IMPLEMENTATION OF THE CLEAN AIR ACT AMENDMENTS OF 1970—PART 3

(Title II)

HEARINGS

BEFORE THE

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OF THE

COMMITTEE ON PUBLIC WORKS UNITED STATES SENATE

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(Title II)

TUESDAY, MARCH 28, 1972

U.S. SENATE,
SUBCOMMITTEE ON AIR AND WATER POLLUTION
OF THE COMMITTEE ON PUBLIC WORKS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 9:30 a.m., in room 4200, New Senate Office Building, Hon. Thomas F. Eagleton presiding.

Present: Senators Eagleton, Boggs, Baker, Tunney, and Buckley.

Senator EAGLETON. The subcommittee will come to order.

Good morning, ladies and gentlemen.

In 1970, Congress, after long and careful consideration, enacted the Clean Air Act Amendments which require a 90-percent reduction in emissions of hydrocarbons and carbon monoxide by 1975 and a 90-percent reduction of nitrogen oxides by 1976.

A key element of this information was HEW data stating that emission reductions of 92.5 percent for carbon monoxide, 93.6 percent for nitrogen oxides and 99 percent of hydrocarbons were essential to assure attainment of air quality standards protective of public health.

This data was developed originally to support an agreement reached at a 1969 White House meeting with the automakers under which they agreed to significantly reduce emissions by 1980 so air quality could meet public health standards by 1990. Congress decided we could not wait this long for clean air.

Despite the urgent need to improve air quality, I am concerned that today there is an effort to avoid achievement of the goals for reduction of auto emissions set in the 1970 Clean Air Act Amendments.

Pursuant to this effort and in disregard of the health and welfare of the American public, these appear to summarize the strategy by the auto companies and some scientists:

Allege that Congress acted arbitrarily and capriciously in requiring a 90-percent reduction in auto emissions by a date certain;

Charge that 90-percent emission reductions are not necessary to protect public health and data supporting strict emission controls is erroneous;

Alarm the public with inflated cost figures and predictions of poor driveability which suggest that great sacrifices must be made to achieve clean air;

Divert attention from the public health issue by focusing discussion upon controls feasible with current technology, not those necessary to protect public health;

Make testing procedures so complicated that checking all new cars to assure they are clean can be alleged to be an impossible task; and

Refuse to consider any alternatives to the existing internal combustion engine, and set standards of comparison which only the internal combustion engine can meet.

This cooperative, concerted effort began in industry-administration meetings in 1971, but it was crystalized at a meeting at the Western White House in San Clemente on January 13 and 14 of this year.

Since that meeting, we have been virtually inundated with industry and administration pronouncements against the clean air effort.

I was most interested to note in reading the auto industry statements this morning that all of them place primary reliance on the National Academy of Sciences report in making their arguments.

The National Academy of Sciences in turn indicated that they had placed primary reliance on the auto industry for the data upon which it based its conclusions.

This is a nice mutual admiration society, but it can hardly stand as an objective review of the problem.

In recent weeks we have heard enough of what can't be done to clean up the air. This morning, I would hope we will get at least some idea of what can be done to protect public health and provide a transportation system with which we, as a nation, can live.

Now I yield at this time to Senator Boggs.

Senator Boggs. I have no comment at this time, Mr. Chairman.

Thank you.

Senator Eagleton. We have four witnesses this morning.

They are Mr. Ernest S. Starkman, vice president of the Environmental Activities Staff of the General Motors Corp.

Mr. Donald A. Jensen, director of the Automotive Emissions Office of the Ford Motor Co.

Mr. Sydney L. Terry, vice president of the Environmental and Safety Relations of Chrysler Motors Corp.

And Mr. John Adamson, vice president of Engineering of American Motors.

Would all of you please come forward, take the four chairs here, and we will go through the prepared statements, and try to get to questioning as soon as possible.

Please sit in this order, Mr. Starkman, Mr. Jensen, Mr. Terry, and Mr. Adamson.

We will hear first from Mr. Starkman of the General Motors Corp.

STATEMENT OF ERNEST S. STARKMAN, VICE PRESIDENT, ENVIRONMENTAL ACTIVITIES STAFF, GENERAL MOTORS CORP.

Mr. Starkman. Thank you very much, Mr. Chairman.

Mr. Chairman and members of the Subcommittee on Air and Water Pollution, I am Ernest S. Starkman, vice president of General Motors Corp. in charge of the Environmental Activities Staff.

The purpose of this hearing, as we understand it, is to review the implementation of title II of the Clean Air Act Amendments of

1970. I would like to address two subject areas relating directly to those amendments to the Clean Air Act. The first concerns General Motors' activities and progress in endeavoring to accommodate the requirements of the act. The second deals with further study of that act in order to take into account the experiences and new knowledge accumulated during the 15 months which have transpired since those 1970 amendments were signed into law.

GENERAL MOTORS ACTIVITIES AND PROGRESS IN AUTOMOTIVE EMISSION CONTROL

In the latter part of 1969, the Federal Government established proposed Federal emission standards for 1975, which were substantially the same as the then existing expressed requirements of the State of California. The Federal Government also established goals for 1980 emission levels. Thus, prior to December 1970, General Motors was deeply involved in developing an exhaust emission control system for its passenger cars which would meet the then proposed Federal standards for 1975. At that time, General Motors publicly expressed confidence that it could meet those 1975 requirements, if adopted as proposed.

In effect, passage of the 1970 amendments to the Clean Air Act moved the 1980 Federal goals to 1975. This dramatically lowered the prescribed vehicular emission levels to be attained within the same period of time. In the intervening 15 months since the 1970 amendments were enacted, General Motors has expended every practicable effort to meet the required emission levels, which for 1975 production model cars now stand at 0.41 grams per mile hydrocarbons, 3.4 grams per mile carbon monoxide, and, in 1976, 0.4 grams per mile of oxides of nitrogen. These reductions, as you know, are 90 percent to 98 percent down from that of uncontrolled cars.

It is important to emphasize that our current 1972 model cars demonstrate the great progress which has already been made in controlling automotive emissions. Our calculations show that as of today, hydrocarbon emissions have been reduced by 85 percent, carbon monoxide by about 71 percent and oxides of nitrogen by about 22 percent, as compared to 1960 models. In our 1973 models, NO_X emissions will be substantially further reduced. Reductions of this magnitude have a favorable effect on the atmosphere. The January 1972, report of the National Academy of Sciences Committee on Motor Vehicle Emissions shows that atmospheric levels of automotive-related hydrocarbons have decreased 28 percent since the 1968 peak, and carbon monoxide levels have decreased 17 percent.

Looking forward to the 1975 levels, we have expended $120 million in 1970 and $182 million in 1971, and project a 1972 expenditure of $225 million in the United States in an effort to meet those vehicular emission targets. We have over 3,600 people assigned to this important task. We have tested 380 cars with experimental emission control systems installed upon them for a total of over 2,400,000 miles, and we have devoted even greater effort to laboratory determination of the potential utility of over 600 catalysts obtained from 42 suppliers, both domestic and foreign, located in Japan, France, and Germany. We have investigated an encyclopedic array of system components and devices.

Considerable publicity has attended some efforts and success by others in experimentally meeting the 1975 certification test numbers. We, as well as others, have been successful in running one-of-a-kind test cars equipped with experimental emission control systems on conventional piston engines that, at under 500 miles, do meet the same goals. If the regulations are modified to permit averaging, it might be possible to produce vehicles which, at the end of the assembly line, would meet the prescribed levels of hydrocarbons and carbon monoxide. However, it is a long way to this point from one-of-a-test cars.

In addition to the foregoing problems of attaining the extremely low levels of emissions with new vehicles, our greatest difficulty is one of making sure that these prescribed emission levels will continue to be attained for an acceptable length of time, and at a reasonable cost to the consumer. Our effort to overcome this difficulty reflects not only desire that our cars in owner use make a minimal contribution to air pollution, but also our deep concern about the potential recall and warranty liability imposed by the Clean Air Act.

We are of the opinion that we will need to incorporate a catalytic converter, or similar device, into our systems in order to manufacture cars which will show the needed improvements over 1974 models to come close to meeting the 1975, and subsequently 1976, standards as established under the 1970 Amendments to the Clean Air Act. We therefore, are concentrating heavily on our effort to find the most suitable and reliable catalyst. To date we have been unable to make a decision with respect to which catalyst, or catalysts, we will use. This is because we do not have sufficient information on the durability or reliability of either the catalysts or the systems to contain them, from our accelerated proving grounds tests, or more importantly, from typical customer usage.

We are now embarked upon a program to ascertain the extent to which these, as yet experimental systems, will deteriorate. We have run a few of such systems for 50,000 miles at our proving grounds. None has yet met the standards for the entire 50,000 miles. The results of these tests show varying degrees of deterioration. Unfortunately, the more initially effective catalysts seem to be more subject to rapid deterioration. In some instances, even though the catalysts being tested never did actually meet the standards, either in new condition or during operation, our experience with deterioration was encouraging and the increase in emissions during the 50,000 miles has been within reasonable bounds. In other cases, with catalysts more promising at the start, and even with fuels which are free of lead, phosphorous, and sulphur, we have found that the emission control systems rapidly deteriorated. In some instances, we have experienced an over threefold increase in emissions at the end of 50,000 miles as compared to the start. We have also run some otherwise promising catalysts which lasted less than 5,000 miles, even with contaminant-free fuels.

I can assure you that we are moving ahead as rapidly as we are able in order to obtain answers to the questions which still remain before we can finalize our decisions and commence the preproduction activity. We sincerely believe that more time is required than the approximately 22 months remaining between this date and the start of final certification testing of 1975 models.

We have yet to finalize our developments of suitable systems, including carburetors and catalytic converters. When this is done, we must order and construct tooling. Finally, we must have some period of pilot line production to insure that commercial assembly line production is feasible. In addition, we must commit to outside suppliers who advise us that their own lead time requires at least 2 years prior to start of our production. We have so indicated in our letter of January 12, 1972, to Mr. Ruckelshaus, Administrator of the Environmental Protection Agency, requesting the 1 year suspension of 1975 emission levels for the reasons outlined above.

Before we close the discussion of our efforts to achieve lower emissions, I want to emphasize that we have not neglected power sources other than the conventional gasoline engine. Experimental laboratories include the gas turbine, the battery and fuel cell, the hybrid-electric, the Stirling, and the steam engine. However, our investigation does not lead us to believe that there is now any practical alternate powerplant which will meet the 1975 and 1976 requirements by those years, better than the spark ignition gasoline engine.

SUGGESTED STUDY OF THE 1970 CLEAN AIR ACT AMENDMENTS

The 1970 amendments to the Clean Air Act prescribed dramatically stringent limitations on vehicular emissions, in an effort to protect the health and welfare of the citizens of this country. General Motors, others in the automobile industry, both domestic and foreign, and the scientific community had no opportunity to appear publicly before the Congress at that time with regard to the need, the technological feasibility or the economic impact of this new set of standards. In the intervening 15 months, however, the technical and scientific community, as well as companies in the automobile, petroleum and chemical industries, have had opportunity to consider the provisions of the law and to test it with respect to control of automobile emissions.

A great deal of information has been collected in this 15-month period. Two conclusions are beginning to emerge. The first of these, and a very important one, is that the very stringent levels prescribed for vehicular emissions do not appear to be warranted, either to protect health, prevent plant damage, or to provide esthetic quality of the air in even the most severely stressed communities of this Nation. I will, however, leave discussion of this matter to such bodies as the National Academy of Sciences and to the EPA.

The Congress, very wisely, called upon the National Academy of Sciences to study and advise on certain of the provisions of these 1970 amendments. Congress directed the Administrator of the EPA "to enter into appropriate arrangements with the National Academy of Sciences to conduct a comprehensive study and investigation of the technological feasibility of meeting the emissions standards." You had a report yesterday from the Committee of the Academy appointed to this task.

It would seem most appropriate, in the light of recent information, for Congress to request the National Academy of Sciences to expand its studies into all of the factors relating to vehicular emissions as they may affect the health and welfare of the citizens of this country.

This would provide a basis for Congress to determine whether a reexamination of the 1975–76 emissions levels is warranted.

The second conclusion now appearing is that the cost of controlling the last increments of emissions from motor vehicles to levels prescribed by the amendments of 1970 will outweigh the gains in health protection or aesthetic quality which will result. I will not burden you with reference to the studies now appearing and which support this latter point, but would note the February 28, 1972, report of the Ad Hoc Committee on Regulatory Effects on the Costs of Automotive Transportation. One part of this report states that the cost for the conversion decade 1967–85 will be $95.1 billion. The benefits are estimated at $18.3 to $46.3 billion or an average excess of about $6.3 billion per year cost over benefit. Beyond that conversion decade, the costs will exceed benefits by $3.8 billion annually. The major proportion of the control cost, the report states, is attributable to meeting the 1976 model year standard of 0.4 gm/mile NO_x. It seems clear that the results of this study create serious questions with respect to the necessity for the stringency of the emission level in the law. This matter, too, would be an appropriate subject for a National Academy study.

At the conclusion of such scientific study, you would be in a much better position to judge the extent to which vehicular emissions do contribute to the overall environmental problems which face the United States, and what should be the appropriate levels of control required in the future. During this study period, General Motors will continue intensive research and development and engineering effort to optimize emission control systems.

Mr. Chairman and members of the committee, we have purposely kept this presentation brief and to the point. We are sure that you will have questions to ask.

Senator EAGLETON. Thank you very much, Mr. Starkman.

Let me ask for clarification of the figures you cited in your statement. Are those figures developed after an averaging test, or are those figures derived after tests based on individual car performance?

Mr. STARKMAN. This is based upon the measurements the EPA has provided to us as being for the uncontrolled cars, and the levels we are attaining in accommodating the laws as they stand today.

Senator EAGLETON. Is it obtained from a prototype of the production line vehicle, or just tell me where you get these figures from?

Mr. STARKMAN. These figures are taken from the requirements we must meet.

Our prototypes are tested, yes, that is true.

Senator EAGLETON. You talk about the Stirling engine.

Is that a diesel engine?

Mr. STARKMAN. No, sir, that is a hot air cycle engine.

Senator EAGLETON. So the ones you have been experimenting with are the gas turbine, the battery and fuel cell, the hybrid-electric, the Stirling and the steam engine?

Mr. STARKMAN. These are alternative systems. We have been always working with such other engines as diesel, and I call those conventional engines, however.

Senator EAGLETON. By conventional, they are currently being mass produced?

Mr. STARKMAN. Yes, sir, that is right.

Senator EAGLETON. Did you know that a third of vehicles produced by Mercedes-Benz are diesel?

Mr. STARKMAN. I understand, sir.

Senator EAGLETON. You mention the Ad Hoc Committee on Regulatory Effects on the Costs of Automotive Transportation.

Is this what is commonly called RECAT?

Mr. STARKMAN. That is correct.

Senator EAGLETON. In my opening statement, I referred to some HEW data that was issued in 1969, 1970, which says that insofar as protecting the public health is concerned, there is a needed reduction of 92.5 percent for carbon monoxide, 93.6 percent for nitrogen oxides and 99 percent for hydrocarbons.

Reductions of this magnitude were required according to HEW to meet the public health standards.

Do you agree with those findings of the HEW, or do you disagree?

Mr. STARKMAN. I think that I would accept the findings of the HEW with respect to the long term for control of the emissions in vehicles.

If I recall properly, Senator Eagleton, those numbers are with respect to the 1960 uncontrolled vehicles.

Senator EAGLETON. Pre 1968 uncontrolled vehicles.

Mr. STARKMAN. Yes, sir, 1960–65 in California, 1960 to 1967 for the rest of the Nation.

Senator EAGLETON. Do you take those numbers as being legitimate and desirable goals as far as the protection of the public welfare is concerned?

Mr. STARKMAN. I would have some reservations. May I add, we were studying the same problem in California at the time.

The California authorities do not necessarily agree with what should be the levels for each of the pollutants, but as far as the order of magnitude of decrease, and those pollutants, those which you discussed, I think it would be reasonable for the long term.

I am not sure whether we have defined long term or not.

Senator EAGLETON. You mentioned in your opening statement, I think that 3,600 employees of General Motors are working on matters relating to pollution control?

Mr. STARKMAN. Yes, sir.

Senator EAGLETON. Full-time on that, and nothing else?

Mr. STARKMAN. No, sir.

I should say that 3,600 is made up of some who work part-time.

That is 3,600, if you add up the halves and quarters.

Senator EAGLETON. How many people are under your direct control in General Motors?

You are a vice president?

Mr. STARKMAN. Yes.

Senator EAGLETON. Do they rank vice presidents at General Motors, are there executive vice presidents?

Mr. STARKMAN. Yes, sir; there are various kinds of vice presidents.

Senator EAGLETON. I mean are they ranked in terms of rank within the company?

Mr. STARKMAN. The easiest way to express this is to say my boss is an executive vice president, and his boss is the president.

Senator EAGLETON. You are a scientist by vocation and training?

Mr. STARKMAN. I like to think I am an engineer.

Senator EAGLETON. How many people are directly under you, Mr. Starkman?

Mr. STARKMAN. There are about 350 people that work directly under me and on my staff.

Senator EAGLETON. And these would be scientists, engineers, and technical people, who have an expertise?

Mr. STARKMAN. Approximately half are what I would call professionals.

May I add, that the limit of my information and the capability to call upon help extends to the other staffs, and specifically, the General Motors research staff, specificially to the engineering staff, as well as to the various divisions that do work in the emissions area, and all of the motor car divisions do work in the emissions area, in addition to AC and Delco and Rochester Products, so I do have a capability to call upon thousands of people for this help, if I need it.

Senator EAGLETON. Is the main thrust of the effort of those 350 people that work under you exclusively directed to pollution control?

Mr. STARKMAN. No, sir.

Senator EAGLETON. You research and technically advise on things over beyond pollution control?

Mr. STARKMAN. We are also concerned with safety.

Senator EAGLETON. You work on bumpers, air bags, seat belts, and so forth?

Mr. STARKMAN. That is correct.

Senator EAGLETON. Can you give me a ballpark figure of what the budget is for you and the 350 employees?

Mr. STARKMAN. My own budget?

Senator EAGLETON. For you and the 350?

Mr. STARKMAN. I cannot give you an exact number.

Senator EAGLETON. A ballpark number.

Mr. STARKMAN. I am even a little cautious about giving the ballpark figures.

Senator EAGLETON. Would it be more than $10 million?

Mr. STARKMAN. Yes, sir.

Senator EAGLETON. $20 million?

Mr. STARKMAN. Well, we are going to limit this to a ballpark figure, aren't we?

Senator EAGLETON. Let's say $25 million.

Mr. STARKMAN. I am not certain, but I can find out the number, I believe.

Senator EAGLETON. And is General Motors on a fiscal or calendar year basis?

Mr. STARKMAN. We operate on a fiscal basis by model year.

Senator EAGLETON. What is the beginning and ending period of the fiscal basis, September 1?

Mr. STARKMAN. Yes, September 1.

Again, I am not certain of the exact date.

Senator EAGLETON. For the last complete fiscal year, what were the gross dollar sales of General Motors?

Mr. STARKMAN. I believe this was published in our annual report, and it was about $28 billion, as I recall.

Senator EAGLETON. $28 billion?

Mr. STARKMAN. Yes.

Senator EAGLETON. Well, assume you spent $28 million for the 350 people, that would be one-thousandth of the gross sales, is that right?

Mr. STARKMAN. That is correct.

Senator EAGLETON. So one-thousandth of the gross dollars received by General Motors would go to your division?

Mr. STARKMAN. That would seem like a small number, if one eliminates completely the work going on in other staffs and other divisions, but——

Senator EAGLETON. You are principally in charge of pollution control technology?

Mr. STARKMAN. No, sir, there are other vice presidents that have responsibilities in research, and in engineering, and in the various car divisions, in AC, in Delco, so that there are a total of about eight vice presidents, or perhaps even more that have staffs working under them, and some of them with much larger staffs working in emissions than I have.

Senator EAGLETON. Who has the final say in your company as to when you tool up for a new emission control device, do you have that, is your word law?

Mr. STARKMAN. No, sir. The decisions are made as a consequence of a meeting of a committee, a committee in which I participate, in which these other vice presidents, most of them participate, in which recommendations are made with respect to the direction in which we should go, and this committee is called the engineering policy group.

Senator EAGLETON. The engineering policy group?

Mr. STARKMAN. Yes, sir.

Senator EAGLETON. How many people comprise that committee, roughly?

Mr. STARKMAN. Oh, about 20.

Senator EAGLETON. Is Mr. Roche on that committee?

Mr. STARKMAN. Mr. Roche retired on December 31.

Senator EAGLETON. Who is the new president?

Mr. STARKMAN. The president is Mr. Edward N. Cole, who is the president of the General Motors Corporation.

Senator EAGLETON. And the chairman of the board is whom?

Mr. STARKMAN. The chairman of the board is Mr. Gerstenberg.

Senator EAGLETON. Mr. Cole serves on this committee?

Mr. STARKMAN. Yes, sir.

Senator EAGLETON. Who is the executive vice president?

Mr. STARKMAN. The executive vice president to whom I report is Mr. Harold Warner.

Senator EAGLETON. So it is a 20-man committee, I take it, and it is like the Senate, technically, they are all qualified, and they are all equal, but some are a little more equal?

Mr. STARKMAN. Sometimes it appears that way, Senator.

Senator EAGLETON. And Mr. Cole and Mr. Warner, if they say all systems go, you go?

Mr. STARKMAN. Not necessarily, sir.

Senator EAGLETON. Well, Mr. Cole and Mr. Warner, if they say no, do you go?

Mr. STARKMAN. We take it very seriously if they say no.

Senator EAGLETON. You do not vote on this committee in terms of majority rule, it is not a question of eight people say we do such and such, and seven say no, and the majority rules?

Mr. STARKMAN. We do not vote formally. We have freedom of expression of opinion, and the freedom of expression is utilized.

Senator EAGLETON. I will yield to Senator Boggs.

Senator BOGGS. Thank you, Mr. Chairman.

Mr. Starkman, I appreciate your testimony here this morning. I gather that your main hang-up at this moment is your lack of information—or satisfying information—about a suitable and reliable catalyst.

Mr. STARKMAN. I think that is a fair assessment, Senator Boggs.

We have questions still with respect to the durability of the containment system, but I think at the moment, our problem is picking that catalyst which we think will be sufficiently durable, that will not have to be replaced too often during 50,000 miles.

Senator BOGGS. You mentioned that even with lead-free gasoline and everything else, that there is still a deterioration. Could you explain what kind of deterioration occurs, what causes it?

Mr. STARKMAN. Yes, sir, there are two reasons for catalysts to deteriorate in the main.

One is material deposits on the catalyst, and preventing it from reacting with the things you want it to react, the carbon monoxide, the nitrogen oxides and the hydrocarbons, and the other thing is getting it too hot.

If it is subjected to temperatures beyond that of a given level, and this differs from catalyst to catalyst, it differs from a capability to operate, so our problem is, one, with materials that are in the gasoline, and come through the combustion process that will contaminate the surface and, two, with being able to contain the temperature.

These occur, not as necessarily normal usage of the car, but to give you two examples, one, if persistent and long use of the car under heavy load, such as a heavy trailer, as an example, were involved, then the catalyst would deteriorate because of the greater amounts of unburned material that it would be subjected to, and the heating it would get, as a consequence of the burning of the material, and the other would occur as a consequence of the malfunction of the engine.

For example, spark-plug fouling, which would also produce unburned hydrocarbons, which in the catalyst would burn and heat it up, and also would either debilitate it badly, or even destroy its utility almost entirely.

Senator BOGGS. Do we need this catalyst, or a system like it, to get to the clean car?

Mr. STARKMAN. We believe so, Senator Boggs.

Senator BOGGS. You need it for that?

Mr. STARKMAN. Yes, sir.

Senator BOGGS. To get the 90 percent reduction you feel you have to perfect a system such as you have discussed.

Mr. STARKMAN. We believe, to put it in its proper perspective, to get very far beyond where we are now, it is going to take a catalyst, or a similar type of device.

I should not limit my discussion to a catalyst. There are other possible systems, such as the thermal reactor. Thus far, the thermal

reactor has not proven as a potentially applicable item, as far as we are concerned, as the catalyst.

It does evolve to higher full consumption rates for the same amount of control than the catalyst, but we are as concerned about fuel consumption as I am sure you are, so while we have been studying, and while we are building experimental reactor systems, for arriving at the kind of numbers we have to hit, we believe the catalyst will probably have to be the route we will have to use.

Senator BOGGS. This may be a difficult question to answer, but what is the degree of your optimism about the catalyst, or the thermal system? Are you fairly optimistic about a breakthrough in a reasonable time?

Mr. STARKMAN. I never program breakthroughs. It is best to hope for them. I think just hard work in development will with time allow us to produce systems that will meet the levels that the Congress has established.

We cannot meet them under present circumstances in 1975.

I guess to sum up, I would say it is possible at some future date, we think to mass produce vehicles, I would say so, which at the end of the assembly line will meet these targets.

We are working toward making those systems reliable and durable, sufficiently so that it will not be a burden on the consumer to replace the catalyst, or otherwise to have his car not operate in a manner in which he would wish it to operate. So, yes, we do have optimism for the long run, I think we can do it, but for 1975, no.

Senator BOGGS. Thank you very much.

Senator EAGLETON. Senator Buckley.

Senator BUCKLEY. Thank you, Mr. Chairman.

Mr. Starkman, I may have to pursue a little further the line of questioning initiated by Senator Eagleton.

In your testimony, you state that in looking forward to the 1975 levels, you have expended $120 million in 1970 and $182 million in 1971, and project a 1972 expenditure of $225 million in the United States in an effort to meet those vehicular emission targets.

Is this a research and development expenditure, or is this also hardware attachments to those cars?

Mr. STARKMAN. Senator Buckley, it includes none of the hardware that goes on the car.

It is principally research and development operation and preparation for the manufacture, but not the actual manufacture.

Senator BUCKLEY. So that might be a more reasonable estimate of the total size of your effort, rather than the $28 million ballpark figure?

Mr. STARKMAN. That is correct, for preparation for this situation.

Senator BUCKLEY. With respect to the fuel consumption, what has been the decline in fuel efficiency which has resulted?

Mr. STARKMAN. This varies from car to car. It is difficult to assess an average, because sometimes it is greater than others, but I would say the average was 20 to 25 percent for the equipment attached to cars thus far.

Senator BUCKLEY. Is this just for equipment that is attached?

Mr. STARKMAN. I should say in modifications made to the engine, it is not just for equipment attached.

Senator BUCKLEY. Is this loss of efficiency just inherent in cleaning up these pollutants, or do you hope eventually to reverse that particular trend?

Mr. STARKMAN. We hope to reverse the trend.

One of the problems is that we are fighting the laws of thermodynamics.

It evolves that maximum efficiency carries with it high temperatures and high pressures, or vice versa, and in order to decrease the amount of hydrocarbon and carbon monoxide, and the oxides of nitrogen, we have had to retreat from a direction in which engines were being designed a few years ago, with the fuel-air ratios for optimum performance in economy, and with compression ratios for maximum performance and economy, with spark plug timing for the same purposes, with valve timing for the same purposes, so that in order to decrease the emissions, we have had to back away, in matters of economy.

Now, there is such a thing as a learning curve, and I am sure with time, we can improve the situation, but I will not make any promises for how far we have to get back to where we were.

Senator BUCKLEY. In hearing your testimony, somebody suggested, because of the loss of fuel efficiency, and decline of performance, some ingenious consumers will find some way of circumventing the catalytic contraptions, is this something that the ingenuity of man will always be able to achieve, or are you working toward ways where the system cannot be dismantled?

Mr. STARKMAN. We try very hard to make sure that the control systems cannot be tampered with, but what one man can do, another man can undo, it evolves, and and we have found reasonably high levels of tampering with the emission control systems on the part of individuals, who are attempting, I presume, to improve the performance of their vehicles, and who at the same time increase the amount of emissions coming from that vehicle by tampering.

Senator BUCKLEY. Thank you very much.

I have no further questions, Mr. Chairman.

Senator EAGLETON. All right. Thank you very much.

Our next witness is by Mr. D. A. Jensen, director of the automotive emissions office of the Ford Motor Co.

STATEMENT OF DONALD A. JENSEN, DIRECTOR, AUTOMOTIVE EMISSIONS OFFICE, FORD MOTOR CO.

Mr. JENSEN. Thank you very much, Mr. Chairman.

Mr. Chairman, and gentlemen, I am Donald A. Jensen, director of the automotive emissions office of Ford Motor Co. In response to your request, I will review our recent efforts to meet the requirements of the Clean Air Act Amendments of 1970. As many of you may recall, we were strongly opposed to that portion of the amendments which wrote specific standards into law. We thought then, and still believe, that in view of the rapidly developing body of knowledge concerning air pollution, there should be sufficient flexibility to permit technical review and reappraisal of the needs for various levels of control of specific contaminants.

That position has been verified and supported by recent impartial scientific reports. The Office of Science and Technology in their February 28, 1972, review of "Cumulative Regulatory Effects on the Costs of Automotive Transportation" clearly state:

> Because of the complexity of these problems, regulatory agencies should have the opportunity and the means to explore alternatives and the flexibility to adopt the best strategies. This requirement is generally incompatible with legislated numerical goals to be attained within arbitrary specified time limits.

They also indicate:

> Regulation should not be based upon a blind faith in technology. Establishing standards beyond the known state of the art on the theory that industry can do anything if enough pressure is put on it is not likely to result in wise governmental decision making or to provide the greatest net benefits to society. Furthermore, crash efforts to meet fixed time limits can delay the development of alternative and perhaps better technology.

The ill advised rigidity in respect to timing which was legislated in the Clean Air Act was also addressed by the National Academy of Sciences in their January, 1972, report which stated:

> For the 1975 model year, the time scale is so short that many new production items will not be adequately proven. An example of such a critical item is the new carburetor design many manufacturers intend to use. Normal field testing and durability testing of production samples of such components may not be completed before these components are installed on assembly-line vehicles. Problems may therefore occur in customer use that did not show up in the limited test period now available. The public may be buying vehicles whose components are more likely to malfunction and whose driveability and reliability may not be satisfactory.

The statements of independent scientific groups points up the fact that Ford Motor Co. is not unique when we express objection to the lack of flexibility in the Clean Air Act Amendments of 1970.

These amendments, however, became law on December 31, 1970. We therefore committed ourselves to an all-out effort to meet the automotive emission standards contained in the law. These efforts necessarily started from the advanced technology already developed by our company in its previous 4 years of development work toward low-emission vehicles.

In April of 1967, Ford began a joint project that now includes 12 other companies for cooperative research to develop what we considered to be the low-emission car of the future. Ford was, and is, project manager of this interindustry emission control program. At the Society of Automotive Engineers annual meeting in Detroit in January, 1971, immediately after the Clean Air Act passed, we published a progress report on the interindustry emission control program. Eight technical papers are contained in this book which I will be glad to leave with your committee for reference purposes.

Among these papers is one which reviews our success up to that time. We reported on one concept car with a thermal reactor, another concept car equipped with a catalyst, and a third concept car which had both a thermal reactor and catalyst in tandem. Even at low mileage the only one which appeared to meet the emission levels specified in the Clean Air Act was the last vehicle mentioned, and then only at very low catalyst miles.

The IIEC was only a small part of our total research and development effort at Ford in the field of emissions. We also surveyed the

state-of-the-art within all of our engineering and scientific facilities, and decided that the reactor-catalyst car described above with other components such as exhaust gas recirculation, improved fuel induction system, and a new ignition system, was still our most promising choice for meeting the standards of the act by 1975. We called it our "kitchen sink" car because it included virtually every control device with which we were experimenting.

There were serious problems even with that vehicle. The emission levels were measured at very low mileage and we had no idea what the durability of the system would be. Although the car was capable of being driven through the test cycle, the driveability was so poor that it would not be acceptable to customers. In January 1971 we reported that there was a fuel economy penalty of 27 percent, and the vehicle appeared to be very costly to the buyer because of platinum catalysts and thermal reactors with expensive, exotic metal liners which lacked proven mass production suitability. This concept did, however constitute a system which, at very low mileage, as of January 1971, appear to meet the emission standards, if not the other legal requirements, for 1975 models.

Other promising engines and concepts were considered as possibly worthwhile for future years, perhaps in the latter half of the decade, and we have continued work on them. But because of the urgency of near term Federal standards, we set up a special task force to work on the "kitchen sink" car for 1975. Its task was, first, to meet the standards with components that would have acceptable durability and could be mass produced, and, then, attempt to gain back some of the losses in fuel economy, performance, and cost.

Our assumption was that, once we were able to achieve the emission levels through 50,000 miles, we could then turn our attention to recovery of other losses important for customer satisfaction.

Approximately 100 vehicle hardware combinations with special component "prove-out" tasks were built and placed on test. Methods of controlling vehicle component temperatures to safe limits under all normal and projected abnormal vehicle operations were developed. Engine dynamometer tests for optimizing reactor and catalyst design were run around the clock. Starting in 1971, we also built complete vehicles of various engine sizes and body weights to run for what we hoped would be 50,000 miles of durability testing.

In our progress report to the EPA Administrator in May 1971, we said our efforts had been slightly encouraging and we were hopeful of meeting 1975 standards. On October 18, 1971, we reported to EPA that our optimism of the spring had now turned to pessimism. Our durability experience on the "kitchen sink" cars was extremely discouraging. In fact, in every instance, the cars missed the standards by a sizable margin within the first 15,000 miles of testing. We continued to attempt corrective measures; but in January of this year, we found it necessary to notify the EPA Administrator that we were going to file an application for suspension of the 1975 standards for 1 year. We are now preparing the detailed submission required to support that request.

In the meantime, we of course took a long hard look at our "kitchen sink" car to determine why the encouraging low mileage levels had deteriorated at such extraordinarily rapid rate. In six of

the durability cars tested in 1971 there were four reactor failures and five catalyst failures, seven exhaust gas recirculation system problems, air pumps failed four times, two transmission failures, and two engines failed in the first 25,000 miles. On that basis, we reexamined the entire emission control effort at Ford, and in IIEC, and reviewed some of the results of cooperative tests by potential suppliers. After reviewing all the available data, we decided we should start a new durability test fleet at the Riverside, Calif. auto racetrack with several different potential control systems (all comprised of kitchen sink elements) which might have promise over extended mileage. The Government-specified durability mileage accumulation can best be accomplished on a closed track, since the test cycle simulates 50,000 miles of downtown urban driving with a specific low speed route which is difficult to duplicate without interruption on city streets. We could not use Ford's own proving grounds and test facilities because they were crowded with emission test vehicles being driven to meet other even more urgent standards for 1973 and 1974. There were emission test laboratories available at our Los Angeles assembly plant, near the Riverside racetrack; we converted these laboratories so they could test according to the 1975 EPA test procedure which, even on an around-the-clock basis, takes approximately 5 months to complete.

Early this month, the first of 32 special cars with different emission control systems started to accumulate 50,000 miles at Riverside. Today, there are 24 such cars on the track, and more are being added.

We are, of course, doing a great deal of additional work at Dearborn. We are, however, so concerned about deterioration in control systems that we hope to get at least a partial reading as soon as possible on that aspect of all the different potential controls systems in the Riverside tests. The urgency of that program has meant around-the-clock, 7-day-a-week driving, and testing of those vehicles.

None of the systems we are now testing has shown capability to meet the 1975 standards of the Clean Air Act beyond a very low mileage point. One of the questions frequently asked by both EPA and the National Academy of Sciences in their reviews of our efforts has been, "If you can't meet the 1975 standards, what levels can you meet?" That question is frequently followed by more specific questions, such as, "Can you meet the California 1975 standards?"

We cannot answer those questions at this time because our prior efforts were not designed to meet standards below the Clean Air Act levels and because these prior efforts did not succeed. From January 1, 1971 (15 months ago) until the beginning of the Riverside program, Ford's objective was to meet the 90 percent reduction standards which the law specified. We tried to prove out a control system without regard to cost, fuel economy, or performance because we were determined to do our utmost to meet the requirements enacted by Congress. We even aimed at different types of systems for 1976 in spite of the huge cost of retooling, in order to maximize our chances of meeting the 1975 standards on time and to take advantage of an extra year of research and development on 1976 systems. As I have indicated, the results of this all-out effort were extremely disappointing. We expect one or more of the systems now being tested at Riverside will produce better results. Until that program is further along

we will not know whether the 1971 durability results were too pessimistic.

We are now documenting all of these good-faith efforts in our submission to EPA requesting an extension of time. In connection with that application, we feel strongly, and our belief is supported by the January 1972, report of the National Academy of Sciences, that the difference in the air pollution in the atmosphere resulting from a 1-year suspension of the 1975 standards will be minimal. One reason for this is the considerable improvement in vehicle emission control that has already occurred. This is expressed for passenger cars in terms of a common 1975 test procedure on attachment A [1] to this statement. We believe that the benefits to the car owner in a safe, more reliable, durable vehicle with less maintenance cost will be considerable if 1975 Clean Air Act standards are delayed. Let me cite just one example of how this extra time can be used to benefit car owners.

Catalytic converters have never been mass produced. New industries must be created to build substrata for the monolithic catalysts we plan to use, to plate the substrata with appropriate material, and to package it in the stainless steel containers required for durability. Factories must be built where none now exist. Those plants must have the capability of producing perhaps 20,000 units each day with the last unit off the line having the same quality as the first. Our assembly plants must be able to install these units so they work in the manner intended in the engineering prototypes. The automobile industry has never attempted tasks of this magnitude across a total product line in a single year. To reduce the serious risks inherent in such an all-at-once conversion, we had intended to install platinum catalysts in California for the 1974 model year so that we and our suppliers could gain experience on 10% of our production. This was not possible because use of lead-free fuel was not permitted by the EPA for certification of California vehicles. We still feel the public interest could be served by the type of field experience we contemplated in 1974. We believe it would be desirable to permit us to gain such experience in 1975 before we are required to install catalytic converters in 100% of our production.

I have outlined Ford Motor Co.'s efforts to meet the standards in the Clean Air Act Amendments in 1975. Your committee may also be interested in the types of control systems we see as having potential for future motor vehicles beyond the mid-1970's.

One approach we have been using in an effort to meet 1976 requirements is essentially a dual bed catalyst system. This means there is a reduction (NO_x) catalyst followed by an oxidation catalyst for HC and CO. We are working on two versions of this concept. One of these (figure 1) [2] includes the use of thermal reactors for fast warm-up, pelleted dual catalysts, and exhaust gas recirculation (EGR). The second version (figure 2) [3] includes monolithic dual catalysts, EGR, and low thermal inertia exhaust manifolds. The major problems which we have at this time with these systems are:

Excessive deterioration of HC, CO and NO_x catalyst activity.

[1] See p. 1287.
[2] See p. 1287.
[3] See p. 1288.

Failure to meet our low mileage emission objectives. (These objectives are more stringent than the standards in order to allow for expected deterioration of the system with mileage.)

Catalyst overtemperature protection.

Another approach is most often referred to as the Ford PROCO engine. The name "PROCO" comes from "programed combustion." The engine is essentially a stratified charge, fuel injection, internal combustion, spark ignited piston engine. It features a high pressure mechanical fuel injection system with special injectors, a bowl-in-piston combustion chamber, special spark plugs, plus EGR, and a noble metal catalyst (figure 3)[4].

Ford has been working on stratified charge engines for over 15 years, with the combined objective of low emissions and improved fuel economy. Over the last 2 years we have been working with the U.S. Army in an effort to use this principle to reduce emissions. These efforts led to the development of a small 4-cylinder engine for the Army Military Utility Transport Truck (MUTT) which has shown encouraging results in preliminary, low-mileage tests. Our work on the PROCO engine received wide and unexpected attention as the result of a September 24, 1971, news release by the Environmental Protection Agency stating that the engine had potential for meeting the 1975-1976 Clean Air Standards and was "the cleanest engine we have ever tested."

The majority of our test data have been obtained with the 141 cubic-inch-displacement 4-cylinder PROCO engine in an Army M151 (MUTT) vehicle. The emission results are encouraging on smaller engines. In order to verify the potential of this system and to prepare "more typical" vehicles for further development work, a 141 CID PROCO engine has been installed in a Capri vehicle and a 351 CID V-8 engine has been converted to the PROCO principle for installation and test in a Torino vehicle. These installations are now being evaluated.

Current engineering research and development efforts on PROCO are aimed at identifying and resolving durability problems, in addition to evaluation of the Torino and Capri vehicles mentioned above. For example, this engine is very dependent on HC/CO catalyst efficiency if it is to obtain required low HC and CO emission levels for 50,000 miles. The number and complexity of the remaining unresolved engineering problems on the PROCO, as well as the special manufacturing problems involved, make it clear that this engine cannot be considered for mass production in the near term. Also, our catalyst system development program results will obviously determine, to a great extent, the eventual potential for control of PROCO engine emissions. We presented a technical paper on this program to the Society of Automotive Engineers earlier this year in Detroit, and you may wish to have this paper incorporated in the record of this hearing.

Another system shown (figure 4)[5] is referred to as "Lean Burn." This concept is essentially a carburetor version of the PROCO bowl-in-piston hardware designed to operate with high EGR rates. The objective is to maximize NO_x control with minimal fuel economy loss and acceptable driveability.

[4] See p. 1288.
[5] See p. 1289.

A low thermal inertia exhaust manifold and a great deal of HC/CO catalytic conversion are required with this system to control pollutants, especially HC. Currently, four 351 CID V-8 engines have been built to "Lean Burn" design specifications and test results are somewhat encouraging. Results are comparable to reported PROCO results which meet 1976 standards at essentially zero mileage. These results, much like the PROCO results, have been obtained with hand built precision hardware at low mileage and incorporate features, such as a manually controlled EGR, which are not suitable for mass production or for customer use.

We are continuing a very active program on this system aimed at reduction of the HC emission levels. In addition, automatic exhaust gas recirculation and choke systems are being developed, thermal reactor effectiveness is being investigated, and octane requirements are being determined.

In summary, the systems I have mentioned have shown encouraging progress as a result of our continuing research; however, none has shown the required degree of emission control after any extended durability running for meeting 1975 HC and CO standards, even with the most carefully adjusted experimental installations. The very low 1976 standards for NO_x in combination with the stringent 1975 carryover standards for HC and CO, present a formidable technological challenge which we have not yet been able to solve. The National Academy of Sciences, in its recent report, also concluded that the technology is not currently available to meet the 1976 standards.

I would also like to mention that our advanced emissions research is not limited to the internal combustion engine. We have very active research and development programs underway on gas turbine engines, Rankine (vapor) cycle engines, Stirling engines, and on high efficiency batteries and electric vehicle components. Studies are also being made on other alternate power sources. Although these various alternates have some desirable features which could have interesting long-range potential, we conclude unequivocally that none has the potential for use in 1975 or 1976 production vehicles. The National Academy of Sciences came to the same conclusion regarding alternate power sources.

Gentlemen, I have tried briefly to review what Ford Motor Co. has been doing to meet the requirements of the Clean Air Act and to research low-emission vehicles beyond the effective dates of those requirements.

The act speaks of "good faith efforts." As the person at our company in perhaps the best position to evaluate the applicability of that phrase to any actual day-to-day work, I can testify that it very accurately characterizes our on-going research and development programs on vehicle emission control. The commitment of our management from the top on down through the thousands of engineers and technicians working full time on solutions to these problems is to achieve a dual target—the levels specified in the Clean Air Act for 1975 and 1976. Mr. Ford, the chairman of our board, said in December 1969, that we would dedicate ourselves to insuring that the automobile will not be a major source of pollution in the future. We have made important strides toward fulfilling that commitment, but it seems clear that we have not met, and cannot meet, the specific standards specified for January 1, 1975, in the present law.

(The attachment and figures referred to during Mr. Jensen's testimony follows:)

Attachment A

CHRONOLOGICAL SUMMARY OF EXHAUST EMISSION STANDARDS FOR GASOLINE POWERED VEHICLES UNDER 6000# GVW

MODEL YEAR	CALIFORNIA					FEDERAL				Standards Expressed in Terms of CVS Cold-Hot Test (gm/mile)					
	Emission Standards			Test Procedure	Date Adopted	Date Waiver Granted	Emission Standards			Test Procedure	Date Adopted or Proposed	CALIFORNIA			FEDERAL		
	HC	CO	NO_x				HC	CO	NO_x			HC	CO	NO_x	HC	CO	NO_x
	Pre-Emission Control Levels						10 g/m 37 g/m	77 g/m 125 g/m	- 4-6 g/m	FTP CVS-C	-	15 g/m	90 g/m	4-6 g/m	15 g/m	90 g/m	4-6 g/m
1966-67	275 ppm	1.5%	N.R.	FTP	5/19/61	N.R.	-	-	-	-	-	6.3 g/m	52 g/m	-	-	-	-
1968-69	275 ppm	1/5%	N.R.	FTP	-	-	275 ppm	1.5%	N.R.	FTP	3/30/66	6.3 g/m	52 g/m	-	6.3 g/m	52 g/m	-
1970	2.2 g/m 180 ppm	23 g/m 1.0%	N.R. N.R.	FTP FTP	11/20/68 10/23/64	5/6/69	2.2 g/m	23 g/m	N.R.	FTP	6/4/69	4.1 g/m 4.1 g/m	34 g/m 34 g/m	-	4.1 g/m	34 g/m	-
1971	2.2 g/m	23 g/m	4.0 g/m	FTP	11/20/68	5/6/69	2.2 g/m	23 g/m	N.R.	FTP	6/4/69	4.1 g/m	34 g/m	5.0 g/m	4.1 g/m	34 g/m	-
1972	3.2 g/m 1.5 g/m 0 Hot FTP for NO_x	39 g/m 23 g/m	3.2 g/m0 3.0 g/m	CVS-C FTP	12/15/70 11/20/68	6/30/71 5/6/69	3.4 g/m 2.9 g/m	39 g/m 37 g/m	N.R. N.R.	CVS-C CVS-C	11/10/70 7/15/70	2.9 g/m 2.8 g/m	28 g/m 34 g/m	4.6 g/m 4.4 g/m	3.0 g/m 2.6 g/m	28 g/m 37 g/m	-
1973	3.2 g/m 1.5 g/m *Requested 9/29/71	39 g/m 23 g/m	3.0 g/m 3.0 g/m	CVS-C FTP	9/15/71 11/20/68	Pending* 5/6/69	3.4 g/m 2.9 g/m -	39 g/m 37 g/m -	3.0 g/m N.R. 3.0 g/m	CVS-C CVS-C FTP	7/2/71 7/15/70 2/10/70	2.9 g/m 2.8 g/m -	28 g/m 34 g/m -	3.1 g/m 4.4 g/m -	3.0 g/m 2.6 g/m -	28 g/m 37 g/m -	3.1 g/m - 4.6 g/m
1974	3.2 g/m 1.5 g/m *Requested 9/29/71	39 g/m 23 g/m	2.0 g/m 1.3 g/m	CVS-C FTP	9/15/71 11/20/68	Pending* 5/6/69	3.4 g/m 2.9 g/m -	39 g/m 37 g/m -	3.0 g/m N.R. 2.0	CVS-C CVS-C FTP	7/2/71 7/15/70 2/10/70	2.9 g/m 2.8 g/m -	28 g/m 34 g/m -	2.1 g/m 1.9 g/m -	3.0 g/m 2.6 g/m -	28 g/m 27 g/m -	3.1 g/m - 4.6 g/m
1975	1.0 g/m .59 g/m *Requested 9/29/71	24 g/m 12 g/m	1.5 g/m 1.0 g/m	CVS-C FTP	9/15/71 1/21/70	Pending* Not Granted	.41 g/m .46 g/m .50 g/m .50 g/m .60 g/m .87 g/m	3.4 g/m 4.7 g/m 11 g/m 11 g/m 11.5 g/m 7.1 g/m	3.1 g/m N.R. N.R. .90 g/m .95 g/m .68 g/m	CVS-CH C.S-C CVS-C FTP FTP FTP	7/2/71 2/25/71 7/45/70 2/10/70 11 22/69 -	.88 g/m .93 g/m - - - -	17 g/m 18 g/m - - - -	1.5 g/m 1.5 g/m - - - -	.41 g/m .41 g/m .45 g/m .93 g/m 1.1 g/m 1.5 g/m	3.4 g/m 3.4 g/m 8.0 g/m 16 g/m 17 g/m 10 g/m	3.1 g/m - - 1.3 g/m 1.6 g/m 99 g/m
	Reference: IIEC Objectives established 4/27/67:																
1976	1.0 g/m **Request for waiver was withdrawn by California	24 g/m	1.5 g/m	CVS-C	9/15/71	Withdrawn**	.41 g/m .46 g/m	3.4 g/m 4.7 g/m	.40 g/m .40 g/m	CVS-CH CVS-C	7/2/71 5/25/71	.88 g/m -	17 g/m -	1.5 g/m -	.41 g/m .41 g/m	3.4 g/m 3.4 g/m	.40 g/m .40 g/m

Crankcase Control: Open system required in California in 1963; installed in 1961 in California and in 1964 nationwide. Closed system required by California in 1964 and nationwide in 1968.

Evaporative Controls: Required in California in 1970 and nationwide in 1971 (6 gram/test). More stringent standard (2 gram/test) required nationwide in 1972.

Note: For a given model year, the standards listed first are in effect and supersede earlier adopted (in California) or proposed (Federal) standards.

FTP = 7 mode-7 cycle test
CVS-C = Cold Constant Volume Sampling Test
CVS-CH = Cold-Hot Weighted Constant Volume Sampling Test
N.R. = Not required
N.S. = Not specified

FIGURE 1

CONCEPT EMISSION PACKAGE
REACTOR-EGR-CATALYST SYSTEM

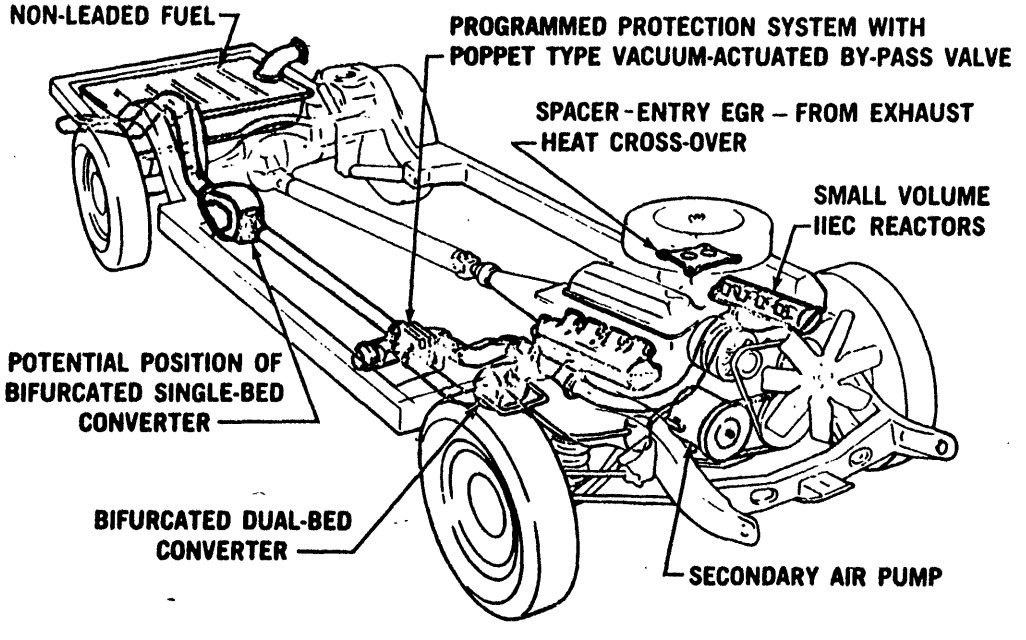


FIGURE 2

CONCEPT EMISSION PACKAGE
EGR & MONOLITHIC DUAL CATALYST
MAJOR HARDWARE COMPONENTS

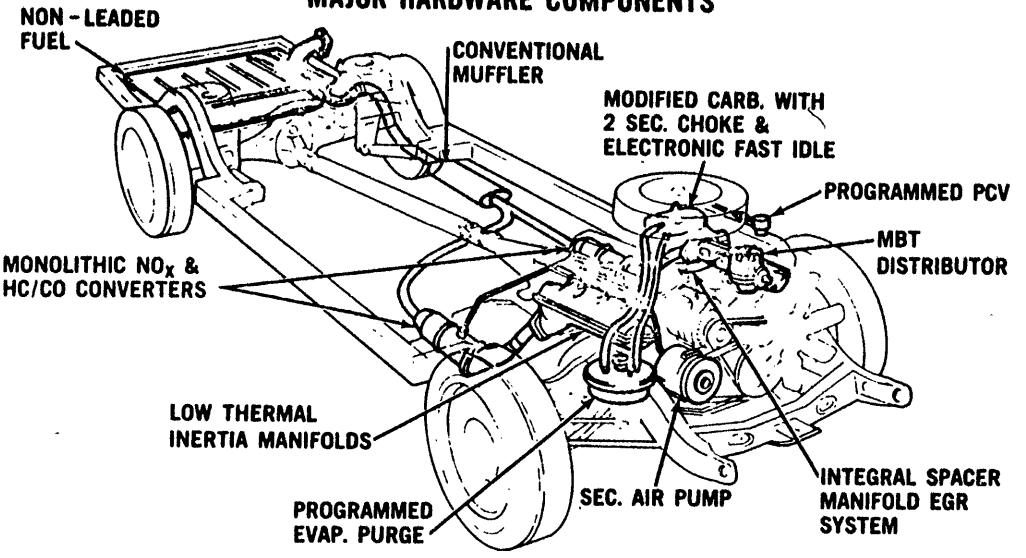


FIGURE 3

STRATIFIED CHARGE
INTERNAL COMBUSTION ENGINE-PROCO

INCLUDED – BUT NOT SHOWN:

- EXHAUST GAS RECIRCULATION
- LARGE VOLUME, LOW THERMAL INERTIA, INSULATED EXHAUST MANIFOLD
- PLATINUM HC/CO CATALYST
- NONLEADED FUEL

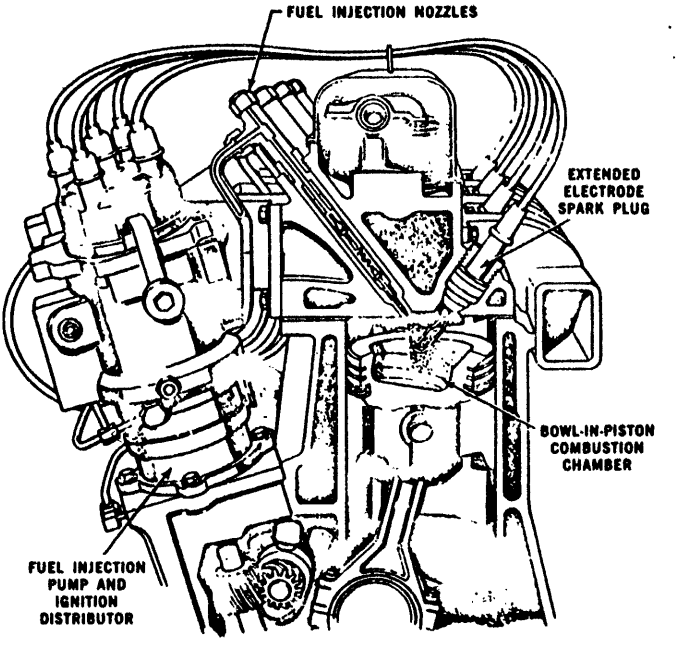
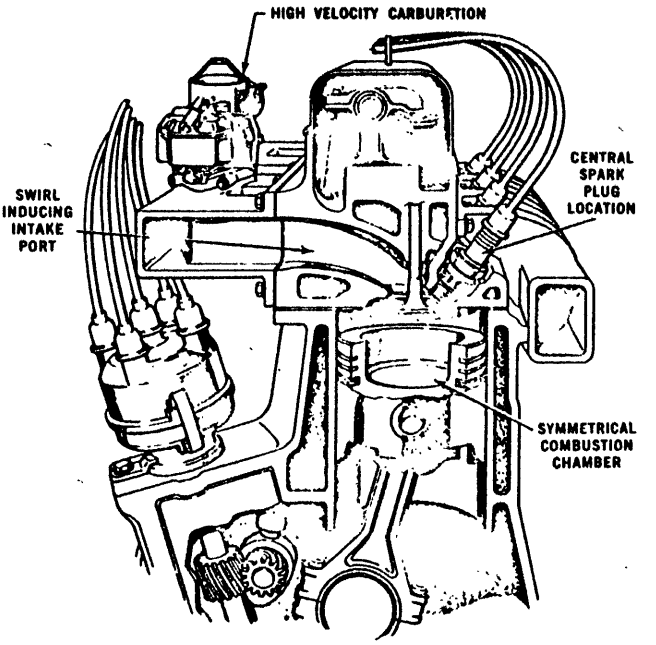


FIGURE 4

(LEAN BURN)

INCLUDED – BUT NOT SHOWN:

- EXHAUST GAS RECIRCULATION
- LOW THERMAL INERTIA EXHAUST MANIFOLD
- SECONDARY AIR INJECTION
- PLATINUM HC/CO CATALYST
- NONLEADED FUEL



Senator EAGLETON. Mr. Jensen, yesterday we had a witness from the Engelhard Industries Co., who indicated they were on the verge of executing a contract with Ford for an emission control device or devices, which relied very heavily on the use of platinum.

Mr. JENSEN. Yes, sir.

Senator EAGLETON. Are you about to contract with Engelhard Industries for this device they manufacture?

Mr. JENSEN. Yes, sir.

On May 23 of last year, we signed a letter of intent with Engelhard.

This was intended for California cars for 1974 models.

We are now in the process of negotiating another letter of intent pointing toward 1975.

The negotiations are not complete, but the report you have heard was accurate.

Senator EAGLETON. And you do know, of course, that, as I said, it relies very heavily on platinum?

Mr. JENSEN. Yes, sir, it is a platinum catalyst.

Senator EAGLETON. According to Mr. Harlan, president of Engelhard, the only substantial source of platinum, in the magnitude needed by a company of your size, is in the Union of South Africa.

Mr. JENSEN. Yes, sir. There is some platinum in Russia, some in Canada, but the largest source is in South Africa.

Senator EAGLETON. Are you a vice president of Ford?

Mr. JENSEN. No, sir.

Senator EAGLETON. How many vice presidents are there?

Mr. JENSEN. I would guess there are probably about 26 in North American Automotive Operations and the Central staffs.

I could supply that for the record.

The ones that are involved in emissions number approximately 15 or 20.

Senator EAGLETON. To whom do you report?

Mr. JENSEN. I report to the vice president for engineering and manufacturing staff.

In effect, my job is different, Ford has a different arrangement than General Motors.

I have a coordinating function at Ford Motor Co.

My background is in public administration. I am in my present position because I was the first Executive Officer of the motor vehicle pollution control board in the State of California when emission controls were first required for cars. The Ford Motor Co. employed me, because of a reputation of getting things done. I have a small staff who work with about 3,000 people in the various parts of the company to accomplish and implement the commitments of our management.

We have an Automotive Emissions Committee, Mr. Chairman, which meets monthly, and which decides policy in this area, and I am secretary of that committee.

Senator EAGLETON. I will yield to Senator Buckley.

Senator BUCKLEY. Mr. Chairman, I do not think I have any questions to ask Mr. Jensen.

Senator EAGLETON. Senator Tunney or Senator Baker, do you have any questions?

Senator BAKER. I have no questions. I apologize for not being here earlier, but I was in executive session of the Commerce Committee.

Senator EAGLETON. We are coming back to all of these witnesses, after they finish their prepared statements.

Senator BAKER. Fine.

Senator EAGLETON. Thank you very much for your statement.

Mr. JENSEN. Thank you.

Senator EAGLETON. Our next witness is Mr. Sydney L. Terry, vice president of the environmental and safety relations of the Chrysler Motors Corp.

STATEMENT OF SYDNEY L. TERRY, VICE PRESIDENT, ENVIRONMENTAL AND SAFETY RELATIONS, CHRYSLER MOTORS CORP.

Mr. TERRY. Thank you very much, Mr. Chairman.

My name is Sydney L. Terry. I am vice president of environmental and safety relations for Chrysler Corp.

With me this morning is Charles M. Heinen, Chrysler's executive engineer for materials engineering.

We are very pleased to have this opportunity to discuss with you the 1970 amendments to the Clean Air Act.

As you know, since the amendments were signed into law nearly 15 months ago, there has been intensive work by industry, Government, and university researchers on the extent of the pollution problem, the relationship between ambient levels and community health, and the technological problems of further reducing automotive emissions.

Because of all this activity, we all have a much more definitive idea today of the effect of the act will have both on the economy and the driving public.

On January 27, we had the opportunity to discuss some of these important new developments with the House subcommittee on Public Health and Environment.

In order to keep my remarks as brief as possible, I would like to submit for the record a copy of the presentation we made to that subcommitee.

Senator EAGLETON. It will be made a part of the record.

(The presentation may be found on p. 1312.)

Mr. TERRY. This morning I would like to touch briefly on the points we raised, and discuss some further developments that have occurred during the past 6 weeks.

First, as the National Academy of Sciences report states, the automotive industry does not now have the technology to reduce emissions 90 percent from 1970 levels.

While we have made substantial progress in developing even more effective emissions controls, we still do not have the technology to meet the 1975 or the 1976 standards.

At the outset, let me point out that in the time the act allowed, our only option was to improve the present internal combustion engine. As confirmed by the NAS report, there was simply not enough time to develop an entirely new, inherently low-pollution powerplant for motor vehicles, if indeed there is a powerplant which can meet all of the requirements of the act.

Senator EAGLETON. We had yesterday the witnesses from the National Academy of Sciences, and it was brought out that the only engine which they considered was the common place gasoline powered piston engine.

Do you think the National Academy of Sciences' report is in any way evidenciary of other engines as to performance and compliance with the 1975 standards?

Mr. TERRY. We talked with the National Academy of Sciences' people, as you know.

My understanding of their position was that the first thing they did was to analyze the possibility of using other powerplants by 1975, and they concluded there was no possibility of using them. In their preliminary discussions and in their first report they therefore concentrated on the large body of knowledge developed in the area where most of the work has been done—on the modification of the spark-ignition engine.

Senator EAGLETON. And the most substantial input in their research is information supplied to them by General Motors, Ford, Chrysler, and American Motors, is that not so?

Mr. TERRY. They indicated that, and we are proud of our contribution. But they did make every effort to get information from other sources, including inviting just about everybody.

Senator EAGLETON. Peculiarly, they did not invite anybody from Mercedes-Benz.

Mr. TERRY. I do know they made a concerted effort to have anybody that knew anything about the problem come in to talk to them.

Senator EAGLETON. Except Mercedes-Benz.

Mr. TERRY. Everybody, sir.

We started our work on emissions controls using the engine modification approach.

This approach has already resulted in reductions of 80 percent in hydrocarbons, 70 percent in carbon monoxide, and 50 percent in oxides of nitrogen in current production vehicles compared with emissions from vehicles without emission controls.

Since the engine modification approach is based on the principle that pollutants should be disposed of in the engine, it is by far the soundest and most economical approach to emission control, but it is subject to limitations on the degree of control possible.

After extensive experimentation with this approach, our best efforts resulted in total reductions of 88 percent in hydrocarbons, 83 percent in carbon monoxide, and 58 percent in oxides of nitrogen, which do not approach the 1975 or 1976 standards.

These standards require reductions of 97 percent of the hydrocarbons and 96 percent of the carbon monoxide in 1975, and 93 percent of the oxides of nitrogen by 1976.

Building on our engine modification approach, we next explored the possibility of using a combination of an oxidation catalyst and exhaust reactors.

We can come close to meeting the numbers required for hydrocarbons and carbon monoxide in 1975. However, we have not been able to find an oxidation catalyst that can maintain performance for the 50,000 miles that the act requires.

As you know, it is one thing to come close to meeting a standard with a one-of-a-kind experimental device installed on a vehicle that is operated in a carefully controlled laboratory setting.

It is a far different matter to develop the same device to the point where it is effective under all kinds of driving conditions for up to 50,000 miles.

And it is a far different matter to manufacture a complex device in mass production volumes.

We are continuing to explore methods of increasing durability of catalysts, but we are not optimistic of success in the short time available.

In order to meet the 1976 standards, an oxide of nitrogen catalyst is absolutely necessary. In spite of extensive efforts, we have not been able to develop a satisfactory catalyst for this application. Since oxides of nitrogen are formed as a result of efficient high temperature combustion, our approaches for control of nitrogen oxides have necessarily been in the direction of obtaining cooler, less efficient combustion.

These have included rich mixtures, retarded timing, exhaust gas recirculation, and lower compression ratios.

Each of these increase carbon monoxide and unburned hydrocarbons in the exhaust which then have to be burned in the oxidation catalyst containers.

The result is deterioration of these catalysts as a result of the higher temperatures. Reducing carbon monoxide and oxides of nitrogen require exactly opposite approaches.

Thus, any easing of the carbon monoxide standard will help in the control of nitrogen oxides and vice-versa.

Another approach we have reexamined does not rely on a catalyst. This consists of running the engine on a very rich mix to improve control of nitrogen oxides, and then burning the resulting carbon

monoxide and hydrocarbons at high temperatures in what amounts to a small furnace called a reactor.

But, while we came very close to the numbers required by the act, the system is limited by materials because of the great heat generated. In addition fuel economy penalties with this approach are of the order of 30 percent.

Although the system is not likely to meet all of the standards for 1975 and 1976, one of the most practical approaches for major reductions that we have investigated relies on lean operation.

To be effective the system requires very precise control of engine timing, fuel-air mixture, and distribution of the fuel mixture.

One of the advances already achieved from this research is our new electronic spark ignition which was introduced on some of our models this year and will be used on all our 1973 models.

We currently have extensive work going on in the areas of electronic control of timing, fuel metering, and exhaust gas recirculation.

As these reach the proper stage of development they will be introduced in our engines. While progress along these lines has been encouraging, a great deal of work still needs to be done to make a complete electronic control system along with the lean-mix approach feasible for mass production.

Even though we are making substantial progress, at this time we do not see how we can meet either the 1975 or 1976 standards with cars that will provide the performance and reliability our customers have come to expect of their cars.

Although the academy stated that the technology to meet the standards was not available at the time the report was issued, they went on to say that with some major concessions in the regulatory area there was a possibility that one or more of the larger manufacturers might be able to meet the 1975 standards.

Senator EAGLETON. I noticed you used the word major concessions. You selected those words advisedly?

Mr. TERRY. They were major concessions in view of the current discussions going on in the regulatory area, yes, sir.

Senator EAGLETON. I agree with you, they were very major.

Mr. TERRY. Yes, sir.

Senator EAGLETON. I take it you are not a lawyer, but using common sense, if you bought a Chrysler, how would you bring suit on your performance warranty if the averaging system is used?

Mr. TERRY. The averaging system is used for measuring total performance of the reduction in pollution from automobiles.

Senator EAGLETON. Say you buy a Chrysler Imperial and you bring suit on the warranty, after you have driven it around the block eight or 10 times, it does not meet the 1975 minimum, but it came off the production line on an average basis, how do you bring suit?

Mr. TERRY. If there are to be individual suits on cars, and suits on warranty, I agree with you that a maximum allowable emission value must be set which a car cannot exceed. This may also be necessary for enforcement in the long run. The numbers set, however, will have to be higher than that set for the average because there is unavoidably a large spread in the emission numbers from cars that are mass produced. This is particularly true when you get down to very low emissions levels where the amounts of emissions are so difficult to measure.

Because of the measurement variations you must have a tolerance from vehicle to vehicle, in order to achieve the levels of the standard on an average. As a practical matter, therefore, if you are going to test individual cars, it is necessary to have a higher number for the acceptable level emissions.

Senator EAGLETON. How would you bring suit on a specific performance warranty when the performance of the car does not meet the emission standards?

Mr. TERRY. I would say the maximum level allowable which you would have to measure would have to be a higher number.

If you used the same test which we use to certify vehicles, which is a very long and very expensive test, that would be one thing, but for any kind of measuring in the field, or for production line measuring or warranty, we will need a much simpler and much shorter test.

Whether a test can be developed that will correlate exactly or even approximately with certification test results remains to be seen.

There is a lot of work and effort being spent in trying to develop one. But it is clear there will have to be a simpler and shorter test, involving less expensive equipment and it will probably give different numbers.

Senator BAKER. Mr. Chairman, the act provides that until the Administrator promulgates a regulation for a particular testing device the warranty does not apply to the performance of the individual unit, but rather to the construction and the design of the unit, and then after the promulgation by the Administrator, the warranty does apply to the emissions of each individual automobile.

Senator EAGLETON. After the test is promulgated, I think that triggers into effect the performance warranty.

Prior to that there is the design warranty.

Senator BAKER. Until the time the Administrator promulgates that, there is a design warranty, and until the Administrator does promulgate that, you do not have an individual test on it.

Senator EAGLETON. Do you have any idea when he was to promulgate that?

He was to do it last December, but he did not.

Senator BAKER. Anyway, there is no test.

Senator EAGLETON. There is no performance test now.

Senator BAKER. There will be when he promulgates the test.

Senator EAGLETON. I was trying to explore what I would do if I bought a Chrysler in the future, after the performance test was established, how I could bring suit on that particular warranty, under the so-called averaging system, because the car I bought, happened to be on the high side, but it averaged out with another car, and I do not think you could bring a suit.

That is what troubles me.

Continue with your statement.

Mr. TERRY. The three provisions were: (1) General availability of lead-free fuel which will not damage the catalysts; (2) provisions for replacement of catalysts and other necessary maintenance during the 50,000 miles or 5-year test period, and (3) a provision for averaging of emissions from production vehicles.

We discussed these points in detail in our earlier testimony to the House.

On February 8, Mr. Ruckelshaus, the Administrator of the Environmental Protection Agency, gave Chrysler as firm an assurance as possible that the recommendations listed in the academy conclusions will be met. I would like to submit for the record a copy of Mr. Ruckelshaus' letter to us and our reply to his letter.

Senator EAGLETON. It will be made a part of the record.

(The letters follow:)

ENVIRONMENTAL PROTECTION AGENCY,
Washington, D.C. Feb. 8, 1972.

Mr. S. L. TERRY,
Vice President,
Environmental and Safety Relations,
Chrysler Corp., Detroit, Mich.

DEAR MR. TERRY: Your letter of January 24, 1972, advising that Chrysler Corporation plans to apply for a suspension of the 1975 light duty motor vehicle emission standards refers to several "unanswered questions of great concern to vehicle manufacturers." The most important of these questions relate to: (1) the availability by the beginning of the 1975 model year of fuel containing suitably low levels of catalyst poisons; (2) the replacement of catalysts and the performance of other maintenance that may be necessary for certain advance emission control systems; and (3) compliance by 1975 and later model vehicles with an assembly-line test. Your letter states that these questions require immediate answers in order for you to continue your development program in an orderly manner.

It is my purpose in this letter to state the Agency's position on these three matters as precisely as can be done at the present time, even while these same matters are undergoing intensive study by the Agency's technical staffs and appropriate regulatory material is being prepared.

(1) *General availability of suitable fuel*—Proposed regulations which will assure the general availability of lead-free and phosphorus-free fuels for use in 1975 and later model year vehicles equipped with emission control catalysts are presently undergoing Federal agency review. We anticipate that those proposed regulations will be published in March. The regulations at 40 CFR 85.71 applicable to 1975 certification test procedures already specify that the lead content and octane rating of the fuel to be used shall be in the range recommended by the vehicle or engine manufacturer.

(2) *Maintenance*—There is no question that the complex control systems being designed to meet the 1975 standards will require more maintenance attention than do the control systems now in use. We have presently under development proposed regulations that would allow increased maintenance under certain guidelines. These regulations contemplate catalyst replacement and other reasonable maintenance.

(3) *Assembly-line testing*—Assembly line test procedures now under consideration contemplate that emissions measured from tested vehicles will be averaged to determine compliance with applicable standards, subject to allowable upper limits of emissions which no vehicle may exceed. Averaging of emissions is clearly consistent with both normal quality control practices and with the intent of the Congress in establishing the 1975 standards in the Amendments to the Clean Air Act.

I am encouraged to note from your letter that you "agree completely with the conclusions of the recent report by the National Academy of Science. . . ." One of those conclusions states:

"While there is no certainty today that any 1975 model year vehicles will meet the requirements of the Act, the status of development and rate of progress make it possible that the larger manufacturers will be able to produce vehicles that will qualify, provided that provisions are made for catalyst replacements and other maintenance, for averaging emissions of production vehicles, and for the general availability of fuel containing suitably low levels of catalyst poisons."

As I have indicated in this letter, the provisos of the Academy conclusion will be met.

Very truly yours,

WILLIAM D. RUCKELSHAUS,
Administrator.

CHRYSLER CORP.,
February 25, 1972.

Mr. WILLIAM D. RUCKELSHAUS,
Administrator, Environmental Protection Agency,
Washington, D.C.

DEAR MR. RUCKELSHAUS: Thank you for your letter of February 8. We appreciate your firm assurances that the three provisos in the conclusion of the National Academy of Sciences report on emissions will be accepted. We feel that your letter, which certainly helps to clarify the situation, will advance the cause of clean air. While your decisions on these provisos were most welcome and helpful, the fact remains, as unequivocally stated by the NAS report, "that the technology necessary to meet the requirements of the Clean Air Amendments for 1975 model year light-duty vehicles is not available." Your assurances that these three problems will be favorably resolved now enable us for the first time to evaluate several approaches to the 1975 objectives.

The knowledge that lead-free and phosphorous-free fuels will be generally available countrywide for 1975 models and beyond will permit us to plan to use catalysts, if necessary. Furthermore, your decision to adopt the averaging concept for any contemplated assembly-line compliance test procedures permits us, for the first time, to set an internal target for the exact levels of emissions we will have to meet. Most important of all, your recognition of the fact that the complex control systems being designed will require maintenance attention by the car owner over and above that required today, including necessary catalyst replacements, makes it possible for us to plan for the use of these sophisticated exhaust treatment systems in production cars.

Prior to receiving your letter last week, we had not been able to develop a single system to meet the 1975 requirements under the stringent interpretations of the ground rules advanced by your people, much less solve the many problems relating to durability and usage. Now that we have your letter clarifying some major issues, we are redirecting and concentrating our efforts to arrive at an optimum system. Once a system is chosen, many different kinds of tests must be run over many thousands of miles before a realistic evaluation of its effectiveness can be made. Undoubtedly, major changes will have to be made as a result of these exhaustive durability tests. And each time a major change is made, the whole testing schedule must be repeated. Consequently, we are still faced with an impossible lead-time problem for 1975 model cars.

We note with interest your reference to that section of the conclusions of the Academy report which indicates that it might be possible for some manufacturers to meet the 1975 requirements if the three previously discussed provisos are accepted. However, when the entire report is considered, it is quite clear, in our opinion, that the NAS Committee believed that forcing such stringent standards for 1975 cars would be uneconomic, unwise, and contrary to the public interest. The report is replete with statements that the technology is not yet developed, and with examples clearly indicating that the risks of putting inadequately developed hardware in the hands of the public without thorough durability and other testing did not appear to be justifiable. Such risks would accrue not only to the manufacturers, but also car owners, and to the cause of clean air.

The report pointed out with illustrative graphs that if the one-year suspension is granted, the effect on total automobile emissions and overall air quality would be very small because of the high degree of controls already built into current model cars. On the other hand, the report states that with new inadequately developed devices, or without assurance of proper owner maintenance, these vehicles might emit as much or even more pollutants than previous model cars. Our experience has shown this to be true.

In view of the many still unresolved problems remaining before improved emission control systems meeting the 1975 model requirements are ready for mass production, we still feel, in keeping with the spirit of the Academy report, that we must apply for the one-year suspension permitted by the Act. As the Academy report states, "one important advantage of the one-year suspension is that it would allow an additional year's work to develop the complete emission control system before major design details of components would have to be 'frozen' for production." We strongly agree, and we are con-

fident that the granting of the one-year suspension by your Agency would be very much in the public interest.

Sincerely yours,

S. L. TERRY,
Vice President, Environmental and Safety Relations.

Mr. TERRY. As pointed out in my reply to Mr. Ruckelshaus:

* * * While your decisions on these provisos were most welcome and helpful, the fact remains, as unequivocally stated by the NAS report, "that the technology necessary to meet the requirements of the Clean Air Amendments for 1975 model year light-duty vehicles is not available." * * * When the entire report is considered, it is quite clear, in our opinion, that the NAS Committee believed that forcing such stringent standards for 1975 cars would be uneconomic, unwise, and contrary to the public interest.

The report is replete with statements that the technology is not yet developed, and with examples clearly indicating that the risks of putting inadequately developed hardware in the hands of the public without thorough durability and other testing did not appear to be justified.

Such risks would accrue not only to the manufacturers, but also to car owners, to the public, and to the cause of clean air.

Data developed by the industry and supported by studies of independent agencies show that we should reconsider the timetable originally set for automotive emission control.

A natural question is whether we can afford a delay of any kind. The NAS report pointed out with illustrative graphs that if the 1-year suspension is granted, the effect on total automobile emissions and overall air quality would be very small because of the high degree of controls already built into current model cars.

On the other hand, the report states that with new inadequately developed devices, or without assurance of proper owners maintenance, these vehicles might emit as much or even more pollutants than previous model cars, particularly when considered over the life of the car. Our experience has shown this to be true.

In addition, we have learned much more about atmospheric concentrations of various air pollutants and the effect of ambient levels on human health since the Clean Air Act Amendments were passed.

As recently as a year ago, there were very few atmospheric measurement stations for the types of pollutants automobiles emit. The New York City Environmental Protection Administration, for example, pointed out in its proposed plan for meeting Federal air quality standards that hydrocarbons, nitrogen oxides, and oxidants have been measured only briefly over the years and then only at one site.

We have learned that readings from only one or even a few measurement stations do not give an accurate picture of air quality in a city the size of New York, or Chicago, or Washington, D.C.

However, over the past 12 months, many stations which had been under construction have been put into operation by various States and municipalities.

And I might add that while we still do not have a completely reliable measurement of pollution levels, the second annual report of the Council on Environmental Quality issued last summer pointed out that "ambient air quality levels seem to be generally improving, at least in the places where the sampling stations are located."

In other words, controls already in force are starting to take effect on overall pollution levels. In the case of automobiles, tables

from the House testimony show that emissions from motor vehicles are decreasing at an increasing rate.

We have also learned more about the effects of air pollution.

For example, an extensive study being conducted for the Coordinating Research Council by the Medical College of Wisconsin shows that the carbon monoxide exposure of people working in our downtown areas is well below any danger point.

This should be thoroughly investigated because any easing of carbon monoxide standards makes lower levels of oxides of nitrogen emissions possible.

Unfortunately, at the time the Clean Air Act Amendments were written, we did not have this information. A year ago it seemed best to many people to take the most conservative approach possible: use the highest readings available at any single station, translate them into carboxyhemoglobin levels based on laboratory experience, and then set a standard based on these data.

It was the only gage we had. But apparently, we have overstated actual exposure risks. And in light of the new data which are being developed it seems we should reconsider our earlier conclusions based on spot experiments.

Since the act was adopted, we have all become more aware of its impact on the total country.

Again, we covered this in detail in our testimony to the House. Let me just point out now that the National Academy of Science report estimated that any of the control systems currently being proposed would result in a total additional cost of more than $300 for the 1975 model year over the base price of an uncontrolled vehicle.

The 1976 model year requirement for nitrogen oxides would probably add at least another $100 to this figure.

These estimates of a total cost of more than $400 represent neither the highest nor lowest figures. In fact, our own estimates run even higher. And this does not include costs manufacturers will bear in issuing and administering the warranty provisions of the act.

In addition, the customer will find that this vehicle will burn considerably more fuel, and since the fuel will probably be lead-free, the total fuel cost will be considerably more than it is today.

The exact amount of the fuel penalty will depend heavily on the system chosen. Also, added maintenance requirements, including possible catalyst replacement, will make car operation more expensive.

Finally, in order to assure that emission levels are being met in the field over the life of the car, there will have to be mandatory vehicle inspections.

A report by the Institute of Public Administration for EPA estimated that the cost of developing an emissions checking program, including equipment, could be in excess of $100 million.

We think that figure is very optimistic. The logistics of equipping inspection stations with emissions checking equipment of sufficient accuracy to measure these very low concentrations (can you visualize how small a proportion 20 p.p.m. really is?) and in sufficient volume (10 million cars the first year and ultimately over 10 million cars) and with sufficient skilled operators (far more skill than required of a normal auto mechanic) seem insurmountable in the available time period.

Your invitation also requested that we also report on our work with alternative power sources.

Even though there is no hope at all that any alternative power source could possibly be ready for production for the 1975 or the 1976 model year, we at Chrysler have been actively experimenting with several types of new engines.

With the Steam Engine System Corp. we are investigating the feasibility of a steam powerplant for automobiles. We are also actively working on gas turbines.

As you know, Chrysler was a pioneer in turbine research for passenger cars, and we are currently continuing that research with a sixth generation turbine engine.

So far one of our biggest problems has been controlling NO_x emissions. We have made a good deal of progress in reducing NO_x emissions from turbines, but we are not optimistic that we can meet the 1976 required levels with a turbine. We are also working on a version of the stratified charge engine.

I will be glad to provide the committee with performance data on any of these powerplants.

When we judge any of these alternative engines by all the criteria that must be used—not just emissions, but driveability, durability, fuel consumption, and cost—our conclusion is that there does not appear to be a practical alternative to the piston engine in the near future.

In summary:

1. The technology is not available to meet the present schedule for emissions reductions.
2. In view of the high degree of control already being applied, a limited delay would not have a significant effect on the atmosphere.
3. The economic impact of overcontrol is very large.
4. The possibility of longer-range reductions in emissions by using alternate powerplants cannot be ruled out, and such powerplants are being investigated by Chrysler.

We would urge that the committee consider treating the automobile in the same manner as other pollution sources covered by the act. Emission standards for the other sources are established only after technological feasibility and economic impact are considered.

We believe that the public interest would be well served if the same provisos were applied to auto emissions.

Chrysler Corp. stands ready to support any effort that will give the country the hard information it needs to determine the best ways to use its limited national resources to improve air quality.

In the past our company has called for a major coordinated effort similar to the effort that put man on the moon to improve the environment here on earth.

We have supported Senator Baker's proposal for a national environmental laboratory. On January 27th, we suggested to the House committee that the National Academy of Sciences be asked to evaluate the total problem and report back to the Congress and the Nation.

You may be sure that Chrysler stands ready to work with the NAS or any other agency in support of any basic research that will help the country determine the best course to take in dealing with its pollution problems.

You may also be sure that we will continue our intensive search for ways to meet the 1975–76 standards. But in light of the new evidence concerning the effects of ambient levels on human health, the present state of the technology, and the enormous potential costs involved, we hope that you will both reconsider the timing of the auto emissions standards called for by the 1970 amendments to the Clean Air Act, and recommend a major evaluation of the entire pollution problem.

Mr. Chairman, I would like to point out that I have some graphs at the end of my statement. The curves on this graph show where the air quality would go, as far as automobile emissions are concerned, on through 1985–90, even though the standards were not made more stringent than the 1973 standards. So if nothing more were done in 1975, pollution from automobiles would continue to go down.

I would like this to be made a part of the record.

Senator EAGLETON. It will be made a part of the record.

(The graphs follow:)

CHART I—NONSMOKERS CARBOXYHEMOGLOBIN MEAN AND STANDARD DEVIATION FOR 14 CITIES

	Milwaukee No. 1	Detroit No. 2	Miami	District of Columbia	St. Louis	New York	Hawaii
Number of samples	603	596	282	839	675	931	517
Mean	1.30	1.34	1.38	1.39	1.40	1.43	1.45
Standard deviation	0.60	0.52	0.69	0.61	0.45	0.61	0.56

	Milwaukee No. 2	Seattle	Detroit No. 1	San Francisco	New Orleans	Alaska	Chicago
Number of samples	225	600	615	664	161	105	417
Mean	1.51	1.56	1.58	1.65	1.72	1.75	1.88
Standard deviation	0.80	0.58	0.69	0.57	0.59	0.68	0.61

CHART II

FUEL COST PENALTY

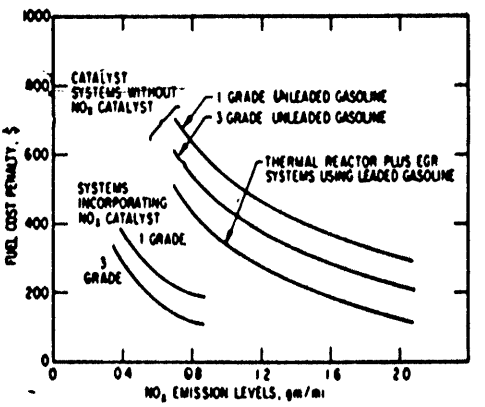


CHART III

FUEL ECONOMY PENALTY DUE TO NOx EMISSION REDUCTION

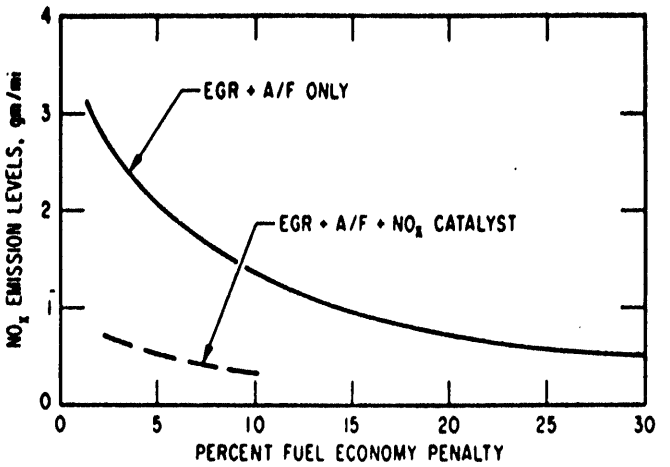


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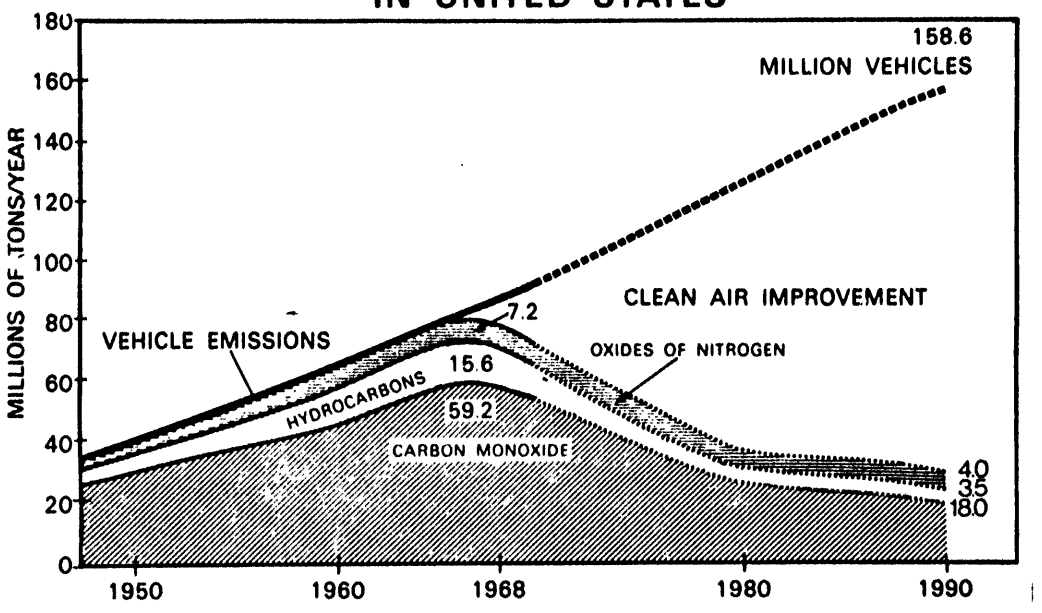
CHART IV

AUTOMOTIVE ATMOSPHERIC IMPROVEMENTS IN UNITED STATES



*Chrysler estimate of emission reductions that could be achieved through further development engineering using the engine modification approach.

REVISED NOVEMBER 1, 1971

CHART V

UNITED STATES NATIONWIDE CARBON MONOXIDE EMISSIONS

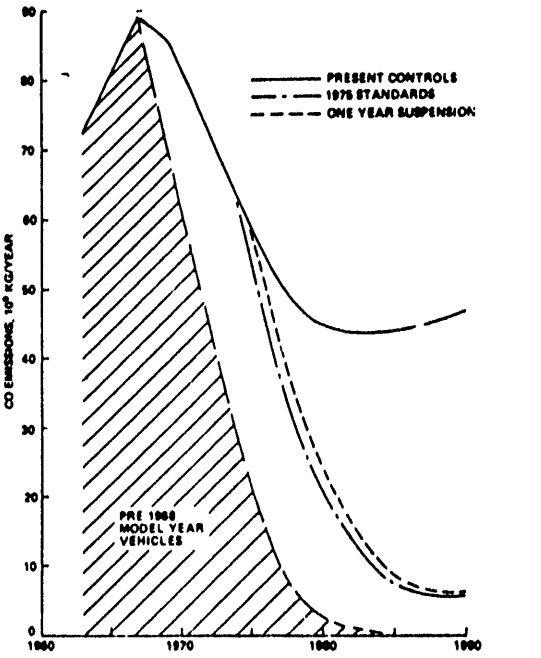
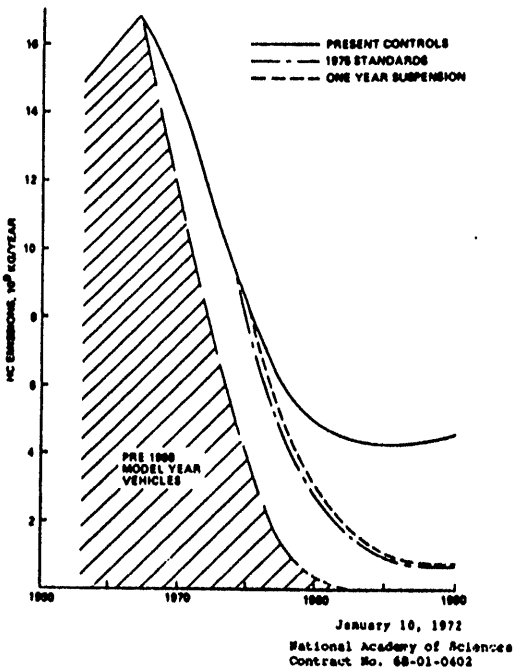


CHART VI

UNITED STATES NATIONWIDE HYDROCARBON EMISSIONS



Senator TUNNEY. What about the Los Angeles Basin, what about the 6 or 7 million people who live there?

Mr. TERRY. The pollution from automobiles in the Los Angeles Valley is also going down for California people.

Senator TUNNEY. For individual automobiles, or are you talking about the air quality?

Mr. TERRY. I am talking about emissions from automobiles.

Senator TUNNEY. Let me just read to you from the testimony that we had from Dr. James Pitts of the University of California, Riverside, on March 25, 1972, in Los Angeles. Dr. Pitts is recognized as one of the foremost experts on the problems of air pollution and air pollution control.

For example, the State of California has had controls on exhaust emissions for six years, yet the air quality has not improved in many areas of the State. In fact, during this period, it has become significantly worse in much of the South Coast Air Basin.

He goes on to state further:

Specifically, to date in the month of March (which used to be included in the "smog-free" season), data from the UCR air monitoring station show that on our campus the State of California air quality standards for oxidant (0.10 ppm for one hour) have been exceeded every day.

Do you still say the conditions in the Los Angeles Basin are better than they were a number of years ago?

Mr. TERRY. I am glad you brought that up, Senator Tunney.

We have been following this very closely. As you know, the controls put on by the State of California, starting about 1966, I believe, were only for unburned hydrocarbons and carbon monoxide. The feeling in those days was that by reducing the unburned hydrocarbons alone, you had to reduce smog, because the formation of smog requires both oxides of nitrogen and unburned hydrocarbons with sunlight acting as a catalyst. These conditions are prevalent many days in Los Angeles. To reduce either one of these elements should cause a reduction in smog. There was not then, and still is not enough research and not enough study of the causes of smog.

We still do not know enough about it. A more recent theory is that oxides of nitrogen takes a more important part than had been suspected in the formation of smog.

In fact, I think it remains to be seen whether or not reducing oxides of nitrogen, in turn, from automobiles in California will actually improve the level of smog. The truth is we just do not know what pollutants and in what relative proportions cause this smog.

Senator TUNNEY. Who does not know about it?

Mr. TERRY. The scientific community.

Senator TUNNEY. I think the scientific community knows pretty well because Dr. Pitts went on to say the following:

Accompanying these high levels of oxidant have been unusually severe attacks of an extremely toxic pollutant, PAN (peroxyacetyl nitrate). This compound is a severe phytotoxicant, eye irritant, and general health hazard to man. This past winter, the attacks in Riverside have been longer and of more severity than in any previous year in history. Thus every day this March, the PAN levels have exceeded the value of 10 ppb (parts per billion), generally considered to be the level at which plant damage to agricultural crops and ornamental plants begins to occur.

Do you still say you feel the conditions in the Los Angeles Basin are better?

Mr. TERRY. Senator Tunney, we know that the total amount of hydrocarbon emissions from cars is less and less and decreasing.

Senator TUNNEY. That is what you say. You said hydrocarbons, but I do not agree with you.

You said that smog is better?

Mr. TERRY. No, we do not know that smog is better. If I said that, I would be mistaken. But emissions from cars are less.

Senator TUNNEY. Less hydrocarbons?

Mr. TERRY. And CO.

Senator TUNNEY. But not NO_x?

Mr. TERRY. Because nobody knew what it was, and we still do not know what is causing it.

Senator TUNNEY. We may not know what is causing it, but we know it is coming out of the back end of the automobile.

Mr. TERRY. We are not even sure of that.

Senator TUNNEY. We had expert testimony in California, Dr. James Pitts and Prof. Lester Lees, both of whom are recognized authorities. They testified to the problem. They said that the oxides of nitrogen were extremely dangerous, extremely serious, and the reason we had this increase in NO_x was because of the fact that when the State established the standards for carbon monoxide, and hydrocarbons, they had not set standards for the NO_x. As a result of that, you had a hotter burning engine, and you had greater emissions of oxides of nitrogen, so I would suggest maybe it would be helpful if you talked with some of the experts in the field.

Mr. TERRY. We have.

Senator TUNNEY. Your testimony is contrary to theirs.

Mr. TERRY. I do not believe there is really a contradiction.

I have tried to explain it.

Senator EAGLETON. I do not understand the basic thrust of your testimony.

Would questions such as these be fair questions, for instance, does a nationwide photochemical smog problem exist?

Mr. TERRY. No, it does not.

Senator EAGLETON. Do facts indicate that motor vehicles are the only air pollution source which should be controlled on a national basis?

Mr. TERRY. No.

Senator EAGLETON. How severe is the air pollution problem and photochemical reaction in various cities in various States?

Do we know quite a bit about that?

Mr. TERRY. We know quite a bit. We know it is very serious in the Los Angeles Basin.

We know some of the problem is present in Denver. Some is beginning to show up in Phoenix. However, it has to be pretty bad to actually get to be a health problem.

Senator EAGLETON. Will the national control of vehicle emissions significantly improve the kinds of air pollution problems?

Mr. TERRY. Will the national control?

Senator EAGLETON. Will the national control of vehicle emissions significantly improve this kind of air pollution problem?

Mr. TERRY. In the case of Los Angeles, Phoenix, and Denver, yes.

Senator EAGLETON. What has been the experience of efforts to control the many sources of air pollution in California?

Mr. TERRY. As Senator Tunney indicated, they have had a frustrating time trying to actually lower the smog level.

Senator EAGLETON. There are a whole series of questions on which the jury is still out, so to speak, here, which we do not know enough about.

Mr. TERRY. Yes, sir.

Senator EAGLETON. Well, all of these questions were questions asked by Mr. Harry A. Williams of the Automobile Manufacturers Association back in 1965, and here it is 1972, so what have we learned between 1965 and 1972.

Mr. TERRY. Well, we have learned a great deal, I think.

Actually, the original nature of this photochemical smog reaction was discovered back in about 1953. But even then, with all of that time in between, it has been very difficult to reproduce the kinds of things that seems to be going on in the air.

Senator EAGLETON. For instance, you stated it was a surprise that NO_x was the problem.

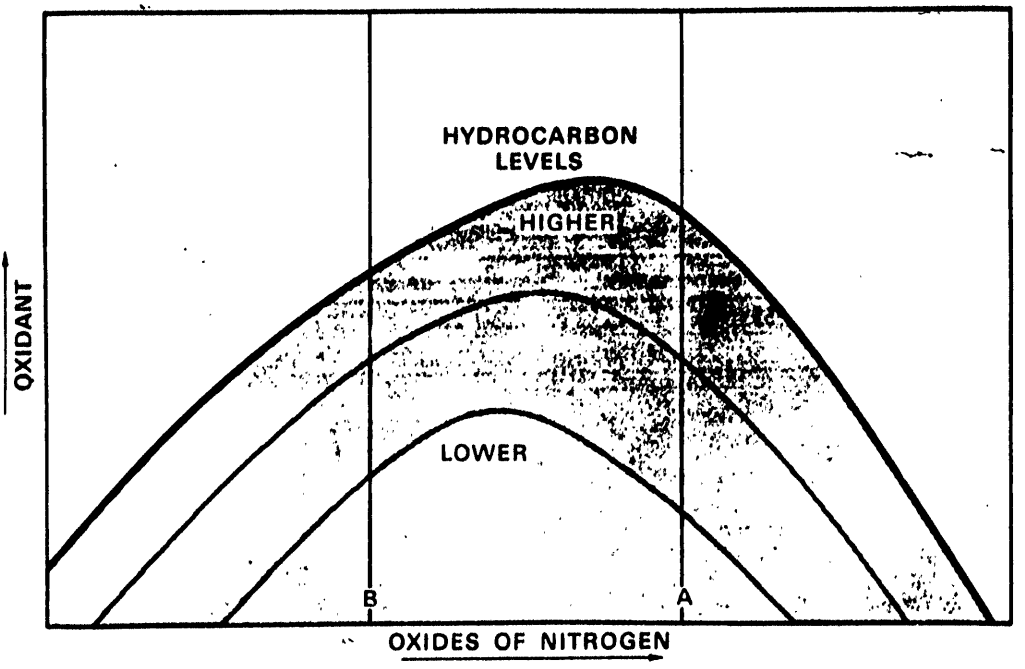
Mr. TERRY. Witness the fact that in 1967 or 1966 it was thought that the best way to reduce smog was to reduce the hydrocarbons. It was believed that if you reduced unburned hydrocarbons you would reduce smog, whereas if you went ahead and reduced NO_x, you could cause an increase in smog.

The Los Angeles photochemical smog is a reaction in the atmosphere between hydrocarbons and oxides of nitrogen. This reaction will vary with many things. It requires low wind speed and inversion, reasonably high temperatures and, of course, concentrations of the various reactants.

One of the characteristics of this reaction is that it will operate only with certain mixtures of oxides of nitrogen and hydrocarbons. Too much, in the way of oxides of nitrogen, will keep the reaction from occurring as, of course, will too little. There is an optimum point and no one knew whether the atmosphere was at that optimum point and for that matter no one knows yet.

As the attached chart shows, if we were on the right-hand side, in other words, if the oxides of nitrogen were high enough to start inhibiting the reaction, decreasing them would actually increase the eye irritating oxidant. If they were on the left-hand side, of course, lowering oxides of nitrogen would be most desirable. The decision has finally been made to go ahead and control oxides of nitrogen and we have already begun in California. For the sake of the record, we believe the decision is correct, but it is still a technical gamble.

(The chart referred to follows:)



Senator EAGLETON. No provision of the 1970 Clean Air Act Amendments permits any compromise on standards relating to the public health, whether they be stationary sources or automobiles.

The public health is treated as something extremely important in that act, and indeed it must be, and there is no compromise permitted.

Mr. TERRY. We certainly agree there should be no compromise with the public health.

Senator EAGLETON. I have asked the previous two witnesses what their role in the corporate structure of the respective companies was.

You are a vice president of Chrysler, Mr. Terry?

Mr. TERRY. Yes, sir.

Senator EAGLETON. How many vice presidents does Chrysler have?

Mr. TERRY. Approximately 25.

Senator EAGLETON. To whom do you report?

Mr. TERRY. I report to Virgil Boyd, who is vice chairman of the board.

Senator EAGLETON. How big a staff do you have under you?

Mr. TERRY. I have one man that works with me directly, and a couple of secretaries.

Senator EAGLETON. Senator Baker, do you have any questions?

Senator BAKER. Mr. Chairman, thank you very much.

In listening to the colloquy between the witness and the chairman, regarding the situation of oxides of nitrogen, and whether we did or did not know some years ago the effect of that particular component of auto emissions on the environment, I asked the staff to bring me a copy of the hearings on this matter that this subcommittee held in Los Angeles in 1967, 5 years ago. Mr. Schuck testified at that time.

I think it relates both to what Senator Tunney and the chairman was talking about, and to what the witness alluded to.

I will submit this to be inserted in this record at this point.
(The material referred to follows:)

Senator BAKER. Mr. Chairman, I don't want to prolong the hearing, but I must confess that I am substantially disturbed by the basic thrust of the witness' testimony.

I am going to put a basic oversimplification on the importance of what has been said and check the accuracy of my own deductions, to the effect that efforts to depollute the atmosphere through the various control devices that we have discussed and heard the testimony about for automobiles, which in effect make for a higher combustion temperature, in turn may very well produce more nitric oxide, which will produce more nitrogen dioxide.

Mr. SCHUCK. That's correct. However, the evidence I heard presented today did not convince me that this was a deliberate act.

Senator BAKER. Really, what I am trying to find out, and the point upon which I am very disturbed, is whether we might be heading in the direction of creating more of one pollutant, that is, the brownish-gray smog, irritant, by the very measures we are employing to combat hydrocarbon pollution.

Mr. SCHUCK. We may be moving toward the brownish hazy atmosphere type of thing, but in reducing the hydrocarbons you can only form so many molecules of this peroxyacetyl nitrate or so many molecules of any other photochemical product, so if you remove the hydrocarbons you must have beneficial effects.

Senator BAKER. I agree. But there is no question in my mind, for your information, but that we have got to continue in the removal efforts for hydrocarbons—the oxide of nitrogen too—but what I really want to find out is whether we may be increasing the concentration of nitrogen compounds in this very process to eliminate hydrocarbons.

Mr. SCHUCK. Well, as I say, the evidence presented today did not convince me that this a deliberate act. We have known for many years that the compression ratio has been increased on cars, and this did lead to more efficient burning of hydrocarbons, thus less CO, less hydrocarbons in the exhaust—but—increased nitric oxide.

Senator BAKER. Does this in turn inevitably lead to a higher concentration of a smog-type reaction we see in the atmosphere?

Mr. SCHUCK. No; it would lead to a different type of mixture. It would lead to a mixture that was higher in nitrogen oxides. It would be lower in the concentration probably of the final photochemical toxicants, the aerosols, and the eye irritants, because they require hydrocarbons to form.

Senator BAKER. I see.

Mr. SCHUCK. But it will be higher in nitrogen dioxide a direct toxic gas. It would be an entirely different mixture.

Senator BAKER. The import of your testimony then would be to continue the efforts to eliminate hydrocarbons but to give fresh attention to the necessity for eliminating nitrogen——

Mr. SCHUCK. That's right. People get on the wrong track by insisting on looking at one reaction. If I look at one reaction, for example, at the presence of nitric oxide in the air, which does, in fact, help reduce the production of photochemical products. This sounds like a logical argument for leaving this relatively nontoxic gas in the atmosphere. It fails to note what might be happening on the highways. I think this is something that should be explored. We need to know more about the dilution processes on our highways, I mean a complete circular study of what happens.

Senator BAKER. The purpose of that, Mr. Chairman, is to point out that 5 years ago, in 1967, we were unsure about the inter-relationship of the two, and my question now is whether or not we are anymore sure of the interrelationship between photochemical oxidants, and hydrocarbons, and NO_x?

Mr. TERRY. My colleague just passed me a note. It indicates that in Mr. Pitts' paper, the one Senator Tunney referred to, he said if you have less than 50-percent control of the oxides of nitrogen, and this is total, you might end up with more smog than you had before.

Senator BAKER. How would that work?

Mr. TERRY. It is because of the curve. You have a certain ratio of unburned hydrocarbons and NO_x. If you reduce either one of these, presumably the total smog decreases. But it depends on which side of the curve you are on. Because of this interrelationship, if you just partially control the oxides of nitrogen, you could still be going up on the curve and you might end up with more smog. If you get over the hump, so to speak, you reduce smog.

This is the same theory that was offered when the standards were written. Apparently, Pitts agrees with that theory which holds that the nature of the curve is such that you are better off to reduce just one of these things as far as reducing true smog is concerned.

On the other end of the curve, the NO_x end, there is still a great deal we do not know yet.

Senator BAKER. Is it not very likely that the situation also varies from various factors?

Mr. TERRY. That is the biggest factor. You will note that in Mr. Pitts' statement, he said that we have had unfavorable meteorological conditions in the last couple of years, and this was one of the big factors. He said in addition you have a problem of oxides of nitrogen from automobiles, but the relative importance is not understood.

Senator BAKER. Just let me hasten to say, regardless of our questions in this respect, there is no question but that you must continue, and the statute requires you to continue, to try to eliminate both forms.

Now, the question in my mind is whether or not you have made the decision to try to continue with the internal combustion engine.

The chairman mentioned that a moment ago in more direct terms. You made some remarks in your statement saying the reason you have trouble is because the statute requires you to try to only improve the internal combustion engine.

Mr. TERRY. I did not say that.

Senator BAKER. That is one of the impressions I received, that one of the reasons we have a problem is because there is no time for alternative power sources.

I am sure that you and others in the industry will recall, prior to passage of the Clean Air Act Amendments of 1970, we had a number of hearings on power sources, we drove steam automobiles and electric cars up and down the mall at the Capitol.

We had extensive hearings on what might be done on the internal combustion engine, and not a single representative came forward with the idea that any of the power systems were viable and a good alternative to the combustion engine, and that was before this committee recommended passage of the Clean Air Act Amendments of 1970.

The point I am making, you have made your bed, and now you have to sleep in it. We wrote that statute on the basis of the best information that we had.

I think it is probably true that you will have to stick with the internal combustion engine.

I did not think so at one time, but now I do, but it is not in good grace now to come here and complain before the committee.

With that little morality play, I will ask no further questions, but I would like the record to clearly reflect that the committee did not

arbitrarily choose between the internal combustion engine and some other power source.

We wrote the bill on the basis the information was supplied from the automobile industry. I will conclude by saying that I have considerable confidence that you can meet the standard.

I think you think you can do it. I know some of you will be able to do it.

The question is how and when.

Senator EAGLETON. May I inquire of the Senator, I do not take it the Senator is saying the 1970 Clean Air Act Amendments precluded consideration of alternate power sources?

Senator BAKER. No.

What I am saying is that the 1970 Clean Air Act Amendments, in effect, compelled them to try to clean up the combustion engine, rather than to give them time to go to alternative power sources. Although the language does not directly say that, if it is so, it is based on this requirement that they must do this by 1975.

Senator EAGLETON. As I read the 1970 amendments, they not only permit analysis, but also research on alternative power sources, and they are designed to encourage such tests, and they do not have to be just the internal combustion engine. Tests could also be done on such things as the diesel engine.

Mr. TERRY. Our company, and I am sure the other companies, are working very hard on alternate power sources because we do hope to be able to get a better and cheaper way of meeting all of the requirements with more dependable engines in the future.

It is just that we cannot do it by 1975.

Senator BAKER. I remember Bill Lear came into the room with a crack of thunder, and he indicated he tried to buy your turbine engine.

Mr. TERRY. I don't know whether he tried to buy it or not. But it is not for sale.

Senator BAKER. What are you doing with it?

Mr. TERRY. We are working with it. In considering any new alternative power source, however, you have to consider what you have to do to bring this power plant into production. And, of course, hundreds of millions of dollars would be involved.

It would be unthinkable to decide on an alternate power source and to spend money on it unless you knew you could meet the pollution standards with that power plant. All of our work on alternate power plants has been confused by the National Pollution Standards. They keep changing so fast that what used to be a good plan, based on the 1967 standards, is now no good because the standards are now something else, and so research and development must go on, to meet another new set of requirements.

Until the standards stay still there is no way to make a commitment on alternative power plants.

Senator BAKER. Is it in fact a fair projection that you can meet the standards of this act by 1976?

If not, what are you going to do in 1976?

Mr. TERRY. We think we can come closer with the internal combustion engine, spark ignition, than we could with any other power plant by 1975 or 1976.

Senator BAKER. Do you think you can meet them by 1976?

Mr. TERRY. No, sir.

Senator BAKER. What are you going to do?

Mr. TERRY. One thing we are doing is what we are doing today. We are going to try to tell Congress, the public and the scientific community, what problems are involved. We are going to try to find out what we can about the air pollution problems, its effect on health, and so on. And, we are going to try to get all of the facts.

Senator BAKER. There are two alternatives: you have to convince us to change the law, or you have to quit making cars; one or the other.

Mr. TERRY. There is also a year's extension written in the Act. That could be given. But other than the year's extension, that is true.

Senator BAKER. The Clean Air Act Amendments of 1970 says that you have to build a clean car. Have you now made a judgment that you can build that car by 1977, or are you going to gamble that Congress will change the law, or are you going to go out of business?

Mr. TERRY. Our judgment is we are going to try our darnest to meet the standards as they exist as soon as we can, with the spark ignited piston engine.

Senator BAKER. Do you think you are going to do it by 1977?

Mr. TERRY. That is a long time away.

That would assume a year's extension is given.

Senator BAKER. What I am saying is, if you run the whole string through, there are no more goodies left, and you have to have a clean car under the act, and there is no alternative, do you think you can have it by the 1977 model year?

Mr. TERRY. Maybe.

Senator BAKER. Could I ask the other witnesses the same question, just going on down the line.

Mr. STARKMAN. I think we can come closer in 1977 than we can in 1976 to building a clean car.

You are asking for NO_x. We have run one of a kind cars, as you call it, that have met the 1976 standards, but not for long, so we are learning, and I can at this date, say we can not run those cars off the end of the production line consistently, meeting the 1976 standards in 1976.

Senator BAKER. Are you sure you can do it with one engine?

Mr. STARKMAN. We can do it with one engine for a few hundred miles.

Senator BAKER. What are you going to do in 1977?

Mr. STARKMAN. Punt.

Senator BAKER. Mr. Jensen, what are you going to do?

Mr. JENSEN. We do not have the data now that says we can meet the standards in 1976 or in 1977, but we have about 500 or 600 dedicated young engineers, who are really working around the clock to do it. Our informal commitment is to try to meet those standards.

I do not know today if we are going to meet the standards, but we are going to try our best. We feel that if we come back to the committee, and to Congress and say, "All right, we did not get 'all the way', but we got very close," that you will listen to us. I think we have to show you, and we have people working right now at Ford who can prove to you that we are making an all out effort.

Senator BAKER. Mr. Terry, do you subscribe to those sentiments?

Mr. TERRY. Yes, sir.

Senator BAKER. Mr. Adamson?

Mr. ADAMSON. I would have to say with the base of technology as we know it today, I could not give a positive statement to that question of yes, we can meet it in 1977, but I agree with Mr. Jensen, that American Motors also is making a tremendous effort, and we are learning more every day, and I would be hopeful in a given point of time, be it a year, whatever it might be, we can come back to this committee to do more than say I don't know.

Senator BAKER. Let me ask another question.

Do any of you regret you started with the internal combustion engine at this point?

Mr. TERRY. I would say unequivocally we do not.

Mr. JENSEN. We have the PROCO engine that I mentioned in my testimony, and it has shown some levels that a low mileage will meet the 1976 requirements.

We worked on that for 15 years for purposes of achieving fuel economy. Just recently, we realized its potential for emissions.

We are putting a lot more work on it, because we realize the potential of low emissions, without losing all of the fuel economy benefits.

It is still a new concept, but I think if we had to go back and retrace our steps—If we had had a crystal ball, a few years back and recognized that we had low-emission potential, more so than just fuel economy we would have started earlier on that phase of PROCO development.

Mr. STARKMAN. I do not think that General Motors has any regrets for staying with the gasoline engine. It is being improved every day. It is quite a different engine today in terms of the way its fuel supply is managed, the manner in which its combustion chamber is designed, the valves are timed, and the sparks are adjusted.

Forgive my facetious remark with respect to what we would do in 1977. I can assure you our target is 1977, 1976 and 1975, in reverse order.

I might add that when we target for 1975, we know we have to meet 1976, and so the systems must be compatible, 1975 to 1976.

We believe that the gasoline internal combustion engine has greater potential for meeting the low emission requirements than any other engine that we know of.

Senator BAKER. Do you have any regrets for having started with the internal combustion engine, Mr. Adamson?

Mr. ADAMSON. As you know, we are the smallest in the industry.

The fact we have come 80 percent of the way in hydrocarbons and other percentages with the other gases, and that development has had to come from our profits and our resources, if we would have allowed those efforts to be made on alternate powerplants, I do not think we would be where we are today.

Senator BAKER. Mr. Chairman, I have two more questions.

Do you have some estimate, Mr. Terry, or any of you, but Mr. Terry in particular, do you have any estimate of what the cost of a car will be in 1977, compared to what it would have been if we had not passed the 1970 Clean Air Act Amendments?

Mr. TERRY. Our estimate of the total increased cost of emission controls for a 1976 car over an uncontrolled car is in the area of $750. Bear in mind we do not know yet how to do what is required for 1976 models so it has to be a pretty rough estimate. But our best estimate is that the total cost of emission controls for 1976 models compared to an uncontrolled car is in the area of $750.

Senator BAKER. What about the comparative operating costs?

Mr. TERRY. It depends on which system we choose. As I testified, we came very close to meeting the requirements with a system that involved a 30 percent fuel penalty.

Until we started the control of oxides of nitrogen we did not lose fuel economy. But now that we are controlling that, we are losing fuel economy, and——

Senator BAKER. I would hasten to say, lest anyone misunderstand these questions about costs, that as far as I am concerned, I view this increased cost as legitimate and necessary. We are only now paying the bill, and we are now internalizing the cost of environmental degradation in operating and manufacturing the car. Otherwise we would pay that same cost in terms of degradation of the environment.

There was quite a debate at the time of the drafting of the 1970 Air Amendments as to whether or not there should be successive rights for appeal with some agency granting the right to extend these deadlines a year at a time.

That was rejected by the Congress in favor of a fixed firm deadline, that is, 1975, with one single year extension to 1976 and to 1977 in the case of NO_x.

It is not entirely safe to bank on a change in the law, because the Congress has considered the question of subsequent extensions, and the Congress has rejected it, as you know, as you find it on the books now.

But I do not for a moment suspect the Congress of the United States would bar the manufacture of automobiles in this country.

I doubt that would be an extraordinary popular thing to do, leave alone very practical, but I do caution the industry to recall that the concept of subsequent extensions has been carefully considered and rejected. So for whatever it is worth, I urge you to try to comply with that 1977 deadline, because it may be difficult to convince the Congress to change that deadline.

Thank you, Mr. Chairman.

Senator EAGLETON. Thank you very much.

Mr. TERRY. Thank you.

(Statement of Chrysler Corp. before the House Subcommittee on Public Health and Environment on Jan. 27, 1972 follows:)

PREPARED STATEMENT OF SYDNEY L. TERRY, VICE PRESIDENT, ENVIRONMENTAL AND SAFETY RELATIONS, CHRYSLER CORP.

My name is Sydney L. Terry and I am Vice President-Environmental and Safety Relations for Chrysler Corporation. With me today is Mr. Charles M. Heinen, who is Chrysler's Executive Engineer of Materials Engineering.

We are delighted to be her today and to have the opportunity to discuss The Clean Air Act of 1970 with you. We believe an Oversight Hearing at this time is particularly appropriate.

The past year has been one of feverish activity in all fields of air pollution research and control. Government, industry and the academic community have

contributed a great deal of new information which was not available at the time the Act was drafted. All this new data must now be considered if jointly we are to make the best possible recommendations to the American public for maintaining and improving the quality of our air.

As you may know, some of the most intensive work in the air pollution field has been in those areas which apply to the automobile and its control. Although it is impossible in a brief presentation to cover all of the data that have been developed by workers in the field, we would like to indicate a few of the more substantive findings that may apply to possible changes in The Clean Air Act. If you wish, we will answer questions on the facts or on our interpretations. We are, of course, as we always have been, very happy to work with specific technical arms of your committee to explore and discuss the details of those things which we will mention today.

There are four general areas that we feel need particular comment.

1. The new findings concerning atmospheric measurements and their correlation with the new information on health effects.
2. The results of our extensive experiments using available technology to meet the 1975-76 automotive emission standards.
3. The problems that we will face in implementing the durability and warranty provisions of the Act and, importantly, the growing awareness of what the various approaches will mean to the average citizen.
4. The general findings that the standards will have a multibillion dollar effect on the economy.

Let us begin with the first point—the new findings on atmospheric measurements and the new data on health effects. As you know, we have made substantial progress in learning what is in the atmosphere in the past year. As recently as a year ago there were very few atmospheric measurement stations for the types of gaseous emissions from the automobile. During the past year, a lot of stations then under construction have been made operational by the various states and municipalities. As a result, we know more than when the act was originally drafted.

Some of the results which seem to be emerging universally are best summarized by the November, 1971 report of the California Air Resources Board entitled "Air Quality and Emissions, 1963-1970." The Board states in the summary that "Air quality data from any one station in an air basin are not adequate to represent the basin as a whole." Similar results can be detected from observing the two or threefold variations in data taken simultaneously at various stations in the New York city area.

The Coordinating Research Council report, CAPA 3–68 showed how very difficult it can be to determine ambient levels when it demonstrated that concentrations can vary by nearly 100% from one side of the street to another; and even at the same spot, recorded concentrations can vary substantially in a matter of minutes. This has very important implications to some of the assumptions that we have made in establishing emission values. What this means simply is that the recorded concentrations do not necessarily tell us the actual ambient levels.

To establish standards that protect the health and welfare we have to know what effect present levels—whatever they might be—have on the general population. For example, as you may know, the primary effect of one pollutant, carbon monoxide, is to react with the blood to form carboxyhemoglobin, and reduce the body's oxygen supply. If the carboxyhemoglobin reaches too high a level, it obviously impairs a person's abilities and even threatens his life. Everyone has at least a carboxyhemoglobin level of about 0.7%—the result of the breakdown of tissues in the body. Smokers have carboxyhemoglobin levels of 5%, or even more, because of the high concentration of carbon monoxide in cigar and cigarette smoke. Yet, as Dr. John Schulte of Ohio State once observed, they move about in the world without any visible impairment. It is interesting to note that the CO blood level of smokers goes down if they stop smoking even though they are in crowded downtown areas.

Right now, in another research study, which is also a CRC project, researchers are analyzing the carbon monoxide concentrations in the blood of 47,000 people to identify effects of exposure to ambient carbon monoxide. The readings are, of course, in terms of carboxyhemoglobin. Although all 47,000 have not yet been analyzed, Dr. Richard Stewart, the Director of the Project, reported in a speech in Miami on November 13, 1971, on over 21,000 results. The findings are shown on Chart I which is attached.

As you can see, the findings are that people exposed to actual carbon monoxide in the atmosphere, as we find it today, do not accumulate more than 2% carboxyhemoglobin in their blood and that, of course, is well below the level of millions of smokers. It is also well below the level of any effect of any kind that any laboratory study has shown.

What this study tells us once again is that the person is exposed to a wide number of concentrations. Since readings vary greatly from station to station, there is no way of accurately measuring the true exposure by a single station. All this strongly supports the thought voiced by the California people that a characteristic of an atmosphere in a city has to be based on a number of measurements in that city. Unfortunately, at the time the ambient air standards were proposed and The Clean Air Act was written, this information was not available.

As a result, the most conservative approach was to take the highest readings available at any single station, translate these into probable carboxyhemoglobin readings, and set the standard on this basis. It was the only gage we had. It now appears that this approach overstates the actual exposure risk.

The information being developed by Dr. Stewart is very heartening in that it indicates that at the present time we have not raised the carbon monoxide level in the environment of our cities to the point at which any physical effect has been shown.

In light of this new data, perhaps we should look again at the earlier conclusion, based on spot experiments, that pollution levels in our cities were well in excess of levels that have an effect on human health.

In this connection one of the very interesting results of the California report mentioned above and one which, as you can well imagine, one that is very gratifying to us in the automobile industry, is that from 1965 there has been a continuing drop in carbon monoxide in both San Francisco and Los Angeles. You may recall that this was what we had hoped for and predicted. I am sure you have seen Chart II, indicating that we are controlling the various sources of emissions. Our analysis of these facts indicates that there is an adequate factor of safety as far as CO is concerned and that the factor is increasing steadily.

How these findings on the relationships between single station measurements and human effects are to be interpreted in connection with the other vehicle emissions is not yet clear. They are more complex because they react with each other to form secondary products, whereas CO does not. Studies are underway, and certainly some of the information on CO will apply. I am sure this is a subject you will want to carefully consider as you discuss any possible improvements in The Clean Air Act.

The second major area I would like to comment on concerns the results of experiments to meet the 1975-76 standards. As you know, this has been a year of great and much progress, but nevertheless disappointing in the field of control devices. Perhaps the best summary of the situation is found in the report of the National Academy of Sciences which was discussed with you yesterday. The Academy concluded that the technology necessary to meet the requirements of The Clean Air Amendments for the 1975 model year light duty motor vehicles is not available at this time. It went on to point out that if several major modifications in requirements were made, it might be possible for some of the larger manufacturers to meet the numbers.

We will address ourselves to these modifications a little bit further in the statement, but first let us review Chrysler's experience with the various systems. Because of the lead-time requirements, it was impossible within the framework of 1975-76 to pursue any other power plant than the piston-type internal combustion engine, even if there were one that showed better promise of meeting the standards. This meant that our options were restricted to those things that could be done with that engine. I will not go into the timing charts, but the basis for our conclusions will be submitted to your committee.

The first approach, and the one that we have been following up to this time, is that of engine modifications. It has already resulted in reductions of 80% in hydrocarbons, 70% in carbon monoxide, and 50% in oxides of nitrogen, compared with an uncontrolled vehicle. We intensively examined what could be done by continuing to follow this approach. Our conclusion, after very considerable experimentation, was that we could not meet the standards for 1975-76 by this procedure. As you may recall, they require 97% reduction in hydrocarbons, 96% in carbon monoxide, and 90% in oxides of nitrogen compared with uncontrolled vehicles. Our best efforts resulted in reductions of 88%, 83% and 58%, respectively.

We next explored the possibilities of using a combination of catalyst and exhaust reactors in our laboratories. We found we could achieve the 97% reduction of hydrocarbons and 96% carbon monoxide with a fresh catalyst. Unfortunately, we have not found a catalyst which could maintain this performance for anywhere near the required period of time.

The problem became even more difficult when we tried to add the control of oxides of nitrogen. The reason was simply that the oxidation catalyst would be overheated as a result of the extra fuel which it had to handle. In effect, the catalyst simply falls apart after a few thousand miles. Perhaps this statement requires some clarification. On page 814 of a very excellent report prepared for the Environmental Protection Agency by the Aerospace Corporation (Aerospace Report #TOR-0172(2787)-2), there is a figure (Chart III) which explains the relationship of extra fuel to oxides of nitrogen control. As you can see, increased control of oxides of nitrogen means increased fuel consumption. Now you will notice at the bottom of the chart that a much more optimistic picture is painted for an oxides of nitrogen catalyst. We, too, realized this from the output of a computerized engine model, and as a result we greatly increased our attempts to develop a catalyst.

To date we cannot report any spectacular success nor any great promise for this approach. However, because of its great potential for saving the customer large amounts on his fuel bill, it continues to be a very active project.

We also re-examined another approach which was originally explored intensively by Chrysler over 10 years ago. In this approach we run the engine rich for oxides of nitrogen reductions, and then burn all of the extra fuel in what amounts to a furnace where the exhaust manifold is located. Here again we achieved numbers which would approach the standards. Unfortunately, it was impractical because the temperatures were so high. Even by using the most exotic materials, we could not provide adequate safeguards. However, we are also continuing to work on this approach.

Finally, there is a system which has a great deal of promise for very substantial reductions. This involves running the engine on a very lean mix. To be effective we need to be very precise in controlling engine timing, fuel handling, and distribution of the fuel mixture. We also need a far more advanced control of exhaust gas recirculation in order to reduce oxides of nitrogen.

To achieve these objectives, we are investigating electronic controls where possible. You may perhaps have read of our electronic spark ignition which is the first outcome of this work. This total electronics approach may be capable of major reductions with only moderate fuel penalties. But even here, we still need a great deal of work to make such a system a reality. Even though we feel that it cannot completely meet the 1975-76 standards, we are pursuing this approach because we believe it is the most practical system for achieving very good control levels.

While we cannot meet 1975-76 federal standards, we do feel there is a chance we can meet the California standards on the average by 1976 using this approach. As you know, California presently requires for 1975-76 a 95% reduction in hydrocarbons, an 80% reduction in carbon monoxide and a 75% reduction in oxides of nitrogen. While we do not now have this attainment in hand, we feel there is a reasonable chance of accomplishment after extensive development work.

I could go on to discuss in detail these and other systems we have considered, but I think that what I have said will illustrate the point that we have explored all available avenues. Each of the approaches has problems of control realiability, endurance, materials or safety. We are continuing to explore them all in an attempt to overcome these problems. We are leaving with your committee details of some of the other avenues we have explored and we will be glad to discuss at length with the staff members any of our findings.

Unfortunately, we just have not come up with an answer. We do not foresee the possibility of coming up with a completely satisfactory answer for 1975 for the federal standards of that year or by 1976 for the standards applicable to that year.

The third major area I would like to comment on concerns the problems involved with the maintenance and warranty aspects of the 1975-76 requirements. As we understand it, our vehicle will be expected to operate at the levels specified in the Act for a period of 50,000 miles. Presumably, the customer will have to provide normal maintenance. This is important not only for us as manufacturers, but also for government and for the customer.

Our experience to date with the present catalysts will illustrate what I mean. Our studies indicate that they will have to be changed a minimum of two to three times over the 50,000 miles. The frequency of these charges will be affected by the type of driving and by the condition of the vehicle. In order to guarantee that the levels are being met, there will have to be mandatory vehicle inspection.

We are all becoming aware of what that involves.

First, we need the instruments and techniques to determine the condition of the vehicle in the field. Obviously, the techniques that we use in the laboratories, which involve a 13-hour procedure and about $150,000 for test stands, cannot be applied on a wholesale basis. We have already made some good progress in developing the instruments, but we have yet to establish an accurate test that lasts only a few minutes. The most promising development in this regard is the New Jersey test station which has just opened up. Unfortunately, it has not been running long enough to find out whether it will be adequate for the purposes required.

Second, if the vehicle fails for some reason, it will have to go to a service station for repair or catalyst replacement. Garages will need the same kind of instruments as the test stations.

What this means is that we will not simply need several thousand measurement units for inspection stations, we will need several hundred thousand for garages and repair stations. No one has yet started producing these instruments in anything near the required quantities.

If there were universal agreement that a particular catalyst could be used to meet the standards, perhaps a crash program could develop such outlets by the latter part of 1976. Unfortunately, there is no such agreement; because, as far as we know at the moment, there is no such catalyst.

We could go on detailing problems which might arise in the event that it is established that nothing less than a 20-minute cycle is adequate for establishing conformity of a given vehicle. The problem of building sufficient inspection stations in the required time is again a monumental task.

While no one of these problems may be insurmountable, given the time restrictions of the 1975-76 Clean Air Act the total combination comes close to being virtually unsolvable. I am hopeful the committee will explore the full implications of all this.

Now the Academy of Sciences states as a qualification "while there is no certainty that the new 1975 model year vehicle will meet the requirements of the Act, the status of development and rate of progress make it possible that the larger manufacturers will be able to produce vehicles that will qualify provided that provisions are made for catalyst replacement and other maintenance, for averaging emissions of production vehicles, and for the general availability of fuel containing suitable low levels of catalysts poisons."

Let us address ourselves for the moment to what is meant by averaging production vehicles. In an average sample, emissions from some vehicles will be higher than the standards and some lower. If there is to be universal enforcement, a level somewhat higher than that of the standards would have to be allowed for individual cars in the field. But this level cannot be established until we have some experience with a cross section of vehicles in general use. This has obvious implications for the whole question of warranty. You may wish to explore this subject completely.

Finally, the provision about the catalyst poison presumably refers to lead. However, some catalysts are poisoned by other materials in either the fuel or lubricants. Once the catalyst is established, the petroleum companies will have a massive task of reformulation of both fuels and lubricants, establishing an uncontaminated distribution network. The integration of this process with the requirements of the catalyst is not likely to be accomplished by 1975-76. So what I am saying is that in the past year we have come to understand more completely the complicated problems involved in meeting the 1975-76 standards.

The fourth piece of new information that has occurred since the Act was passed is an accurate evaluation of the costs of controls and the degree to which these can be affected by even minor changes in the standards. Now I'm not even going to comment on the enormous costs the manufacturers would have to bear in issuing and administering the warranty provisions of the Act. Let's look just at the hardware and the cost to consumer. The most recent evaluation of these costs can be found in the Aerospace report cited above and in the Academy of Sciences' report. These estimates represent neither the

highest nor the lowest. In fact, some of our own estimates run higher. But the estimates from these two independent agencies are similar and are very useful in our discussion today.

Assuming that any of the systems currently being proposed would work adequately, the 1975 requirements would result in a total additional cost of more than $300 over the base price of an uncontrolled vehicle. The 1976 requirements would probably add at least another $100 to this number. That amounts to a total increase of more than $400.

One of the most interesting and important aspects of this situation is that minor modifications in terms of percentage reductions, such as are proposed by California for 1975-76, would cut these costs in half.

Of even greater interest to the consumer is the fuel penalty from various levels of oxides of nitrogen control. In Chart IV, taken from page 8-22 of the Aerospace report, we see this graphically. The difference in lifetime penalties, depending on the system used and the oxides of nitrogen level required, will vary from $200 for the California 1975-76 standard to upwards of $800 for The Clean Air Act standard. When these costs are equated in terms of total population, it can be seen, as pointed out by the Aersopace report, that we are dealing with costs to the country on the order of ten billion dollars a year. As you gentlemen have apparently concluded, this requires most careful consideration.

In light of all the new data it is natural to ask if we should defer implementing some of the automotive provisions of The Clean Air Act. One of the important observations in the National Academy of Sciences' report is that deferment of the date of compliance with the standards for a short period will have no substantial effect on air quality. Charts V and VI from their report show this effect.

We wish that we had been able to come to this committee and say that that which was proposed a year ago has been accomplished and there are no problems. As you have heard, there are problems—serious problems. There is much new information that clearly indicates the necessity for evaluation of the present and future role of the automobile in the environment.

Specifically, we have learned more about the environment, the ambient levels of pollutants, and their effect on human health. We are discovering the effect may be less than originally feared, primarily because air measurements tend to overstate exposure.

We have no solution yet to the difficult control problems, though we have made considerable progress. We can substantially and economically reduce the already low emission levels.

We have come to recognize the enormously complicated problems involved in meeting the warranty provisions of the Act.

And finally, several sources outside the industry have adequately identified the costs involved in meeting the standards. This information gives all of us a more accurate guide to use in deciding the best ways of allocating our national resources. Independent studies have also shown that even a small modification of the 1975-76 Act could produce enormous savings for the nation with no significant adverse effect on air quality.

I know that when we originally considered The Clean Air Act, there was a general feeling in many quarters that we were very close to achieving and even guaranteeing the large emission reductions the Act required. Perhaps for this reason, the automobile was treated differently than any other source of pollution.

The Act required specific reductions in automotive emissions. Unlike other sources there was no requirement that the Administrator consider technological feasibility or impact on the economy.

In the light of the new data developed not just by the industry, but by independent agencies, the time has come to re-examine this basic approach. In other words, since we are not as close to achieving our original objective as some were led to believe, we need to treat the automobile as we would any other source.

We need to look at the total problem: the degree of control needed, the feasibility of control, the cost of control, and the overall impact on the American public. To assist in this kind of complete evaluation, we would suggest that the commitee carefully consider asking an independent agency such as the National Academy of Sciences, to evaluate all that is involved in controlling automotive emissions.

Such a study would include not only current information on the health hazards of automotive emissions but also current information on the effects ambient levels have on the general community.

It would consider not only the various means of controlling emissions, but also the effect the controls would have on ambient levels and general health.

Finally, the study would not only consider the technical feasibility of controls, but also the impact the controls would have on the nation's limited national resources.

Authorizing a major evaluation of this kind is not postponing action—it is actually taking the kind of firm action needed to assure that the country will correctly control its air quality problems.

In view of public concern, the easy course might be to ignore the signals the new information raises, and insist on the 1975-76 standards no matter what the cost, no matter how impossible they might be. But the easy course is not always the right course.

You may be sure that we at Chrysler Corporation will continue our intensive efforts to meet either the present standards or any modified standards you might develop.

Beyond this, we assure you of the most wholehearted cooperation of the Chrysler Corporation should you authorize the type of comprehensive studies the nation needs. We believe that a re-evaluation of automotive emissions will give us what we all want: namely, good clean air with a minimum application of national resources. Even if this requires some additional time with intermediate levels of control, we believe the time will be well spent.

Senator EAGLETON. Our next witness is Mr. John Adamson, vice president of engineering of American Motors Corp.

STATEMENT OF JOHN ADAMSON, VICE PRESIDENT, ENGINEERING, AMERICAN MOTORS CORP.

Mr. ADAMSON. Thank you very much, Mr. Chairman.

My name is John F. Adamson, and I am vice president of engineering and research for American Motors Corp. The testimony I will present today applies both to the passenger cars manufactured by American Motors, and the vehicles manufactured by Jeep Corp., a wholly-owned subsidiary.

Let me say at the outset that we have informed the Environmental Protection Agency of our intention to formally request a 1-year delay in meeting the 1975 emissions standards, and we expect to file our documented requests in the near future. The basis for our request is that we do not have the engineering ability or the technology for full compliance with the 1975 emissions control requirements within the time schedule prescribed by the Clean Air Act Amendments of 1970. This is our carefully considered position after a thoroughly concentrated effort over a long period during which a large percentage of our engineering staff time and financial resources have been expended in seeking solutions to many still unsolved problems relating to our technical ability to meet the required emissions levels and warranty requirements.

At this point in time, we cannot project whether or not we will be able to solve these technological problems in the time span required to release new drawings and specifications. In addition, we must add the many months that are needed to procure manufacturing facilities and production components by the date necessary to meet 1975 production schedules. I will deal with the factors involved in our conclusions in detail later, but first, I would like to clarify our position as related to our exploration of alternate power sources.

American Motors has investigated and is continuing to study alternate forms of vehicle propulsion such as electric, steam, natural gas and turbine systems. These studies have included in-house building and testing of prototype systems as well as design studies, consultations and explorations with outside companies and individuals.

A number of the outside sources that we have contacted in the course of these investigative programs include Kinetics, Inc., and Lear Motors (steam), Williams Research Corp. (turbines), Gulton Corp. and Electric Fuel Propulsion (electric) and Renault and NSU (rotary internal-combustion engines).

Our research and investigations have lead us to the firm conclusion that the internal-combustion engine is the only powerplant that American Motors can produce for the 1975 model year which has any practical chance of meeting both customer requirements and near-term emissions regulations. Furthermore, we presently are convinced that this will be true well beyond the 1975 model year.

Our engineering projects on internal combustion engines have included the exploration and evaluation of a series of design concepts which appeared to have potential for the reduction of pollutants. As a result of these studies, we established tentative specifications for our 1975 powertrains and these have been pursued as a top priority program for potential 1975 production release.

In this system, we will continue to use our internal combustion engines to which would be added oxidizing catalytic converter devices. We intend to continue the exhaust gas recirculation (EGR) system which is to be first used in our 1973 model cars. In addition, an air injection system will be fitted to all vehicles.

Detail revisions to our engines would encompass changes in the cylinder head and valve train areas. These changes would be substantial and would have major impact on present production tooling, especially in terms of lead-time requirements.

Revised intake manifolds designed to provide superior fuel preparation would also be required. This improvement would be accomplished by providing a low thermal inertia area heated by exhaust gas, and located under the carburetor riser. Carburetor and ignition system modifications would be necessay to optimize control of fuel and ignition characteristics during all vehicle operating modes.

We have built a series of engineering vehicles which contain the components mentioned and which have been tested to determine emissions control capabilities. These tests were conducted at both the clean engine, or zero mileage level, as well as at advanced mileage. Our experience indicates that some of our engine-transmission-vehicle combinations can meet the numerical limitations required in 1975 for a short mileage period. However, none of these installations has maintained these levels through a 50,000 mile period, and in only one instance has a vehicle remained within the necessary limitations for more than 20,000 miles.

It should be noted that engineering emission goals or targets must be substantially lower than Federal standards on these laboratory-built test vehicles. This is due to the fact that production vehicles introduce a relatively wide band of variables primarily related to dimensional tolerances and which are a normal and necessary consideration of the mass production process. Our engineering cars

must meet these low internal numerical standards in order to assure that production cars, on the average, will meet legal requirements. Allowing for this consideration, engineering judgment indicates that our best effort to date has failed to meet the requirements after 4,000 miles.

Let me emphasize that our test mileage has been accumulated on the official Federal certification schedule, which does not necessarily duplicate normal customer driving patterns. When our vehicles are subjected to our broader range of tests which more nearly simulate anticipated customer usage, it is possible that more rapid control loss will be experienced than has been noted to date.

We have a listing showing the data obtained on our test vehicles, which we can submit for your records if you so desire.

Recently a serious new obstacle was created which threatens to negate that data which we have been able to generate on these advanced control concepts. This problem relates to the proposed rule making, published in the February 23, 1972, Federal Register, which would allow lead content as high as .05 gm./gal. in 1975 fuel. All of our data to date has been generated with fuel containing less than .024 gm./gal. We are certain that the deterioration rate of our catalysts will increase with higher lead content, but we do not know the magnitude of this increase at a .05 gm./gal. level.

This proposed rule making does not include limits for sulfur content or for metallic elements in the engine lubricants. These elements could also have a substantial effect on catalyst life, and if the final rule allows other chemical substances to be at higher levels than those used in our test vehicles, we again would have to question the validity of our endurance data.

To summarize our position, here are some of the considerations which are basic to American Motors' continuing ability to meet more stringent control levels.

1. We must first achieve systems to meet the 1975 standards for HC and CO. These systems, however, must be capable of being integrated with a control system for meeting the 1976 NO_x standard since it would not be practical to tool a 1-year HC-CO control system. We recognize basic interaction characteristics of the currently-known HC-CO and NO_x systems and the inherent problems that must be solved, but we do not have a suitable system for meeting the 1976 requirement which limits NO_x to .4 gm/mi.

2. We must determine whether prototype control devices used with powerplants built by highly skilled engineering technicians can be effectively transferred to our manufacturing processes, and whether such components can be produced and assembled by production line workers.

3. Acceptable vehicle parameters relating to driveability, safety considerations, durability and reliability, etc., must be maintained when these new control devices are produced. We have not yet completed required investigations in these areas.

4. Still to be developed are necessary instrumentation and service techniques for maintaining these very complex systems in the field. The eventual implementation of the performance warranty provisions of the Clean Air Act, as amended, require careful indepth studies and practical solutions for this problem.

5. As previously mentioned, EPA recently (February 23, 1972) promulgated proposed fuel standards for the 1975 and future model years. There is still uncertainty as to the total composition and performance characteristics of these fuels as the standards are not comprehensive in terms of certain contaminants, such as sulfur, and we do not know the operational specifications such as boiling points, motor octane number and vapor pressure of fuels that will be marketed. Of immediate importance is the allowance of .05 gm./gal. lead. All our data has been with fuels containing less than .024 gm./gal. lead and we don't know the effect of a .05 gm./gal. lead level.

6. Of concern to us is the fact that American Motors' 1975-model production will begin in early August 1974, which means that units needed for pollution control, as well as all other vehicle components affected by such devices, must be tooled and produced in quantity previous to the August, 1974 date. Many such components are of the long-lead variety, which means that up to 24 months must be allowed for design and procurement of the manufacturing tooling needed. Thus, the control system must be established, and engineering completed on all other vehicle components affected, by early summer of 1972. Obviously, the little time remaining as of this date is insufficient to complete the vast engineering program that will be needed.

Beyond these technological problems and the lead-time difficulties we face in trying to meet the 1975 standards, there are other concerns which we share with those who have made careful evaluations of the economic impact on the industry and potential depressing effect on our markets. We believe there is a question of consequential effect which must be answered if Government regulation results in a possible disruption of an industry directly related to the Nation's economic welfare. Further, we believe that the public should have ample opportunity to be informed of the high cost involved in achieving the emissions level prescribed.

In December the National Academy of Sciences issued its findings on the costs involved in meeting the 1975 emissions requirements. This report was recently substantiated by the EPA in its report to Congress titled "The Economics of Clean Air."

In view of the potentially high cost to the public, American Motors again raises a question as to whether the relatively small improvement in air quality which might be obtained through the 1975 standards is warranted when the small incremental improvement over 1973 standards is put in perspective. Will the public receive a commensurate return for its dollar investment in control devices?

In our opinion, the scientific evidence documenting the effect of automotive contaminants on human health or plant life is marginal. However, we are aware of studies which maintain that mobile power sources were responsible for less than 15 percent of injurious airborne pollutants during 1969. Automotive emissions reduction since that time should have reduced that figure noticeably. If these studies have any credibility, it appears that there may be no justification for creating a potentially detrimental impact on the national economy or imposing unnecessary cost penalties on car buyers.

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The Environmental Protection Agency's report on March 2, 1972, projects an annualized increase of nearly $5 billion in cost to the American public by 1975 for the purchase and operation of vehicles. By 1977, the cost is projected to increase to $8¼ billion.

As cost projections alone, these figures are alarming to anyone who is sensitive to the effects of increased prices on car buyers. There is no question in our mind that a significant number of consumers will be turned away from the market place because of higher vehicle cost. We urge a careful reexamination of all the facts of these increased prices on the national economy and employment if annual vehicle sales drop below the levels required to support a healthy, progressive U.S. automobile industry.

Recently, a former national president of the Society of Automotive Engineers warned against a "pollution backlash" which could possibly prevent the country from achieving its national clean air objectives. He said, and I quote: "If we follow the present irrational approach in the control of auto emissions, the costs can easily be 5–10 times as much as they should be." He further said that in concentrating on eliminating up to 98 percent of auto emissions, we are guilty of ignoring other sources of these same emissions where the pollutants could be eliminated for far less money. For example, the Department of Health, Education, and Welfare has said that up to 90 percent of the oxides of nitrogen from stationary powerplants could be eliminated for $10 to $50 a ton of NO_x. However, it will cost between $1,000 and $2,000 to eliminate a ton of NO_x from vehicle exhaust systems.

I believe these relative costs should be carefully weighed by all concerned with establishing the priorities of our national clean air program. I think that the first step in this direction would be to again review what reduction in pollutants is needed from the standpoint of health and environmental damage.

In closing, I would like to restate that American Motors cannot presently meet the projected 1975 emissions standards. We are applying our maximum efforts and resources to the objective of eventual compliance, but with the overriding knowledge that we are running out of time. For this reason, we believe it is consistent with the public good to petition for new air quality criteria which will have the least detrimental effect on our industry and its markets.

We appreciate the opportunity to appear before this committee to state our position. With the understanding of those responsible for Government regulation of the vital issues at stake, I believe we can continue to make significant progress in cleaning up the environment on the basis of acceptable costs to the public.

I might go back a moment, Mr. Chairman, I did not read the description of all of our work with regard to the catalytic converters, but testing has been carried on with gasoline that has a lead content of 0.024 lead.

The standards proposed by EPA calls for 0.05, approximately twice as much lead in the fuel.

We do not know what that will do to our catalyst at this point in time.

Senator EAGLETON. Thank you, Mr. Adamson.

I understand that American Motors has entered into an agreement with General Motors, under which General Motors will per-

form some of American Motors technical work in developing emission controls, is that correct?

Mr. ADAMSON. That is not a very good description of it, Mr. Chairman.

I would like to take a few moments to clarify the record.

Also, at the present time, we have no agreement. We had two 1-year agreements—the last one expired, I think it was last week, and our legal staff is discussing extension with the Justice Department.

We feel this agreement with General Motors has been of tremendous help to us, on the basis that probably two of the primary tasks involved with automotive engineers meeting pollution requirements is, one, the very basic scientific data, that determines how a pollutant is formed in an engine, the various ways it gets there, why it comes out the tailpipe, and so on, and from that data we can determine a number of alternative ways in an attempt to correct that problem or reduce that emission.

Because of our relative position in the industry, and our inability to generate the profits required to pay for this work, we do not have the capability to do any of this basic scientific work, and possibly, even more importantly, when we do get this information, we are always faced with any number of ways to go. We cannot afford to go in all directions, and test 10 ways of doing something, so the basic thing we have gotten from General Motors is some of this basic scientific information. We can then determine what our alternatives are, and we then essentially question General Motors, relative to them. We feel that getting this engineering consultation from them, based on their experience, or their best judgment, allows us to determine what alternatives we should pursue, and then it is within our capability to try three of them that look like the best, but not 10.

If we went all 10 ways, we would fall flat on our face.

That is the basic advantage we see in our agreement.

Senator EAGLETON. You did say the agreement expired recently, and you have an application for a Justice Department waiver so you can extend this?

Mr. ADAMSON. I know our legal staff has been in consultation with the Justice Department.

I don't know what you would call the document they are talking about.

Senator EAGLETON. All right.

Now, there was a meeting at the Western White House, in San Clemente, Calif., on January 13 and 14, and, Mr. Adamson, you were present at that meeting, I am told, and, Mr. Jensen, you were present at that meeting?

Mr. ADAMSON. Yes, sir.

Mr. JENSEN. Yes, sir.

Senator EAGLETON. You were there representing the Ford Motor Co., Mr. Jensen, and there was a Mr. Lacy representing the Chrysler Motors Corp.

Mr. STARKMAN. And a Mr. Fred Bowditch, and he is here with me today.

Senator EAGLETON. And it would appear that there were more than 60 people who participated in that meeting, I will make it a part of the record, the roster of those who attended, in addition to the two men here, Mr. Adamson and Mr. Jensen.

(The information referred to follows:)

TECHNICAL AND POLICYMAKING ATTENDEES AT THE NATIONAL MOTOR VEHICLE AIR POLLUTION CONFERENCE, WESTERN WHITE HOUSE, SAN CLEMENTE, CALIF. JANUARY 13–14, 1972[1]

Adamson, Mr. John F., Vice President, Engineering, American Motors Corporation, 14250 Plymouth Road, Detroit, Michigan 48232.

Bachman, Mr. William B., President, American Automobile Association, 1712 G Street, N.W., Washington, DC 20006.

Behar, Dr. Joseph V., Assistant Research Chemist, Statewide Air Pollution Research Center, University of California, Riverside, CA 92502.

Biddle, Mr. W. Craig, Assemblyman, 74th District, California State Assembly, State Capitol, Sacramento, CA 95814.

Bintz, Mr. Louis J., Manager, Automotive Engineering Dept., Automobile Club of Southern California, 2601 South Figueroa Street, Los Angeles, CA 90007.

Bonamassa, Mr. Frank, Supervising Engineer, California Air Resources Board, 434 South San Pedro Street, Los Angeles, CA 90013.

Bowditch, Dr. F. W., Director, Automotive Emission Control, General Motors Corporation, Environmental Activities Staff, General Motors Technical Center, Warren, Michigan.

Bradley, Dr. William E., Vice President of Research, Union Oil Company of California, P. O. Box 76, Brea, CA 92621.

Brooks, Dr. Douglas L., Special Assistant to the Director, National Science Foundation, Room 549, 1800 G Street, N.W., Washington, DC 20550.

Burton, Dr. George, Chief, Pulmonary Division, Loma Linda University, School of Medicine, Loma Linda, CA 92354.

Campion, Dr. Raymond J., Products Research Division, Esso Research and Engineering Co., P. O. Box 51, Linden, NJ 07036.

Chass, Mr. Robert L., Air Pollution Control Officer, Air Pollution Control District, County of Los Angeles, 434 South San Pedro Street, Los Angeles, CA 90013.

Cleghorn, Mr. Robert B., Technical Advisor, Western Oil and Gas Association, Standard Oil Co. of California, 605 W. Olympic Blvd., Los Angeles, CA 90015.

Cologne, Mr. Gordon, Senator, California State Senate, State Capitol, Sacramento, CA 95814.

Corbeil, Mr. Reine J., Manager of Dual Fuel Systems, Inc. R & D, Pacific Lighting Service Company, 720 West Eighth Street, Los Angeles, CA 90017.

Crocker, Dr. T. Timothy, Professor and Chairman, Dept. of Community & Environmental Medicine, University of California, Irvine, CA 92664.

Currie, Mr. Malcolm R., Vice President for Research, Beckman Instruments, Inc., 2500 Harboe Blvd., Fullerton, CA 92632.

Davidson, Mr. David G., President, Kern Co. Refinery, Independent Refiner's Association, Kern County Refinery, Inc., 612 South Flower Street, Suit 421, Los Angeles, CA 90017.

Deeter, Mr. Wendell F., Fuels Specialist, Atlantic Richfield Company, 515 South Flower Street, Los Angeles, CA 90017.

Diggs, Dr. Donald R., Marketing Manager, Petroleum Chemicals Division, E. I. du Pont de Nemours & Company, 1007 Market Street, Wilmington, Delaware 19898.

Eastin, Mr. Maurice R., Special Consultant to the Administrator, Environmental Protection Agency, Waterside Mall, 401 M Street, S.W., Room 3910-G, Washington, DC 20460.

Fuller, Mr. Jack D., Air Conservation Group, Ethyl Corporation, Russ Bldg., 235 Montgomery Street, San Francisco, CA 94104.

Galler, Mr. Sidney, Deputy Assistant Secretary for Environmental Affairs, U. S. Department of Commerce, Main Commerce Building, 14th & Constitution, Washington, DC 20330.

Gardner, Dr. David P., Vice President, Public Service Programs & University Dean of University Extension, University of California, 650 University Hall, Berkeley, CA 94720.

[1] This conference was requested and sponsored by Congressman Victor V. Veysey, in cooperation with the Statewide Air Pollution Research Center, University of California, Riverside.

Goldschmidt, Mr. Peter, Special Assistant for Governmental Relations, University of California—Washington Office, 1310 19th Street, N.W., Washington, DC 20036.

Hanna, Mr. Richard, Member of Congress, U. S. House of Representatives, 213 Cannon Building, Washington, DC.

Hartley, Mr. Fred, President, Union Oil Company of California, P. O. Box 7600, Los Angeles, CA 90051.

Havenner, Mr. Joseph E., Executive Vice President, Automobile Club of Southern California, 2601 South Figueroa Street, Los Angeles, CA 90007.

Hernacki, Mr. Raymond P., Assistant Chief, Los Angeles Office, Antitrust Division, U. S. Department of Justice, 6241 Glade, L-318, Woodland Hills, CA 91364.

Hesselberg, Mr. H. E., Vice President for Air Conservation, Ethyl Corporation, 1600 West Eight Mile Road, Ferndale, Michigan 48220.

Hinderaker, Dr. Ivan, Chancellor, University of California, Riverside, CA 92502.

Hoagland, Mr. Charles E., Western Representative, Automobile Manufacturers Association, Inc., 927 Tenth Street, Suite 302, Sacramento, CA 95814.

Hoffman, Dr. William D., Technical Director, Products Division, Atlantic Richfield Company, 600 Fifth Avenue, New York, NY 10020.

Hutchison, Dr. Dale, Chief, Research Section, California Air Resources Board, 1025 P Street, Sacramento, CA 95814.

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Senator EAGLETON. I note that there were eight Government officials, and then there was Mr. Veysey, a Member of Congress from California who participated, and then there were other groups.

Also this record should show that this meeting was closed to the public and to the press, but after the meeting was over, they issued a summary, and I will make this as a part of the record at this point.

(The summary referred to follows:)

UNIVERSITY OF CALIFORNIA,
WASHINGTON OFFICE,
Washington, D.C.

Note to Editors:

Scientists at the Statewide Air Pollution Research Center of the University of California and other key UC faculty provided, at the invitation of Congressman Victor V. Veysey, scientific and technical support utilized at the National Motor Vehicle Air Pollution Conference held January 13-14 at the Western White House in San Clemente, California.

Attached is a copy of the assessment of this two-day event by members of the scientific staff at the Center. In no sense is this document an attempt to provide a consensus of the views of *all* participants, or all scientist-participants. Rather it is limited to the views held by Center scientists who participated at all sessions of the conference.

For further information, please contact Arthur E. Sutton at 785-2666 in Washington, D. C.

SUMMARY OF DISCUSSIONS AT THE NATIONAL MOTOR VEHICLE AIR POLLUTION CONFERENCE, WESTERN WHITE HOUSE, SAN CLEMENTE, CALIFORNIA, JANUARY 13–14, 1972

AIR QUALITY STANDARDS

General agreement was reached that air quality standards should continue to be related to health effects; although some participants viewed aesthetic effects as having a greater impact on the public. Programs designed to satisfy the health-related standards may or may not contribute rapidly and substantially to the improvement of certain aesthetic effects, such as visibility. Participants concurred that the present standards are based upon data over which various experts disagree, and further short- and long-term epidemiological studies are urgently required. In the interim, it is acceptable to follow the example of the Federal Drug Administration and use the results from experiments with animals to aid in the formulation of air quality standards.

Representatives of the automotive industry, the Los Angeles Air Pollution Control District, and the California Air Resources Board favored the California Air Quality Standards, but the Environmental Protection Agency (EPA) representatives disputed that the California standards are more realistic and technologically feasible than the federal standards. However, most participants agreed that the California standards were satisfactory, both on medical grounds and on the time periods over which the pollutant concentrations were averaged.

EMISSION STANDARDS

General consensus was reached among the representatives of the automobile manufacturers that it would be virtually impossible for them to reach the 1975-76 Federal Emission Standards, operating on current ground rules. They felt that the following provisions would facilitate the meeting of the federal standards:

(1) A reasonable maintenance requirement for control devices would have to be enacted to ensure that, for example, catalysts are working.

(2) Unleaded gasoline would be available in sufficient quantities.

(3) The averaging concept for vehicle emission certification would be necessary rather than the requirement that *every* car be tested and required to pass the emission standards.

The automobile industry representatives stated that attainment of the California Emission Standards is more feasible, provided the industry is allowed to make this its goal. All changes which require major tooling-up operations must be recognized by April-June, 1972.

Most of the participants felt that too much emphasis had been placed on the validity of a *precise* number for the emission standard of a particular pollutant, in view of the uncertainties involved in the derivation of emission standards from air quality standards. They suggested that the currently available data were adequate to support values somewhere between the California and federal emission standards.

The necessity of requiring a 90% reduction from the 1970-71 levels of all three pollutants—NO_x, CO, and HC—in exhaust emissions by 1975 was open to serious question. The majority opinion supported the possible adoption of a CO standard somewhere between the California value of 24 gm/mi and the federal standard of 3.4 gm/mi; perhaps ~17 gm/mi. They felt that the California standard for CO was adequate to protect the health and welfare of the people. Such a move would have significant benefits for both the public and the automobile manufacturers. It would facilitate the attainment of the NO_x emission standard; this, in turn, would lead to an improvement in air quality sooner, since according to current knowledge, NO_x plays a far greater role in photochemical smog formation than does CO. (Little or no evidence was presented to support a relaxation in the federal standards for HC and NO_x.)

LEAD IN GASOLINE

Possible adverse health effects and the poisoning of catalysts used in certain emission control devices constitute the two major reasons for eliminating lead from gasoline.

Agreement was reached that a grade of unleaded gasoline should be made generally available to insure the effectiveness of catalytic devices which would probably be employed to meet future emission standards.

A number of areas of disagreement emerged. Of these, the most significant are the possible health effects of atmospheric lead and the result of lead removal on exhaust particulates, aldehydes, and aromatic hydrocarbons. The problem of lead from leaded gasoline as a health hazard is not that clinical poisoning can be attributed to lead from this source; rather, it is a dearth of knowledge of the long-term effects of exposure to low levels of tetraethyl lead, absorbed by inhalation.

It was pointed out that the EPA will soon be publishing regulations on lead in gasoline; these will include a provision for general availability of unleaded gasoline.

AUTOMOBILE EMISSION TESTING

Whereas the automobile manufacturers have accommodated reasonably well to the new federal constant volume sampling (CVS) of measuring emissions, the control officers are faced with a dilemma in correlating the data obtained when using the old and new test procedures. The new federally adopted test cycle was based, in part, on the previous experience of the Air Resources Board. It was noted, however, that the last one-third of the California test cycle (which represents the high-speed portion of the cycle) was omitted. This omission could be critical in relating test cycles to real driving habits in the Los Angeles Basin.

Comments from both the automobile industry and the EPA indicated that the original intent of AB 1*, i.e., 100% assembly line testing of HC, CO, and NO_x emissions from all new automobiles sold in California—as passed in the legislature, would probably not be satisfied. This has several implications, including the fact that it would preclude a surveillance program involving mandatory and random testing of emissions from each individual car, since it would be impossible to know the emission levels of each automobile when it left the factory. The concept of "averaging" and the "functional" testing of key components involved in the control systems for reducing pollution were suggested, primarily by the auto industry, as being more realistic. The EPA is preparing its own guidelines with respect to assembly line testing, and these are to be available shortly.

ALTERNATIVE FUEL SOURCES

Natural gas (primarily CNG) and propane (LPG) have been used successfully by the General Services Administration (GSA) in fleets of automobiles used for rental purposes. The GSA reports both operational cost savings in this fleet, as compared to gasoline-fueled cars, as well as a significant reduction in exhaust emissions.

However, several problems associated with the use of CNG or LPG fuel were discussed. First, present supplies would not allow the immediate conversion of every car; however, by about 1974 other sources of natural gas are expected to become available. Second, the manufacturing cost of natural gas may be significantly higher than that required to produce the necessary equivalent gasoline. Also, the advantage of natural gas and LPG are not taxed will expire in 1975. Third, some loss in power when using natural gas fuel has been noted; in addition, no complete product analysis of the exhaust emissions has been performed. Fourth, storage tanks take considerable space, particularly for CNG.

MODIFICATIONS AND ALTERNATIVES TO THE INTERNAL COMBUSTION ENGINE

It was generally agreed that the modifications to the internal combustion engine and its exhaust system required to meet the 1975-76 Federal Emission Standards would have a significant detrimental effect on the durability and performance of the automobile. However, the possibility of a feasible alternative to the internal combustion engine being available to meet the 1975 emission standards was considered extremely remote. Looking at the long term, most participants who were qualified to pass judgment thought the gas turbine engine was the most attractive alternative to the internal combustion engine.

In the meantime, it was generally felt that careful consideration should be given to the possibility of conversion to dual fuel systems, even though retro-

* 1970 California bill authored by Assemblyman Craig Biddle.

fit conversion to natural gas or LPG costs over $400 on an individual basis. However, mass production and factory installation on new cars would reduce costs substantially and provide other benefits.

SOCIETAL OPTIONS

The following suggestions were raised as possible societal options.

(1) Retrofit emission controls for all used cars.
(2) Conversion of all pre-1966 cars to gaseous fuels.
(3) Car pooling.
(4) Gas rationing.
(5) Mandatory inspection.
(6) Four-day workweek and staggered working hours.
(7) Public transportation and restricted travel in congested areas.

It was the consensus of all concerned that the impact of such societal options upon the public, as well as their effectiveness in improving the atmosphere, should be carefully considered. It was felt to be particularly important that the public be well informed of the technological, social, and economic trade-offs and personal sacrifices involved in implementing these options.

AREAS FOR IMMEDIATE ACTION

The following, either directly or indirectly, emerged as areas upon which initial or additional work should be urgently focused. (No significance should be attached to the order in which these are presented.)

Health Effects:

A critical reevaluation should be undertaken of the medical, epidemiological, and technical data upon which the present air quality standards are based.

Further research should be initiated into health effects, with particular emphasis on the health implications of chronic exposure to prevailing levels of pollutants in ambient air.

There is a critical need to elucidate the relationship between instantaneous maxima of pollutants and the longer-term averages used to define "health warning" or "emergency" situations. Control officers need to be able to predict the likely concentration of a pollutant and the time period for which this concentration exists to protect the "health risk" segments of the public; currently, no good correlation exists between such values and the peak maxima normally recorded.

Air Quality Standards and Emissions Standards:

The technical data from which emission standards were derived from the air quality standards should be carefully reexamined and reevaluated.

There is an urgent need for both short-term and long-term research into the atmospheric chemistry and physics or polluted atmospheres, which should be specifically designed to further elucidate the complex relationship existing between emissions and the quality of ambient air.

A definitive look should be taken at the effects of aldehydes and other oxygenated hydrocarbons on emission levels as a result of controls applied to automobiles. Based on this study, the possibility of a standard for aldehydes and other oxygenated hydrocarbons should be considered.

The role of aldehydes (particularly formaldehyde) and other oxygenated hydrocarbons in photochemical smog—both its generation and effects—should be fully explored.

The exact relationship between the emission data obtained by using the old test cycle, as compared to that by using the current test cycle, needs urgent evaluation. The whole concept of a realistic test-driving cycle should be examined.

Instrumentation:

More reliable and convenient instrumentation for determining NO and NO_2 in ambient air should be developed. Particularly in the case of NO_2, there is no simple, reliable instrument available to measure the concentration of this species in photochemical smog.

A convenient, reliable, and accurate method for the measurement of aldehydes and other oxygenated hydrocarbons in ambient air requires development.

Education:

It is imperative that students, legislators and the public be educated in all aspects of the air pollution problem and the measures suggested for its alleviation.

The public should be made aware of the total impact of control measures and of the exact cost to them—both financially and otherwise—of possible societal and technical options.

Technical Options:

The possibility of using gaseous fuels, especially for older cars and fleet vehicles, should receive immediate attention. Testimony indicated that conversion of fleets to gaseous fuels is one of the few immediate changes which would improve air quality by as much as 10 percent in the Los Angeles basin. Vehicle manufacturers should be encouraged to provide factory options for use of gaseous fuels.

A comprehensive evaluation of the possible long-term alternatives to the internal combustion engine should be undertaken. The status and possibilities of the gas turbine in particular should be ascertained.

Technical information should be compiled and criteria developed to serve as a basis for minimum performance standards to accompany minimum emission standards for pollutants.

Legislation:

The members of the California Legislature and the California Delegation to Congress should:

(1) Explore the possibility of requesting a critical evaluation of the Federal Air Quality Standards and the Federal Emission Standards for motor vehicles.

(2) Explore the trade-offs in the use of gaseous fuels—e.g., CNG, LNG, and LPG—in critical air pollution areas, particularly for fleet vehicles and possibly for private cars.

(3) Explore the possibility of legislation specifying minimum performance standards to accompany minimum emission standards of pollutants, the objective being to insure a "safe," drivable, useful car which is a low emitter.

(4) Explore the possibility of legislation which would insure critical evaluation of gas turbine engines as power sources for motor vehicles by the late 1970's. They would be evaluated in terms of performance characteristics, as well as low-pollution capabilities.

COMPARISON OF NEW FEDERAL CALIFORNIA AIR QUALITY STANDARDS

Substance	Federal standard		California standards
	Primary	Secondary	
SO_2	0.03 annual; 0.14 p.p.m./24 hrs.	0.02 annual; 0.10 p.p.m./24 hrs.; 0.5 p.p.m./3 hrs.	0.04 p.p.m./24 hrs.; 0.5 p.p.m./1 hr.
Particulate	75 $\mu g/m.^3$ annual; 260 $\mu g./m.^3$ 24 hr.	60 $\mu g./m^3$. annual; 150 $\mu g./m.^3$ 24 hrs.	60 $\mu g./m.^3$ annual; 100 $\mu g./m.^3$ 24 hrs.
CO	9.0 p.p.m./8 hrs.; 35 p.p.m./1 hr.	9.0 p.p.m./8 hrs.; 35 p.p.m./1 hr.	10 p.p.m./12 hrs.; 40 p.p.m./1 hr.
Oxidant	0.08 p.p.m./1 hr	0.08 p.p.m./1 hr	0.10 p.p.m./1 hr.
NO_2	0.05 p.p.m. (annual)	0.05 p.p.m. (annual)	0.25 p.p.m./1 hr.
HC (less methane)	0.24 p.p.m., 6-9 a.m.	0.24 p.p.m., 6-9 a.m.	

AIR POLLUTION EMISSION STANDARDS FOR LIGHT DUTY VEHICLES

	Federal (grams/mile)	California (grams/mile)
1973:		
HC	3.4	3.2
CO	39.0	39.0
NO_x	3.0	3.0
1974:		
HC	3.4	3.2
CO	39.0	39.0
NO_x	3.0	2.0
1975:		
HC	0.41	1.0
CO	3.4	24.0
NO_x	3.1	1.5
1976:		
HC	0.4	1.0
CO	3.4	24.0
NO	0.4	1.5

Senator EAGLETON. The letterhead is from the University of California, and it is labeled summary of discussions at the National Motor Vehicle Air Pollution Conference, Western White House, San Clemente, January 13–14, 1972.

This has all appeared in the record, but in this meeting between the automotive industry and the oil industry and the executive branch of Government, I find it interesting that these conclusions on emission standards, that came about on January 13 and 14, are almost identical to the findings of the National Academy of Sciences that we had before us yesterday.

They too drew, as they said, on information primarily supplied them from the automobile companies, and it is outlined in the report.

Did anybody participate in that meeting from the National Academy of Sciences, to your knowledge?

Mr. JENSEN. No.

Senator EAGLETON. Was there any reference made to the National Academy of Sciences?

Mr. JENSEN. Yes, the report came out from the National Academy of Sciences on January 7, it was about a week before this meeting, and they did refer to the NAS report during that session of January 13 and 14.

Senator EAGLETON. I once again bring to the attention of the committee, page 5 of the testimony of Mr. Terry of Chrysler, where he said:

> Although the Academy stated that the technology to meet the standards was not available at the time the report was issued, they went on to say that with some major concessions in the regulatory area there was a possibility that one or more of the larger manufacturers might be able to meet the 1975 standards.

Here it states "major concessions."

As you gentlemen read the law, does any Government official, Mr. Ruckelshaus, or any other Government official, have the authority to make major concessions under the statute as it is now enacted?

I will address this to you, Mr. Terry, since you are the one that used the words.

Mr. TERRY. There is a great deal of freedom in the regulatory system under the law as to exactly how the law will be administered.

All three of the things mentioned in the report lie in the area that is subject to regulations, and, therefore to interpretation and so forth.

Senator EAGLETON. What does this section of the statute infer to you, section 207(a), as well as subsection(b), effective with respect to vehicles and engines manufactured in model years beginning more than 60 days after the date of the enactment of the Clean Air Amendments of 1970, the manufacturer of each new motor vehicle, under subsection (b), "If the Administrator determines, (1) there are available testing procedures to ascertain the emissions of each vehicle and engine," what does that convey to you?

Mr. TERRY. Senator Eagleton, as you noted earlier, I am not a lawyer, and I would rather not answer that.

Senator EAGLETON. In a common sense way, reading the statute as a layman, just trying to obey the law, which we all want to do, what does each vehicle and engine in that context mean?

Does it not mean each?

Mr. TERRY. I would have to study the entire text.

I have read the Clean Air Act a great many times in trying to determine what was meant.

Senator EAGLETON. I take it from your testimony, one of the major concessions, you would like to see someone give to you would be to go to an averaging system, rather than an each motor vehicle testing system?

Mr. TERRY. Mr. Chairman, I believe that averaging as a method of determining performance to a 90 percent reduction in automotive emissions complies fully with the spirit of the law, and in fact, with the exact wording of the law.

Senator EAGLETON. When it says each vehicle that is not averaging, is it?

Mr. TERRY. What was meant by the act is that emissions from automobiles must be reduced by 90 percent from 1970 vehicles.

Senator EAGLETON. And each vehicle meant an average?

Mr. TERRY. Yes, sir.

Senator EAGLETON. You could not be more wrong. It was never intended that the averaging system be used. It was debated at great length in the executive session, and it was specifically eliminated. It was specifically written into the statute, that each engine be tested.

I don't know how many law firms represent your corporation, but no lawyer, whether he is in Wall Street or anywhere else can read each vehicle to be average.

There is no mention of average, so as one member of this committee, I want to make it clear, for the system you are going to operate under, each vehicle must be tested, and I do not think you ought to put any great reliance on the RECAT report, which goes into the term of averaging.

It is not valid.

The law requires that each vehicle be tested.

Mr. TERRY. May I interject something?

In the letter from Mr. Ruckelshaus to me, which is part of the record, this is what he said about assembly line testing and averaging:

> Assembly-line test procedures now under consideration contemplate that emissions measured from tested vehicles will be averaged to determine compliance with applicable standards, subject to allowable upper limits of emissions which no vehicle may exceed. Averaging of emissions is clearly consistent with both normal quality control practices and with the intent of the Congress in establishing the 1975 standards.

Senator EAGLETON. What is the date of that letter?

Mr. TERRY. The date is February 8.

Senator EAGLETON. 1972?

Mr. TERRY. 1972.

Senator EAGLETON. That is precisely my point. After four automobile manufacturers met at the Western White House, with eight members of the executive branch, and said we want major concessions given, we want to go to the averaging system, Mr. Ruckelshaus then went to the averaging system, precisely, that is the point I want to make.

He is wrong, he is clearly wrong.

The statute does not permit any interpretation of averages, and his letter to you is in error, his letter to you backs up the position

that industry wanted him to take, and he took it, and our country is going to take it on the chin.

Senator BAKER. Mr. Chairman, could you yield at that point?

We discussed earlier the distinction between the situation on the testing of individual vehicles, before the publishing of a test procedure, and after.

We have precisely the same situation with respect to averaging, or the testing of each individual production line automobile.

I wonder if Mr. Terry would agree with me, or maybe someone else cares to speak on the subject, that under the act, under the Clean Air Act Amendments of 1970, the production line testing of each vehicle is triggered by the promulgation of the test, that is the test technique, and not before that?

Mr. TERRY. Yes, sir, I think that is correct.

Senator Baker. And there has not been such a test?

Mr. TERRY. Yes, sir.

Senator BAKER. Under those circumstances, until there is such a test procedure promulgated by the Administrator of EPA, there is no requirement of the 1970 requirements of the Clean Air Act that requires individual testing, rather than the act permits averaging?

Mr. TERRY. That is right. That is my understanding.

Senator BAKER. Mr. Chairman, I call attention to the report which accompanied the act, which is dated September 17, 1970.

Senator EAGLETON. What page?

Senator BAKER. Pages 28 and 29.

While we are going into that, and while there is an opportunity, Mr. Terry, as I read your testimony, you said there must be some major concessions in the regulatory area.

Do you mean to imply concessions in the law, or concessions in the statute?

Mr. TERRY. I now see that the use of the words "major concessions" is unfortunate. But when you have a law, and especially a law involving such a complicated and technical set of situations as we have here, a great many regulations are necessary in order to establish how the law is to be administered and how performance to the law is to be measured.

Senator BAKER. You were referring then only to those discretionary actions that might be done by EPA, by regulation?

Mr. TERRY. Yes, sir.

Senator BAKER. Now, identify for me, if you will, those concessions that you wanted in the regulatory area?

We have already talked about averaging. What are the other two?

Mr. TERRY. The second is that lead-free or catalyst-poison-free, gasoline be available on a countrywide basis so that anybody can buy it by the middle of 1974. And the third one, and probably the most important one, is that maintenance procedures——

Senator BAKER. Be established by regulation?

Mr. TERRY. Be established which would recognize the additional complexity of the devices that are needed to meet the standards.

Senator BAKER. You believe that all three of these items would be within the purvue of the Administrator under the existing law?

Mr. TERRY. Yes, sir.

Senator BAKER. It would be fair to say they would be no longer within the discretion of EPA, after EPA promulgates the test?

Mr. TERRY. I guess that is true. I would have to read the act.

Senator BAKER. I am not trying to dispute you, Mr. Chairman, but it seems we do have a two-tiered situation once again.

We probably do have a situation, where you can average, until the Administrator triggers the production line test.

Senator EAGLETON. The Administrator has already conceded the unattainability of production line testing, and he has gone to averageability.

Section 207(a) talks about each new motor vehicle, and it talks about the design warranty, and sub (b) talks about the performance, in essence the performance warranty, it was specifically written into the act, that there should not only be a design warranty, but also a performance warranty, and they rather strenuously objected to, but anyway it is stated in the law.

The only way you can implement a performance warranty is to have each vehicle tested. You cannot use an averaging test and sue on the average.

You have to sue on what your car does or does not do in performance, so I take it, if we go to averaging, I think from a practical point of view, the warranty provision, it goes out the window.

You did point my attention to, Senator, pages 28 and 29 of the report, let me read a sentence from page 29 of the report:

> The need to assure individual vehicle compliance became evident after sample testing of vehicles on the road, both in California and Nashville, revealed deterioration from conformance with the standard.

I emphasize the need to insure individual vehicle compliance. I don't know of any other way you can enforce a performance warranty other than having individual car testing.

Senator BAKER. I think we are arguing two things. I think the law is clear that you can use averaging, until the Administrator publishes the test, and that is one of two things involved.

One is production line testing and the other is the performance warranty. They are two different things. They both happen to be triggered by the same thing.

I think it is important that this record reflect, contrary to the impression that had been left so far, there is no requirement of the law for individual testing at the moment, and averaging is perfectly within the discretionary power of the Administrator of EPA, both as to production line testing and as to the warranty.

Senator EAGLETON. How would a recall system work, Senator, for cars now being recalled from time to time for different defects, how would the recall system work on averaging?

Senator BAKER. Once again, I am not prepared to argue whether this is good law or bad law, or what the effect should be. I am just saying that this is the law.

Senator EAGLETON. You and I differ. This is one of the areas that I think was as strenuously debated as perhaps any other area in the entire Clean Air Amendments.

It is a question of whether we will go to averaging, or individual car tests.

Senator BAKER. Clearly we went to averaging. On page 28, it says as follows:

SECTION 206. CERTIFICATION AND PRODUCTION MODEL TESTING

Section 206 has been revised, at the request of the Administration, to provide the Secretary with authority to test representative samples of motor vehicles on the production line to assure that production line vehicles are meeting the same degree of emission controls for which prototypes were certified prior to production. The Committee interpreted the existing law as providing the Secretary the necessary authority to carry out this purpose. However, because the Secretary is of the opinion that he does not have authority to test productionline vehicles and revoke certification for failure to conform with specific standards the Committee at the request of the Secretary has elaborated the original intent of the Congress. If the Secretary should find that production line vehicles are not meeting the standard for which certified, the Secretary could revoke certification for any vehicles not delivered by the manufacturer and could withhold certification for those vehicles until he was satisfied that compliance with the standard would be achieved.

The Secretary's decision would be reviewable. An accelerated process of review would be provided in order to facilitate re-certification and continue delivery of new vehicles.

Senator EAGLETON. Well, we disagree. As a lawyer I would not want to represent a client who brought a suit on an averaging test. I do not think he would last in court.

Senator BAKER. That is not the question. The question is what the law is, and I might agree or disagree on whether there is a defect in the remedies the consumer has against the manufacturer or not, but whether or not he should be able to sue is not a valid test of what the law is but rather a test of what maybe it should be. I am not prepared to say that is what it should be.

Senator EAGLETON. Let me ask the witnesses, if you were faced with a situation of what people might call Hobson's choice, would you prefer to try to meet the 1975 standards, using averaging or get the 1-year extension to 1976, that to be measured by individual car testing. I have a sneaking suspicion, and we will have to await Mr. Ruckelshaus decision, and we should, but I have a sneaking suspicion he might rule that you have to meet the 1975 standard, but that you can do it by averaging and by other methods of dilution, so that it will be met only in a window dressing way.

Which would you prefer to meet, the 1975 with averaging or the 1976 with individual car testing, Mr. Starkman?

Mr. STARKMAN. That really is Hobson's choice, Mr. Chairman.

We have made the calculation based upon normal variation or even highly improved variation, and our capability to control production variation between cars, and specifically in the area of emission control.

We have taken the automobile population, now being tested to the extent of 2 percent in the State of California, at the end of the assembly line, with the full test, and applying statistical analysis, to what we would expect if reduced to the 1975 levels. We come to the conclusions that in order for 99 percent of our cars to meet the absolute level, we would have to shoot for a target that is on the order of 25 percent of the levels that are called for in the 1970 Act in 1975.

That is, you get a bell shaped curve, normal distribution of emission from vehicles, and this is just way down toward zero. Understanding that I have only two choices, I think the averaging for 1975 might be a less stringent target than every car in 1976.

Senator EAGLETON. I concur with you, that is, 1975 with averaging is less stringent than individual car testing.

Mr. STARKMAN. I am making the assumption of every car having to meet the 1975 standard.

Senator EAGLETON. If every car will have a performance warranty attached to it, like the sticker on the window, it will say this is warranted for performance. If it does not perform, we will fix it.

Mr. STARKMAN. We are making the assumption that every car would be tested by this extensive test, when we did this calculation.

Senator EAGLETON. It is the only way to do it, to make the warranty viable.

Mr. JENSEN. I think it is completely academic, primarily for one of the reasons you made at the outset in the opening statement.

It relates to test procedure. You would have to test the car 200 times to get a 90-percent confidence level as to whether or not the car passed the emission tests for 1975 or 1976 models. There has to be a great deal of improvement in the test procedure. This is a 13-hour test, so with a 30% plus or minus, we are up against a difficult technical situation. I would hate to say anything is impossible, because almost everything eventually seems to become feasible in this emission control field, but until we get a short test that can be accurate, you almost have to accept the present test procedure.

I am sorry I cannot answer the question. There is no way to test a large group of cars at this point of time to find if every one meets the standards.

Senator EAGLETON. How would I as a purchasor bring suit on a warranty for the performance?

Mr. Jensen. I can explain what the State of California did on assembly line testing.

They have a law, which goes into effect in 1973, that calls for 100 percent testing at the end of the assembly line. They made a determination to test for gross emitters after extended debate over a period of a couple or 2 years. This was based on the recommendation of their Technical Advisory Committee, and certainly no automobile manufacturer was represented on that group. Incidentally, Dr. Pitts was, on that committee, he, among other people, mostly college professors and consultants, recommended an assembly line testing based on the present state of the art. They said that the target should be to find the gross emitter; the "bad actor;"—that is the automobile that had to be fixed. So California adopted a test procedure to meet that target to implement the 100 percent testing at the end of the assembly line.

Senator EAGLETON. You do not know how I could file a suit on my performance warranty?

Mr. JENSEN. I am going back to the California system, Mr. Chairman. If you had the California system, and you had a gross emitter, obviously that is the one you would file a suit on.

Senator EAGLETON. I only buy one car, and it is of interest to me, and I want a warranty.

It is like if I buy a TV set, I want a warranty. How do I bring suit on a performance warranty, on a car that comes off of an assembly line on an averaging basis?

Mr. JENSEN. Mr. Chairman, what I have described is the attempt of the State of California to eliminate averaging by testing every single car at the end of the line, and in their deliberations, for what

they are worth, they set a standard designed to pick out the gross emitter; the "bad actor"; the car which was not put together right. On that vehicle a red flag goes up, and that car has to be fixed. So when the customer gets his new car it meets the California Assembly Line Test standard.

Senator EAGLETON. Suppose the car I buy is not the one with the red flag that went up, and is the next one down the line, and it does not meet the established requirements, how do I bring suit on the warranty?

Mr. JENSEN. The only way you could prove the car did not meet with a 90-percent confidence level would be to run 200 tests at 13 hours each.

I do not like this, and the Government does not like it, and certainly the Congress does not like it, but there has to be not only technological breakthroughs in the emission control systems, and I think we are getting to those, but in the emission testing procedures.

We have got a whole group at Ford Motor Co. working in our laboratory trying to improve test procedures, so we can solve the present complication.

Senator EAGLETON. Let's assume we double the 1975 standard, say to 0.4, and we move it up to 0.8 for Los Angeles, and let's assume we move the standard for carbon oxide to 6.

Could you then guarantee compliance for each vehicle, or would you still want to take refuge in averaging?

Mr. JENSEN. What you would have to do in a situation like that is to statistically evaluate what your confidence level would be, on the present test procedure, in finding the one that exceeded the standards.

I am not arguing with you about every car meeting the standards. I am saying there is no test procedure to find the one that does or does not meet the levels specified. This is one of the areas where we have to achieve some scientific advances, both within Government and industry to alleviate the problem.

Senator EAGLETON. Is there evidence the cars substantially deteriorate from certified emission levels, when they are put in use, and if that is the evidence, what protection does the purchaser have against such deterioration?

How is the manufacture made liable for such deterioration?

Mr. JENSEN. Again, there is no way now, to make a manufacturer liable because of the test procedure.

Let me indicate what the tests show in California, which is the only State now that has a surveillance program of cars in the field.

The way they operate—they test the vehicle of a man when he goes in to get a driver's license, Mr. Chairman. They park a mobile test facility in the parking lot and while an applicant is in the department of motor vehicles taking a test, the State will sample his car on a "quicky" test, to see whether it passes or fails.

They have tested about 13,000 cars since 1967, through this method, to get a representative sample.

In the 1966 models, there was considerable deterioration.

There was less in 1967, less in 1968, and each year the deterioration has gone down, so that now as they test the cars in the field, they find even smaller deterioration.

This gets to one of the points you made earlier, that the automobile manufacturers have a responsiblity, and a major responsibility to build our cars so they do not deteriorate in the field.

I think the records will show vast improvements in the California tests which have been done over the years. Certainly, there is a lot more that has to be done, but our job, and our responsibility is to build cars that will last, so that when they are tested in the field, they will not deteriorate with time. The record is a good one so far, with a lot further to go.

Senator EAGLETON. I will yield to Senator Tunney.

Senator TUNNEY. Mr. Chairman, thank you.

I would just like to explore the area of nitrogen oxides a little bit more.

Is it my understanding that the automobile industry feels that there is not enough study yet on the question of the effects on health of nitrogen oxides, as they are emitted from automobiles?

Mr. STARKMAN. Well, Senator Tunney, if you will bear with me, I will preface my remarks by saying until a year ago, I was one of your constitutents, and had the privilege in 1968 of helping to formulate the first levels of control to be applied to automobiles, and with reference to nitrogen oxides, and this on behalf of the State of California Legislature.

Now, the matter of the extent to which oxides of nitrogen are deleterious is still open to question.

I don't think there is any question further that oxides of nitrogen in combination with hydrocarbons do form photochemical smog.

The question that still remains is the rate at which these reactions go forward, and the mix of oxides of nitrogen and hydrocarbons, which might form the optimum, or we will say worse situation.

There is argument between the experts with respect to ratios.

There is some question still with respect to the other effects of oxides of nitrogen. Now, I understand from my exposure to people in the medical field that there is suspicion that oxides of nitrogen do in themselves have health implications.

Again, there is a difference of opinion with respect to the levels which are deleterious.

Both the State of California and the Federal Government through the EPA have set their quality standards.

The experts in the State of California do not necessarily agree with the results of the study by the EPA. So that long answer is to your short question; I don't think there is complete agreement, Senator Tunney, but I do think it is generally agreed that oxides of nitrogen are not good for you.

Senator TUNNEY. And you would agree also, would you not, that the leaders in the field of study of the effects of nitrogen oxides on humans state that they feel that there ought to be controls over nitrogen oxide emissions from the automobile?

Mr. STARKMAN. Yes, sir. I do not think the automobile industry has differed with the opinion they should be controlled, if that is the implication.

Senator TUNNEY. One of the statements we had at our hearings in California last Saturday came from, again from Professor Pitts, in answer to one of my questions, about nitrogen oxide in the air. He said:

We flew through that, and we went on oxygen. In any case, we went on oxygen going in and out of the cloud, while we were monitoring, and that is further down over Watsonville.

Senator TUNNEY. It looks pretty bad. Can we assume breathing it is bad for the health?

Professor PITTS. Well, we do not use oxygen for fun. To give you a frame of reference, the air quality standard for the State of California, for nitrogen oxide, is .25 per mile, and if you divide .25, into what we saw, approximately, you are well over.

I might say in flights in February, made in the Long Beach area, the level was in the order of 3 parts per mile.

Again, that is ten times what it should be. This is at about 500 feet.

The point I am trying to make here is that the evidence that we deduced at our hearings in California indicated very clearly that the danger to health of smog in the Los Angeles Basin is greater today than at anytime in history, not because of the hydrocarbons, not because of the carbon monoxide, but because of the nitrogen oxides, and as a result, interestingly enough, of the controls that were put on automobiles by the State of California, limiting hydrocarbons and carbon monoxide emissions and creating a hotter car, they produced more nitrogen oxides. I think there has been, on the part of some, an attempt to suggest that smog, and the danger to health from smog in all parts of the country, including the Los Angeles Basin, is less today than it has been in the past, and that simply is not true, from the facts deduced at our hearings, and I just would like to have you comment on that.

Mr. STARKMAN. The oxides of nitrogen in Los Angeles at least, perhaps in other locations, is going through a peak this year.

It will probably hit its highest level during this year, or it did in 1971.

Now, as far as oxides of nitrogen are concerned, there is a difference of opinion within the Los Angeles Basin, and Bob Chass, of the Los Angeles Air Control Pollution District, indicates the data collected by that body shows that oxidants are decreasing in the Los Angeles Basin.

The evidence is not conclusive, but the trend is in that direction.

The evidence based upon average lower levels of oxidants in downtown Los Angeles indicates that, but there is this problem, not necessarily in Riverside, but Riverside happens to be a very highly affected area at the moment in the Los Angeles Basin, that by the Los Angeles County Air Pollution Control District's own measurement levels, there were seven alerts for oxidants in 1970, and there was one in 1971, and that was in Riverside.

By Riverside's own measurements, the average levels are remaining constant, or increasing slightly.

By Riverside's own definition, more alerts are brought out there because they set the alert level somewhat lesser than the Los Angeles County Air Pollution Control District, so it is a function of exactly where the measurements are taken, and what is happening to the history of the particularly affected community. I would not deny that Riverside has not shown any improvement yet.

Senator TUNNEY. Well, Professor Lees of Caltech said in this testimony to us:

Let me speak to that point. There is another standard which the Los Angeles County Medical Association has proposed as a health warning, which is twice as high, we violate that standard 150 days a year in this basin.

By doing the steps I showed you on the slide, we can produce results that reduce the number of intolerable days to fifteen by 1975, and to ten by 1977.

You have 150 days during which you violate a standard proposed by the Los Angeles County Medical Association, which standard is set in order to make it clear to the public those days that air quality is below a level that is conducive to good health.

You have a substantial problem, as anyone who has lived any length of time in the Los Angeles Basin knows. In Los Angeles this is perhaps the No. 1 domestic issue, and the reason it is the No. 1 domestic issue is that there are children. They are not allowed to play in the playgrounds, maybe 7 or 8 days during the school year and in 1970, you had doctors warning citizens 2 days in Riverside that they should not go outside, should not walk outside because it was dangerous if they walked outdoors, you begin to realize the impact of that smog problem upon the daily lives of individuals.

Now, I would just like to go to another area, which is the relationship of costs of controls.

Are these costs reflective of actual costs, or are you marking up the costs, so as to profit from pollution control?

The reason I ask this question, is that Professor Pitts in his statement to the committee said, and I quote:

As far as industry's pricing structure for assembly line tests is concerned, I have been told that in California, where assembly line testing of 25 percent of all 1972 cars sold is now taking place, the buyer is paying not only the manufacturer's cost of the test plus profit, but also a substantial profit markup for the dealer.

Would someone care to comment on that statement?

Mr. TERRY. Cost is a very complex subject. We have several different kinds of costs, as you can appreciate. We do not charge any more for pollution equipment, or for assembly line testing, or for any other factor connected with antipollution than we do for any other kind of addition to the car, or any other kind of change to the car.

Now, as to how you interpret this cost, I think the best answer to that is how you come out on the balance sheet at the end of the year. As I said, there are many costs that can properly be charged to an item like this. On the other hand, costs can be put together on the basis of just material, let's say, and direct labor and so on. If you measured profit based on these items alone you would end up with an astronomical profit.

The truth of the matter is the automobile business is a low-profit business, on a percentage basis.

There are very large commitments made in terms of investments, both short-term tooling investments and long-term total capital investments. In terms of total sales, and all of the things that go with the ups and downs of the business, to end up with such a low profit margin at the end of the year indicates you have a fairly precarious business. There are no excessive markups in the automobile business.

Senator TUNNEY. I am not concerned at the moment on the markup of the construction of the car, but we are talking about the pollution control devices, and the testing.

Now, is there a markup on the manufacturer's costs, and/or dealers taking the markup on the cost of the testing?

Mr. TERRY. I cannot speak for the dealer. But as far as the manufacturer's testing, as far as we are concerned, we would not call the pricing of the antipollution devices, or the assembly line testing, marked up anymore than the rest of our product is marked up.

Senator TUNNEY. But he is marking up the same as the way the rest of the automobile is marked up?

Mr. TERRY. The same way as other things are marked up, yes.

Senator TUNNEY. Now, you franchise the dealers, do you not?

Mr. TERRY. Yes, sir.

Senator TUNNEY. You do not know whether or not the dealers are making a profit on the testing?

Mr. TERRY. I don't know, no, sir.

I suspect that they are, but I don't know.

Senator TUNNEY. Is there a markup in the suggested retail price?

Mr. TERRY. For the dealer?

Senator TUNNEY. Yes.

Mr. TERRY. Certainly.

Senator TUNNEY. You mean over what it costs him to buy the car?

I understand while I was out, you were talking about costs, and you said it costs about $750 to achieve the standards by 1975, 1976, per car.

How much of that represents profit?

Mr. TERRY. That, based on our performance, would represent maybe a 1 percent, or 1½ percent profit.

Senator TUNNEY. To the manufacturer?

Mr. TERRY. Yes.

Senator TUNNEY. And how much to the dealer?

Mr. TERRY. I cannot speak for a dealer profit, Senator Tunney.

Senator TUNNEY. On a suggested retail markup?

Mr. TERRY. He does not sell it for that, of course.

Senator TUNNEY. Assuming he did sell it, for the suggested retail markup, what would it be?

In other words, what we are trying to find out, is a profit being made on pollution control, and I think that is a legitimate area for inquiry.

Mr. TERRY. Yes, sir; I agree with you.

Senator TUNNEY. How much would represent profit, if the dealer did sell the car for the suggested price?

Mr. TERRY. The suggested retail price is somewhere between 17 and 22 percent over what it costs the dealer as a rule. Somewhere in that neighborhood.

Senator TUNNEY. So about $150 would be the markup for the dealer as a profit?

Mr. TERRY. It depends on how much the car is.

Senator TUNNEY. You said it would be about $750 additionally per car, and you said inasmuch as the dealer suggested retail price markup would be 20 percent, 19 to 22 percent, I figure that to be about $150 per car for the dealer as a profit on pollution control devices.

Mr. TERRY. No, because he does not sell the car with the pollution devices in it for the suggested retail price.

Senator TUNNEY. Could you say that again?

Mr. TERRY. Because he does not actually sell the car for the suggested retail price.

Senator TUNNEY. If he did, he would be able to make a profit, about $150.

I don't think that is being unfair, because that is what you recommend, is it not?

Mr. TERRY. Yes. But the dealer usually ends up making only 1 or 2 percent because he has a used car to handle that the buyer brings in. And, he also sells under the suggested retail price, which everybody knows. He is lucky if he makes 1 or 2 percent profit on his sale.

Senator TUNNEY. Well, EPA, in their report on the Economics of Clean Air, 1972, state that they believe it will cost per vehicle $351 in order to comply with the 1976 standards.

Now, why do you believe that their estimate is $350, why is your estimate so high?

Mr. TERRY. I do not know exactly what they are estimating, Senator Tunney.

I do not know how they figured it. I do not know where their numbers came from. They talked to a lot of people, a lot of experts. And, as I said before, there are all kinds of costs, costs are figured all kinds of ways. I just cannot speak for their figure, or how they arrived at it.

Senator TUNNEY. When you suggest $750 per vehicle, are you basing that also on the recommended markup to the dealer, which would be 19 or 22 percent of the cost of the vehicle, in other words approximately $150.

Mr. TERRY. That does include that figure.

Senator TUNNEY. So if we discounted that figure, we are talking about $600, if we were not making a profit on that end?

Mr. TERRY. No, we cannot price the car that way.

Senator TUNNEY. If the dealer were not making a profit, we would be reducing it from $750 to $600, and if the manufacturer were not making a profit on the devices and the testing, it would reduce it how much more?

Mr. TERRY. As I said, we cannot price it that way to the dealer. And, we cannot price it that way in our own operation, especially on an item that represents a substantial percentage of the overall cost of the car as this will because concessions from your normal pricing policy come out of that 1 or 2 percent profit at the end. Therefore, you have to start out with how much profit you have at the end before you can start to talk about what it really costs to take the profit out, as you put it, with regard to the individual item.

Senator TUNNEY. I do not object to profits at all, and I am happy when the automotive industry makes a profit, but I do feel the cost to the public health with regard to toxic emissions from automobiles demonstrates that we must evaluate how we are going to establish standards, and get the automotive industry to do the research, and the development, the engineering, to produce a car, which will result in automobiles not being injurious to the health of the people. We must consider all of these factors, and I do not think this is doing too much to suggest that there not be a profit on the pollution control devices, which would enable the average person to purchase a car, not with a $750 additional price tag, but maybe a $500 price tag, or using the EPA study, with a $350 price tag.

Mr. TERRY. Senator Tunney, I would like to say that the competition to reduce the costs and the prices of these emission control devices has always been very keen. And it will certainly be very keen in this particular case.

I can speak for our efforts when you talk about the big numbers. We stated we do not know how to meet the standard. So we included in these costs every additional device that we think can be made practicable on a production car by 1975 and 1976. We are now in the stage where these things are being experimented with and are being developed: when we try to figure out how much it will cost we have made conservative estimates. I am very confident, however, that the price pressure on the industry will be such that there will not be much profit if any in the antipollution devices that we end up putting on cars.

I think I can guarantee the Senator that.

Senator TUNNEY. Of course, you did give me as an estimate that there would be in the suggested retail price about $150 profit to the dealer, and then a profit to the manufacturer in addition to that, I would hope that when you look at the economics of selling automobiles, that that profit would not exist, but I would have to believe that if you are going to treat pollution control devices the same way you treat power steering, in all likelihood there will be a profit.

Mr. TERRY. I am an engineer so some of these things we have discussed are out of my area. However, based on my general knowledge of pricing policies and so on it is rather rudimentary that emissions controls will certainly not be treated that way because they will be on every car. However, I really do not feel that I can shed anymore light on it than I have.

Senator TUNNEY. Well, I am just simply suggesting, when we talk about the health of the Nation, and we have evidence that the health of the Nation is affected by smog, that it is not asking too much to suggest that maybe there would not be a profit charged on these devices, which are going to eliminate the emission to a degree, that the public health should be benefited.

Mr. TERRY. We agree with you on that, Senator.

Seantor TUNNEY. Now, I would like to go into another area, and that is with respect to the size of the car, the weight of the car, and the fuel demands.

We had testimony from Mr. Fred Hartley, at our Los Angeles hearings on Saturday, and he is the president of the Union Oil Company.

He stated:

We are actually going backwards in fuel consumption in this country, as we solve the pollution problem.

There are two or three ways of getting around that. One of course is to improve the technology of pollution control, and I am sure that will come.

Again, it is hard to legislate, but I am sure competition will make that one of the goals.

I have a friend that I think he said he gets eight and a half miles in a Mercury.

That is kind of ridiculous, so we must reduce the size and weight of the car, and cut down on the gasoline, and it will take the car twice as far, and I think economics will become part of the factor.

Now, I would like to ask you, Mr. Terry, what do you think about that suggestion?

Mr. TERRY. Well, that is quite a few suggestions.

Senator TUNNEY. The suggestion that we cut down on the size and the weight of the car which will then cut down on gasoline consumption.

Mr. TERRY. We think that is very much in order. We are always in the process of trying to reduce the weight of the cars, and more recently the size of the cars, because this is important to efficient operation.

Senator TUNNEY. Well, if for instance for a period of 5 years you had just one standard model per company, would not the savings that you would have as a result of that one standard model give you substantial additional moneys to invest on research and development?

Mr. TERRY. If we could sell one standard model, and maintain our volume, we would surely like to do it.

Senator TUNNEY. What about going to the Congress and asking for an exemption of the antitrust laws so that you could get together and each one sell one standard model, so that we would have additional moneys available to the companies so that they could spend more money on research and development?

Mr. TERRY. Well, we have had very little luck so far with asking for exemptions from antitrust laws.

Senator TUNNEY. The thing I am concerned about, and maybe people do not share the same concerns that I do, but I am concerned naturally about the health and welfare of my constituents, many of whom are adversely affected, and I had information given to me 2 years ago, which indicated that 10,000 people are told by their doctors they ought to leave the Los Angeles Basin because of health.

This is 10,000 people per year. Now, that bothers me, so if we assume that this is a factor that is important, if we assume the profits for the automobile industry is important, and I assume it is important, because the automobile industry is a major industry in the country, and the fact is that you employ people, you have to have profits, and I recognize that. But why can't we think in terms of cutting back on some of the costs to the automotive companies so that there would be more money available to develop an engine which would substantially reduce emissions, which in turn would enhance the health and welfare of the people of this country?

Mr. TERRY. Senator Tunney, we are cutting costs all the time.

If there is one thing, I think the automotive industry knows how to do, is to cut costs.

We have had an outstanding record. If you study the record of the automotive industry prices and compare them to the increased prices of other consumer products in general, you can see that the automotive industry has had quite a record in keeping costs down.

If we knew how to reduce our costs in any way at all, we would do it.

Senator TUNNEY. Well, style of model changes would be one way, would it not?

Mr. TERRY. Model changes I think are greatly misunderstood.

The annual model change actually gives us an opportunity to make quality improvement and cost reduction changes that might otherwise have to wait perhaps years until the next model change.

When you have a mass produced product like an automobile, it is very difficult to phase in any kind of change which involves three or four or 10 or 20 parts all of which have to fit together. They all have to hit the line at the same time and fit, and the cars are going by pretty fast. So we have a very difficult time making changes during the model year. Therefore, we have the practice of discontinuing production once a year, in effect, so that we can bring in these new developments that we have. Which reduce costs and make an improvement on quality. Then we start up again with those changes incorporated.

Even if we said we are not going to make anymore changes for appearance sake we would still want to have an annual model change, in effect, and we would still change a lot of parts in an effort to get cost reduction and quality improvement.

Furthermore, there are many, many times that we have to buy new tools anyway because they wear out. You have to replace your tools anyway from time to time.

When you put the whole thing together you end up with the conclusion that the most economical way to run a mass production industry of any kind is to have an annual model change. Since you have to make some of the changes for these other reasons anyway, at the same time you might as well make the car more appealing, or more in line with the styling trend. Only really a small fraction of the amount we actually spend to retool cars per year, is done purely for aesthetic purposes.

Senator EAGLETON. If I may interject, in the course of retooling, it is not a real factor in this pollution control business, because you do it every year anyway?

The costs to retool is not a real factor, is it?

Mr. TERRY. To some extent, yes.

Senator EAGLETON. We had testimony yesterday from the National Academy of Sciences, and I do not know how they got into retooling, but they said that was a real whopper of the factor.

Mr. TERRY. In the case of our largest car, for example, which is the major part of our tooling, one of the major factors is the retooling for the emission controls.

Now, as I said, we have been going along and making some changes on each car line every year, because of the advantages of the annual model change. But in this case, we are going to an all new car and we must provide for enough room to put in the emission controls. To do this we have to make some changes in our basic suspension. In addition there are many other basic changes that must be made. So all of this is required in order to get the room for the emission control equipment. Therefore, our tooling expenditures will be much, much higher than they would have been if we did not have to make room for the emission controls.

There are many, many factors that could help us in many other ways, but they include changes in the whole process.

Senator EAGLETON. In the exchange between Senator Tunney and Mr. Terry on costs, I think this is a relevant inquiry, and I will ask all four of you, if you will furnish for us some information under section 207 with regard to cost data, as it is called for in the statute, at a later date. Will you make that information available to us?

Finally, I would like to have the position of each of you on the two-car strategy, do you favor it, or do you not?

Mr. STARKMAN. We have had a two-car strategy. We have been furnishing a different car to the State of California since 1966, so as far as the two-car strategy is concerned, I cannot see that we would find it objectionable.

Senator EAGLETON. Would you define it as preferable to a one-car strategy?

Mr. STARKMAN. I do not believe I could answer it as being preferable.

I would say we would be in a position to accommodate such a strategy.

It imposes some considerations in our assembly lines, but we have done it for California.

Senator EAGLETON. We have had the companies testify before the committee in 1967 and 1970. It was my impression, that they wanted to get away from the multiplicity of State requirements, and they asked for a national standard that would be good across the board, so you did not have a different car in each State.

Mr. STARKMAN. That is quite correct. If it were in the best interest of the citizens of the country to have a distribution of the kind you have indicated, the automobile companies could do it.

They would prefer not to have to make different cars for different areas of the country.

I am speaking for General Motors now.

Mr. JENSEN. Yes, sir, but we do not agree with the RECAT report which recommended a two-car system spread across the country.

We do feel a two-car emission control system, California versus the rest of the country, is a valid approach.

The way our assembly lines are set up, it can be done and it has been done. It gives us an opportunity to prove out a control system on 10 percent of the car population. In that situation we can also try out mass production of new systems.

That is why we wanted to put a catalyst on California cars in 1974.

The industry testimony in 1970 was along the same line. We wanted one common test procedure, but we would go along with two standards for cars, one for California, one for the rest of the country.

Mr. TERRY. We find a two-car strategy has some very good things about it.

The thing we were really testifying against was we did not want a 50-car strategy, or a five-car strategy.

Senator EAGLETON. Mr. Adamson.

Mr. ADAMSON. We feel a two-car strategy would be advantageous, if it was a short-term situation only.

I think we should be able to learn to work in the field and get some valuable information.

Senator EAGLETON. You mean ultimately we ought to proceed with a one-car strategy?

Senator BAKER. I don't know what you all think, but so the record has it, I think it is a bunch of nonsense, having a two-car system.

Preventing the right to pollute in areas not yet polluted is the very essence of the whole concept of Federal legislation in this field.

I think I have argued and struggled with the thought that we will have an ambient criteria system, or emission standard, and the Clean Air Act was the first bold step toward the standard approach nationwide.

We are talking about moving back from that, going to another system, and I am against that.

I have always been willing to go along with the California standard, because California was in it before we were, but inherent in the law that we wrote, was the implication that the Nation would come up to the California standard, not that these would be a proliferation different manufactured items. I do not believe in the dilution theory. I do not believe I should be able to drive a dirty automobile through the Grand Canyon, I do not believe I ought to have to go to the suburbs to buy a cheaper car than I can buy in the city.

I reiterate what I said so undiplomatically: it is a bunch of nonsense.

Senator TUNNEY. I agree with the Senator.

When we had Mr. Hartley before our committee in Los Angeles, he made some observations with respect to fuel consumption and horsepower, which I found fascinating.

One of his statements was:

> It is a pretty unhappy situation. I think that we should not wait too long to limit the horsepower on the cars. I do not know if you have noticed it or not, but this was a few years ago, I believe a typical Cadillac on a Harbor Freeway, which is more or less a level freeway, doing thirty-five miles per hour is using about 35 horsepower, maybe 50 with all of the gadgets. That corresponds to one eighth of the total horsepower under the hood.

He says further that there is a serious energy crisis, there is danger of running out of petroleum in the relatively near future, nobody really knows, but it is possible that it will be 30 years by some estimation.

Now, I wonder what your thoughts are with respect to cutting down on horse power, cutting down on the fuel consumption in that way, which would make a car go substantially farther on a given gallon of gasoline.

Mr. TERRY. Senator Tunney, cutting down on horsepower does not have the effect of increasing fuel economy.

We have a lot of tests to prove this. I know this sounds kind of surprising when you hear it for the first time. But what we do with these high-powered engines is to gear them down so they do not turn over as many revolutions per mile of travel. Consequently we are actually able to get improved fuel economy with larger engines. So limiting horsepower by regulation would be a mistake as far as what would be in the best interest of reducing the energy used, or reducing the amount of fuel used.

That would not be the way to go at it.

Senator TUNNEY. We have had testimony, your testimony, as well as testimony in California, that as these pollution control devices go onto cars, fuel economy goes down, the amount of fuel that is used goes up.

Now, would you please indicate to the committee how you think that we are going to be able to achieve better fuel economy, as these devices are put into effect further?

Mr. TERRY. As I indicated earlier, Senator Tunney, you get the formation of oxides of nitrogen when you just have a high temperature in the air.

NO_x is simply oxygen and nitrogen combined and these are the two principal elements in the air. So if you put an electrode in the air at 3,000° or more, you get oxides of nitrogen pouring off around it. It is fundamental that anytime you have a heat machine using air to burn the fuel you will get some oxides of nitrogen.

Additionally, the higher the heat, the more efficient the machine can get.

The higher the heat in an engine the more efficiently it can operate. These are all fundamental principles. The most obvious way to control oxides of nitrogen, which you feel are so important and which we agree are important, is to reduce the maximum heat generated. However, this also reduces the basic efficiency.

There is one way that holds outstanding promise for achieving the control we want, and at the same time maintaining efficiency. We mentioned this in our testimony. That is to develop an oxides of nitrogen catalyst. We need this very badly to control this element. Otherwise, we will have an inefficient engine.

We do not have such a catalyst yet. However, all of the engineers, chemists, and other people we need are doing a lot of work on it.

Senator TUNNEY. I am not an engineer but I am a legislator, and we do listen to expert opinion, regarding what types of standards ought to be set in order to achieve a better environment for people, and as I understand your testimony, you say that horsepower is not related to the type and the amount of the emissions that come out of the tail end of the automobile, and that weight and size are unimportant?

Mr. TERRY. No sir.

Senator TUNNEY. Weight and size are important?

Mr. TERRY. Yes, sir.

Senator TUNNEY. Then why don't we cut down substantially on the weight and size of the automobiles?

Mr. TERRY. We are attempting to do that everyday. We are trying to reduce the weight of the cars.

Senator TUNNEY. What about the size?

Mr. TERRY. There are too many conflicting requirements. For example, the experimental safety vehicles, just completed and delivered to the Government, made under U.S. contract weigh a lot; they weigh respectively something like about a thousand pounds more than the basic vehicles they replace because of the safety features. This just illustrates one of the conflicting demands. I am not complaining about this. I am just saying there are more and more demands on automobiles, more and more factors engineers must consider as they try to do more and more things for more and more good reasons. So we have a very difficult time in deciding how much and what to put in these cars.

Senator TUNNEY. I would assume that other witnesses on the panel would substantially agree with what Mr. Terry said?

Mr. ADAMSON. Let me address myself to that. Most of our business is in the lighter weight category of market, so any additional weight being required by various safety regulations on one hand to us is very serious, not only in the way of adding weight, but the very

structure of the vehicle, which forces the weight to go up in these vehicles, and in which there must be space to put in the additional devices.

We add pounds to the front of the car, and suddenly we have bigger tires, and to a manufacturer of a light vehicle, this is a very serious problem.

Going back to this matter of weight versus emissions and engine size, we have several models, because of their weight, that we have to go to bigger engines just to pass the current emission cycle, so again, we are continually adding weight to our cars.

Senator TUNNEY. Your cars are getting heavier?

Mr. ADAMSON. Yes, sir.

Senator TUNNEY. Mr. Jensen?

Mr. JENSEN. We feel very strongly that the appropriate government regulation speaks to standards and permits us the flexibility to determine how to meet these standards, that is fine. Everytime that design standards are frozen into legislation, it reflects on results. This is one of the difficulties. As you may know, in California about 2 years ago they passed a law restricting compression ratio.

In September of last year the EPA reported on the cleanest car they ever tested, and it had a higher compression ratio than the limit set in California.

I think the directions from Congress to the auto industry should be to meet standards that are required for public health. It is up to us to learn to achieve the required levels.

For the 1972 models, we now have to test vehicles on grams per mile basis, so a Pinto or a Lincoln are only permitted to put out an equal amount of contaminants. So there is no differentiations between automobiles, and this does tend to put cars on an equal basis. As far as we are concerned we would suggest that the performance standard you require is the one we have to hit. We have to explore every possible way to get there rather than putting limitation, for example on horsepower, on weight or size. I think we should continue with this grams per mile type of performance standard at the present time.

Senator TUNNEY. Another problem faced by society is what we are going to do when we have no more fuel to run cars.

Mr. Hartley made a very powerful statement. I thought, in California, on that point.

Do you envision that within 30 years, 40 years, we will have to have some substitute for the automobile because of that problem?

Mr. JENSEN. I am no expert on this subject. Obviously I do not think any of us at this table can answer that. In respect to fuel economy, if I can address the point Mr. Hartley made, I know something about this, because it relates to emissions.

As you probably know, the name of the game in the automobile industry a few years back was for Ford to beat its competitor in the market place by getting a better performing car with better fuel economy. That is now a practice of the past.

You start our first by qualifying the emission control system and meeting the emission standard. Then you try to gain back fuel economy and performance, so that Ford for example can do a better job overall than the other people sitting at this table in that competitive market.

In one of the reports which I referred to in my statement we meet the 1975 requirements at the low mileage. On that car we had a 27 percent fuel economy loss reported in January, 1970.

That same car today has only an 8 percent fuel economy penalty, and as time goes on, it is incumbent upon us to eventually eliminate any fuel penalty.

I cannot tell you how we are going to do it, but our first priority is to meet the emission standards. These are the emmission levels that the Congress has told us we have to meet, and then we will gain back these other features which are important to customer satisfaction.

I recognize the total fuel supply problem is serious. As a layman, I read articles on this—on the world supply of fuel, I understand some of the problems involved.

I just cannot speak to that problem. All I can speak to is what we do when we design emission systems at our company at Ford, and I presume the other companies can do the same.

Senator EAGLETON. Would you care to comment Mr. Starkman?

Mr. STARKMAN. I think most everything has been said, except perhaps to review once more, call it the facts of life, instead of the theory, and again referring back to California, and the records kept by the Air Resources Board, one of our competitors, who markets only small cars, and who shall remain unnamed, had the most difficulty in meeting the emission standards.

It is a small car with a small engine, not wishing to reflect purely on him, may I say in our own case, the car which we have the most difficulty in accommodating the standards is our smallest car with the smallest engine.

We have much less difficulty with the big car with the big engine.

Senator TUNNEY. The basic that we get back to is the health and the welfare of the people of the country, and I think that everyone will agree that we have to make certain accommodations regarding personalities, consumer taste, in order to protect health and welfare.

I enjoy a car that has big pick up, I think we all do, but where the health of my fellow citizens is involved, the time has come for me, and others like me to restrict our tastes for cars with high acceleration. In other areas as well, accommodations in taste that are going to have to be made, in order to protect health, so we get back to the question that I raised earlier of having one model, perhaps, for the time being, in order to achieve economies, so it would be possible to utilize the money saved on developing a cleaner engine, and I guess from what you said, that you do not agree with that, is that correct, Mr. Terry?

Mr. TERRY. I certainly do not agree with that. I feel we can do a much better job of meeting the social requirements for the lowering of pollution, and whatever they may be, if we have performance standards set so that everybody has to meet the same standards. Let competition take care of reducing the costs, and saving the money that has to be saved to pay for it. Experience has shown us—at least I am certainly convinced—that we could do a lot better job of meeting any kind of goals if we are given the freedom to research and to develop the product in order to determine what is the most economical way to do it. If conclusions are reached ahead of time, as ground

rules, they might sound good, but such advance decisions can only limit how good a job we will be able to do, rather than help us do a better job.

Mr. STARKMAN. I would like to speak to this point, your observation, that if we were to limit ourselves to one vehicle, say one engine, the savings thereby would be to get on to controlling pollution, but we happen to think we are putting as much effort into the area of improving our vehicles from the standpoint of pollution that can be put into the area.

I might point out we have 3,600 people devoted to this problem, and I do not know how we could effectively apply much more resource, or much more manpower. The brains, the time, the effort being put into this problem right now could not be optimized very much more, if at all, by putting more resources and more people upon it.

Senator TUNNEY. The question of course then is raised, how many people do you have employed in such areas as styling retooling.

Mr. STARKMAN. I cannot give you the figure, but let me say also, a goodly number of the people working in our design areas, they are devoting cars to being redesigned so we can put the emission control systems on them, and putting the safety devices on them, so what I am saying is that the general concept of our design people, is that they do what you might call styling, and they are drawing pretty pictures, and making molds, that is just not true, that picture of them.

They are modifying the structure of the vehicle to make it more safe. They are modifying the structure to be able to put all of these things in them.

Now, further, I have a hard time visualizing these men doing that designing, being applied to the design of our emission control systems, or testing of control systems.

We are now involved in a heavy program of determining which should be the catalyst, and what that means is that we are driving cars, both on the accelerated test program, and we are driving cars on the more or less normal use program, insofar as you can squeeze 5 years down to a shorter period of time in normal use.

In my opinion, I do not see how optimizing that operation very much more, if at all, can be done, than what we are doing at the moment.

Senator TUNNEY. Well, it is my understanding that the automotive industry is asking for a change in the law, which would put the standards off from 1975 to 1976, and then perhaps by a few years more. If that is the case, then it seems to me that it has to be demonstrated very clearly that there has been cost efficiency by the automotive industry in every area that is possible.

If business is going to continue as usual, with regard to model changes, and styling changes, and other things, it would seem to me, on the face of it, that there has not been demonstrated that an effort has been made to achieve cost efficiencies.

Mr. STARKMAN. Senator, business is not as usual. The frequency of model changes has decreased fantastically.

Senator TUNNEY. How many models do you have?

Mr. STARKMAN. I cannot tell you how many, but we have a considerable number.

Senator TUNNEY. Well, probably in excess of what, 30?

Mr. STARKMAN. We are talking about body styles, I guess so.

I cannot give you the numbers.

Senator TUNNEY. This might sound like heresy, but it would seem to me that if we are talking about protecting the public health, it might just be that we might have to cut back on the number of styles, and the models that are available to the public, in order to devote more resources for research and development, to get a clean engine.

I am sure that sounds like heresy to you.

Mr. STARKMAN. No, you are precisely saying what we are doing, Senator Tunney.

We are cutting back, and we are putting our resources into developments.

Senator TUNNEY. I was thinking of cutting back further.

Mr. STARKMAN. It may be necessary.

We may consolidate further our number of models, and our number of engines.

I can only repeat one of the other witness' statement here, that there are some engines that no longer can be applied to certain cars.

We have even cut out the engine entirely in some instances, because we were not able to control its operation satisfactorily, both with respect to emissions, and performance of the automobile, so what you are stating is a fact of life we face now, and where you projected, it may become even more so. I think it is well taken; we may indeed have to do a little more, or a lot more, as the case may develop, in cutting back in changes, and in other areas, in order to apply the resources for the social areas, the emissions noise, safety matters.

Senator TUNNEY. One of the things I understand you are complaining about is lead time?

Mr. STARKMAN. Yes, sir.

Senator TUNNEY. Could not that device have been made 2 years ago, if you had cut back significantly on the number of models and styles in order to achieve the efficiencies to enable you to develop a clean engine?

Mr. STARKMAN. No, sir.

What I am trying to say, we are at the point at the moment where our major problems are in determining durability and reliability of the systems, and in accelerating that process, with respect to a catalyst system, or emission control system of another type. It is not like a spring. You test it many, many times in 8 hours, and you say now, go put that on the car, and it will last for a hundred thousand miles.

If you test the emission control device this way, you are neglecting the facts. You must remember that the individual who purchases the car drives it a few miles, and he lets it sit and cool off, with materials condensing inside, and then he fires it up, and he drives it some more. The deterioration of a system like that, we have not learned how to accelerate in time satisfactorily to know what is going to happen in the hands of the public.

Mr. ADAMSON. I would like to add to that observation, I believe the automobile industry has made great strides to date, and this has been accomplished by paying for this research and development out of the profits of the industry.

It is a good possibility that if there is a reduction in models, possibly, there would be some more money available for more development work for the near term. But I could easily visualize a reduction of models would cause a tremendous shrinking of the market, and then of profits, which will be needed for future development work and this procedure could in fact hurt us.

Mr. TERRY. Senator Tunney, you said we could have made the decision a couple of years ago.

Any reduction we have in models today, and we have substantially reduced models today, is because of decisions that were made 2 years ago.

That is the lead time it takes to make those decisions.

Senator TUNNEY. Well, the facts are, however, that you are asking for an amendment to the 1970 Clean Air Act, and the amendment that you are asking for is to reduce the level of standards that are contained in that act, a standard, which according to a HEW report, in 1970, is necessary for the public health.

That report, just for the purposes of the record, emanated from a paper presented in June, 1970, at the annual meeting of the Air Pollution Control Association, and which is contained on page 25 of the Senate Public Works Committee report on the air bill.

The problem that we get into is whether or not in the development of alternative strategies, to achieve the emission control levels that are required in the act, that the automotive industry has exerted sufficient effort. I suppose that is what it comes down to, and that is the decision the members of the Congress will have to make. I recognize the problems of lead time, but I also recognize that the economies of the industry are such that if you did reduce significantly the number of styles and models, there would be considerable savings, and I must say, I find it difficult to agree with the statement that has been made that no additional amounts of money for research and development would produce faster results in achieving a clean engine.

I think if we used that kind of a philosophy, with respect to our space program, we would have never gotten to the moon in the decade of the 1960's, and I just cannot believe that we have utilized all of the resources that are needed in order to develop the clean engine, I recognize the problems of the automotive industry, because they are using profits to support the research and development, but what I am suggesting is perhaps ultimate strategies could be developed, which would cut down on the number of models and make more money available for development in this area. I would assume everyone on the panel would disagree with this suggestion, if you would not disagree, I would appreciate hearing your thoughts.

Mr. TERRY. No matter how much money you spend, you cannot legislate invention. You can spend money at any rate, at any given rate, and increase the chances that you might invent something sooner, because more people are working on it. But there is no way that you can set a timetable, and say something has got to be invented by that date, because Congress passed a law, and still to make sure that it will actually happen. It depends on factors that no one can predict. The situation now is that in fact we need invention, at least we at Chrysler need invention, in order to meet the limits that have been set by the Clean Air Act.

That being the case, we have no choice but to go back and ask for a year's extension in this case. Whether or not we will ask for changes in the standards has not yet been decided.

I would say this, as far as Chrysler is concerned, we do not feel that catalysts should be put on cars, production automobiles. True, we are planning to put oxydization catalysts on our cars in order to be able to meet the 1975 standard. But we feel from the standpoint of the public, the public health, and clean air, that it is a mistake. From an engineering technical point of view, we feel putting catalysts on 1975 cars, and maybe 1976 cars, from what we know about the catalyst right now, would be a mistake. We just do not see how we can insure, or how anybody can insure to the Government, the States, dealers, or whoever you want to pick that the catalyst will continue to perform correctly. We do not see how it can be done. We do not think catalysts are in the best interest of public health or cleaner air.

First we must be sure that the vehicles we produce meet these standards when they come down the line. Assuming we can do that, we must assure ourselves that they will continue to meet those standards, if they get the kind of maintenance, and so on, that they require. But are very concerned that without proper maintenance, they might end up causing more air pollution then the cars that preceded them—cars that did not have these catalysts on them.

Now, that is Chrysler's opinion, and it is why we are saying all the time that we feel we do need some relief in the interest of clean air, and so on, over the 1975 requirements.

Mr. ADAMSON. Senator Tunney, you indicated silence would be in agreement.

American Motors, I am sure, would welcome somehow to get more money to pour into emission research.

I think our situation is a little different, with our 3 percent of the market, I am continually faced day by day with making choices of spending money on safety, or on exhausts, or spending money on customer demand.

Senator TUNNEY. I would like to say that when you have the record in front of you, and you have the opportunity to read your statements, and the statements of the other witnesses, if you would care to add anything to your statement, which would indicate either a different opinion, or a supplementary opinion to a statement that was made by somebody else on the Panel, please do so. We want to allow for that, and we certainly specifically in this case will allow for it.

I have no further questions at this time. I want to thank you gentlemen for coming; we appreciate it.

The hearing stands adjourned.

(Whereupon, at 1:25 p.m. the hearings were recessed subject to the call of the Chair.)