ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 80, 86, and 89

[AMS–FRL–5288–4]

RIN 2060–AF76

Control of Air Pollution From Heavy-Duty Engines

AGENCY: Environmental Protection Agency.

ACTION: Advance notice of proposed rule.

SUMMARY: This advance notice of proposed rule (ANPRM) reviews the need and potential for additional reductions in emissions of oxides of nitrogen (NO_X), hydrocarbons (HC), and particulate matter (PM) from mobile source heavy-duty engines (HDEs), announces EPA's intent to establish new emission controls for highway heavy-duty engines, and also describes EPA's plans to work cooperatively with engine and equipment manufacturers to consider additional reductions from nonroad (off-highway) heavy-duty engines. Ozone pollution poses a serious threat to the health and well-being of millions of Americans and a large burden to the U.S. economy. Many ozone nonattainment areas face great difficulties in reaching and maintaining attainment of the ozone health-based air quality standards in the years ahead. Recognizing this challenge, states, local governments and others have called on EPA to promulgate additional national measures to reduce NO_X and HC in order to protect the public from the serious health effects of ozone pollution. The control of PM emissions from HDEs is also a priority for these stakeholders.

In response to the need for national pollution reduction measures, EPA has initiated discussions with engine manufacturers regarding future emission controls for HDEs. EPA, the California Air Resources Board (CARB), and HDE manufacturers recently signed a Statement of Principles (SOP) calling for significantly tighter NO_X and non-methane hydrocarbon (NMHC) standards for on-highway HDEs starting with model year 2004. The SOP calls on manufacturers to achieve these ozone precursor reductions without increasing PM emissions, even though current diesel technology typically results in increased PM (and HC) emissions when NO_X emissions are reduced. The parties plan to continue their discussions and to invite others to join them, with a goal of reaching a similar SOP for nonroad HDEs.

DATES: EPA requests comment on this ANPRM no later than October 2, 1995. Should a commenter miss the requested deadline, EPA will try to consider any comments that it receives prior to publication of the expected NPRM regarding additional highway heavy-duty engine emission controls. There will also be an opportunity to comment on any NPRM that EPA publishes.

ADDRESSES: Materials relevant to this ANPRM 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 SW., Washington, DC 20460. The docket may be inspected from 8 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 ANPRM should be sent to Public Docket A–95–27 at the above address. EPA requests that a copy of comments also be sent to Tad Wysor, U.S. EPA, Regulation Development and Support Division, 2565 Plymouth Road, Ann Arbor, MI 48105.

This ANPRM is 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. The service is free of charge, except for the cost of the phone call. Users are able to access and download TTN files on their first call using a personal computer and modem: TTN BBS, (919) 541–5742; Voice Helpline, (919) 541–5384.

FOR FURTHER INFORMATION CONTACT: Tad Wysor, U.S. EPA, Regulation Development and Support Division, 2565 Plymouth Road, Ann Arbor, MI 48105. Telephone: (313) 668–4332.

SUPPLEMENTARY INFORMATION: EPA is issuing this ANPRM to invite comment from all interested parties on the need and potential for additional reduction of NO_X, HC and PM emissions from HDEs and EPA's plans to achieve such reductions. After reviewing the comments, EPA intends to issue a Notice of Proposed Rulemaking (NPRM) proposing standards for Model Year 2004 and later heavy-duty highway engines in accordance with the SOP. In addition, comments received regarding reduction in emissions from nonroad HDEs will inform any EPA discussions with manufacturers regarding additional emission reductions.

I. Introduction

Poor air quality represents 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 pre-control rates. However, continued industrial growth and expansion of motor vehicle usage threaten to reverse these past achievements. Today, more than four years after the passage of major amendments to the Clean Air Act (CAA or Act),[1] many states are still finding it difficult to meet the air quality standards by the CAA deadlines. Furthermore, other states which are approaching or have reached attainment of National Ambient Air Quality Standards (NAAQS) may see those gains lost if current trends persist.

In recent years, efforts to improve air quality have focused largely on ground-level ozone and its main precursors, nitrogen oxides (NO_X) and volatile organic compounds (VOCs, consisting mostly of hydrocarbons, HC). 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.

At this time, ozone levels 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 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 the most effective strategy for reducing ozone, especially where ozone is high over a large region (as in the Midwest and Northeast). As a result, attention has turned to NO_X emissions as the key to improving air quality in many areas of the country.

Current projections show a slight decrease in total NO_X emissions during the next few years as stationary and mobile source control programs promulgated under the 1990 CAA are phased in. However, downward trends in NO_X pollution will begin to reverse and NO_X emission inventories begin to rise by the early 2000s, due to growth in stationary and mobile source activity, and emissions from heavy-duty highway and nonroad engines are projected to represent a significant fraction of mobile

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

source NO_X emissions by the middle of the next decade. In some areas, the rise in NO_X emissions can be expected to be accompanied by a significant increase in ground-level ozone. Levels of PM are also expected to rise, both because of the expected increase in numbers of PM sources and because in the atmosphere, NO_X is transformed into fine acidic nitrate particles which account for a substantial fraction of the airborne particulate in some areas of the country (''secondary particulate formation'').

Given these expected trends, and in the absence of new emission control initiatives, some of the nation's hard-won air quality improvements will begin to be seriously threatened in the early 2000s. In response to widespread urging by states, municipalities, health officials, and concerned citizens in virtually every region of the country,[2] EPA has intensified its efforts to understand and respond to today's stubborn air quality challenges. Over the past decade, ambient air measurements and computer modeling studies have repeatedly demonstrated that ozone and its precursors, NO_X and VOC, are transported across large distances. Thus, while 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.

States are assigned the jurisdiction by the CAA for implementing most stationary source emission controls. In most regions of the country, states are implementing stationary source NO_X control options (as well as stationary source VOC controls) for the control of acid rain, ozone, or both. However, in many areas these controls will not be sufficient for reaching and/or maintaining the ozone standard without significant additional NO_X reductions from mobile sources. California can establish emission control standards for new motor vehicles, and other states may adopt California's programs.[3] Traditionally, however, nationwide VOC and NO_X control programs for new motor vehicles are initiated at the federal level. Similarly, mobile sources of PM emissions, especially the direct and indirect PM from diesel engines, are a major consideration to local and state officials in areas facing current and future air quality problems. Thus, those charged with delivering cleaner air to the citizens of their states are looking to the national mobile source emission control program as a necessary complement to their efforts to reduce NO_X, PM, HC, and other emissions. Common emission standards for mobile sources across the nation are also strongly supported by manufacturers, which often face serious production inefficiencies when different requirements apply to engines/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 being focused on heavy-duty trucks (ranging from large pickups to tractor-trailers), buses, and nonroad equipment. For purposes of this ANPRM, the Agency is primarily interested in the component of nonroad sources greater than 50 horsepower (37 kilowatts), which is termed ''heavy-duty nonroad'' in this Notice. (Nonroad engines greater than 50 hp represent the single largest contributor to total nonroad NO_X emissions.) EPA is addressing other off-highway sources, such as small nonroad engines, locomotives, aircraft and marine engines in separate actions.

Since the 1970s, manufacturers of heavy-duty engines for highway use have developed new technological approaches in response to increasingly stringent emission standards. However, the technological characteristics of heavy-duty engines, particularly diesel engines, have to date prevented the achievement of emission levels comparable to today's light-duty gasoline vehicles. While diesel engines provide advantages in terms of fuel efficiency, reliability, and durability, control of NO_X emissions is a much greater challenge for diesel engines than for gasoline engines. Similarly, control of PM emissions, which are at very low levels for gasoline engines, represents a substantial challenge for diesel engines.

Despite these technological challenges, there is emerging agreement that heavy-duty highway engines offer the potential for substantial 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 today 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 highway heavy-duty engines is discussed further in Section VIII below.

In addition, many engines used in highway trucks have similar counterparts that are used in certain nonroad equipment applications. The first emission control regulations covering these heavy-duty nonroad engines have been only recently established; these new standards are less stringent than current standards for similar heavy-duty engines intended for highway use. A strong potential exists for current highway engine emission control technology to be applied in many cases to heavy-duty nonroad engines (even though differences in application and usage complicate direct translation of the technology), representing a future avenue for additional mobile source emission reductions.

Recognizing the need for additional NO_X (and PM) control measures at the national level to address air quality concerns in a number of parts of the country and the growing contribution of the heavy-duty engine sector to ozone (and PM) problems, EPA recently held a series of discussions with the California Air Resources Board (CARB) and representatives of the heavy-duty engine manufacturing industry. The purpose of these discussions was to exchange views on the appropriateness and feasibility of new emission standards for heavy-duty engines. Based on these discussions, a Statement of Principles (SOP) regarding highway heavy-duty engines has been signed by these parties.

The SOP is described in more detail in Section VII of this notice and is attached as an Appendix. It addresses NO_X, PM, and NMHC standards for highway heavy-duty engines starting in model year 2004, the important role that fuel may play in achieving these standards, a procedure to reevaluate the appropriateness of these standards in 1999, the intent of the parties to undertake development of a joint industry/government research program aimed at meeting and exceeding the NO_X and PM levels discussed in the SOP, and the intent of the parties to continue discussions with others with the goal of signing a similar SOP with respect to nonroad heavy-duty engines. Other important elements of the SOP are also discussed in Section VII.

The main purposes of today's ANPRM are to provide an early focus for an open and comprehensive discussion of the issues involved in achieving additional emission reductions from heavy-duty engines and to make the SOP available to the public for comment on specific

[2] See Section VI for more detailed discussion of the comments received by EPA to date.

[3] A similar relationship applies to new nonroad engines and vehicles, although states may not set standards for certain classes of these engines and vehicles. See Sections 209 and 213 of the Act.

emission reductions from highway heavy-duty engines.[4] The rest of the ANPRM is organized as follows: Section II summarizes the public health and welfare needs for this initiative and trends in overall nationwide NO_X, VOC, and PM emissions; Section III describes the contribution of HDEs to overall emissions; Section IV summarizes the need for control of heavy-duty engines; Section V provides the history and status of highway heavy-duty engine emission standards; Section VI summarizes a range of requests for action that EPA has received to date; Section VII reviews the development and content of the Statement of Principles; Section VIII discusses some approaches to highway HDE emission control; and Section IX describes EPA's plans for involving the public in the upcoming rulemaking process. The complete text of the Statement of Principles is included as an Appendix to today's Notice.

II. Health Concerns and Air Quality Issues: NO_X, VOC, Ozone, and Particulate Matter

A. Health and Environmental Effects Related to NO_X, VOC, and Ozone[5]

Oxides of nitrogen comprise a family of highly reactive gaseous compounds that contribute to air pollution in both urban and rural environments. Because 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, and mobile sources, such as light- and heavy-duty vehicles as well as construction, agricultural, and other nonroad equipment. NO_X is directly harmful to human health and the environment, contributes to particulate pollution, and plays a critical role in the formation of atmospheric ozone. The current primary (health-based) and secondary (welfare-based) national ambient air quality standards (NAAQS) for NO_2 are both set at a concentration of 0.053 parts per million (ppm), on an annual average.

Exposure to NO_2 can reduce pulmonary function and increase airway irritation in healthy subjects as well as people with pre-existing pulmonary conditions. In children, exposure to NO_2 at or near the level of the ambient standard appears to increase the risk of respiratory illness.[6] NO_X and its transformation products (e.g., nitric acid, peroxyacetyl nitrate (PAN) and nitrate particles) also contributes to a number of adverse environmental impacts such as the overgrowth of algae and oxygen depletion (eutrophication).[7] NO_X and its products contribute to acid rain, which affects both terrestrial and aquatic ecosystems, including acidification of surface waters, reduction in fish populations, damage to forests and associated wildlife, soil degradation, damage to materials, monuments, buildings, etc., and reduced visibility.[8]

NO_X is also a primary precursor to atmospheric ozone (O_3). (Volatile organic compounds (VOC), composed of a very large number of different hydrocarbons (HC) and other organic compounds, are also primary precursors to ozone. Their effects as a class of compounds on health are generally considered in terms of ozone health effects; health implications of individual toxic compounds are not separately addressed in this Notice.) The rate of ozone creation depends on highly complex interactions between VOCs and NO_X in the presence of sunlight. However, in areas with high VOC to NO_X ratios, which includes most of the area covering the eastern United States, ozone formation is NO_X limited, and NO_X reductions will reduce ozone levels. Areas with lower VOC to NO_X ratios (particularly the core of many large highly urbanized nonattainment areas) are VOC limited and NO_X emissions will interact with ozone to reduce ozone levels. However, in NO_X limited areas, downwind of these same areas, NO_X reductions will reduce ozone levels.

Ozone is a highly reactive chemical compound which can affect both biological tissues and man-made materials. Ozone can affect human pulmonary and respiratory health—symptoms include chest pain, coughing, and shortness of breath.[9] Studies, to date, indicate that at the current standard these effects are reversible when exposure stops.

The presence of elevated levels of ozone is of concern in rural areas as well. Because of its high chemical reactivity, ozone causes damage to vegetation. 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 damage in many crops, which reduces marketability and value. Finally, there is evidence that exposures to ambient levels of ozone which exist in many parts of the country are also 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 and has been reported to occur in areas that attain the current standard. There are complexities associated with evaluating such effects due to the wide range of species and biological systems introduce significant uncertainties.

B. Health and Other Effects Related to Particulate Matter[10]

Air pollutants collectively called particulate matter (PM) 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.

Based on studies of human populations exposed to high concentrations of particles (sometimes in the presence of SO_2), and laboratory studies of animals and humans, there are major human health concerns associated with PM. These include deleterious effects on breathing and respiratory systems, aggravation of existing respiratory and cardiovascular disease, alterations in the body's defense systems against foreign materials, damage to lung tissue, 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 chronic obstructive pulmonary or cardiovascular disease,

[4] Also, in a letter to certain organizations related to clean air issues in California, EPA agreed that it would issue an ANPRM regarding national standards for highway HDEs.

[5] Information cited in this section and other related information on health effects of NO_X, VOC and Ozone are available from 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).

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

[8] "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.

[9] Air Quality Criteria Document for Ozone and Related Photochemical Oxidants (External Review Draft), EPA–600/AP–93/004a–c, February, 1995 (NTIS #: PB94–17–3127, –3135, –3143).

[10] Information cited in this section and other related information on the health effects of particulate matter are available for the public from Docket A–95–27.

those with influenza, asthmatics, the elderly, and children. Particulate matter also soils and damages materials, and fine particles are a major cause of visibility impairment in the United States.[11]

C. Need for NO_X and VOC Control; Ozone and Other Air Quality Management Issues

States are obligated under the Clean Air Act to submit State Implementation Plans (SIPs) demonstrating how each nonattainment area will reach attainment of the ozone NAAQS. For nonattainment areas designated as serious or worse, this obligation involves 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 which 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,[12] based on a two-phase approach for the submittal of ozone SIP attainment demonstrations. Under the first phase, the state is required to submit a plan implementing a set of specific control measures to obtain major reductions in ozone precursors along with limited UAM modeling. The second phase includes a two-year process during which EPA, the states, regional associations, and other interested parties can improve emission inventories and modeling and better assess regional and local impacts and control strategies on ozone attainment. These analyses are then to be used by states as their basis for demonstrating ozone attainment plans in their phase II SIPs.

Modeling results already available and the need for two-phased ozone attainment plans highlight the fact that ozone pollution is a regional problem, not simply a local or state problem. Ozone itself and its precursors are transported long distances by winds and meteorological events. Thus, achieving ozone attainment for an area and thereby protecting its citizens from ozone-related health effects often depends on the ozone and/or precursor emission levels of upwind areas. Local stationary source NO_X and VOC controls will assist nonattainment areas toward their ozone reduction goals, but for many areas with persistent ozone problems, attainment of the ozone NAAQS will require broader control strategies for both NO_X and VOC. As a result, effective national ozone control requires an integrated strategy which combines cost-effective approaches in both the mobile and stationary source arenas at both the local and national levels.

The rate of ozone creation depends on highly complex interactions between VOCs and NO_X in the presence of sunlight. While regional concentrations and transport of precursor pollutants have a significant role in determining the rate of ozone production in many areas, local conditions are also important and may be predominant factors in some cases. Generally, the formation of ozone in locations with low VOC to NO_X ratios tends to be VOC limited. Low VOC to NO_X ratios are characteristic of the central core of many highly urbanized nonattainment areas, which may thus be dependent on VOC control for effective ozone reduction. On the other hand, in areas with higher VOC to NO_X ratios, ozone formation is NO_X limited, and NO_X reduction strategies are required for effective ozone control. Such conditions occur over broad regions of the U.S., including many areas downwind of large urban centers. As concluded in a recent report by the National Research Council (NRC), ''the optimal set of controls relying on VOCs, NO_X, or, most likely, reductions of both, will vary from one place to the next.'' [13]

While both NO_X and VOC emissions are subject to various stationary and mobile source regulations, VOCs have often been the primary focus of past ozone abatement strategies, and specific air quality issues regarding NO_X emissions have received somewhat less attention. Accordingly, the next sections describe some of the key regional ozone and other air quality problems around the country for which additional NO_X controls will be beneficial.

1. Eastern United States

There is a growing body of evidence that reduction of regional ozone levels holds the key to the ability of a number of the most seriously polluted areas in the Eastern United States, in both the Southeast and the Northeast, to meet the ozone NAAQS. Regional Oxidant Modeling (ROM) studies conducted by EPA (called the ROMNET and Matrix studies [14]) strongly suggest that reducing NO_X emissions is the most effective approach for reducing ozone over large geographical areas. (In contrast, as described below, local NO_X controls may or may not be helpful in individual nonattainment areas.) At the same time, these studies, as well as ongoing UAM modeling by states, suggest that reduction in VOC emissions may be key to reducing locally generated peak ozone concentrations. Additional NO_X control will also contribute to addressing the problems of year-round NO_X deposition in the Chesapeake Bay and other nitrogen-limited estuaries [15] and acid rain in the eastern part of the country.

In its analysis supporting the approval of a Low Emission Vehicle program in the eastern and northeast states comprising the Ozone Transport Region (OTR),[16] EPA reviewed existing work and performed new analysis to evaluate in detail the degree NO_X controls are needed.[17] These studies showed that 50–75 percent reductions in NO_X from 1990 levels would be needed throughout the OTR. These studies also showed that 50–75 percent reductions in VOC would be needed in and near the portion of the OTR comprising the Northeast urban corridor. The studies also concluded that transport of ozone and precursors from upwind areas is a significant contributor to ozone exceedances downwind in essentially all nonattainment areas in the OTR.

More recently, three new studies have become available which confirm 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.[18]

[11] Air Quality Criteria for Particulate Matter (External Review Draft), EPA–600/AP–95/001a–c, April 1995 (NTIS #PB95–22–1727, –1735, –1743).

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

[13] National Research Council. Rethinking the Ozone Problem in Urban and Regional Air Pollution. National Academy Press, Washington, D.C., 1991.

[14] 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.

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

[16] Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, and northern Virginia.

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

[18] Environmental Protection Agency, ''Summary of EPA Regional Oxidant Model Analyses of

Continued

Taken together, these studies strongly support the view that NO_X emission reductions in the range of 50–75 percent will be needed in each state in the OTR and VOC reductions in the range of 50–75 percent will be needed in and near the Northeast urban corridor to reach and maintain attainment.

2. Other Regions

A recent Southern Oxidant Study (SOS) report [19] describes the results of research showing that, in the south, relatively high concentrations of ozone accumulate in both rural and urban areas. Although the rural ozone levels tend to be lower than in urban areas, and are generally in compliance with the current ozone NAAQS, the rural ozone concentrations are still high enough to inhibit photosynthesis, thus reducing agricultural yields and causing damage to forests and ornamental plants.

These rural concentrations of ozone and its precursors create a relatively high ozone background on which the ozone plumes from stationary and area sources in urban areas are superimposed. As a result, modeling in the Atlanta metropolitan area, designated as a serious ozone nonattainment area, suggests that a 90 percent decrease in NO_X emissions will be required to achieve the current NAAQS in Atlanta.

Modeling studies performed to date for the states surrounding Lake Michigan (Wisconsin, Illinois, Indiana, and Michigan) indicate that reducing ozone transported into this region has a significant effect on the number and stringency of local control measures likely to be needed to meet the ozone NAAQS. Without such reductions, these studies suggest that the necessary degree of local control will be very difficult to achieve. The EPA Matrix study referenced above also indicates that NO_X control will be effective in reducing regional ozone in the Midwest. This suggests that new reductions in NO_X emission will be helpful in meeting the NAAQS in the Lake Michigan area, even though NO_X control in the immediate vicinity of and within major nonattainment areas near Lake Michigan do not appear to contribute to attainment in these areas.

The ozone SIP that the State of California has submitted to EPA for approval relies on NO_X and VOC reductions for most California nonattainment areas to demonstrate compliance with the NAAQS. Specifically, the revised SIP projects that the following NO_X reductions will be required: South Coast, 59 percent; Sacramento, 40 percent; Ventura, 51 percent; San Diego, 26 percent; and San Joaquin Valley, 40 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. Transported ozone and precursor emissions are also an important factor in California's need for additional NO_X controls.[20]

The Agency requests comment on these studies and the application of their findings to the planned actions in this Notice as well as any additional data or analysis that would inform any future actions.

4. Waivers of Local Stationary Source NO_X Control Requirements

In some cases, states with nonattainment areas subject to NO_X Reasonably Available Control Technology (RACT) requirements for stationary sources have petitioned EPA for a waiver from these requirements. EPA guidance on such waivers provides that waivers may be granted if states show that reducing NO_X in a nonattainment area would not contribute to attainment of the ozone NAAQS within the same nonattainment area.[21] EPA's policy is to limit the assessment of the petitions to the effect that NO_X reductions within a nonattainment area have on that specific area's ability to meet the NAAQS (i.e., an assessment of pollutant transport outside the area is not made). EPA has separate authority under the CAA to require a state to reduce emissions from sources where there is evidence showing that such emissions would contribute significantly to nonattainment or interfere with maintenance of attainment in other states.

EPA's approval of a NO_X exemption is granted on a contingent basis.[22] That is, a monitoring-based exemption lasts for only as long as the area's monitoring data continue to demonstrate attainment and a modeling-based exemption lasts for only as long as the area's modeling continue to demonstrate attainment without NO_X reductions from major stationary sources.[23]

Given these circumstances, EPA's approval of NO_X waivers for certain areas should not be viewed as contradictory to the consideration of regional and national measures to reduce NO_X emissions. As discussed above, new regional and/or national NO_X controls are needed to obtain the NAAQS designed to protect the public health.

5. National NO_X and VOC Emissions Trends [24]

Figure 1 displays projected total NO_X emissions over the time period 1990 to 2020 as well as stationary and mobile source components over the same period. Figure 2 presents similar data for VOC emissions for the period 1990 to 2010 (later-year projections for VOC are under development).[25] As the figures show, a similar pattern is projected for both of these ozone precursor emissions. Initially, the projections indicate that the national inventories will decrease over the next few years as a result of continued implementation of existing CAA stationary and mobile-source NO_X control programs. After the year 2000, however, as the implementation of new CAA programs is completed and the

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.

[19] The State of the Southern Oxidant Study (SOS): Policy-Relevant Findings in Ozone Pollution Research, 1988–1994. North Carolina State University, April 1995.

[20] In addition, the revised SIP concludes that secondary formation of nitrate particulate from NO_X (primarily ammonium nitrate) contributes to the particulate problem in the South Coast Air Basin and the San Joaquin Valley. Reduction of this fraction of the total PM will require additional NO_X emission reductions.

[21] ''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.

[22] ''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.

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

[24] For today's notice, EPA has assembled data available to date projecting emissions from various sources into the future. The data comes from the EPA ''Trends Document'' (National Air Pollutant Emission Trends, 1900–1993, EPA–454/R–94–027, October 1994), MOBILE5 emissions modeling, and work performed under EPA's contract with E.H. Pechan and Associates. EPA expects to continue to revise and improve its projections of emissions and will discuss and rely on such updated information in future rulemakings.

[25] The data in these and the succeeding figures in this ANPRM take into account the expected effects of various CAA control programs which have been promulgated to date, including 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 are not reflected in the data. In these figures, nonroad emission data includes emissions from a broad range of off-highway sources including, locomotives, aircraft and marine vessels.

pressure of growth continues, these downward trends are expected to reverse, and national VOC and NO_X emissions are both expected to rise again.

Figures 1 and 2 present emissions data for the entire country. In nonattainment areas, the fraction of NO_X and VOC total emissions contributed by mobile sources on average is greater than in the nationwide assessment and is in excess of the stationary source contribution.

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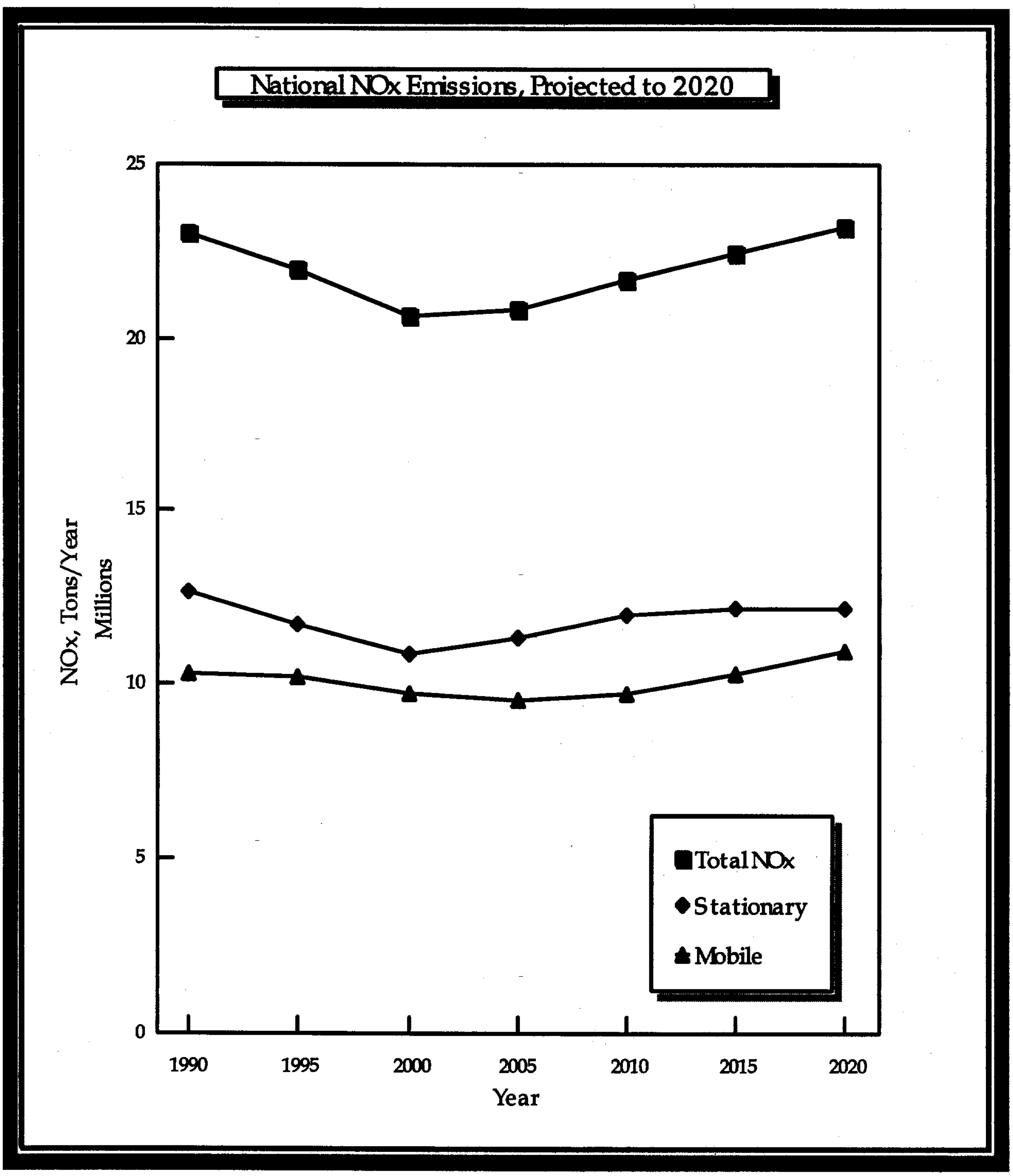
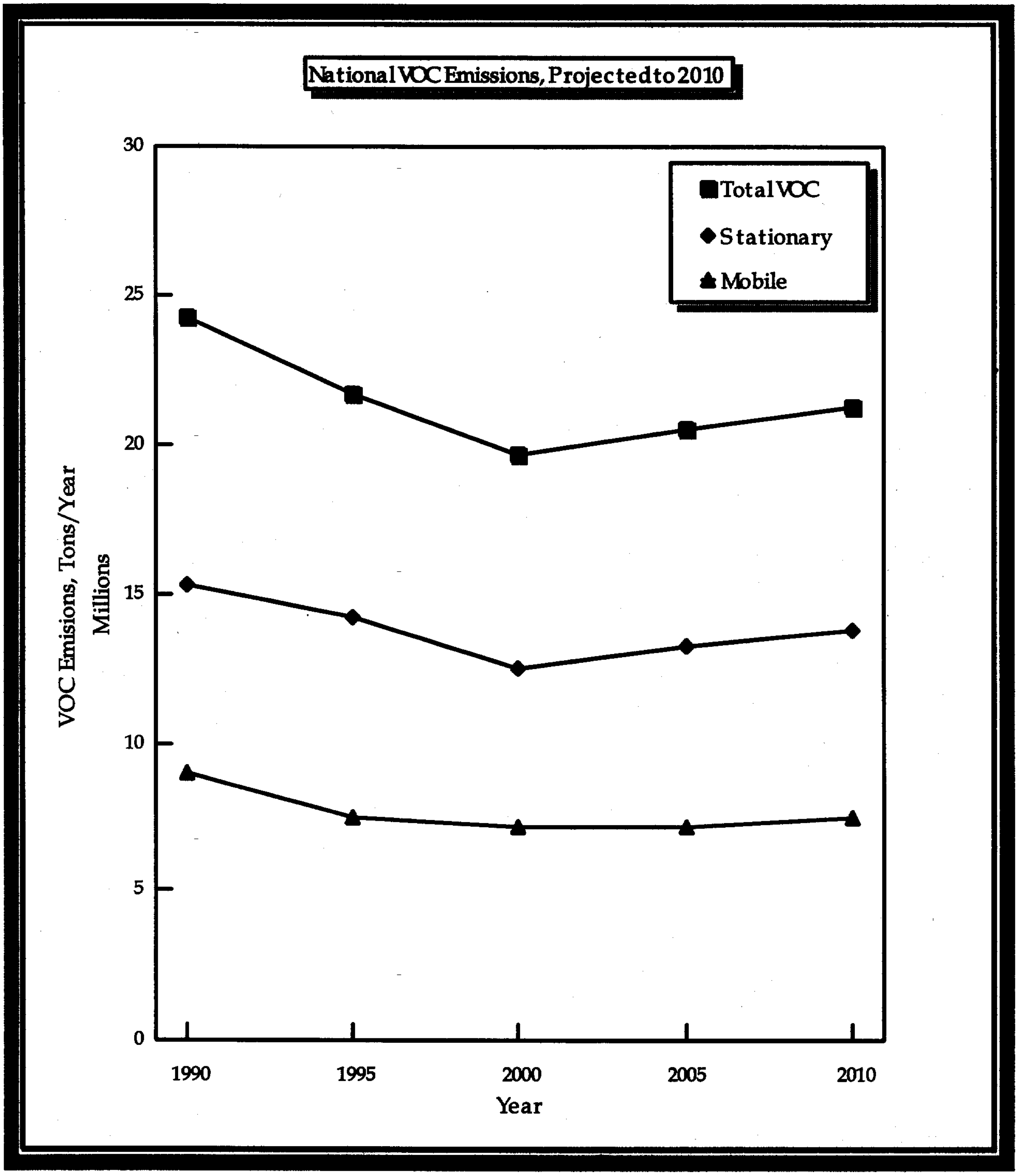
Figure 1



Source: Contract No. EPA-68-D3-30035 (Pechan)

Figure 2



Source: National Air Pollutant Emission Trends, 1900-1993 (EPA 1994)

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D. Need for PM Control; 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, when considering the need for PM controls it is appropriate to focus on the ‘‘controllable’’ portion of the particulate pollution problem. The result is shown in Figure 3, which displays national trends in PM–10 levels from stationary and mobile sources, 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, mobile source and industrial source emissions of PM–10 levels are expected to rise after 2000.

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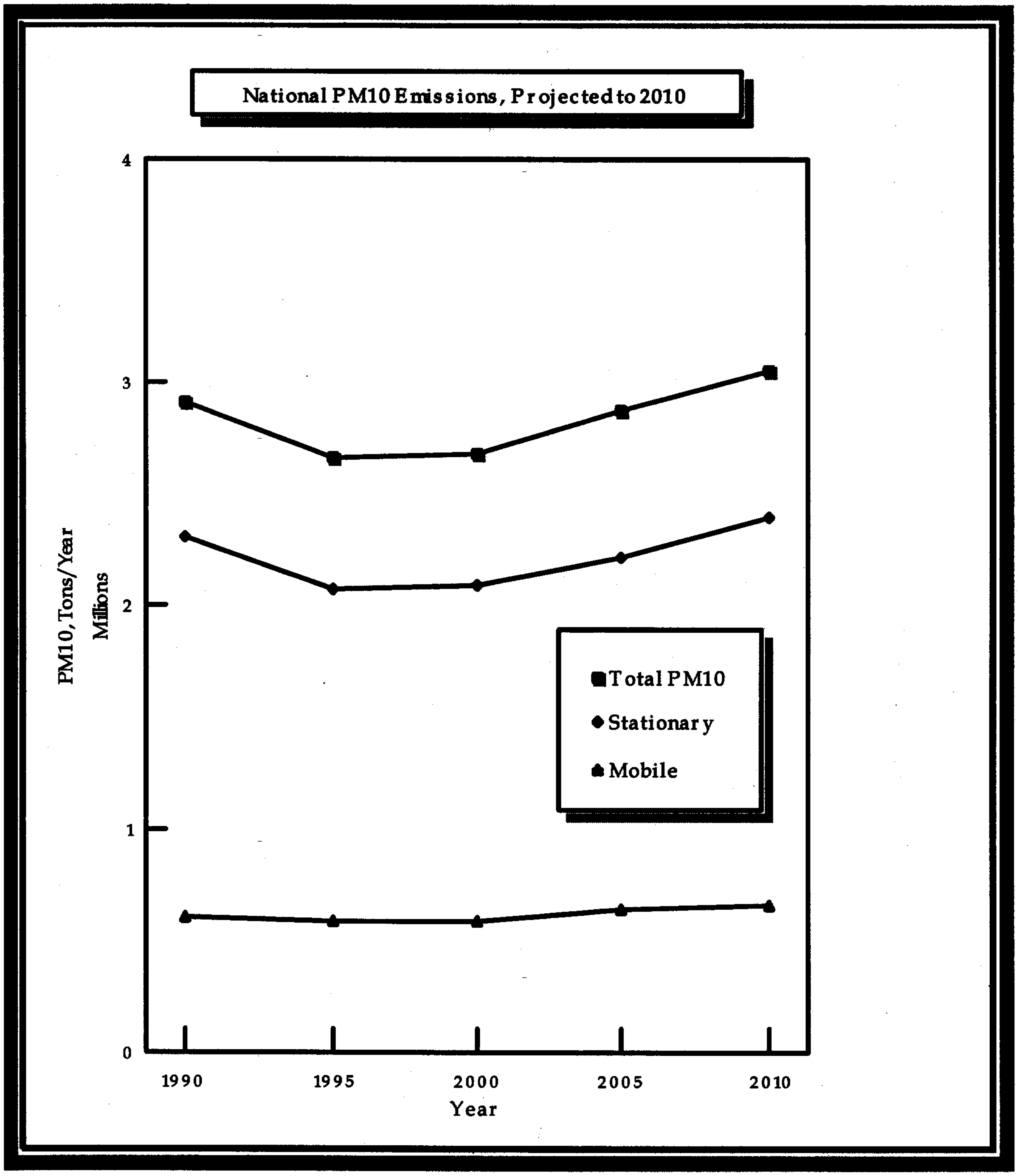
Figure 3



Source: National Air Pollutant Emission Trends, 1900-1993 (EPA 1994)

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Currently, there are 44 PM–10 nonattainment areas in 18 states. More generally, diesel emissions contribute significantly to higher than average PM levels that tend to occur in high-population, high-traffic urban settings. These areas frequently have elevated ambient levels of other air pollutants as well. To the extent that higher PM exposures result from these factors, control of PM emissions from diesel engines could be expected to provide public health and welfare benefits for a relatively large number of individuals.

III. Contribution of Heavy-Duty Engines to National NO_X, VOC, and PM Emissions

Heavy-duty highway and nonroad engines contribute significantly to levels of NO_X and are also an important source of VOC (as a result of HC emissions) and PM in most parts of the country. This section describes the current and expected future role of HDEs in contributing to the nation's major air pollution problems.

A. HDE Contribution to National NO_X Emissions

Figure 4 shows the total mobile source NO_X inventory by emission source (light-duty highway vehicles, heavy-duty highway vehicles, and nonroad engines), projected over the next 25 years.

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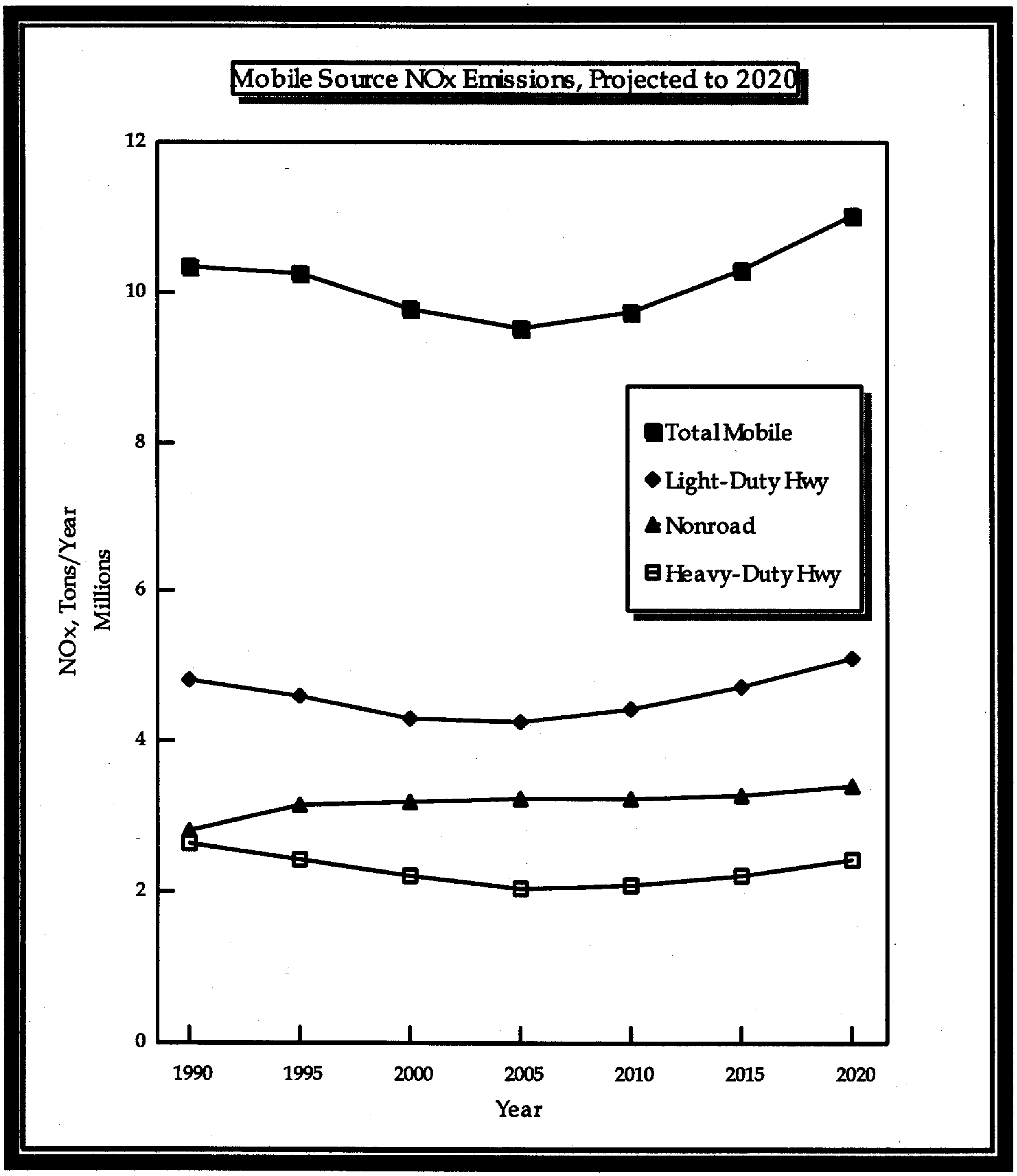
Figure 4



Source: Contract No. EPA-68-D3-30035 (Pechan)

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B. HDE Contribution to National VOC Emissions

Figure 5 shows the total mobile source VOC inventory by emission source. The 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 highway heavy-duty engine and nonroad sources are projected to rise slightly throughout this period.

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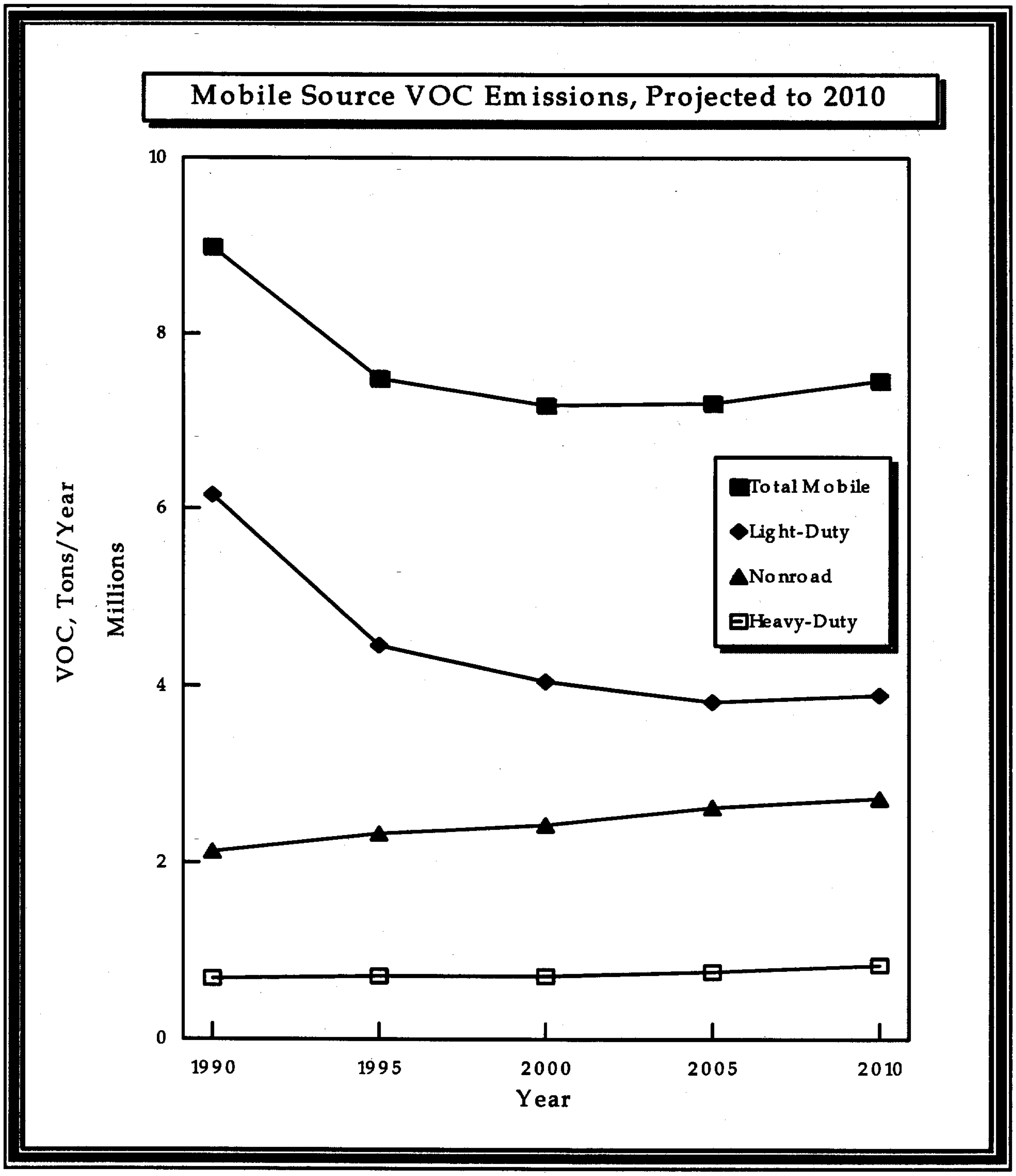
Figure 5



Sources: 1) National Air Pollutant Emission Trends, 1900-1993
2) Mobile5.0(a) mobile emissions model

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C. HDE Contribution to National PM Emissions

Projected mobile source trends for PM–10 are shown in Figure 6.[26] The figure shows that, over the next 15 years, the contribution of highway sources including HDEs to PM–10 emissions are expected to decrease and then remain relatively constant well into the next decade, while PM emissions from nonroad sources are expected to increase.

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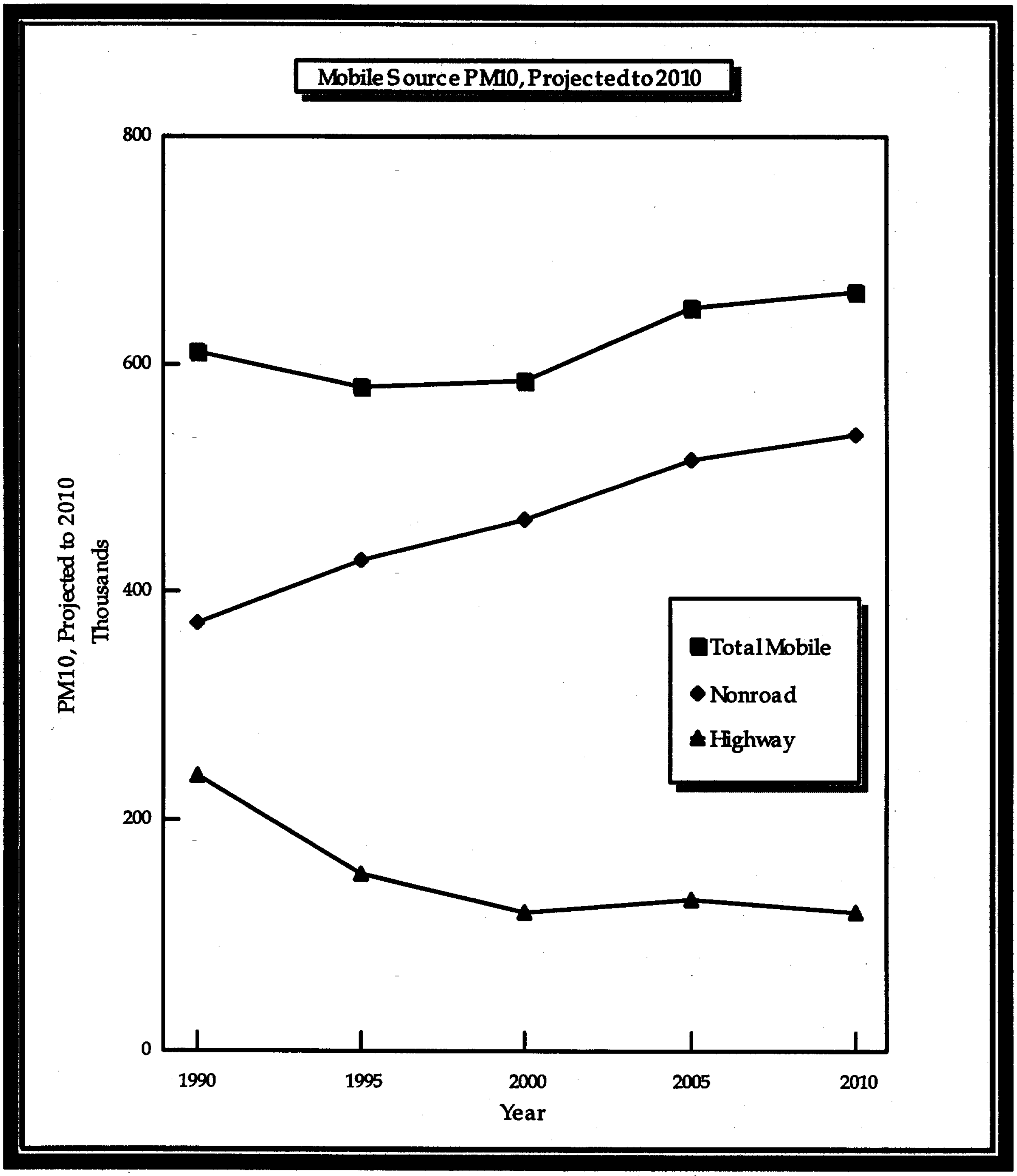
[26] Environmental Protection Agency, ''National Air Pollutant Emission Trends, 1900–1993,'' EPA–454/4–94–027, October 1994.

Figure 6



Source: National Air Pollutant Emission Trends, 1900-1993

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IV. The Need for New Heavy-Duty Engine Emission Control

The Agency believes several factors combine to support rulemaking to reduce NO_X, HC, and PM emissions from highway and nonroad heavy-duty engines in the next decade. First, HDE emission controls offer a means to address at the national level the need for new approaches to NO_X, HC, and PM reductions that is described in Section II. As explained more fully above, local measures alone to control NO_X, HC and PM will prove insufficient if all areas of the country are to achieve and maintain attainment of the ozone and PM NAAQS in the years ahead. Heavy-duty engines, like other mobile sources, represent an emissions source that crosses attainment areas and state boundaries; trucks and buses often travel long distances while nonroad heavy-duty engines power a variety of equipment used in both urban and rural areas, and are often relocated to different regions of the country as needed.

Second, the projections in Section III above show that heavy-duty engines contribute in varying degrees to the national inventory of NO_X, HC, and PM emissions.[27] Third, an effort now to implement national HDE controls may prevent a patchwork of regulation where some states require HDE controls while other states do not. Indeed, engine manufacturers felt it was very important that the new program which EPA expects to propose regarding highway HDEs (see Section VII below) provide for the harmonization of requirements between EPA and CARB, resulting in a single set of heavy-duty standards applicable in all 50 states. A national program thus appears to offer the most efficient way for states, engine manufacturers, and EPA to implement additional HDE controls. Fourth, since states must soon finalize SIPs demonstrating attainment in the years ahead, action on additional HDE controls will allow states to incorporate the expected reductions from HDE controls in their SIPs.

Fifth, with respect to highway HDEs, cost effective technology options now appear to be within reach which can achieve very large NO_X emission reductions from new highway HDEs manufactured in model year 2004 and subsequent years (see Section VIII below for a more detailed discussion of this issue). The Agency is optimistic that, with continued investment in research and development by the highway HDE manufacturers, and with cooperation between EPA, CARB, the manufacturers, and the oil refining industry, technological barriers which have prevented NO_X emissions from diesel HDEs from reaching levels characteristic of gasoline engines will be overcome. For the benefits of these NO_X reductions to be realized to a significant degree in the next decade, the Agency believes that this work must begin soon.

Finally, with respect to nonroad heavy-duty engines, EPA believes that there is the potential to apply current highway HDE emission control technology to many nonroad HDEs, providing an avenue for significant additional mobile source emission reductions. Only recently have the first emission controls been applied to heavy-duty nonroad engines, and standards are currently set at levels significantly higher than current highway heavy-duty engine standards. While control of some or all nonroad heavy-duty engines raises special issues such as the lack of a vehicle registration system and the potential difficulty of ‘‘packaging’’ engines on a variety of equipment types, many engines used in highway trucks have similar counterparts that are used in nonroad equipment applications. It therefore makes sense to explore ways to apply highway HDE emission control technology to nonroad HDEs.

The Agency is interested in comment on the role of NO_X emissions in contributing to high ozone levels over broad areas and the need for national HDE controls to address NO_X and ozone levels. In addition the Agency solicits comment on other approaches such as local and regional controls.

V. Background on Highway Heavy-Duty Engine 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 are used in a wide range of heavy-duty vehicle categories, from small utility vans to large trucks. Because one type of heavy-duty engine 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 a heavy-duty engine consists of exercising the engine over a prescribed duty cycle of engine speeds and loads using an engine dynamometer.

Emissions from heavy-duty engines 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 heavy-duty engines is to perform work and that there is a large variation in work output among the engines used in heavy-duty applications. Under this system, standards per unit of work are the same for all heavy-duty engines.

Emission standards have been in place for highway diesel and gasoline heavy-duty engines 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 engines and for PM from buses. 42 U.S.C. 7521(a)(3), 7521(f), 7554(b).

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

[27] For PM emissions, the projections show that the mobile source contribution is growing; available data shows that heavy-duty highway and nonroad engines represent significant fractions of mobile source emissions.

TABLE 1.—HIGHWAY HEAVY-DUTY EMISSION STANDARDS

Year	Hydrocarbons (g/bhp-hr)	Carbon Monoxide (g/bhp-hr)	Oxides of nitrogen (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
Gasoline:				
1991–97:				
(A)	1.1	14.4	5.0	4.0
(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. GVWR.
‘‘(B)’’ denotes the standard for engines in trucks ≥ 14,000 lbs. GVWR.
*.07 g/bhp-hr in-use.

Under Section 202(a)(3), emission standards for heavy-duty highway engines 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 heavy-duty engine 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 heavy-duty engines 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 heavy-duty highway engines before the model year 2004. 42 U.S.C. 7521(b)(1)(C).

VI. Summary of Public Support for EPA To Take Action

Several states, public interest groups and environmental organizations, trucking associations, and others have strongly encouraged EPA to pursue additional NO_X, HC, and PM emissions reductions from HDEs through national programs. The Agency has received numerous letters encouraging EPA to move forward with a national program to reduce heavy-duty engine emissions. In December of 1994, several organizations including the American Lung Association and the Natural Resources Defense Council sent a letter to the EPA Assistant Administrator for Air and Radiation requesting that EPA tighten the heavy-duty engine standards to 0.05 g/bhp-hr for particulates and 2.0 g/bhp-hr for NO_X.[28] Jim Edgar, Governor of Illinois, sent a letter to U. S. Senator Paul Simon in March of 1995, urging him to request that EPA implement national rules to reduce ozone precursor emissions from, among other sources, heavy-duty engines. The California Air Resources Board signed a Memorandum of Understanding with EPA in April, 1995 to undertake joint efforts in support of EPA's development of a national program for the control of NO_X, PM, and HC emissions from heavy-duty engines. In addition, the ozone SIP submitted by the State of California relies on EPA to set national standards for highway heavy-duty engines at the level of 2.0 g/bhp-hr and requests such action. During May and June of 1995 the Administrator received letters from the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO), the Northeast States for Coordinated Air Use Management (NESCAUM), and the Mid-Atlantic Regional Air Management Association (MARAMA) on behalf of their member states, requesting that EPA implement new national controls for heavy-duty engine emissions. The Northeast Ozone Transport Commission adopted a resolution on June 13, 1995 supporting EPA's efforts to control diesel engine emissions. EPA also received support for reducing the heavy-duty engine NO_X standard from the Manufacturers of Emission Controls Association (MECA). On June 22, 1995, the Appalachian Mountain Club, a conservation and recreation group with 65,000 members in eleven regional areas, sent a letter to the Administrator that supports EPA's initiative as critical for controlling ozone, PM, acid deposition, and regional haze in the Northeast. In addition to written requests, EPA has received numerous positive comments from concerned individuals, municipalities, and other organizations endorsing a new national control program to reduce emissions from heavy-duty engines.

VII. Summary of Government/Industry Statement of Principles

EPA initiated discussions with engine manufacturers, California's Air Resources Board (CARB), and others to begin to explore what additional controls could be implemented to further reduce emissions from heavy-duty engines. As a result of these discussions, EPA, individual members of the highway heavy-duty engine industry, and CARB have signed a Statement of Principles (SOP) regarding future highway HDE emission reductions. The manufacturer signatories[29] represent more than 95 percent of sales by the highway heavy-duty engine industry. With this SOP, presented in its entirety as an Appendix to this notice, the heavy-duty engine

[28] Copies of all letters cited and received to date can be obtained from Docket A–95–27, as described at the beginning of this Notice.

[29] Caterpillar, Inc., Cummins Engine Company, Inc., Detroit Diesel Corporation, Ford Motor Company, General Motors Corporation, Hino Motors, Ltd., Isuzu Motors America, Inc., Mack Trucks, Inc., Mitsubishi Motors America, Inc., Navistar International, and Volvo Truck Corporation.

industry has stepped forward to become a leader in environmental protection, and industry and government will work as partners to bring about cleaner air. The following presents a summary of the key elements of this Statement of Principles.

The goal of all Signatories to the SOP is to reduce NO_X emissions from highway HDEs to levels approximating 2.0 g/bhp-hr beginning in model year (MY) 2004, while also achieving reductions in HC. Accordingly, the Signatories concur that EPA would issue a notice of proposed rulemaking (NPRM) proposing to implement (1) a combined NO_X plus non-methane hydrocarbon (NMHC) standard of 2.4 g/bhp-hr and (2) a combined NO_X plus NMHC standard of 2.5 g/bhp-hr together with a NMHC cap of 0.5 g/bhp-hr, with flexibility for an engine family to comply with either of these standards as the manufacturer determines. The Signatories expect that these standards will result in emissions comparable to a NO_X standard of 2.0 g/bhp-hr as well as reduced NMHC emissions. In order to facilitate the rulemaking process and solicit additional views, the SOP Signatories concur with EPA's desire to precede the issuance of the NPRM with this ANPRM.

The Signatories acknowledge that fuel composition[30] has a significant effect on emissions, and commit to making improvements in HDE fuel as appropriate under the CAA to meet the MY2004 emission standards, taking into consideration costs and other relevant factors. The Signatories also recognize that any changes to both certification and commercial fuel specifications would have to become effective no later than October 2003 to ensure fuel availability at the time the MY2004 engine standards would go into effect.

In accordance with the SOP, EPA would in 1999 review any rulemaking adopting the MY2004 standards by issuing a notice providing the opportunity for public comment on whether or not the MY2004 standards are technologically feasible and otherwise appropriate under the CAA. EPA would review the need, feasibility, and cost of the standards under the criteria imposed by the CAA, and would assess whether any fuel improvements that are needed to assist heavy-duty engines in complying with the MY2004 standards would be available nationwide by the appropriate date. After receiving public comment, EPA would take final Agency action. Depending on the results of EPA's review, the MY2004 standards would remain at the levels described above or EPA would propose to adjust them. The Signatories expect any adjustment of the standards would not exceed (1) 2.9 g/bhp–hr NO_X plus NMHC and (2) 3.0 g/bhp–hr NO_X plus NMHC with a proportional increase in the NMHC cap (to 0.6 g/bhp–hr), unless improvements to fuel quality are needed but not made.

Both EPA and California recognize in the SOP the benefits of harmonizing state and federal regulations regarding highway HDEs. California confirms its intent to hold a public hearing regarding harmonization of its regulations for dynamometer-certified engines greater than 8500 lbs. GVWR with the federal regulations adopted under the SOP, provided such action would not compromise California's obligations to comply with state and federal law.

Neither PM nor CO emission standards change under the SOP. Also, the SOP is premised on the assumption that EPA will not alter federal test procedures for heavy-duty highway engines. With respect to durability, the Signatories commit to work to develop appropriate measures which ensure that emission gains are maintained in-use.

As part of the SOP, EPA and CARB commit to work cooperatively with industry to develop improved averaging, banking, and trading programs that will create more incentive for early introduction of cleaner engines. At a minimum EPA would, in the NPRM on the MY2004 standards, propose to eliminate any limitations on credit life, propose to eliminate all credit discounts, and solicit comment on the merits of allowing cross-fuel, cross-subclass, and cross-category credit exchanges, to the extent permitted under the CAA.

A key purpose of the SOP is to provide the HDE industry with increased certainty and stability for their business planning. Without such certainty and stability, industry would not commit to the enormous investment that the SOP standards will require. EPA and CARB in turn acknowledge that industry will be making a commitment and investment that will require more than the minimum period of stability of three years set forth in the CAA.

The SOP also outlines a plan to undertake a joint industry/government research program with the goal of developing engine and fuel technologies which can meet and exceed the MY2004 standards. Pursuant to a separate research agreement, the SOP Signatories and possibly others will try to reduce NO_X emissions to 1.0 g/bhp–hr and PM emissions to 0.05 g/bhp–hr while maintaining current highway diesel engine attributes such as performance, reliability, durability, safety, and efficiency.

Finally, while the SOP focuses on highway HDEs, the SOP Signatories commit to participate in discussions with nonroad HDE and equipment manufacturers to develop a separate SOP by October 1995 addressing emission standards for nonroad HDEs.

The SOP plan offers a flexible means of achieving a 50 percent reduction in NO_X emissions from the 4.0 g/bhp–hr NO_X standard that goes into effect beginning in model year 1998. Figure 7 shows the estimated national NO_X inventory for highway heavy-duty engines with and without the potential control measures articulated in the SOP. These projections are based on preliminary analysis of available information and subject to revision as EPA continues to analyze such factors as the future growth and turnover of the heavy-duty fleet, in-use emission performance, expedited or delayed introduction of new emission reduction technology and other factors.

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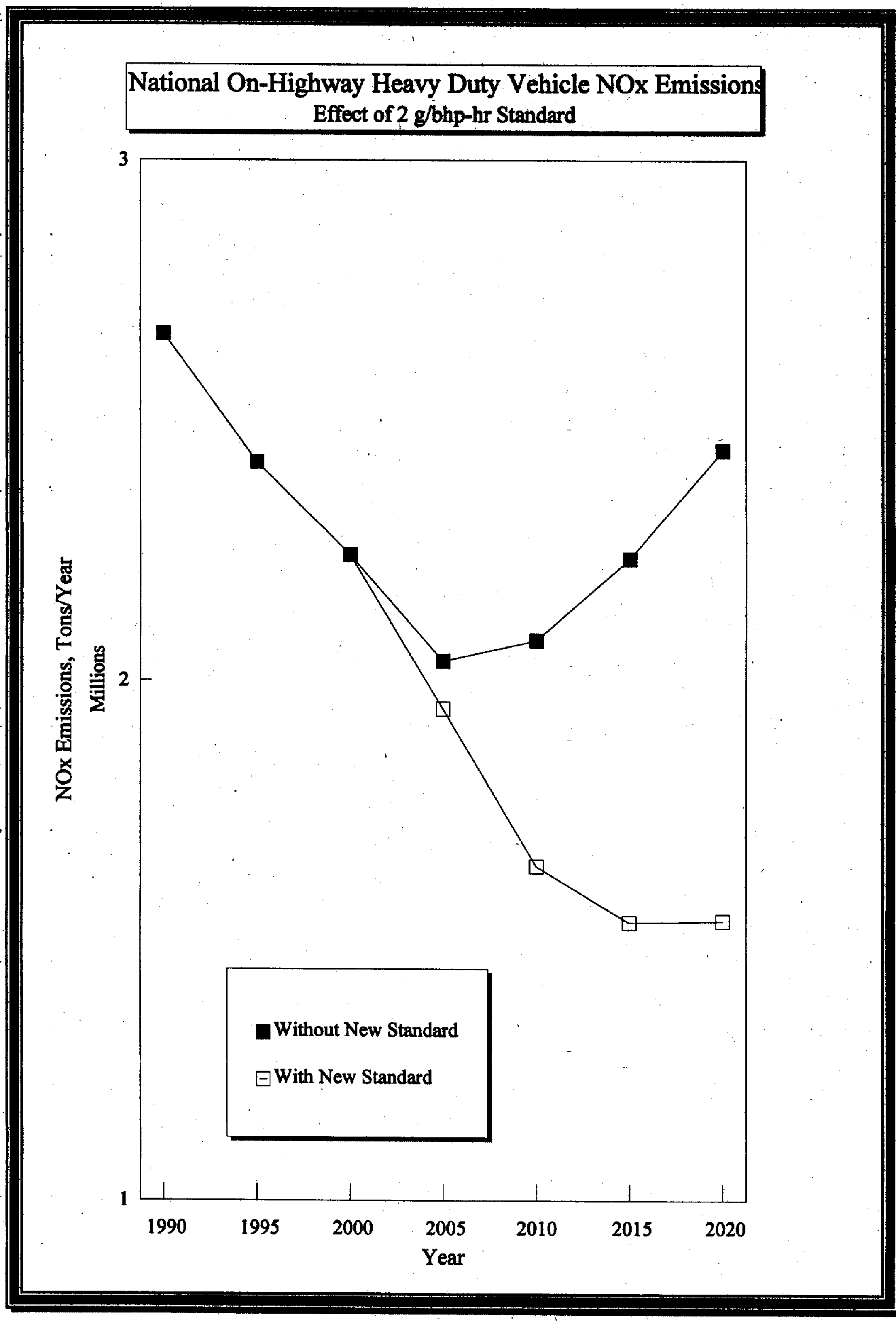
[30] Representatives of the fuel industry are not parties to this agreement as noted above. EPA will continue to engage the fuel industry in discussions as we proceed to implement the SOP, including identifying formal ways to cooperate with all parties affected by potential heavy-duty engine changes.

Figure 7



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For hydrocarbons, EPA expects the NMHC plus NO_X standards in the SOP to be equivalent to about half or less of the current HC standards (1.3 g/bhp–hr for diesel engines and 1.1–1.9 g/bhp–hr for gasoline engines). Further, the standards ensure continued control of PM emissions from highway HDEs at current levels (0.1 g/bhp–hr), despite a tendency for PM emissions from diesel HDEs to increase when NO_X emissions decrease. Ambient PM reductions may also result from the NO_X emission reductions, since NO_X contributes to secondary particulate.

EPA will actively seek to work with both the Signatories to the SOP and the oil refining industry to evaluate the role of fuel improvements in achieving the MY2004 standards. EPA believes the joint industry/government research program with the goal of achieving highway HDE emissions of just 1.0 g/bhp–hr NO_X and 0.05 g/bhp–hr PM offers an unusual opportunity to work collaboratively for the benefit of the environment. EPA will also continue discussions with the Signatories and others with the aim of achieving an SOP on nonroad heavy-duty engines comparable to this SOP regarding highway heavy-duty engines.

VIII. Approaches to Highway Heavy-Duty Engine Emission Control

Highway heavy-duty engine manufacturers are engaged in ongoing efforts to design and produce the cleaner engines envisioned in the SOP. As with any motor vehicle engine technology, control of emissions from heavy-duty highway engines can come from changes in the design of engines and related hardware, changes to fuels, or some combination of the two. While EPA and the engine manufacturing industry are not yet certain which types of technologies in which combinations might be necessary for manufacturers to reach the standards under consideration, several promising approaches have been identified to date. EPA has prepared a document that describes the causes of highway HDE emissions and several engine-based approaches and exhaust aftertreatment devices to control emissions. This document is available in Docket A–95–27.

Changes in engine technology or aftertreatment which can reduce HC, NO_X and PM emissions must be evaluated with respect to, and bear a close relationship to, the fuel composition the engines will be using. The petroleum industry has changed fuels a number of times in the past either to reduce the emissions from existing vehicles (e.g., gasoline volatility, reformulated gasoline) or to make it possible for engine manufacturers to employ new engine designs or emission control technologies that are sensitive to fuel characteristics (e.g., unleaded gasoline to facilitate the use of catalytic converters, low-sulfur diesel). EPA intends to work jointly with the petroleum industry and the highway HDE manufacturers to develop emission and cost data to help EPA assess the potential role of fuel changes in achieving the standards set forth in the SOP (Section VII above). EPA request comment on the planned approach for assessing the potential role of fuels. In addition, engines designed to use non-petroleum alternative fuels may provide another avenue for manufacturers to comply with more stringent standards.

EPA is interested in exploring programs and approaches which have the potential to help achieve the goals of the planned regulatory program in the most effective ways, including cost considerations. The Agency expects to continue a broad and open discussion of such potential approaches. The sections below briefly discusses an initial set of ideas which may improve this program; EPA solicits comments on these ideas and encourages suggestions for others.

A. In-Use Emissions Control Elements

Historically, EPA has viewed in-use emissions deterioration as a problem associated more with gasoline engines than diesel engines. EPA believes that deterioration of emissions for diesel engines, especially NO_X, has tended to be less than that of gasoline engines because diesel engines currently use fewer aftertreatment or other 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 provided performance, fuel economy, and durability benefits as well.

As standards are reduced and diesel HDE manufacturers introduce new technologies such as catalysts and exhaust gas recirculation (EGR) solely for emissions control purposes, long-term emissions performance becomes a greater concern. 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. The HDE engine market has demanded longer-lasting engines, and manufacturers have been successful in increasing engine life. It has been brought to EPA's attention that some current engines accumulate in excess of 600,000 miles before the first rebuild and are often rebuilt many times; the current regulatory ''useful life'' is 290,000 miles. Failure of emissions controls early in the engine's life would offset much of the benefit associated with the expected more stringent standards.

Programs which encourage manufacturers to design and build engines with very durable emission controls and programs to encourage the proper maintenance and repair of engines and emissions controls are important in achieving the full benefit of emissions standards. The goal is for engines to maintain ''new'' engine performance throughout their in-use operation. EPA is considering changes to current manufacturer emissions durability-related programs to further encourage the design and production of durable emission control systems. Possible changes include extending the period over which manufacturers are responsible for meeting emissions standards (the ''useful life'') and adjusting the regulations relating to the emission-related maintenance that is required of owners by manufacturers to maintain the engine's emissions warranty. EPA is also interested in exploring a program where manufacturers would perform in-use compliance testing and could take advantage of an averaging, banking, and trading program to help achieve in-use compliance. Under such a program, manufacturers would test a set percentage of their in-use engine families each year and could potentially generate emission credits (or take on liabilities) depending on the results of in-use tests relative to the Family Emission Limits established for the engine families involved. EPA believes such a program could offer a cost-effective means of achieving better assurance that standards are being met in-use.

Proper maintenance and repairs are likely to be important for durable emissions controls, especially for engines designed for a million or more miles. Therefore, EPA is also interested in approaches that involve increased responsibility of the vehicle owner. One approach EPA is considering and on which it invites comment is whether the incorporation of onboard diagnostic systems for emissions monitoring into heavy-duty engine designs would be appropriate. With the increasing availability of sophisticated computer controls, there is a potential to monitor emission control performance and components. EPA is also considering establishing requirements relating to the rebuilding of HDEs as a way of ensuring that engines and emission controls remain in their proper working condition throughout their full operating life. See 42 U.S.C. 7521(a)(3)(D).

B. Elements to Add Compliance Flexibility

EPA desires to implement any new regulatory programs in ways that minimize the complexity and cost of compliance and maximize flexibility for the regulated industry in complying with the requirements. EPA's chief goal with such approaches would be to encourage the early introduction of cleaner engines whenever possible. EPA may explore a number of options for increasing flexibility to comply with more stringent emissions standards for highway HDEs. The following presents some of the ideas that EPA may consider.

Averaging, Banking and Trading Program. Currently, an averaging, banking, and trading (ABT) program is in place for heavy-duty highway engines which allows heavy-duty highway engine manufacturers to average the emissions of their various engine families and to generate credits when they introduce cleaner engine families than are required by law. Under this program, a manufacturer may choose to certify an engine family slightly higher or lower than the standard so long as the average emission level for all engine families produced by the manufacturer is at or below the standard. Credit for selling engines that are cleaner than is required can be used immediately, ''banked'' for later use, or traded to another manufacturer.

Along with the standards discussed above, EPA expects to propose an expanded ABT program that would apply for these new standards. Because exceeding the requirements of the standards under consideration will be very challenging, EPA will propose revisions to the current program which are expected to encourage aggressive emission control development efforts on the part of manufacturers and the early implementation of new technology. EPA will propose changes to the ABT program which would eliminate the discounting of credits over time and would extend the life of the credits indefinitely. EPA will also seek comment on other changes to the ABT programs such as trading between highway and nonroad engines, among the four heavy-duty diesel subclasses, and between heavy-duty diesel and gasoline engines, to the extent permitted under the Act. Such approaches could be difficult to develop in an equitable way given the very different emissions characteristics of these engine types and the fact that the manufacturers' product lines vary.

Non-Conformance Penalties. In addition to the ABT program described above, another existing program which serves to increase the flexibility for manufacturers of heavy-duty highway engines facing new emission standards is non-conformance penalties (NCPs). The Clean Air Act (Section 206(g)) requires EPA to allow a heavy-duty engine manufacturer to receive a certificate of compliance for an engine which exceeds the standard (but does not exceed an upper limit) if the manufacturer pays an NCP established by EPA through rulemaking. NCPs increase periodically to discourage long-term nonconformance. EPA expects to consider establishing NCPs related to the new heavy-duty emission standards that EPA plans to propose.

Incentive-Based Approaches. EPA is aware of several program initiatives that could potentially supplement the emission reductions from improved design of new heavy-duty engines. Some of these are described briefly in the following paragraphs. EPA encourages these activities, and in some cases will be supporting their development. Any actions to develop these initiatives, however, will progress in parallel with the planned rulemaking to revise highway heavy-duty engine emission standards, rather than being incorporated into that rule directly.

Incentive-based approaches to emission control generally seek to provide some credit or reward to encourage businesses to make voluntary changes in operations or procedures to reduce air emissions. In the case of heavy-duty engines, EPA desires incentives that would encourage early introduction of cleaner engines. The ongoing effort to establish these policies must focus on designing a program to ensure that a business's emission reductions are voluntary, quantifiable, and enforceable. Open market trading, which is currently under development by EPA, could be designed to include the credits generated under these programs.

One potential incentive program would encourage fleets to buy cleaner truck engines earlier than required or buy cleaner engines than otherwise required and make these credits available as Mobile Emissions Reduction Credits. Another idea is to design a program to encourage truck fleet owners to accelerate the turnover of their fleets to newer engines. Typically, this would involve an encouragement to scrap old engines and purchase new lower-emitting engines. Another possibility is to rebuild heavy-duty engines with upgraded components so the ''new'' engine has the emission control capability of a more recent model year.

Other Approaches. Changes to vehicle operation may also reduce emissions. For example, trucks are frequently allowed to idle for several hours to power accessories such as air conditioners during extended stops. The potential for electrical hookup at truck stops, rest areas, etc., in combination with changes to engine and vehicle designs, could reduce the contribution of extended idling to engine emissions without inconveniencing drivers. Similarly, a program to limit the operating speeds of heavy-duty vehicles, through engine design or other changes, would reduce the excess NOx emissions caused by vehicle operation at high speeds. The reduced fuel consumption associated with these measures would represent a secondary benefit to fleet owners.

Finally, EPA is working with the freight transportation industry to identify potential infrastructure or regulatory changes that could increase system efficiencies. Any move to improve the efficiency of freight transportation, while reducing costs to industry, would reduce emissions by decreasing the total mileage driven by heavy-duty trucks.

IX. Public Participation

EPA intends for this Notice to provide the basis for the beginning of a broad-based public discussion of the issues surrounding more stringent standards for heavy-duty highway engines presented in the Statement of Principles signed by EPA, CARB, and heavy-duty engine manufacturers. Specifically, the Agency requests comment on the need for heavy-duty engine controls, the proposed timing for Agency action, and on whether the standards and other regulatory provisions planned in the SOP are reasonable and appropriate. EPA also requests comment on the planned approach for dealing with fuels. The Agency requests comment on the plan and need to pursue nonroad heavy-duty engine standards through cooperative discussions with engine and equipment manufacturers and CARB. The Agency also requests any emissions data, technical information, or analyses of technical feasibility which can be used to inform the planned actions. Finally, the Agency requests comment and information on the economic feasibility, including cost considerations for the planned actions.

EPA expects to issue a Notice of Proposed Rulemaking in the near future proposing new emission standards for highway heavy-duty engines in accordance with the SOP. The Agency is committed to a full and open regulatory process and looks forward to input from a wide range of interested parties as the rulemaking process develops. These opportunities will likely include meetings and workshops in addition to the minimum required process involving a formal public comment period and a public hearing. EPA encourages all interested parties to become involved in this process as it develops.

X. 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 apply for the useful life period established by the Agency. See 42 U.S.C. 7521(a)(1), 7521(d).

Section 213 authorizes EPA to establish emissions standards for new heavy-duty nonroad engines where EPA determines that they cause or contribute to ozone or carbon monoxide air pollution in more than one area that is in nonattainment for ozone or carbon monoxide, or where EPA determines that emissions of other pollutants significantly contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. As with heavy-duty motor vehicle engines, the emissions standards apply for the useful life established by the Agency. See 42 U.S.C. 7547.

Section 211(c) authorizes EPA to establish controls or prohibitions on fuels and fuel additives for use in highway and nonroad vehicles and engines. EPA may issue such regulations if it determines that (1) any emission product of the fuel or fuel additive causes or contributes to air pollution which may reasonably be anticipated to endanger the public health or welfare, or (2) emissions products of a fuel or fuel additive will impair to a significant degree the performance of any emissions control device or system which is in general use or which the Administrator finds has been developed to a point where in a reasonable time it would be in general use were such regulation promulgated. See 42 U.S.C. 7545(c).

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 discussed in this ANPRM.

XI. Unfunded Mandates Reform Act

Under Section 202 of the Unfunded Mandates Reform Act of 1995 (''UMRA''), P.L. 104–4, EPA must prepare a budgetary impact statement to accompany any general notice of proposed rulemaking or final rule that includes a Federal mandate which may result in estimated costs to State, local, or tribal governments in the aggregate, or to the private sector, of $100 million or more. Under Section 205, for any rule subject to Section 202 EPA generally must select the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule and is consistent with statutory requirements. Under Section 203, before establishing any regulatory requirements that may significantly or uniquely affect small governments, EPA must take steps to inform and advise small governments of the requirements and enable them to provide input.

EPA has determined that the requirements of UMRA do not extend to advance notices of proposed rulemaking such as this notice regarding potential controls for heavy-duty engines.

XII. 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 (including an advanced notice of proposed rulemaking) 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.

This Advance Notice 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 Notice.

List of Subjects in 40 CFR Parts 80, 86, and 90

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

Dated: August 24, 1995.

Carol M. Browner,

Administrator.

Appendix: Statement of Principles

Statement of Principles

Members of the heavy-duty engine industry, the U.S. Environmental Protection Agency (''EPA''), and the California Air Resources Board (''CARB'') (collectively, the ''Signatories'') recognize the importance of preserving the environment while maintaining a strong industry. This Statement of Principles (''SOP'') increases certainty and stability for the heavy-duty engine industry which is vital for their business planning. It also ensures cleaner air in a manner which is both realistic for industry and responds to environmental needs. With this SOP, the heavy-duty engine industry has stepped forward to become a leader in environmental protection, and industry and government will work as partners to bring about cleaner air.

This SOP outlines the joint understanding of all Signatories, including issuance by EPA of a Notice of Proposed Rulemaking (''NPRM'') which would be consistent with the points outlined in this document. EPA intends to issue the NPRM in 1995 and plans to promulgate a final rule by the end of 1996. However, this SOP does not change the importance of EPA demonstrating the need for the standards described below and EPA's obligation to meet the criteria of the Clean Air Act (the ''Act'' or ''CAA'') in finalizing any rule, including complying with all applicable rulemaking procedures. In order to facilitate the rulemaking process and to solicit additional views, EPA will precede the issuance of the NPRM with an Advanced Notice of Proposed Rulemaking (''ANPRM'') announcing this SOP.

1. National Standards for On-Highway Heavy-Duty Engines: For more than two decades, as public concerns about air pollution and smog caused by emissions from heavy-duty trucks and buses have increased, both the industry and the government have responded to protect public health and the environment. Standards have

dropped from levels of 16.0 grams per brake-horsepower/hour (''g/bhp-hr'') for Hydrocarbons (''HC'')+Oxides of Nitrogen (''NO_X'') in 1974 to just 5.0 g/bhp-hr NO_X and 1.3 g/bhp-hr HC for heavy-duty diesel engines today. The NO_X standard will fall again to 4.0 g/bhp-hr in 1998. California also has NO_X standards of 5.0 g/bhp-hr for these engines today and plans to adopt the federal 4.0 g/bhp-hr standard for 1998 models.

Much of the recent focus on improving emissions from diesel engines has centered around reducing smoke and soot from the exhaust. Particulate matter (''PM'') standards for heavy-duty diesel engines have dropped from 0.6 g/bhp-hr in 1988 to just 0.1 g/bhp-hr today. The current PM standards represent a 90% reduction from unregulated levels. The 0.1 g/bhp-hr standard applies both in the California and federal programs. Urban buses have even tighter standards.

Heavy-duty engine manufacturers have certified vehicles to operate on clean alternative fuels such as natural gas and methanol and continue to research the emissions benefits of alternative and renewable fuels. Clearly, the industry has worked hard to improve technology and provide cleaner vehicles and engines.

However, in recent years, concern over the role of NO_X and HC emissions in causing ozone formation has grown considerably, and reducing both has become an important goal. The opportunity to reduce overall emissions of these pollutants by producing cleaner heavy-duty engines is significant.

The goal of all Signatories to this SOP is to reduce NO_X emissions from on-highway heavy-duty engines to levels approximating 2.0 g/bhp-hr beginning in 2004. The Signatories also recognize the need to reduce HC emissions. Because of the air quality importance of reducing hydrocarbon emissions to the maximum extent feasible and in order to maximize industry's ability to achieve low NO_X levels, EPA will propose for all heavy-duty engines as part of the NPRM: (1) a combined Non-methane Hydrocarbon (''NMHC'')+NO_X standard of 2.4 g/bhp-hr and (2) a combined NMHC+NO_X standard of 2.5 g/bhp-hr together with a NMHC cap of 0.5 g/bhp-hr (collectively, the ''Standards''), with flexibility for an engine family to comply with either one of these Standards as the manufacturer determines. It is expected that the Standards would result in emissions comparable to a NO_X standard of 2.0 g/bhp-hr (*i.e.*, half of the 1998 NO_X standard), and also significant reductions in HC emissions.

While this SOP focuses on NO_X and NMHC emissions, the Signatories recognize it does not affect other existing emission or safety standards which pertain to heavy-duty engines. Specifically, all Signatories concur that the feasibility of the Standards would be affected by any changes in PM standards. Thus, this SOP is premised on EPA not changing the 0.1 g/bhp-hr diesel particulate standard currently in effect (or the lower PM standards for urban buses). Further, all Signatories concur that any changes in Carbon Monoxide (''CO'') standards could affect compliance for spark-ignited engines. Thus, this SOP is premised on EPA not changing the CO standards currently in effect for heavy-duty engines.

2. Fuel Improvements: All Signatories acknowledge that fuel composition has a significant effect on emissions and that changes in the composition and improvements in the quality of fuel may be needed to make the Standards technologically feasible and otherwise appropriate under the Act. As part of the focus on reducing NO_X, and in cooperation with the fuels industry, the Signatories are committed to making improvements in diesel fuel (and other fuels used in heavy-duty engines) as appropriate under the Act to meet the 2004 Standards, taking into consideration costs and other relevant factors. Such efforts may include evaluation of the contribution of fuel parameters to heavy-duty engine emissions, including a higher cetane number and lower levels of aromatics and sulfur. The Signatories recognize fuel improvements are important and may be essential in reaching low NO_X levels in the most efficient manner, considering costs and other factors. The Signatories also recognize that any changes to both the certification and commercial fuel specification would have to become effective no later than October 2003 to ensure fuel availability at the time the Standards take effect.

3. Feasibility: To assess the progress of industry efforts to meet the Standards set forth in this SOP and to assure the lowest appropriate standards in 2004, in 1999 EPA shall review any rulemaking adopting the Standards discussed herein by issuing a notice providing the opportunity for public comment on whether or not the Standards are technologically feasible and otherwise appropriate under the CAA. After receiving public comment, EPA shall take final Agency action on the review under § 307 of the CAA, and shall revise the rule if the Agency determines that the Standards are not technologically feasible or are otherwise not appropriate under the CAA. The evaluation will consider the status of heavy-duty engine technology in that year and its projection to 2004. In addition, the evaluation will include an assessment of whether any fuel improvements (see item #2) that are needed to assist heavy-duty engines in complying with the Standards will be available nationwide.

In reviewing the rulemaking as set forth above, EPA shall review the need, feasibility and cost of the Standards under the criteria imposed on EPA by the Act, including, without limitation, the need to provide engine manufacturers no less than four full model years of lead-time. If EPA determines compliance with the Standards in 2004 is not technologically feasible or is otherwise not in accordance with the Act, then the Administrator will adjust the standard. If an adjustment is deemed necessary, the Standards for 2004 are not expected to be raised beyond a cap of: (1) 2.9 g/bhp-hr NMHC+NO_X and (2) 3.0 g/bhp-hr NMHC+NO_X with a proportional increase in the NMHC cap. However, if improvements to fuel quality are needed but not made, the Standards are not expected to be raised beyond a cap of: (1) 3.4 g/bhp-hr NMHC+NO_X and (2) 3.5 g/bhp-hr NMHC+NO_X with a proportional increase in the NMHC cap.

The Signatories shall meet periodically to provide updates on their efforts and progress in complying with the SOP.

4. California Standards: The California State Implementation Plan (''SIP'') includes a proposed control measure to establish a 2.0 g/bhp-hr NO_X emission standard for new engines used in on-highway trucks sold in California in 2002 and thereafter. Both EPA and California recognize the benefits of harmonizing state and federal regulations. California confirms its intent to notice a public hearing to consider action to harmonize its regulations for dynamometer-certified engines greater than 8,500 lbs. GVWR with the federal regulations adopted under this SOP, provided such action would not compromise California's obligations to comply with state and federal law including the SIP. The Signatories recognize that California regulations establishing separate emission standards and test procedures for gasoline chassis-certified vehicles are not affected by this SOP.

5. Test Procedures: While there has been some discussion of current test procedures for heavy-duty engines, the SOP and the subsequent NPRM are premised on EPA not altering federal test procedures. It is possible that the Agency may evaluate changes for testing heavy-duty engines in the future, but it is recognized that the SOP is made in the context of current test procedures. Further, all Signatories recognize that any test cycle changes or additions would likely complicate and delay industry's ability to research, design, test, and produce engines that comply with the Standards by 2004. Any changes to test procedures used to determine compliance with the Standards for purposes of EPA certification or enforcement programs could also affect industry's ability to meet the Standards.

6. Durability: All Signatories recognize that it is important that emissions from cleaner heavy-duty engines be maintained throughout the life of the engine. To meet this goal, the Signatories will work to develop appropriate measures which ensure that emission gains are maintained in-use.

7. Averaging, Banking, and Trading Incentives: As part of this SOP, EPA and CARB will work cooperatively with industry to develop improved national averaging, banking, and trading (''AB&T'') programs that will create more incentive for the early introduction of cleaner engines. At a minimum, EPA will propose to modify the existing AB&T program to eliminate any limitations on credit life and to eliminate all credit discounts. The Signatories acknowledge that an improved AB&T program may be critical in making the Standards feasible in 2004, and would provide an incentive for early introduction of cleaner technology.

In addition, EPA shall solicit comments in the NPRM on the merits of allowing cross-fuel, cross-subclass, and cross-category (e.g. on-highway and nonroad) credit exchanges, to the extent permitted under the Act.

8. Scope: These standards will apply to all on-highway heavy-duty engines, including those operating on diesel, gasoline, or alternative fuels or fuel blends. It is recognized that EPA and California place a

high priority on the need for additional nonroad heavy-duty engine standards, and that additional nonroad heavy-duty engine standards may be required. The Signatories intend to participate in discussions with nonroad heavy-duty engine and equipment manufacturers to develop a separate SOP by approximately October 1995 addressing emissions standards for heavy-duty nonroad engines.

9. Stability: One of the key principles of the SOP is to provide industry with increased certainty and stability for their business planning. Without such certainty and stability, industry would not commit to the enormous investment that the Standards will require. And, without such certainty and stability, those investments might never be recouped. EPA and California recognize the huge investment that will be required of industry. Under the Act, the minimum period of stability that EPA must provide for new on-highway heavy-duty engine emissions standards is three years. However, EPA and California acknowledge that under this SOP industry will be making a commitment and investment that will require more than the minimum period of stability.

10. Research Agreement: The Signatories recognize the benefits of a joint industry/government research program with the goal of developing engine and fuel technologies which can meet and exceed the standards for heavy-duty on-highway engines outlined in this SOP. The Signatories will undertake development of a separate research agreement with goals of reducing NO_X emissions to 1.0 g/bhp-hr and PM emissions to 0.05 g/bhp-hr while maintaining attributes of current on-highway diesel engines such as performance, reliability, durability, safety, and efficiency. These characteristics have allowed current diesel engines to serve as the pillar of the international trucking industry. This research agreement would include certain of the industry signatories below, EPA, CARB, and other organizations, such as the U.S. Department of Energy, as are approved by the participants.

Signed July 11, 1995, Chicago, Illinois.

Mary D. Nichols,

U.S. Environmental Protection Agency.

John D. Dunlap,

California Air Resources Board.

Members of the Engine Manufacturer Association

Caterpillar, Inc.
Cummins Engine Company
Detroit Diesel Corporation
Ford Motor Company
General Motors Corporation
Hino Motors, Ltd.
Mack Trucks, Inc.
Mitsubishi Motors America, Inc.
Navistar International
Volvo Truck Corporation
Environmental Protection Agency (Mary D. Nichols)
California Air Resources Board (John Dunlap)

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