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Attainment of EPA's Ozone Standard

Statement of
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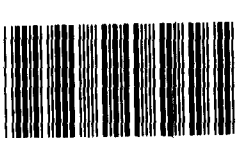
Before the
Subcommittee on Oversight and Investigations
of the House Committee on Energy and Commerce



Mr. Chairman and Members of the Subcommittee:

We are pleased to be here today to discuss our ongoing reviews of the Environmental Protection Agency's (EPA) efforts to protect the public health from ozone, a primary constituent of smog.

Mr. Chairman, you have expressed concern about the ability of states to comply with the EPA-established ozone standard and the implications that may have for their meeting the December 1987 attainment deadline. We believe that these concerns are well-founded. As we have reported in the past, we believe that the Clean Air Act affords EPA no alternative but to apply sanctions to those areas that have not attained the ozone standard by December 31, 1987.

As you know, Mr. Chairman, we have issued several reports to you dealing with various aspects of EPA's effort to deal with the ozone problem, including reducing gasoline vapor emitted during automobile refueling, controlling vehicle emissions by requiring states to implement inspection and maintenance programs, and imposing sanctions in areas that do not attain EPA's air quality standards.[1] We are currently conducting two reviews at your request: a case-study review of EPA, state, and local government actions to ensure attainment of the national ozone standard and a

[1]See attachment I of this statement for a list of our recent ozone-related reports.

review of EPA's plans to control refueling and excess evaporative emissions. The case study review is also being conducted jointly for the Chairman of the Senate Committee on Environment and Public Works.

Our testimony today addresses three issues relating to our on-going reviews of EPA and state efforts to deal with the ozone problem.

-- What progress have three "case study" cities made towards attaining the ozone standard?

-- What are some of the reasons that ozone standard attainment has become elusive?

-- What steps has EPA taken to control vapor emitted during automobile refueling and to address the effects of increases in gasoline volatility?

In addition, we have some observations that may be useful to the Congress should it consider legislative changes to address the nonattainment problem.

BACKGROUND

Let me begin with a few words of background on the ozone problem. Ozone, a primary constituent of smog, continues to be one of the nation's most pervasive air pollution problems. Formed when emissions of hydrocarbons combine with nitrogen oxides in the presence of heat and sunlight, ozone has been linked to reduced lung functions, difficulties in breathing, asthma, eye irritation, and reduced resistance to infection. Over one-third of the population lives in areas of the country that have not reached attainment with the ozone standard that EPA established under the Clean Air Act.[2]

Ozone has been a recognized problem for many years. The Clean Air Act Amendments of 1970 required each state to submit to EPA a State Implementation Plan (SIP) describing its program for attaining the ozone standard by 1975 or at the latest mid-1977. However, a number of areas did not meet the standard by the deadline. The 1977 Amendments to the act allowed states to revise their SIPs to provide for attainment of the ozone standard by December 31, 1982. An additional extension to December 31, 1987, could be granted to areas demonstrating that attainment by 1982 was

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[2]The ozone standard is set at .12 parts per million (ppm). If the average number of daily exceedances per calendar year is equal to or less than one, based on 3 years of monitoring data, EPA considers the area in attainment with the standard. (See attachment III for a detailed discussion on monitoring site section).

not possible. States not reaching attainment by the deadlines are subject to a construction ban on new facilities and possibly other sanctions. EPA's efforts to control ozone have focused on reducing hydrocarbons emitted from motor vehicles and stationary sources, such as chemical plants and refineries.

GAO CASE-STUDY CITIES: PROGRESS TOWARDS OZONE ATTAINMENT

EPA estimates that as many as 76 metropolitan areas of the country may not meet the ozone standard by December 31, 1987. Some of these areas are close to meeting the standard while others may not reach attainment in the foreseeable future. Our ongoing review has examined three of those areas--Los Angeles, California; Houston, Texas; and Charlotte, North Carolina. We selected these cities to include areas requested by the committees and to ensure coverage of areas close to and far from reaching attainment. I will briefly outline the progress these cities have made towards attaining the ozone standard.

Los Angeles, California

In part because of a combination of meteorological and geographic factors, the California South Coast Air Basin (encompassing the Los Angeles area) is considered to have the worst ozone problem in the country. For the 1979 to 1981 period the area

had an ozone level of .44 parts per million (ppm),[3] compared to EPA's standard of .12 ppm. California's 1982 SIP called for the implementation of a variety of control measures to move the Los Angeles area closer to meeting the standard. However, the SIP stated that, even if such measures are implemented, the South Coast Air Basin could not meet the ozone standard by 1987. By the end of 1985 the area's ozone level had declined to .36 ppm, showing progress, but still far in excess of the .12 ppm standard.

At this time EPA does not know when or if the South Coast Basin will reach attainment with the ozone standard. Even if mobile source emissions are eliminated, the area would still not meet the standard. South Coast officials estimate that, even if all short-term measures outlined in its 1982 revised SIP are fully implemented, the Los Angeles area will have peak ozone readings of .30 ppm and .26 ppm during 1987 and 2000, respectively. EPA initiated a Reasonable Extra Efforts Program (REEP) to help assure progress is made in reducing ozone levels. REEP is discussed in attachment II of my statement.

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[3]This level refers to the design value, EPA's term for the highest ozone reading in an area, excluding allowable exceedance readings, and generally covering a 3-year period. EPA uses design values to indicate the amount of control an area will need to reduce hydrocarbon emissions. Higher design values generally indicate a higher percentage of needed emission reductions.

Houston, Texas

Houston is another area that is not close to meeting the ozone standard. For the 1979 to 1981 period, the Houston area (Harris County) had an ozone level of .30 ppm. For the 1983 to 1985 period, that value had declined to .25 ppm. While this decline shows some improvement, it remains far in excess of the ozone standard. Houston's 1982 revised SIP planned to reduce ozone through hydrocarbon reductions from the manufacturing of organic chemicals and plastics as well as other sources, including motor vehicle emissions. However, EPA's data show that the area will not meet the standard by December 1987 or in the foreseeable future.

Charlotte, North Carolina

Unlike Los Angeles and Houston, the Charlotte area (Mecklenburg County) is close to meeting the ozone standard. During the 1979 to 1981 period, Charlotte's ozone level was .14 ppm and had declined to .13 ppm for the period 1983 to 1985. Charlotte's ozone readings exceeded the standard in 1984 and 1986. Even if the area's readings do not exceed the standard in 1987, Charlotte still will not be in attainment with the standard, because it will have more than three readings that exceed the standard over a 3-year period.

Charlotte's 1979 SIP projected that it would attain the standard in 1982, primarily through emission controls on the storage, transport, and retail marketing of petroleum and reductions in emissions from federally-required control measures on new motor vehicles. Although the area did not reach attainment by 1982, EPA did not request that Charlotte submit a revised SIP because EPA officials expected the area to reach attainment before 1987 with the projected control measures.

REASONS WHY OZONE ATTAINMENT HAS BEEN ELUSIVE

We have identified a variety of problems that individually or in combination have contributed to the nonattainment problem. These include (1) underestimation of hydrocarbon inventories, (2) difficulties in predicting ozone formation, (3) lack of or ineffective implementation of controls, and (4) interstate pollution contributing to some areas' problems.

Hydrocarbon Inventories Were Underestimated in SIPs

In developing its implementation plan, each state is required to develop a hydrocarbon emissions inventory. This inventory is used to project emission reductions needed to reach attainment with the standard. We found that a variety of factors affect the accuracy of these inventories.

According to EPA officials, some SIPs understated inventories because they did not include all major hydrocarbon sources. Examples of sources not included are publicly-owned sewage treatment plants, hazardous waste sites, and storage and disposal facilities. EPA is revising its emissions inventory guidance requirements and plans to include these sources for new inventories. Local air quality officials from the three areas we visited agreed that these sources were not included in their SIP inventories. However, they could not quantify how such exclusions influenced an area's failure to attain the ozone standard. According to information obtained from EPA and the states, even for sources that were included in the SIPs, emission estimates were not precise, thus affecting the accuracy of hydrocarbon inventories.

Mobile source emissions used in developing SIPs have also been understated. States have used different generations of an EPA mathematical model to estimate hydrocarbon and other emissions from mobile sources.[4] Several areas of the country, including Houston and Charlotte, used earlier generations of this model in developing their SIPs; these models underestimated emissions and did not account for other factors affecting emissions. Attachment IV of my statement further discusses how these models contributed to underestimated inventories and other problems.

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[4]Most areas used EPA's Mobile 1 model as a basis for estimating mobile source emissions in the 1970's. An updated version, Mobile 2, was used in making 1982 SIP revisions. Further modifications were made to the model and it was released as Mobile 3 in 1985. At present, EPA is developing a fourth generation Mobile model.

Another area of underestimated mobile source emissions is vehicle miles travelled. Because of the role of motor vehicle emissions in ozone formation, these are important in determining hydrocarbon inventories used to project ozone attainment. EPA officials believe that SIPs covering several areas of the country, including Los Angeles, significantly underestimated these figures.

Difficulties In Predicting Ozone Formation

Ozone formation is a complex phenomenon and not completely understood. Unlike other ambient air pollutants regulated by EPA, ozone is not emitted but, instead, is produced from the combination of hydrocarbon and nitrogen oxide emissions, sunlight, and other factors. The chemical transformation and the variability of the climatological factors involved contributes to the difficulty in determining with certainty how much hydrocarbon control is required to decrease the ozone level by a certain percentage.

EPA and states rely on various mathematical models to predict the hydrocarbon reductions required to project attainment with the ozone standard. These models have uncertainties associated with them and often tend to underpredict needed emission reductions. For example, in preparing their SIPs, Los Angeles and Houston used an EPA model that, according to an EPA contractor study, varies greatly depending upon the complexity of data and assumptions used.

Another uncertainty in the modeling results from the quality of data used in the model, such as hydrocarbon to nitrogen oxide ratios. If inaccurate, this information can affect an area's projection of attainment with the standard. The uncertainties associated with the models and the model input are further discussed in attachment IV to my statement.

Some Controls Not Implemented and Others Not as Effective as Anticipated

Emissions of hydrocarbons have been higher than anticipated, because (1) planned controls were not always implemented, (2) implemented controls were not always as effective as projected, and (3) enforcement programs were sometimes ineffective. For example:

-- As of September 1986, 16 of 29 planned control measures for stationary sources in the Los Angeles area SIP had not been implemented generally because the control technology was not fully developed or was considered too costly. A 1986 evaluation by the state of California and EPA found that the actual reduction of hydrocarbons in the Los Angeles area would be 10 percent below previously projected reductions and that additional emission reductions could be achieved through improved enforcement of existing rules.

-- As we reported in 1985 and 1986, automobile inspection and maintenance programs have not been as effective in

controlling emissions as projected; also, implementation of several of these programs was delayed because of opposition from state legislators.

-- In 1984 an EPA inspection team found that sources in the Charlotte area were not in compliance with existing regulations and concluded that enforcement was not adequate. According to EPA officials, Charlotte has been taking steps to improve enforcement based on the inspection.

Interstate Pollution May Contribute to Ozone Levels

Some state officials have complained that their difficulties in attaining the ozone standard are at least partially due to emissions outside of their control. EPA officials agree that hydrocarbon or nitrogen oxide emissions can contribute to ozone formation in downwind areas, regardless of the controls put into place in these areas. They acknowledge, however, that they cannot measure the degree to which one area's emissions affect another area or state.

EPA EFFORTS TO CONTROL REFUELING AND EVAPORATIVE EMISSIONS

EPA has been studying measures to control gasoline vapor emitted during automobile refueling for 14 years and has not yet announced whether the controls should be placed on automobiles or

gasoline pumps. As we stated in our December 1985 report,[5] this decision is affected not only by concerns for ozone pollution, but also for public exposure to gasoline vapor, which contains benzene, a known carcinogen. Recent studies also suggest that the vapor itself--apart from its benzene component--may be carcinogenic. In addition, the hydrocarbons emitted during refueling contribute to ozone formation. In the year since our report was issued, EPA has continued to study the matter. EPA has sent a draft proposal to the Office of Management and Budget for their preliminary review and plans to announce a decision to control these emissions in the next few months. In the meantime, controls on gasoline pumps have been in place in California and the District of Columbia for about 10 years, and other areas are considering installing such controls.

An associated problem is the increased hydrocarbon emissions caused by rising gasoline volatility. Since the 1970's refiners have been blending in butane and other additives to gasoline to offset oil cost increases and boost octane levels. While giving refiners more flexibility, this has increased evaporative hydrocarbon emissions.

Currently all gasoline-fueled vehicles are equipped with canisters designed to capture the majority of evaporative hydrocarbon emissions generated in vehicle fuel tanks and

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[5]Air Pollution: EPA's Strategy to Control Emissions of Benzene and Gasoline Vapor (GAO/RCED-86-6; December 1985).

carburetors. In order to be certified under EPA's evaporative emission standards, the canisters can only emit a limited amount of hydrocarbons. For example, light-duty vehicles, such as automobiles, can emit no more than 2.0 grams of evaporative hydrocarbons per test. EPA requires that a 9.0 pounds per square inch (psi) RVP certification gasoline be used in its tests;[6] that RVP level represented the volatility of commercial gasoline sold during the 1970's, when the standards were developed.

In 1983 EPA began testing in-use automobiles and found that on average they were exceeding the 2.0 gram standard; some cars exceeded the standard by as much as six times the allowable limit. On the basis of these tests, EPA concluded that most of the excess emissions were caused by the volatility of commercial gasoline that had increased steadily since the late 1970's and currently exceeds certification gasoline volatility.

As a near-term alternative for reducing the excess emissions caused by the increase in gasoline volatility, EPA has considered lowering the volatility of commercial gasoline to make it more in line with that of certification gasoline. This is a near-term solution, because it could be implemented within months after a

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[6]RVP is Reid vapor pressure, a measure of gasoline volatility; 9.0 psi RVP is a volatility of nine pounds per square inch. Generally, the higher the volatility, the greater the hydrocarbon emissions.

regulation is finalized, and it would not require any changes to the canisters on new vehicles.

As a long-term alternative, EPA has also considered increasing the volatility of certification gasoline above the current 9.0 psi level and equating it to the volatility of commercial gasoline. This is a long-term solution because any increases in certification gasoline volatility will necessitate enlarging the canisters on new vehicles in order to be certified under EPA's evaporative emission standards using a higher volatility gasoline. EPA estimates that it could take up to 7 years after the regulation takes effect before the larger canisters would be installed in half the in-use vehicle fleet, and up to 20 years before they would be present in almost all the fleet. EPA estimates that, depending on the strategy employed, these excess evaporative controls could result in about a 2 to 7 percent reduction of the total national hydrocarbon inventory, compared with no more than a 2 percent reduction from refueling controls.

EPA's decisions on controlling refueling and evaporative emissions are closely related. For example, if EPA requires onboard refueling controls, then those controls in most cases would be able to capture excess evaporative emissions. If, however, EPA decides to limit gasoline volatility, it would reduce excess evaporative emissions and have a limited impact on refueling vapors.

GAO CONCLUSIONS AND OBSERVATIONS

In summary, EPA and states have clearly not achieved the ozone reduction goals envisioned in the Clean Air Act. A variety of factors have contributed to this problem, and there does not appear to be a single simple fix available to correct the problem. EPA has identified as many as 76 metropolitan areas of the country that may not attain the ozone standard by the act's December 31, 1987, deadline. As I stated at the outset of my testimony, we believe that the Clean Air Act requires EPA to impose sanctions in those areas. In a previous report and legal opinions,[7] we recommended that EPA take steps to either (1) enforce the Clean Air Act and begin implementing sanctions against areas it has identified as being in nonattainment or (2) seek legislative relief from the provisions in the act which, in our view, require imposing those sanctions.

We recognize that the Congress is considering changes to the act to address the ozone problem beyond 1987. While we plan to issue our report on this matter in a few months, we do have some observations based on our work to date that we believe may be helpful in considering the ozone question.

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[7] EPA's Sanctions Policy Is Not Consistent with the Clean Air Act (GAO/RCED-85-121; September 30, 1985); B-221421, Feb. 28, 1986; B-208593, Jan. 6, 1986; Id., April 21, 1983, and Dec. 31, 1982.

First, if the ozone attainment deadline is extended as some have suggested, the Congress may want to consider an approach that does not establish a single attainment date for all areas of the country. As I have indicated, the various nonattainment areas differ in the degree to which they need to reduce emissions to meet the standard. Some areas, such as Charlotte, would presumably be able to reach the standard sooner and with fewer control measures than areas with more serious problems. Other areas, such as Los Angeles, suffer from a variety of factors, including geographic location, and may not be realistically expected to attain the standard for many years. It is important that ozone reduction efforts be continued in all areas but it is also important to recognize the reality that some areas will not be able to meet near-term deadlines.

One option to consider is a program that would focus on reducing ozone levels while providing some flexibility with regard to specific deadlines. A similar approach has been considered by EPA. Some areas may be able to reach attainment by a short-term deadline through a combination of improving enforcement of existing control measures, implementing new control measures, and federal initiatives, such as volatility controls. Other areas, such as Los Angeles, could continually take steps to ratchet down ozone to specified levels by an agreed upon deadline, even though the EPA standard may not be attainable in the near-term.

Under an approach such as this, before determining how best to deal with a given nonattainment area, we believe it is critical that EPA and the state in question (1) evaluate the extent to which the area has implemented its SIP, (2) review the adequacy and enforcement of existing control measures, and (3) identify additional needed control measures to reduce ozone levels.

Second, if the attainment deadline is extended, EPA should publish and implement a strategy outlining its plans to deal with nonattainment areas. EPA's strategy should identify what steps it plans to take to ensure that we will not be sitting here several years in the future discussing the same dilemma. This strategy should, among other things, establish a clear policy on the use of sanctions; address steps to upgrade hydrocarbon inventories; ensure that current data are used in models; identify needed control measures; and ensure that in-place controls are implemented and adequately enforced.

Third, an underlying factor that may be slowing progress toward solving the problem is the apparent reluctance of some government officials to make politically unattractive and difficult regulatory decisions if the controls are going to affect economic development or lifestyles. Some of these officials seem to question whether the health effects of ozone warrant the measures needed to reach attainment. This problem may be exacerbated in the future as EPA reevaluates the health data supporting the standard. EPA's

current .12 ppm standard is based on health studies demonstrating that ozone causes a variety of respiratory problems and other discomforts. EPA's ongoing re-evaluation of the standard has found new evidence revealing that, if anything, the standard may have to be tightened.[8] This would result in more areas of the country falling into nonattainment.

We believe that EPA must address this issue of reluctance to implement controls if those controls will have economic consequences or impact on lifestyles. If EPA believes, as it indicated in hearings in February, that the health effects associated with ozone are significant, it should consider working with state and local officials to initiate an education program for the general public, to promote the idea that ozone warrants swift regulatory control action.

Finally, EPA should take an active role in making decisions that have a national impact on ozone levels. For several years states have been unclear about EPA intentions on issues, such as refueling controls, and this uncertainty has clouded efforts to address the ozone problem.

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[8]New health studies show a reduction in lung capacity at ozone levels of .12 ppm. Because the Clean Air Act requires that EPA include an "adequate margin of safety" to protect the public health, EPA may lower the ozone standard.

EPA analyses of evaporative and refueling emission controls provide it with extensive information on such factors as emission reductions, costs, time of implementation, and ease of enforcement. EPA must now weigh these factors and determine what objectives it is trying to accomplish by regulating refueling and evaporative emissions. For example, if EPA's goal is to have a relatively immediate impact on ozone levels, the one step it can take is to limit the volatility of commercial gasoline. On the refueling issue, EPA should take into account both the reduction of public health risks from hazardous pollutants and the reduction of ozone associated with each of the control strategies in determining whether it should implement a nationwide control program or one that will address the problem only in ozone nonattainment areas. In addition, EPA's choice of control strategy will depend on the priority it places on the timeliness of implementation relative to emission reductions and overall cost-effectiveness. EPA has the necessary information and should address these issues in its final decision on controlling evaporative and refueling emissions.

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Mr. Chairman, this concludes my prepared statement. We would be glad to respond to your questions.

ATTACHMENT I

OZONE-RELATED REPORTS RECENTLY ISSUED BY GAO

Air Quality Standards: EPA's Standard Setting Process Should Be More Timely and Better Planned (GAO/RCED-87-23; December 1986)

Air Pollution: Improvements Needed in Developing and Managing EPA's Air Quality Models (GAO/RCED-86-94; April 1986)

Air Pollution: EPA's Strategy to Control Emissions of Benzene and Gasoline Vapor (GAO/RCED-86-6; December 1985)

Vehicle Emissions: EPA Response to Questions on Its Inspection and Maintenance Program (GAO/RCED-86-129BR; May 1986)

EPA's Sanctions Policy Is Not Consistent With The Clean Air Act (GAO/RCED-~~85~~-121; September 30, 1985)

Vehicle Emissions Inspection And Maintenance Program is Behind Schedule (GAO/RCED-8522; January 16, 1985)

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REASONABLE EXTRA EFFORTS PROGRAM (REEP)

The Environmental Protection Agency (EPA) is developing a new program in California called the "Reasonable Extra Efforts Program" (REEP). Its purpose is to reduce emissions of hydrocarbons and other pollutants in four nonattainment areas of the state, including the South Coast Air Basin, in order to work towards attaining national ambient air quality standards as expeditiously as possible.

In 1986, EPA Region 9 initiated REEP to have some formal system for dealing with California areas that could not demonstrate attainment by 1987. It was also initiated in an attempt to resolve litigation brought by a citizen who did not believe EPA was aggressive enough in its efforts to assure that the South Coast plan would result in the demonstration of attainment.

The REEP consists of two main components: (1) control strategy development and (2) program improvements identified through auditing of SIP implementation. Under control strategy development, existing rules and regulations are analyzed to see if they can be strengthened, and new measures are identified where the technology appears to be feasible and effective. Under the program improvements component, each area will be audited by EPA and the state to determine if enforcement of rules could be improved and if the SIP is being implemented.

Control Strategy Development

As part of the control strategy development, EPA has evaluated existing regulations covering 16 categories of hydrocarbon

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stationary source controls. Included among these are aerospace coatings, automobile refinishing, bulk terminals, and degreasing. As a result of this evaluation, EPA made recommendations to the nonattainment areas on changes needed to improve the effectiveness of various rules.

In addition, a joint review process consisting of federal, state, and local air pollution control agencies in California has been established to review and evaluate the development of new control measures. Under this process, the potential for new control is assessed for a specific source category and a new "suggested measure" for that category is drafted. A number of source categories are currently being assessed or will be assessed in the next 2 years under the REEP, including wineries, large commercial bakeries, and vegetable oil manufacturing.

Program Improvements Identified

As part of the REEP, and with assistance from the South Coast Air Quality Management District, the California Air Resources Board and EPA conducted an evaluation of the District's air quality program. Issued in February 1987, the report identified several areas where enforcement of regulations could be made more effective. For example:

-- Field inspections of 230 industrial facilities and 424 gasoline stations revealed that emission reductions from controls were 10 percent lower than expected. The report makes several regulatory and program recommendations to reduce these shortfalls.

-- An analysis of 158 selected facilities (involving 1,190 permit applications under the new source review program) found that, although the South Coast District has stringent requirements, exceptions were being made to the requirements, and program practices weakened the effectiveness of the new source review program.

In the next several months, EPA also expects to complete its review of the South Coast District's implementation of its 1982 revised SIP. If EPA determines that the District is not fully implementing the SIP, it could impose construction bans and restrict air pollution grants.

Legality of the REEP

EPA's General Counsel analyzed REEP in a Memorandum to the Administrator dated November 26, 1986. REEP and the sustained progress program are EPA's response to expected nonattainment of the Primary National Ambient Air Quality Standards by the deadline dates set in the 1977 Amendments to the Clean Air Act. EPA's General Counsel advised the Administrator that, in his opinion, the REEP is legally defensible. However, he cautioned that there was a high risk that the programs would provoke litigation. Moreover, he advised that, if challenged, the possibility of an adverse court decision was also high.

We have consistently maintained that EPA may not administratively extend the deadlines set out in Part D of the Clean Air Act by encouraging additional cooperative efforts toward attainment in lieu of enforcing the statutory penalties for

nonattainment.[1] EPA has taken the opposite position in a regulation it issued in November 1983. The EPA General Counsel's conclusion that REEP is legally defensible assumes that EPA has the authority to postpone the attainment deadlines created by Part D of the Act. This builds on the conclusion in the 1983 regulation that the deadlines and penalties in the Act were intended by Congress to assist in planning, rather than to sanction nonattainment. As we reported to you in our April 2, 1987, opinion (B-208593), we disagree with REEP on the same grounds as those we have stated in our several decisions to you on the subject of Clean Air Act enforcement.

Thus, we agree with the EPA General Counsel's assessment of the risks attendant on litigation if REEP was to be implemented. We understand the arguments he would make in support of the programs if called upon to do so. However, our position would be that the programs are not legally correct.

We understand EPA's interest in taking those actions which its officials think will further the goal of producing healthful air at the earliest possible date. We also sympathize with EPA's desire to refrain from imposing penalties that could be economically disruptive and would be viewed as draconian. Our legal opinions have often commented on our sense of the urgent need for congressional action to update the Clean Air Act, particularly to revise the deadlines and abandon or rework those penalties which are now considered to be overly harsh or unproductive. Until this happens, however, EPA is still required to enforce the law as Congress wrote and intended it in 1977. We continue to maintain

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[1]See GAO legal opinions, B-221421, Feb. 28, 1986; B-208593, Jan. 6, 1986; Id., April 21, 1983 and Dec. 31, 1982.

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that this includes enforcing the statutory penalties for nonattainment after applicable deadlines.

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SELECTION OF MONITORING SITES AND USE OF MONITOR READINGS TO DETERMINE ATTAINMENT

The 1977 Clean Air Act Amendments required a uniform ambient air quality monitoring network and data reporting system to (1) develop and implement SIPs and (2) obtain national air pollution trends. The act also required EPA to establish criteria for monitoring air pollution nationwide. Pollutants to be monitored were those for which national ambient air quality standards have been established, according to EPA's May 1979 regulations.

In creating the national monitoring network, EPA modified the existing network to meet the provisions of the 1977 amendments. These monitors, called State and Local Monitoring Stations (SLAMS), provide air quality data for SIP purposes. Selected monitors within the SLAMS network were designated as National Air Monitoring Stations (NAMS). EPA uses the data from NAMS to provide national trend data on a timely basis.

Monitor readings used to determine attainment

EPA uses readings from monitors to determine whether an area is in attainment with the national ambient air quality standards.[1]

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[1]The ozone standard was originally established in 1971 as a photochemical oxidant (which includes ozone) standard. The standard specified that the average hourly concentration must not exceed .08 ppm more than once a year. In 1979, this standard was made less stringent by limiting it to ozone, relaxing it to .12 ppm, and allowing a 1-day exceedance instead of 1-hour exceedance. The current standard is attained when the average number of daily exceedances per calendar year is equal to or less than one. The number of daily exceedances at all monitoring sites are recorded for each year and averaged over the prior 3 years to determine the average exceedances.

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EPA also computes ozone design values from monitoring data. The fourth highest reading over a 3-year period is determined for each monitoring site. The highest of these readings is selected as the area's ozone design value. EPA assumes an area will meet the standard if the design value is no higher than .12 ppm. Three, rather than one, year's worth of monitoring data is used to determine if an area meets the standard in order to minimize the effects of unusual weather conditions occurring in any one year.

Criteria for choosing monitoring sites

EPA's criteria for SLAMS site selection state that sites should determine, at a minimum, the following monitoring objectives: (1) the highest concentrations expected to occur in the area covered by the network, (2) representative concentrations in areas of high population density, (3) the impact on ambient pollution levels of significant sources, and (4) general background concentration levels. EPA regional and local officials determined the number of monitors included in each SLAMS network on the basis of factors such as geography, population, emission density, and climate. Determining the size of any SLAMS network involves trade-offs among data needs and available resources, according to EPA officials.

In selecting NAMS, EPA uses urban area population as the criterion for both ozone and carbon monoxide. For ozone, the criterion is any urban area with a population of more than 200,000. EPA regulations generally require each area to have two NAMS. One should be located in the area of highest ozone concentration and the other in densely populated areas. For carbon monoxide, sites must be in any urban area with a population greater than 500,000.

As with ozone NAMS, each area generally requires two carbon monoxide NAMS. One should be located at a peak concentration area around major traffic arteries and near heavily travelled downtown streets. The other should be in a neighborhood with "significant" concentrations.

Readings from monitors in the high pollution concentration areas are used to ensure that all parts of each air quality area are in compliance with the standards, according to EPA officials. By ensuring that pollutant levels do not exceed the standard in all parts of the area, including those parts with the highest concentrations, EPA expects to protect all members of the public with the adequate margin of safety provided for in the Clean Air Act.

EPA's selection of monitoring sites in case study cities

The cities we used as case studies illustrate how EPA applies its criteria to select national monitoring sites. To select NAMS, EPA reviewed monitoring data from the SLAMS network to identify areas with the highest ozone and carbon monoxide concentrations; these areas include densely populated areas. Further, an EPA official visited each SLAMS site that would potentially be selected as a NAMS and considered recommendations made by local air quality officials.

Table III.1 shows the number of ozone and carbon monoxide SLAMS and NAMS in each case study area. The area covered by the South Coast Air Basin SIP encompasses two urban areas, a number which typically would contain four ozone and four carbon monoxide NAMS. However, EPA selected an additional national monitoring site known to have high concentrations for each of the pollutants,

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according to officials responsible for selecting the NAMS locations.

Table III.1: Number of NAMS and SLAMS in Case Study Areas

	Ozone SLAMS	Carbon monoxide SLAMS	Ozone NAMS	Carbon monoxide NAMS
South Coast Air Basin (LA)	28	21	5	5
Houston	9	4	2	2
Charlotte	3	5	2	2

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MODELS USED TO DEVELOP OZONE SIPs

In preparing their SIPs, states use mathematical models to project ozone levels and predict the reductions needed to reach attainment with the ozone standard. These include models to predict mobile source inventories and the impacts of emission control measures on ozone levels. The use of models has contributed to the ozone nonattainment problem because SIPs and SIP revisions were partially based on models that did not account for certain emissions and/or tended to underpredict emission levels.

MODEL THAT PREDICTS MOBILE SOURCE INVENTORIES

EPA has developed different generations of a model called Mobile that have been used to estimate mobile source inventories of hydrocarbons, nitrogen oxides, and carbon monoxide. When preparing SIPs, states and local governments use these estimates to assist in determining control strategies. Introduced in 1977 as Mobile 1, the model was updated as Mobile 2 in 1981, Mobile 3 in 1984, and is currently being revised in a fourth generation. According to EPA officials responsible for developing Mobile, each version of the model is an improvement over its predecessors because of lessons learned in earlier versions and improvements in the accuracy of data input.

EPA has not formally evaluated any version of the Mobile model to compare the model predictions with actual emission levels. As a result, EPA cannot express the model's accuracy to within a plus or minus percentage of actual conditions. However, according to EPA officials, they have improved the model on the basis of user comments and have evaluated some parts of the Mobile model.

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MODELS THAT PREDICT IMPACTS OF EMISSION CONTROLS

EPA has allowed the use of a number of models to estimate the impact of emission controls on urban ozone concentrations. These include: 1) the Urban Airshed Model (UAM), 2) the Empirical Kinetic Modeling Approach (EKMA), and 3) the linear rollback modeling technique.

The UAM was developed for EPA by Systems Applications, Inc., in 1973 and has been subsequently modified. EPA recommends the UAM for determining pollution control requirements; they note, however, that it is expensive to use. EPA developed the EKMA in 1977 and has updated it periodically since then. Since 1978, states have used the EKMA more than any mathematical model to project ozone attainment. In the early 1970s, states used the linear rollback modeling technique, a concept that assumes that ambient concentrations of a pollutant are directly proportional to the emissions of that pollutant. In the past, EPA allowed linear rollback to be used for projecting attainment but now considers it a screening tool to identify areas that have serious air quality problems.

THE USE OF MODELS HAS CONTRIBUTED TO THE NONATTAINMENT PROBLEM

The models used in developing 1979 SIPs and 1982 SIP revisions contributed to the nonattainment problem because: (1) the models did not account for certain emissions, (2) models tended to underpredict needed emission reductions, and (3) information used in the models may not have been accurate. For example:

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-- In developing its 1979 SIP, the Charlotte area used Mobile 1, which was based on assumptions that were later changed or shown to have been inaccurate. Mobile 1 assumed that vehicles would be fueled with gasoline that had a volatility level of 9.0 psi RVP. Mobile 1 also assumed that the public would not tamper with emission control systems. However, gasoline volatility has increased steadily since the late 1970s and recent studies have shown emission control tampering to be widespread. For example, gasoline volatility has climbed from about 9.0 psi in the late 1970s to as high as 11.5 psi in 1985. Also, a 1985 survey in Charlotte found that 19 percent of inspected vehicles had at least one of their emission control components disabled or removed.

   Because these factors were not included in Mobile 1, the use of the model contributed to the understanding of the mobile source component of Charlotte's hydrocarbon inventory and may have resulted in the underestimation of needed reductions in hydrocarbons. For example, assuming an automobile has a carburetor and an emissions system that has not been tampered with, EPA estimates that daytime evaporative emissions more than doubles when gasoline volatility increases from 9.0 psi to 10.5 psi.

-- A similar situation existed in the Houston area. In its 1982 SIP revision, the Houston area used the Mobile 2 model which did not fully take into account tampering and did not include gasoline volatility increases. A 1985 survey in Houston found that 18 percent of inspected vehicles had at least one of their emission control components disabled or removed.

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-- The Los Angeles area and the Houston area used the EKMA model when preparing their 1982 SIP revisions. There is uncertainty in EKMA's capability to predict peak ozone levels. Studies conducted in 1982 by an EPA contractor showed that the accuracy of the EKMA's predictions varied, depending upon the complexity of the data and assumptions used. When more complex data and assumptions were used, the model consistently underpredicted actual peak ozone concentrations. When less complex data and assumptions were used, the model predicted peak ozone concentrations to within plus or minus 30 percent of actual levels. The study reported that the predictions based on the more simplified data may have been due to chance and that the model needed further evaluation.

-- Los Angeles also used the UAM in preparing its 1982 SIP. The UAM is more sophisticated, complex, and expensive to use than the EKMA. Although studies have shown the UAM has a tendency to underpredict peak ozone levels, EPA officials believe it is better than the EKMA for predicting attainment. The accuracy of the model varies greatly with the quality of data used as input and the experience and ability of people using it, according to an EPA study. Studies have shown that the UAM's results generally vary by plus or minus 30 percent but have varied from as much as plus 314 percent to minus 84 percent.

-- Because EPA expected the Charlotte area to reach attainment with the ozone standard before 1987, it did not require North Carolina to revise its Charlotte SIP in 1982. As a result, the area's current projections are based on its 1979 SIP, which relied upon the linear rollback modeling

technique to project emission control requirements. EPA believes this modeling technique underestimates needed emission control requirements and that its results are more uncertain than those obtained from the EKMA. EPA no longer allows the linear rollback modeling technique to be used for evaluating control strategies.

-- An important input into the modeling is the hydrocarbon-nitrogen oxide ratio for ozone formation. Generally, as the ratio increases, so does the percentage of total hydrocarbon emissions that need to be reduced to meet the standard. If inaccurate, these ratios can affect the ability of the SIP to project attainment with the standard. For example, Houston's 1982 SIP was based on a 5.8 to 1 ratio which, when considered in the EPA model, showed that a 41 percent reduction in hydrocarbon emissions would be needed for Houston to attain the .12 ppm standard. However, 1985 data for Houston indicated that the ozone formation ratio was higher, 12.9 to 1. An EPA official estimated that with this ratio, hydrocarbon emissions would need to be reduced 71 percent for Houston to be in attainment. According to EPA officials, the reason that the actual ratio was so different from the projected ratio was that measuring equipment and procedures had improved.

MODEL USE BEYOND 1987

As discussed above, EPA is developing a fourth generation Mobile model that officials expect to be an improvement over its predecessors. Also, EPA no longer allows states to use the linear rollback technique to evaluate control strategies. It is also planning to further evaluate and improve the EKMA and the UAM.

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If EPA requires another round of SIP revisions after 1987, many areas may find that by using the more accurate and current models and more current data in those models, their hydrocarbon inventories may be greater than previously projected and their need for control may be greater. Whatever the case, the updated models should give a more accurate projection of hydrocarbon inventories and the reductions needed to reach attainment with the ozone standard.

ATTACHMENT V

GAO OFFICE OF GENERAL COUNSEL OPINION ON REQUIREMENT FOR STAGE II CONTROLS

As the Chairman requested, our Office of General Counsel is reviewing a draft brief by the Multinational Business Service, Inc., which concludes that under Section 172(b) of the Clean Air Act, EPA must require that SIPs for ozone nonattainment areas provide for Stage II vapor recovery controls. We expect to have an opinion on this issue shortly.