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ENERGY RESOURCES COUNCIL MEMORANDUM

Congress should amend the Clean Air Act by extending the current automobile emission standards from 1977 until 1981.

While this action will have no significant impact on our attempt to achieve the objectives of the Clean Air Act, the proposed modifications are necessary to (1) avoid certain recently recognized potential health risks associated with the catalytic converter and (2) permit substantially greater fuel efficiencies over the next five years. All of the enforcement, certification and inspection measures contained in the Clean Air Act will be retained.

Background

This proposal supersedes Section 503, Title V, of the President's Energy Independence Act of 1975 which he sent to Congress on January 30, 1975. At that time, the President proposed emission standards based on a modification of the current California standards.

After submitting the Energy Independence Act to the Congress, the Environmental Protection Agency held public hearings on the manufacturers' requests for a suspension of the 1977 auto emission standards and also took testimony related to five-year emission levels. The hearings established that the catalytic converter, used to meet the HC and CO standards for 1975 and 1976 model year vehicles, produces sulfuric acid in amounts that can pose a significant public health risk.

In addition, because of the technology likely to be used to achieve these tighter standards, automobile emissions of sulfuric acid may double if the more stringent HC and CO standards proposed in the Energy Independence Act are imposed for 1977 and subsequent years.

Accordingly, the President directed an interagency task force to undertake a major review of the public health, energy and consumer cost implications of several widely discussed levels of automobile emission standards.

The President's decision is based upon this review. Some of the more significant considerations which led to the President's recommendation are contained in his statement released today.

Additional information on those considerations is outlined below.

The Interagency Review

The review by Executive Branch agencies considered the implications of a range of alternative automobile emission requirements which might be applied to 1977 through 1981 model automobiles. Specifically, the following standards, applicable to hydrocarbons (HC), carbon monoxide (CO) and oxides of nitrogen (NOX) emissions have been considered:

	Emissions in grams per mile		
	HC	CO	NOX
Retain statutory standards which will apply to 1978 models	0.41	3.4	0.4
Energy Independence Act proposal covering 1977-81 models	0.9	9.0	3.1
EPA's March 5 conclusions			
- for 1977-79 models	1.5	15.0	2.0
- for 1980-81 models	.9	9.0	2.0
Continue standards applicable to 1975-76 models for 1977-81	1.5	15.0	3.1
Adopt Canadian 1975-76 standards for 1977-81 models	2.0	25.0	3.1
Reimpose standards applicable to 1973-74 models for 1977-81	3.0	28.0	3.1

Based upon this review, the following conclusions were reached:

1. Controls on automobiles necessary to meet the current standards have reduced ambient concentration levels in those areas that have auto-related HC and CO problems; and have reduced the rate at which NOX concentrations have increased.

2. Through the year 1985, tighter or looser standards for HC, CO and NOX, in the range being considered, will make little difference in the air quality in those areas that have an auto-related pollution problem, although many parts of the country have no auto-related pollution problem.

3. Present data are not sufficient to make specific calculations or final judgments on what sulfuric acid emission levels would be safe from a public health perspective. However, it is believed that sulfuric acid emissions could prove to be a significant public health risk and that emissions could increase substantially if standards more stringent than the 1975 interim standards are adopted.

4. Further mandated reductions in emissions from internal combustion engines may have the effect of increasing or creating pollutants other than CO, HC and NOX.

5. Auto emission standards have had an impact on fuel economy and, therefore, on our nation's total petroleum demands and reliance on foreign sources. Standards tighter than the 1975 interim will result in higher initial car costs and higher operating costs.

6. The basic philosophy and approach to future auto emission controls need to be reconsidered in light of current conditions.

   (a) Significantly tighter standards at this time may preclude continued development of some promising fuel efficient and low emission technologies.

   (b) Actions to reduce auto emissions must take into account other sources of the same pollutant.

7. Prompt Congressional action is needed on auto emission standards in order to establish a five-year emission program which is compatible with a strict fuel efficiency program.

DISCUSSION

1. Controls on automobiles necessary to meet the current standards have reduced ambient concentration levels in those areas that have auto-related HC and CO problems; and have reduced the rate at which NOX concentrations have increased.

2. Many populated areas of the country have no auto-related pollution problem. Through the year 1985, tighter or looser standards for HC, CO and NOX in the range being considered, will make little difference in the air quality in those areas that have an auto-related pollution problem.

The Clean Air Act has imposed increasingly more stringent automobile emission limitations. 1973-74 vehicles produce about 65 percent less HC and CO than uncontrolled (pre-1968) vehicles. 1975 vehicles, meeting the current standards, produce 83 percent less HC and CO and 11 percent less NOX than uncontrolled vehicles. The existing law, however, requires that these automobile emissions be reduced even further beginning with model year 1977 for NOX and model year 1978 for HC and CO.

The attached tables show the direction and magnitude of change in ambient concentration levels for HC, CO and NOX which would result from adopting standards which are less (or more) stringent than those proposed in the Energy Independence Act. The ambient standards are used as criteria because they are the health-related pollutant limits in each air quality region, toward which reductions in both automobile and stationary emissions contribute. Thus the levels shown are the result of mobile and stationary source emissions. Three points should be noted:

- First, though the tables assume that the statutory standards will be in force after the 1981 model year, if any of the options were kept through model year 1990, the concentration levels for each region would change very little and the conclusions reached remain basically the same.

- Second, because the concentration levels are projected through modeling techniques marginal changes in the concentration levels, whether increases or decreases, are often within the range of statistical error.

- Third, the estimates of total auto pollution emitted are based on historical growth rates for vehicles miles traveled and auto fuel economy. No compensation has been made for the higher cost of gasoline which already affected total pollutants through reductions in vehicle miles traveled.

Hydrocarbons

Out of the thirty regions considered to have an HC problem, twenty are projected to exceed the ambient standard in 1985, regardless of the automobile emission level chosen. More importantly, all of the regions projected to have concentration levels below the ambient standard in 1985 at the statutory vehicle limitation level are also projected to be below the ambient standard if any of the other less stringent automobile emission standards shown is chosen instead.

Only 25 percent of total hydrocarbon emissions are generated by automobile exhaust. Therefore, hydrocarbon ambient air concentrations tend to be much less sensitive than carbon monoxide to the level of vehicle emission control.

Attachment 1 shows the limited differential impact that vehicle hydrocarbon limitations more stringent than the 1975 (Interim) standard would have on ambient air quality by 1985 in those areas considered to have a hydrocarbon problem. The measure of air quality is photochemical oxidants to which hydrocarbons are converted and in which form HC most adversely affects air quality.

Carbon Monoxide

Carbon monoxide levels in the atmosphere are much more sensitive to changes in automobile emission controls than either HC or NOX. Unlike those pollutants, the growth of stationary sources over the next ten years will have little effect on CO air quality.

Attachment 2 shows 1985 projected concentration levels for twenty-six problem regions for each of the alternatives presented. The most important conclusion is that air quality is improving rapidly and will continue to improve until 1985 under all of the emission control options presented. This is because older uncontrolled cars are being replaced by newer controlled cars. The regions with asterisks are those which would still exceed the ambient standard if an automobile CO standard were adopted that was less stringent than either the statutory standard or the one proposed in the Energy Independence Act.

First, there is only a limited difference in ambient concentration levels for all of the standards presented, but the difference is particularly small when comparing the statutory standard (3.4 grams/mile) with either the Energy Independence Act proposal (9.0 grams/mile), EPA's recommended standard (15 grams/mile until 1979 and 9.0 grams/mile from 1979 to 1981), or the current standard (15 grams/mile) extended until 1981. By 1985, the average ambient levels for this pollutant will have been reduced about 70 percent below 1970 levels regardless of which option is chosen.

Second, the choice of option will not significantly affect any single area's ability to achieve or maintain the ambient standard by 1985. When comparing all the alternatives (except the 1974 or Canadian Standards), those areas below the ambient standard in 1985 will be below it regardless of the automobile emission standard chosen, with the sole exception of Denver. The adoption of the Canadian Standard would mean that only two additional areas (Portland, Oregon and Puget Sound) would still be above the ambient standard in 1985 by a marginal amount.

Nitrogen Oxides

Federal government and independent scientists predict that a steady increase in ambient nitrogen dioxide concentrations will occur in metropolitan areas over the next ten years regardless of the auto emission limit chosen. This is because stationary sources emit most NOX pollution and the technology for controlling stationary sources is very limited. Attachment 3 (b) shows the average percentage increases in NO2 ambient concentration levels that will occur for each of the auto emission alternatives studied (3.1, 2.0 and 0.4 grams/mile) under varying assumptions about the auto standard after 1981.

When comparing the 2.0 and 3.1 auto emission alternatives, Attachment 3 (B) shows that as long as the 2.0 NOX standard were implemented after 1981, no significant difference in the predicted increases of NO2 concentration levels would occur in either 1980 or 1985, as a result of maintaining the 3.1 grams/mile standard through the 1981 model year (columns 2 and 3).

Though the statutory standard would have a significant effect on the overall predicted increase, the differential effect of a more stringent automobile standard than currently in force on the ambient concentration levels in those areas with nitrogen dioxide problems is much less pronounced. This is shown in Attachment 3 (a), which displays ambient projected concentration levels in the ten problem areas for 1985 under various automobile emission standards.

With the exception of San Francisco, by 1985 all ten regions are predicted to have concentration levels above the ambient standard if either the 3.1 or 2.0 grams per mile limitation is placed on automobiles through the year 1980 (columns 1 and 3). San Francisco would remain below the standard if the more stringent emission limitation is adopted and, in fact, California has the more stringent limitation in force as a State regulation.

It should also be noted that regardless of whether the 3.1 or the 2.0 limitation is imposed through 1981, and even if the statutory standard (.4) is imposed after 1981, only one additional region (Phoenix) would be brought into compliance with the ambient standard (columns 4 and 5). In fact, implementing the statutory standard in 1978 would result in only two additional areas (Phoenix and Baltimore) meeting the standard (column 6).

It is, therefore, clear that the projected increases in nitrogen dioxide cannot be stopped without major technological innovations in stationary source control. Therefore, regardless of how stringent the automobile standard, the future concentration levels in major metropolitan areas will primarily be a function of stationary source emissions.

3. With present data experts generally agree that standards which are tighter or looser than those currently in force would have minimal differential health impacts -- especially for HC and CO. However, present data are not sufficient to make specific calculations or final judgments on what sulfuric acid emission levels would be safe from a public health perspective. It is only known that sulfuric acid emissions could prove to be a significant public health risk and that emissions would increase if standards more stringent than the 1975 interim standards are adopted.

4. Further mandated reductions in emissions from internal combustion engines may have the effect of increasing existing pollutants or creating other pollutants.

Health Impacts:

Based upon existing air quality data, there are no measurable health risks associated with the application of HC and CO emission standards (within the range of options presented) which are less stringent than those in the Energy Independence Act or the statutory standards.

The application of the 3.1 NOX level will not greatly increase health risks nationwide. With an ambient air quality standard of 100 ug/m3 health data suggests that the level at which people would have an increased risk for excess respiratory disease is 200 ug/m3. Los Angeles is the only area which is expected to approach the 200 ug/m3 level by 1985, and California has the lower 2.0 grams/mile level in effect as a State regulation.

Sulfuric Acid:

Though ambient carbon monoxide and hydrocarbon concentration levels are not significantly affected by the range of automobile emission standards presented, the concentrations of sulfuric acid are affected.

Gasoline contains sulfur which, after combustion, is released as sulfur dioxide. In the process of removing other pollutants the catalytic converter changes some of the sulfur dioxide into sulfuric acid mist.

Current estimates indicate that with existing automobile emission technology, emission standards for hydrocarbons and carbon monoxide of .9 and 9.0, will require the use of air-injected oxidation catalysts. This catalyst results in a substantial increase of sulfuric acid emissions. Though there are several catalytic and non-catalytic technologies which can potentially meet the stricter HC, CO and NOX emission limitation without significant sulfuric acid emissions, there is little production potential for using these systems in the near term. (See discussion below).

While all scientists agree that sulfuric acid is a toxic and potentially dangerous pollutant, there is still disagreement on the quantities of emissions needed to pose a health risk and on how long it would take for the buildup in concentration levels to occur.

Major studies by government and industry have already begun in order to resolve some of these uncertainties. Much of the unknown about sulfuric acid results from our current inability to precisely measure how much sulfuric acid is being emitted by vehicles and our inability to precisely measure how much emitted sulfuric acid is being concentrated in the breathing zone.

To improve vehicle measurements, EPA is developing a new test driving cycle which will more accurately reflect emission of sulfuric acid and is jointly working with private industries on the relationship of catalysts and other control options to sulfuric acid. To improve our knowledge of the disposition of sulfuric acid once emitted into the air, EPA has instituted a long run trend study on one major highway and has jointed with State government agencies to measure roadside concentrations on other highways as well. EPA is also working with the State agencies to determine the change in sulfuric acid emissions as catalyst equipped vehicles age and accumulate mileage.

Until these and other studies are completed no final judgments on the potential health impacts of sulfuric acid emissions can be made. However, recent information presented in EPA's "Estimated Public Health Impact as a Result of Equipping Light Duty Motor Vehicles With Oxidation Catalysts" (January 30, 1975) suggested the following estimates of the years in which sulfuric acid emission levels from automobiles could pose a serious threat to public health.

Standard	Model Year 1/ in which Sulfuric Acid could pose a serious health problem: Average Meteorological Conditions	Adverse Meteorological Conditions 2/
1975 Interim Standards	1981	1979
1975 California Standards		
In 49 States	1979	1977
In California 3/	1978	1977

1/ The data assumes that there are no emissions of sulfates from stationary sources, and that 70 percent and 90 percent of the fleet in 1975 and 1976 respectively will utilize catalysts.

2/ Adverse meteorological conditions would occur in large metropolitan areas on an average of 6-7 days a year.

3/ The dates for reaching a critical problem are earlier in California than the remaining 49 States because California utilizes higher sulfur gasoline.

In interpreting the preceding table the following factors should be noted. Data available to date do not take into account "background" emissions of sulfates from stationary sources, e.g., coal-fired generating plants. Therefore, the table represents only the potential health effects of emissions from mobile sources. The extent to which sulfate emissions from stationary sources add to the potential health risk associated with sulfuric acid emissions from automobiles is not known at this time. However, most health analyses treat stationary source and mobile source emissions of sulfates independently. This is primarily because (1) the particle size of sulfates from stationary sources is much larger than sulfuric acid mist and is not absorbed as deeply into the respiratory system; (2) the toxicity of sulfate emissions from stationary sources is generally much less than sulfuric acid; and (3) emissions from stationary sources do not occur in the breathing zone as do automobile emissions.

Under certain adverse meteorological conditions localized sulfuric acid problems could occur. There are two short-term actions available to offset this possibility. While feasible, both have drawbacks.

- Gasoline blending - catalysts equipped vehicles could be provided with lead-free low-sulfur fuel. This would reduce emissions of sulfuric acid, but would impose an allocation problem on the industry. Refiners have also indicated that sufficient quantities would not be available to meet widespread problems beyond 1977 or 1978.

- Desulfurization of oil - technically possible at this time. Desulfurization would require substantial additional capital investment, at a time when refiners are attempting to expand domestic capacity. It would also require an increase in crude oil consumption due to additional refining. Increases in the price of gasoline would occur. Nationwide, the capital cost of desulfurization would range between $2 and $4 billion, crude oil consumption would increase .5 percent and the price of gasoline would increase by 1 to 2 cents per gallon.

<u>Actions That May Increase or Create Pollutants</u>:

It is generally agreed that reducing NOX emissions will result in an increase in the emissions of HC from engines. To reduce that increment manufacturers may increase the use of the air-injected oxidation catalyst -- even to meet the Federal Interim HC and CO standards. If this were the case, then nearly twice as much sulfuric acid would be generated as projected. At this time it is not known definitely whether manufacturers could achieve reductions of the HC increment through the use of engine modifications or modified catalyst equipment instead of the air-injected catalysts in 1977-78. However, if the HC and CO standards are also lowered after model year 1978 there is a high probability that the air-injection catalyst would be retained throughout the entire period.

There are other anecdotal problems with the converters such as potential fire hazards, hydrogen sulfide emissions and the creation of other potentially hazardous compounds, but none of these has been proven a significant risk.

Mandated reductions in the automobile emission standard will also narrow the choice of technological options to abate the three regulated pollutants. For example, if a sulfuric acid standard were set for model year 1979, implementation of the statutory standards for HC, CO and NOX in 1978 would, in essence, dictate the use of either "dual" or "three-way" catalyst technologies on most vehicles. While these catalysts have promise as abatement technologies they are still in the early stages of development and their premature implementation could possibily have adverse health effects far in excess of the benefits of reducing HC, CO and NOX.

Based on existing data, the dual catalyst system appears to be the most promising technology for meeting the statutory emission standards. However, its ability to limit sulfuric acid emissions to low concentrations, and thus meet a sulfuric acid standard, is still in question since an integral component of the dual catalyst system is an oxidation catalyst like those currently in use for 1975 model vehicles. Sulfuric acid emissions would increase if, to meet the statutory HC and CO standards, an air-injected oxidation catalyst were used.

If the statutory standards are in effect in 1978, along with a sulfuric acid standard in 1979, then it appears that the most likely technology to be used is the three-way catalyst -- a single device that simultaneously abates HC, CO and NOX.

However, to achieve these simultaneous reductions, extensive redesign and control of the fuel induction system must be undertaken because the three-way catalyst must be operated at stoichiometric (no excess air) conditions. In fact, the permitted margin of error is so narrow (on the order of ± 0.50 percent of the exact air to fuel ratio needed, as compared to normal production variations of ± 7 to 10 percent) that the use of an oxygen sensor and a feedback system are required to regulate the air mixture for either a carburetor or fuel-injection process.

When operating at the stoichiometric conditions, sulfate emissions would be no greater than emissions from non-catalyst cars. However, if variations from that condition occur, severe adverse health effect may be generated. Three-way catalysts applied to exhausts from engines operated outside the carburetion design limits (variations greater than ± 0.50 percent from stoichiometric) have a potential for emitting dangerous quantities of such toxic pollutants as hydrogen sulfide, carbonly disulfide, carbon disulfide and hydrogen cyanide.

It should be emphasized that only the most preliminary data exists on the total emissions from three-way catalysts and no firm judgment can be made on whether or not such emissions will occur in normal use, or in what quantities they will occur. However, they must be treated as potential risks until there is firm evidence that demonstrates otherwise. The development of this technology has not progressed to the stage where firm conclusions on their long run health impacts are possible.

The long run durability of this technology is also unproven at this time and several more years of testing and development seem needed before full scale introduction of three-way catalysts should be undertaken regardless of the emission standard mandated. Furthermore, the required changes in the fuel induction system would most likely require the use of electronic fuel injection, which is now available from component manufacturers only in very limited quantities. These manufacturers testified at the EPA suspension hearings that, after a decision had been made to use electronic fuel injection systems on a widespread basis, from 3 to 5 years would be required to design, manufacture, and deliver these components.

It seems clear, that given the limited health benefits derived from instituting the statutory standards (see #2 above) and given the unknown but potentially adverse health effects of introducing a technology which has not been thoroughly tested, the wiser choice is to avoid forcing either of these catalyst technologies into mass production at this time.

5. <u>Auto emission standards have had an impact on fuel economy and, therefore, on our Nation's total petroleum demands and reliance on foreign sources.</u>

The options presented will have differential fuel economy impacts.

<u>Impact on 40 percent fuel economy goal</u>

Alternatives	% over 1974	Shortfall (-) or excess (+) over President's goal
Statutory Standards after 1977	14-30%	-10 to -26%
Energy Independence Act	40%	--
EPA Recommendation	36%	- 4%
1975 Standards thru 1981	46%	+ 6%
Canadian & 1974 Standards thru 1981	46%	+ 6%

Alternatives*	Barrels per day (in 1980)
Statutory Standards after 1977	224,000 - 411,000 (loss)
Energy Independence Act	85,000 (loss)
EPA Recommendation	137,000 (loss)
1975 Standards thru 1981	0
Canadian and 1974 Standards thru 1981	0

* Base is 1975 model year automobiles meeting 1975 interim emission standards.

<u>Energy Implications for lowering NOX to 2.0 grams/mile</u>

It is generally agreed that a reduction in the NOX emission levels from 3.1 to 2.0 grams/mile will require engine modifications. It is estimated that these modifications will result in a fuel economy penalty of 3-4 percent on the average in 1980. If a 3 percent fuel penalty is assumed, an additional requirement of 85,000 barrels of oil per day will occur nationwide in 1980.

This estimated fuel penalty figure is the subject of debate, however, on two grounds. First, it has been argued that fuel penalties in 1980 assume that certain advanced engine technologies will be introduced over the next five years. However, these advanced technologies would not be available in the first two years. Therefore, at the year of introduction, initial fuel penalty resulting from lower NOX emission standards would be substantially greater. A range of between 5 and 7 percent, i.e., from 120,000 to 150,000 barrels per day is estimated, if the 2.0 grams/mile standard were adopted.

The second argument revolves around the very sensitive relationship that exists between fuel economy and NOX emissions at more stringent NOX standards than currently required. For a given level of HC emissions a dramatic drop in fuel economy is required to meet a NOX standard below 2.0 grams/mile. Because of mass production variations, to ensure that emission standards are met, manufacturers must design their emission systems well below the Federal standards -- about 23 percent lower. Thus, to meet a 3.1 gram/mile limitation, vehicles are designed to achieve 2.4 grams/mile and to achieve a 2.0 level, vehicles are designed to emit not more than 1.3 to 1.5 grams/mile. (To meet the statutory .4 grams/mile vehicles would have to be designed to meet about .3 grams/mile). Thus, designing vehicles to meet even the 2.0 standard places the fuel economy loss well within the sensitive range at which fuel economy begins to drop most rapidly. Attachment 4 (a) illustrates the general relationship between fuel economy and NOX emissions for all spark ignition engines while 4 (b) shows the situation for a specific class of V-8 engines.

Energy Implications of HC and CO Standards Tighter Than Those Currently In Force

Assuming a 3.1 gram/mile NOX standard, a fuel economy penalty of 3 to 5 percent is associated with emission standards for hydrocarbons and carbon monoxide of .9 and 9.0 grams/mile when compared to extending the current standards of 1.5 and 15 (i.e., 85,000 barrels of oil per day in 1980). Retention of the 1.5 (CO) and 15 (HC) levels until 1979 would avoid most of the penalty. Retention of the current standards through 1981 would allow continued fuel economy improvements as would the adoption of the Canadian standards.

Energy Implications of the Statutory Standards for HC, CO and NOX

With either the dual or three-way catalyst, a single device is used to abate all three regulated pollutants. Thus, at the statutory standards the energy impacts are not measured separately for NOX and HC/CO. On the average, the adoption of the statutory standard in 1978 would result in a fuel penalty of 7 to 17 percent by 1980 over 1975 vehicles. This would mean an energy loss of 224,000 to 411,000 barrels of oil per day in 1980.

Attachment 5 shows the specific fuel economy losses (or gains) associated with each of the options presented (and the anticipated costs) with respect to model year 1974.

Standards Tighter Than the 1975 Interim Will Result in Higher Initial Car Costs and Higher Operating Cost Due to Associated Fuel Penalties

The options presented will impose varying cost burdens on the consumer. Also, separate costs are associated with actions on NOX and actions on HC and CO, except for meeting the statutory standards with a dual or three-way catalyst system.

NOX:

Consumers will face sticker price and operating cost increases over the 1975 model vehicles if a 2.0 gram/mile limitation is imposed. Estimates range from $10-25 for front-end costs per vehicle and from $0-25 in operating costs over 50,000 miles. In addition, the consumers will pay the costs of increased fuel consumption associated with this lower standard, which rough estimates place at $1.7 million per day, or over 600 million dollars per year.

HC and CO:

The costs of adopting the more stringent hydrocarbon and carbon monoxide standards (.9 and 9.0) as proposed in the Energy Independence Act is estimated to be $50 per vehicle over 1975 automobiles. This would represent the additional costs of using the air-injected oxidation catalyst. Additional operating costs, which would result from the increased consumption of gasoline, are estimated at $1.7 million per day, or over 600 million dollars per year.

Statutory HC, CO and NOX:

Adoption of the statutory standards would result in a sticker price increase of $230 to $270 per vehicle over 1975 model cars. This would represent the average costs of using a mix of the dual and three-way catalyst systems. Operating costs resulting from the associated fuel penalties of this alternative would roughly be $4 million per day or over $1.5 billion per year.

6. The basic philosophy and approach to future auto emission controls needs to be reconsidered in light of current conditions

While the choice of emission standards must represent a balance among public health, air quality, esthetic, energy and cost considerations, the problems currently confronting the Nation are different from those prevailing in 1970 when the Clean Air Act was passed. Inflation, unemployment, and the added cost and reduced availability of energy call for reassessment of the relative weights accorded to various factors other than measures necessary to health. The high cost and fuel penalties caused by further tightening of the standards; and the emergence of the sulfuric acid problem, compared to the marginal improvement in HC, CO and NOX air quality also call for careful reconsideration.

(a) Significantly tighter standards at this time may preclude continued development of some technologies

There is substantial evidence that by model year 1981 new "lean-burn" or stratified charge" engines would permit meeting the lower (2.0) NOX standard. However, NOX standards more stringent than 2.0 would preclude introduction of those technologies. In fact, unless application of the current statutory NOX standard (.4 grams/mile) is delayed through at least 1990, the industry will not (and cannot) shift to a lean-burn or stratified charge engine, as far as can be foreseen.

(b) Actions to reduce auto emissions must take into account other sources of the same pollutant

Only 25 percent of total HC emissions are generated by automobile exhaust. Therefore, HC ambient air concentrations tend to be much less sensitive to the level of vehicle emission control than is carbon monoxide.

The projected increases in NOX cannot be stopped without major technological innovations in stationary source control. Therefore, regardless of how stringent an automobile standard is applied, the future concentration levels in major metropolitan areas will primarily be a function of stationary source emissions.

CO levels in the atmosphere are much more sensitive to changes in automobile emission controls than either HC or NOX. Unlike those pollutants, the growth of stationary sources over the next ten years all have little effect on CO air quality.

7. Prompt Congressional action is needed on auto emission standards

In order to meet deadlines for emission testing and certification of 1977 model cars, the automobile industry will need to know 1977 emission standards by early August 1975 so that there will be time to complete designing and engineering, build prototypes, complete emissions testing such as 50,000 mile endurance tests, and finally to produce new cars in adequate quantity to meet the demand from the American public.

Predicted Ambient Oxidant Concentration Levels in 1985
(In parts per million)
Ambient Standard = .08 ppm*

	HC Automobile Emission Standard					
Region	1974 and Canadian Standards through 1981	Current Stds through 1981	EPA's Recom-mended Stds	Energy Independ-ence Act Proposal	Statutory Stds 1977-1990	Base 1971-73
Birmingham	.12	.12	.11	.11	.11	.22
Mobile-Pensacola	.04	.04	.04	.04	.04	.11
Clark-Mohave	.13	.12	.12	.12	.12	.22
Phoenix-Tucson	.16	.16	.16	.16	.16	.19
Los Angeles	.43	.42	.42	.41	.41	.62
Sacramento Valley	.21	.20	.20	.20	.20	.24
San Diego	.20	.20	.20	.19	.19	.30
San Francisco	.23	.23	.23	.23	.23	.30
San Joaquin	.22	.21	.21	.21	.21	.26
S.E. Desert	.32	.32	.32	.32	.32	.28
Denver	.17	.16	.16	.16	.16	.28
NY-NJ-Conn.	.14	.13	.13	.13	.13	.26
Philadelphia	.10	.10	.10	.10	.10	.20
National Capital	.26	.26	.25	.25	.25	.38
Cincinnati	.12	.11	.11	.11	.11	.17
Indianapolis	.08	.08	.08	.08	.08	.14
S. Lou.-S.E. Texas	.20	.20	.19	.19	.19	.32
Boston	.11	.10	.10	.10	.10	.21
Toledo	.07	.07	.07	.07	.07	.14
El Paso-Las Cruces	.06	.06	.05	.05	.05	.13
Genessee-Finger Lakes	.08	.08	.08	.08	.07	.15
Dayton	.13	.12	.12	.12	.12	.18
Portland, Oregon	.08	.08	.08	.08	.08	.14
S.W. Penn.	.12	.12	.11	.11	.11	.21
Austin-Waco	.07	.07	.07	.07	.07	.16
Corpus-Christi	.14	.14	.14	.14	.14	.19
Dallas-Ft. Worth	.05	.05	.05	.05	.04	.13
Houston-Galveston	.27	.27	.27	.27	.26	.32
San Antonio	.07	.07	.07	.07	.06	.15
Puget Sound	.08	.08	.08	.08	.08	.16

* The projected concentration levels assume the continuance of historic growth rates in the central business districts in each region.

The effect of a higher, areawide or "metropolitan growth rate" on oxidant concentrations was also considered. The metro-growth rate assumes a much higher rate of growth in vehicle miles traveled and includes entire metropolitan areas rather than central business districts alone. However, predicted ambient concentration levels for oxidants using the higher growth rate are only marginally higher than predicted concentration levels using the CBD growth rate for all the HC auto-emission alternatives studied. More importantly, only three areas (Indianapolis, Genesse-Finger Lake and San Antonio) which would achieve the standard using the CBD growth rate, would exceed the standard by a very marginal amount if the higher metro-growth rate were assumed.

Therefore, assumption of the higher growth rate would not change the above analysis or conclusions about the impact of HC auto standards on photochemical oxidant concentration levels.

Predicted Ambient Carbon Monoxide Concentration Levels in 1985
(In parts per million)
Ambient standard = 9 ppm

	CO Automobile Emission Standard					
Region	1974 and Canadian Standards through 1981	Current Stds through 1981	EPA's Recommended Stds	Energy Independence Act Proposal	Statutory Stds 1977-1990	Base 1971-73
Birmingham	6	5	5	5	4	18
North Alaska	11	11	11	11	11	35
Clark-Mohave	6	6	5	5	5	15
Phoenix-Tucson	16	14	14	13	12	42
Los Angeles	13	12	11	11	10	41
Sacramento Valley	7	6	6	6	5	22
San Diego	5	5	5	5	4	15
San Francisco	6	6	6	6	6	18
San Joaquin	4	3	3	3	3	13
Denver*	11	11	9	9	8	33
Hartford-New Haven	9	9	7	7	7	27
NY-NJ-Conn.	15	13	13	13	11	51
Philadelphia	9	8	8	8	8	32
National Capital	7	6	6	6	6	20
E. Washington-N. Idaho	7	7	6	6	6	18
Chicago	7	6	6	5	5	23
Indianapolis	5	4	4	4	4	15
Kansas City	6	5	5	5	4	15
Baltimore	7	7	7	7	6	18
Boston	6	5	5	5	4	18
Minneapolis-St. Paul	9	8	8	7	7	22
Central New York	5	4	4	4	4	15
Portland, Oregon**	10	8	8	8	7	26
S.W. Penn.	7	6	6	6	5	22
Wasatch Front	15	13	13	13	11	41
Puget Sound**	10	8	8	8	7	24

*Would not meet the ambient standard in 1985 if the Current Interim, 1974 or Canadian CO standard for vehicles were adopted through 1981

**Would meet the ambient standard under all options except the 1974 or Canadian vehicle CO standard

Nitrogen Dioxide

Chart A displays ambient concentration levels in 1985 for NO2 in the ten problem regions under various NOX auto-emission standards. For example, column 1 shows that if a 3.0 gr/mile auto-NOX standard were in force from 1977 to 1990, Philadelphia's ambient NO2 concentration levels in 1985 are predicted to be 121 ug/m^3. Column 5 shows that if an NOX standard of 2.0 gr/mile were adopted for the 1977-1981 period, followed by the statutory (.4) standard until 1990, then Philadelphia's ambient NO2 level in 1985 is predicted to be 113 ug/m^3.

Chart B shows the average percentage increases in NO2 concentration levels for all ten regions for each alternative NOX level. For example, column 2 shows that if the NOX emission level were 3.1 gr/mile from 1977-1981 and 2.0 gr/mile from 1982-1990, the NO2 concentration levels are predicted to increase by 16% in 1980 and by 26% in 1985. Column 3 shows that if the NOX standard were 2.0 from 1977 to 1990, NO2 levels are predicted to increase by 12% and 22% in 1980 and 1985 respectively.

A. Predicted Ambient Nitrogen Dioxide Concentrations in 1985
(In micrograms per cubic meter)
Ambient standard is 100 micrograms per cubic meter*

		(NOX Emission Standard (in grams per mile)					
Effective Date of Standard		(1)	(2)	(3)	(4)	(5)	(6)
1977-1981		3.1	3.1	2.0	3.1	2.0	0.4(1978)
1982-1990		3.1	2.0	2.0	.4	.4	0.4
Region							
Phoenix		111	105	100	98	93	87
Los Angeles		194	183	173	167	157	145
San Francisco		102	96	92	89	83	77
Denver		135	129	125	123	117	112
NY-NJ-Conn.		144	139	136	132	129	124
Philadelphia		121	119	117	115	113	109
National Capital		116	111	107	105	101	96
Chicago		152	148	145	143	139	134
Baltimore		116	112	109	107	103	99
Wasatch Front		137	131	124	121	115	108
B. Increases in Concentration Levels in 1980 and 1985							
Average percent increase in air quality concentrations	1980	16	16	12	16	12	6
	1985	32	26	22	19	14	8

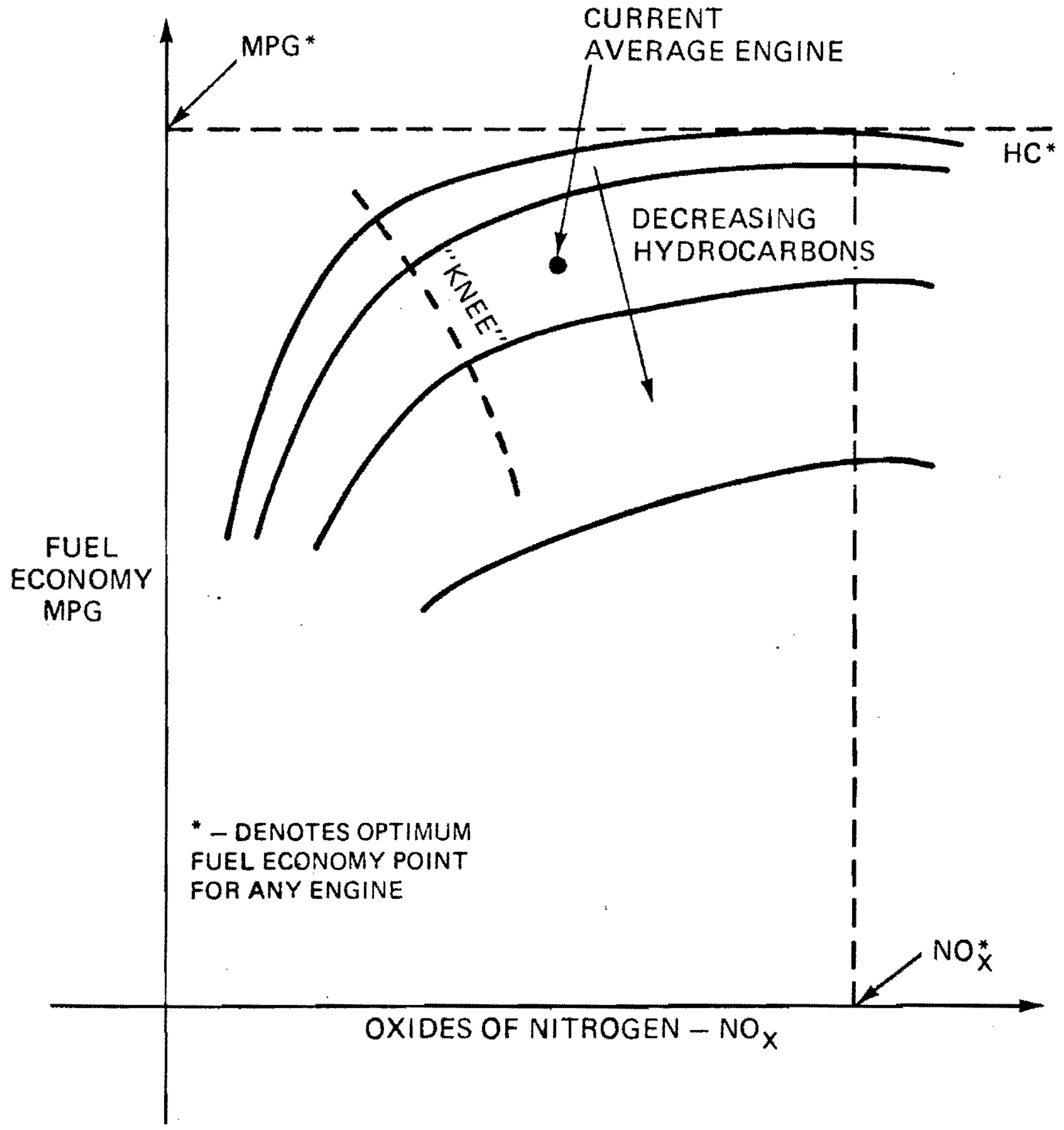
*The projected concentration levels assume the continuance of historic growth rates for the central business districts in each region. The effect of a higher, areawide or "metropolitan growth rate" on NO2 concentrations was also considered. The metro-growth rate assumes a much higher rate of growth in vehicle miles traveled (VMT) and includes entire metropolitan areas rather than central business districts alone. Ambient levels of NO2, using the metro-growth rate were considerably higher under all the auto-emission alternatives presented. When comparing 1985 percentage increases (Chart B) using a metro-growth rate as opposed to the CBD growth rate, average NO2 concentration levels are predicted to increase by 46% as compared to 33% for a long term 3.1 gr/mile NOX standard (Column 1); 33% as compared to 22% for a long term 2.0 gr/mile NOX standard (Column 3) and 16% as compared to 8% for the statutory standard (Column 6).

The higher predicted NO2 concentration levels that result from assuming the metro-growth

Nitrogen Dioxide cont'd.

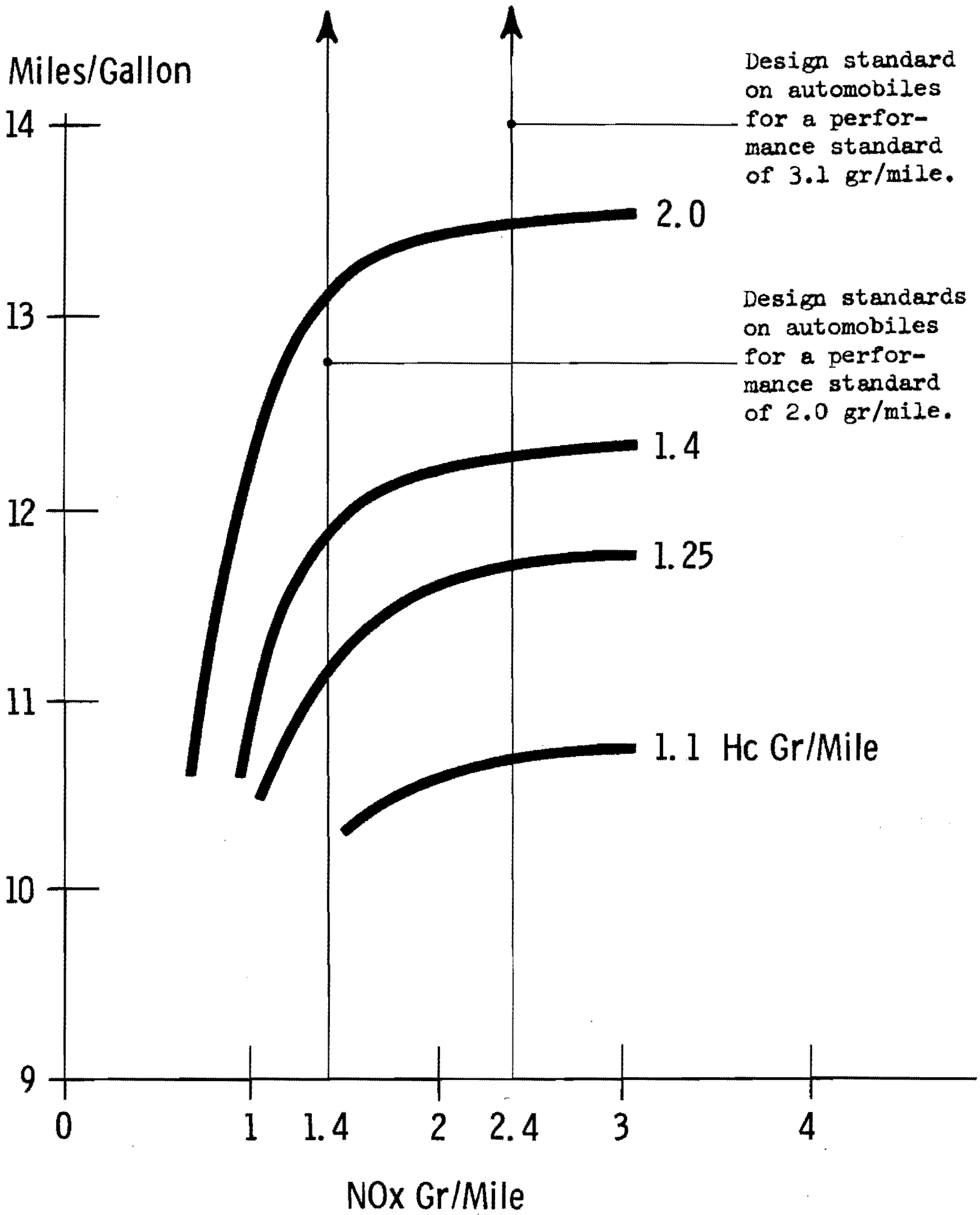
rate strongly suggest that the choice of NOX emission standard for automobiles would have even less impact on the ability of communities to maintain the ambient standard than is the case above, using the CBD growth rate. In fact, if the higher growth rate is assumed, all ten regions are predicted to exceed the ambient NO2 standard by 1985 regardless of the auto emission limit chosen for NOX. The only exception would be San Francisco, which would stay below the standard if the statutory auto standard for NOX were implemented in 1978.

MAXIMUM FUEL ECONOMY POTENTIAL VERSUS EMISSIONS FOR 1980 ENGINES UNDER OPTIMAL CONTROL



NOTE:
1. CURVE SHAPES ARE REPRESENTATIVE OF MOST ALL SPARK IGNITION ENGINES.
2. STATUTORY NO_X STANDARD IS BELOW THE "KNEE" FOR ALL ENGINES CAPABLE OF LARGE SCALE PRODUCTION THROUGH THE MID 1980's'
3. THE OPTIMUM-MPG* AND RESULTING NO_X^* AND HC* ARE SIGNIFICANTLY GREATER THAN THE ENGINE OUT PERFORMANCE OF 1975 CARS.

FUEL-ECONOMY-NOX EMISSION TRADE OFF



1980 New Car Fuel Economy and Cost
Versus Emission Standards

Emission Standards For 1977-1981	Cost Per New Car For Emission Controls Compared to 1974 Cars: Cost	Cost Per New Car For Emission Controls Compared to 1974 Cars: Uncertainty	New Car Average Fuel Economy in 1980: MPG	New Car Average Fuel Economy in 1980: % Over 1974	Uncertainty Range in % Over 1974 Due to: Engine Technology	Uncertainty Range in % Over 1974 Due to: Sales Mix
1. Statutory Standards after 1977 (three-way catalyst or dual catalyst)	$350	$215-$450	16.0*	14%*	-4% to + 8%	-4% to +7%
2. Base - 1.5/15/2.0 or 0.9/9.0/3.1						
With Catalysts	120	$ 90-$150	19.6	40%	-3% to + 3%	
No Catalysts	50	$ 40-$100	18.4	31%	-4% to + 8%	-4% to +7%
3. EPA Proposal						
With Catalysts	135	$100-$170	19.0	36%	-5% to + 8%	
No Catalysts	65	$ 50-$110	17.8	27%	-4% to +12%	-4% to +7%
4. 1975 Standards						
With Catalysts	95	$ 70-$110	20.4	46%	-2% to + 2%	
No Catalysts	35	$ 25-$ 65	19.2	37%	-3% to + 7%	-4% to +7%
5. Canadian or 1974 Standards With or Without Catalysts	25	$ 5-$ 35	20.4	46%	-2% to + 1%	-4% to +7%

*FEA - DOT Estimate