Administrator determines will be available, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology. This provision also establishes the lead time and stability requirements for these standards, and in addition authorizes EPA to establish requirements to control rebuilding practices for heavy-duty engines. Pursuant to Sections 202(a)(1) and 202(d), these emissions standards

[53] The 1994 California Ozone SIP includes both the proposed national HDE measure and 3 proposed State measures for HDEs. The California Ozone SIP also includes other national mobile source measures for nonroad engines, ships, aircraft, and pleasure craft as components of the attainment demonstration for the South Coast nonattainment area. For further details on the California Ozone SIP, see 61 FR 10920–10962 (March 18, 1996).

apply for the useful life period established by the Agency. See 42 U.S.C. 7521(a)(1), 7521(d). EPA's authority to issue a certificate of conformity upon payment of a non-compliance penalty established by regulations is found in Section 206(g) of the Act. See 42.U.S.C. 7525(g). Other provisions of Title II of the Act, along with Section 301, are additional authority for the measures proposed in this action.

IX. Administrative Designation and Regulatory Analysis

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

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

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

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

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

Pursuant to the terms of Executive Order 12866, EPA has determined that this proposal is a ''significant regulatory action'' because the proposed standards and other regulatory provisions, if implemented, would have an annual effect on the economy in excess of $100 million. A Regulatory Impact Analysis has been prepared and is available in the docket associated with this rulemaking. This action was submitted to the Office of Management and Budget (OMB) for review as required by Executive Order 12866. Any written comments from OMB and any EPA response to OMB comments are in the public docket for this proposal.

X. Impact on Small Entities and Compliance With Regulatory Flexibility Act

The Regulatory Flexibility Act of 1980 requires federal agencies to identify potentially adverse impacts of federal regulations upon small entities. In instances where significant impacts are possible on a substantial number of these entities, agencies are required to perform a Regulatory Flexibility Analysis.

EPA certifies that the new emission standards and other related provisions proposed in this action will not have a significant impact on a substantial number of small entities, since none of the engine manufacturers affected by these regulations is a small business entity.

This action also proposes provisions clarifying what would and would not be considered a prohibited act (tampering) under CAA Section 203 during the heavy-duty engine rebuilding process. Small businesses are integral to the heavy-duty engine rebuilding industry as noted in comments provided by the Automotive Engine Rebuilders Association.[54] However, EPA does not believe that the proposals related to engine rebuilding will have a significant impact on a substantial number of these small entities. EPA is proposing to define how a broad existing requirement (CAA Section 203) applies specifically to the process of rebuilding engines, but EPA is not creating a new program. Second, during the development of the proposal EPA consulted with the Engine Manufacturers Association, the Automotive Engine Rebuilders Association, and the Production Engine Rebuilders Association, associations which together represent a substantial portion of the engine rebuilding and related businesses. These organizations did not raise concerns that the proposal may have a significant impact on small businesses. EPA requests comments on the proposals regarding engine rebuilding, any significant effect that the proposals would have on small businesses, and the reasons why such effects might occur.

XI. Compliance With Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* An Information Collection Request (ICR) document has been prepared by EPA (ICR No. 783.35) and a copy may be obtained from Sandy Farmer, Regulatory Information Division' U.S. Environmental Protection Agency (2136); 401 M St., SW., Washington, DC 20460 or by calling (202) 260–2740.

The information we propose to collect includes certification results, durability, maintenance, and averaging, banking and trading information. This information will be used to ensure compliance with and enforce the provisions in this rule. Section 208 (a) of the CAA requires that manufacturers provide information the Administrator may reasonably require to determine compliance with the regulations, therefore submission of the information is mandatory. EPA will consider confidential all information which meets the requirements of § 208 (c) of the CAA.

EPA estimates the average first year hours burden per response to be 4,670, the proposed frequency of response to be annual, and the estimated number of likely respondents to be twenty. EPA estimates the aggregate first year hours burden to be 93,410. EPA estimates the annual first year cost to be $5,603,280, including the annualized capital and start-up costs. Subsequent year burdens are estimated to be one-tenth of the first year estimates due to the practice of engine family carry-over from model year-to-model year. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; and transmit or otherwise disclose the information.

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

Comments are requested on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques. Send comments on the ICR to the Director, OPPE Regulatory Information Division; U.S. Environmental Protection Agency (2136); 401 M St., S.W.; Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th St., NW., Washington, DC 20503, marked ''Attention: Desk Officer for EPA.''

[54] EPA Docket A–95–27, II–D–41.

Include the ICR number in any correspondence. Since OMB is required to make a decision concerning the ICR between 30 and 60 days after June 27, 1996, a comment to OMB is best assured of having its full effect if OMB receives it by July 29, 1996. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

XII. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), P.L. 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with ''Federal mandates'' that may result in expenditures to state, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more for any one year. Before promulgating an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost effective, or least burdensome alternative if the Administrator publishes with the final rule an explanation of why that alternative was not adopted. Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

Today's rule contains no Federal mandates (under the regulatory provisions of Title II of the UMRA) for State, local, or tribal governments. The rule imposes no enforceable duties on any of these governmental entities. Nothing in the proposed program would significantly or uniquely affect small governments. EPA has determined that this rule contains federal mandates that may result in expenditures of $100 million or more in any one year for the private sector. EPA believes that the proposed program represents the least costly, most cost-effective approach to achieving the air quality goals of the proposed rule. EPA has performed the required analyses under Executive Order 12866 which contains identical analytical requirements. The reader is directed to section IX, Administrative Designation and Regulatory Analysis, for further information regarding these analyses.

XIII. Copies of Rulemaking Documents

The preamble, draft regulatory language and draft Regulatory Impact Analysis (RIA) are available in the public docket as described under **ADDRESSES** above and is also available electronically on the Technology Transfer Network (TTN), which is an electronic bulletin board system (BBS) operated by EPA's Office of Air Quality Planning and Standards and via the internet. The service is free of charge, except for the cost of the phone call.

A. Technology Transfer Network (TTN)

Users are able to access and download TTN files on their first call using a personal computer and modem per the following information.

TTN BBS: 919–541–5742 (1200–14400 bps, no parity, 8 data bits, 1 stop bit) Voice Helpline: 919–541–5384

Also accessible via Internet: TELNET ttnbbs.rtpnc.epa.gov Off-line: Mondays from 8:00 AM to 12:00 Noon ET

A user who has not called TTN previously will first be required to answer some basic informational questions for registration purposes. After completing the registration process, proceed through the following menu choices from the Top Menu to access information on this rulemaking.

<T> GATEWAY TO TTN TECHNICAL AREAS (Bulletin Boards)
<M> OMS—Mobile Sources Information
<K> Rulemaking & Reporting
<5> Heavy-duty/Diesel
<1> File area #1...Heavy-duty Truck and Bus Standards

At this point, the system will list all available files in the chosen category in reverse chronological order with brief descriptions. To download a file, select a transfer protocol that is supported by the terminal software on your own computer, then set your own software to receive the file using that same protocol.

If unfamiliar with handling compressed (i.e. ZIP'ed) files, go to the TTN top menu, System Utilities (Command: 1) for information and the necessary program to download in order to unZIP the files of interest after downloading to your computer. After getting the files you want onto your computer, you can quit the TTN BBS with the <G>oodbye command.

Please note that due to differences between the software used to develop the document and the software into which the document may be downloaded, changes in format, page length, etc. may occur.

B. Internet

Rulemaking documents may be found on the internet as follow:

World Wide Web

http://www.epa.gov/omswww

FTP

ftp://ftp.epa.gov Then CD to the /pub/gopher/OMS/ directory

Gopher

gopher://gopher.epa.gov:70/11/Offices/Air/OMS

Alternatively, go to the main EPA gopher, and follow the menus:
gopher.epa.gov
EPA Offices and Regions
Office of Air and Radiation
Office of Mobile Sources

List of Subjects in 40 CFR Part 86

Environmental protection, Administrative practice and procedure, Air pollution control, Motor vehicles, Motor vehicles pollution, Reporting and recordkeeping requirements, Research.

Dated: June 19, 1996.

Carol M. Browner,

Administrator.

[FR Doc. 96–16330 Filed 6–26–96; 8:45 am]

BILLING CODE 6560–50–P

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40 CFR Parts 180, 185 and 186

[OPP–300433; FRL–5380–9]

RIN 2070–AC18

Glyphosate; Proposed Revision of Tolerances

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: EPA has completed the reregistration process and issued a Reregistration Eligibility Decision document (RED) for the herbicide glyphosate (*N*-phosphonomethyl glycine). In the reregistration process, all information to support a pesticide's continued registration is reviewed for