Lead Industries Association, Inc.
292 Madison Avenue · New York, N. Y. 10017 · Telephone: (212) 679-6020

July 12, 1972

SUBJECT: LEAD IN GASOLINE

TO: BOARD OF DIRECTORS,
LEAD INDUSTRIES ASSOCIATION, INC.

Gentlemen:

You are aware, I'm sure, that Senator Philip A. Hart and 48 other Congressmen dispatched a letter to EPA Administrator William Ruckelshaus on June 20, 1972 demanding the removal of all lead from gasoline by 1977. They charged that the soil in most major cities is already a health hazard and subjects children in these cities to lead poisoning and mental retardation.

While the LIA's position has been stated on many occasions respecting the health hazard of lead in gasoline - particularly as it relates to childhood lead poisoning - we felt that the letter from Senator Hart, et al, should be answered, once again setting forth the facts that have been developed in hearings before the EPA and elsewhere.

Attached are copies of the materials which were sent to Senator Hart and his colleagues as well as to all Members of the United States Congress.

The Washington Post, on June 28, 1972, carried an editorial: "Lead Poisoning in the Streets." Dr. Cole replied to this, and his letter was printed in its entirety on Friday, July 7. A copy is enclosed.

If you have any questions about this activity, please let me know.

Cordially,

Philip E. Robinson
Executive Vice President

PER:so'h
Enc:

THE WASHINGTON POST
Friday, July 7, 1972

Letters To The Editor

More Lead Poisoning

Your editorial entitled "Lead Poisoning in the Streets" (June 28) has come to our attention. It is noteworthy that the very day your editorial appeared a three-day conference on childhood lead *poisoning* was beginning in Washington. Throughout the conference, it was clearly, explicitly and unequivocally made clear by all the speakers from cities and agencies concerned with this problem that childhood lead *poisoning* is directly connected with leaded paints. These paints were formerly used in housing interiors and are now chipping and flaking in substandard housing. The possibility of a causal role in childhood lead *poisoning* of lead fall-out from the air was raised during a press conference connected with the meeting and was dismissed.

Numerous studies have shown conclusively that childhood lead *poisoning* has one cause—old lead paint which is now chipping and flaking from dilapidated housing. A well-known study in Cleveland compared the prevalence of lead poisoning in a poor area in Cleveland. It was found that 4.7 per cent of children living in old housing showed signs of lead poisoning whereas no children in a new housing project were afflicted.

In its highest concentration in atmospheric fallout, the lead content in dust is 0.3-0.4 per cent while the old lead paint may contain up to 50 per cent lead. In view of this fact and the statements of eminently qualified experts in the field of pediatric lead poisoning, it seems that the real cause of pediatric lead poisoning should not be in doubt. Yet, the EPA and certain politicians in their zeal to condemn lead in gasoline have fabricated a theory linking lead usage in gasoline with pediatric lead poisoning.

Contrary to the statement in your editorial there is not a shred of evidence to support their fanciful theory and the very lack of such evidence represents a strong argument against its validity. Pediatric lead poisoning is among the most intensively studied toxicological phenomena. Were lead from gasoline a factor in pediatric lead poisoning surely some hard evidence would have turned up by this time.

The real danger is that the public will be confused by the *nonsense* and delay the solving of the real problem—eating old lead paint. Your editorial questions whether or not children's lives are as important to the nation as bearing the extra costs. Certainly the answer is emphatically yes. Yet the present administration has appropriated only a small portion of the funds allocated by Congress to fight the acknowledged real problem. Funds are needed to combat the inner city decay which has spawned this and other problems related to inadequate housing. Wasting hundreds of millions of dollars and billions of barrels of precious crude oil together with introducing potentially hazardous substances into the air—the consequences of banning lead in gasoline—will do nothing to prevent pediatric lead poisoning and further will cause disenchantment among the public who is being asked to bear these costs. Recently, Robert Novick, of the Department of Health, Education, and Welfare, the man who has the responsibility for the federal government's pediatric lead poisoning prevention programs, characterized such theories as described in your editorial as "diversions" and cautioned against our getting lost by "chasing paper tigers." We would do well to heed his advice.

J. F. COLE,
Director, Environmental Health, Lead Industries Association.
New York.

Lead Industries Association, Inc.
292 Madison Avenue · New York, N. Y. 10017 · Telephone: (212) 679-6020

July 6, 1972

Dear Senator:

On June 20, 1972, a letter was sent by Senator Philip A. Hart to Environmental Protection Agency Administrator William Ruckelshaus, requesting a more stringent timetable for the removal of lead in gasoline. You also signed the letter.

Therefore, we have enclosed a copy of the Lead Industries Association's response to Senator Hart. We hope you will be able to take the time to read it.

Sincerely,

Philip E. Robinson
Executive Vice President

PER/rs
Encs.

Lead Industries Association, Inc.
292 Madison Avenue · New York, N. Y. 10017 · Telephone: (212) 679-6020

July 3, 1972

Senator Philip A. Hart
Office 253
Old Senate Office Building
Washington, D. C. 20510

Dear Senator Hart:

Your recent letter dated June 20, 1972 to Environmental Protection Agency Administrator William Ruckelshaus, bearing the endorsement of 48 additional members of Congress, on the subject of eliminating lead from gasoline was based primarily on two serious misconceptions:

a. City dirt contains enough lead in automotive exhaust fallout to constitute a major contributing factor to the problem of pediatric lead poisoning;

b. A more severe schedule of lead reduction (than now under consideration by EPA) is economically feasible.

This question is extremely complicated with many opposing views. The attachments to this letter represent some of the views in opposition to statements made in your letter to Administrator Ruckelshaus.

They include:

1. A Lead Industries Association reply to a Washington Post editorial of June 28 entitled "Lead Poisoning In The Streets." This clearly refutes the implication that lead fallout contributes to childhood lead poisoning.

2. Testimony before EPA hearings on April 12 refuting the misconception that lead in the air from automotive exhausts is a health hazard. The testimony was presented by M. K. Williams, M.D., from Great Britain, a man of substantial knowledge and direct personal experience involving some 50,000 medical examinations of lead workers.

3. A copy of testimony by Mr. Lee H. Soloman, an engineering consultant before EPA's hearings April 27 in Dallas. This statement bears importantly on costs and reaches quite a different and we believe more

realistic conclusions than that expressed by the proposed two-cent per gallon extra price rise of the authority you have cited in your letter to Mr. Ruckelshaus.

We believe you will find these statements helpful before recommending further hasty action.

Sincerely,

Philip E. Robinson
Executive Vice President

PER/rs
Attachments.

Copies of this letter with attachments are going to all members of the U. S. Congress.

Lead Industries Association, Inc.
292 Madison Avenue · New York, N Y 10017 · Telephone (212) 679-6020

July 3, 1972

Letters to the Editor
Washington Post
1515 L Street, N.W.
Washington, D. C. 20005

Dear Sirs:

Your editorial of June 28 entitled "Lead Poisoning in the Streets" has come to our attention. It is noteworthy that the very day your editorial appeared a three-day conference on childhood lead poisoning was beginning in Washington. Throughout the conference, it was clearly, explicitly and unequivocally made clear by all the speakers from cities and agencies concerned with this problem that childhood lead poisoning is directly connected with leaded paints. These paints were formerly used in housing interiors and are now chipping and flaking in substandard housing. The possibility of a casual role in childhood lead poisoning of lead fallout from the air was raised during a press conference connected with the meeting and was dismissed.

Numerous studies have shown conclusively that childhood lead poisoning has one cause -- old lead paint which is now chipping and flaking from old dilapidated housing. A well-known study in Cleveland compared the prevalence of lead poisoning in a poor area in Cleveland. It was found that 4.7% of children living in old housing showed signs of lead poisoning whereas no children in a new housing project were afflicted. Dr. J. J. Chisolm of Baltimore has described the triad which causes pediatric lead poisoning, namely; dilapidated housing with old lead paint on the walls, a child with pica, and parents with inadequate resources to cope with the family's needs. Dr. Rene Dubos, the noted environmentalist has said: "The problem is so well defined, so neatly packaged, with both causes and cures known, that if we don't eliminate this social crime, our society deserves all the disasters that have been forecast for it."

In its highest concentration in atmospheric fallout, the lead content in dust is 0.3 - 0.4% while the old lead paint may contain up to 50% lead. In view of this fact and the statements of eminently qualified experts in the field of pediatric lead poisoning, it seems that the real cause of pediatric lead poisoning should not be in doubt. Yet, the EPA and certain politicians in their zeal to condemn lead in gasoline have fabricated a theory linking lead usage in gasoline with pediatric lead poisoning.

Contrary to the statement in your editorial, there is not a shred of evidence to support their fanciful theory and the very lack of such evidence represents a strong argument against its validity. Pediatric lead poisoning is among the most intensively studied toxicological phenomena. Were lead from gasoline a factor in pediatric lead poisoning surely some hard evidence would have turned up by this time.

The real danger is that the public will be confused by this nonsense and delay the solving of the real problem -- eating old lead paint. Your editorial questions whether or not children's lives are as important to the nation as bearing the extra costs. Certainly the answer is emphatically yes. Yet the present Administration has appropriated only a small portion of the funds allocated by Congress to fight the acknowledged real problem. Funds are needed to combat the inner city decay which has spawned this and other problems related to inadequate housing. Wasting hundreds of millions of dollars and billions of barrels of precious crude oil together with introducing potentially hazardous substances into the air -- the consequence of banning lead in gasoline -- will do nothing to prevent pediatric lead poisoning and further will cause disenchantment among the public who is being asked to bear these costs.

Recently, Mr. Robert Novick, of the Department of Health, Education, and Welfare, the man who has the responsibility for the federal government's pediatric lead poisoning prevention programs, characterized such theories as described in your editorial as "diversions" and cautioned against our getting lost by "chasing paper tigers." We would do well to heed his advice.

Sincerely,

J. F. Cole, Sc.D.
Director, Environmental Health

JFC/rs

cc: Philip Geyelin
Editorial Page Editor
Benjamin C. Bradlee
Executive Editor

LIA038831

TESTIMONY ON

The Document "Health Hazards of Lead"

Cited in Support of the Environmental Protection Agency's

Proposed Regulation of Fuels & Fuel Additives

Presented by

M. K. Williams, D. M., B. M.,

B. Ch., D. I. H., D(Obst.)R. C. O. G.

General Medical Practitioner

at the

Environmental Protection Agency Hearings

Washington, D. C.

April 12, 1972

Mr. Chairman.

My name is Michael Kingsley Williams and I am a general medical practitioner. I qualified at Oxford University, first in Engineering Science and then in Medicine. After one year in general medical practice I spent four years as full time medical adviser in a lead-acid electric accumulator (battery) company, where I was responsible for the safety of about 1,000 lead workers in 2 factories. I then spent four years as Lecturer and Senior Lecturer in Occupational Medicine at the London School of Hygiene and Tropical Medicine in London University and wrote a thesis "The Measurement of Lead Absorption," for my post-graduate degree of Doctor of Medicine. Parts of my thesis have been published, and I understand the American Conference of Governmental Industrial Hygienists have revised their "threshold limit value" for lead as a result of my data relating lead-in-air concentrations with biological tests. I have done some 50,000 routine medical examinations of lead workers. In 1969 I re-entered general medical practice because I thought that the control of lead absorption in a well-run industrial organization no longer constituted a clinical problem, but I have continued to spend one day every fortnight advising one of the lead-acid battery factories.

Since 1969 increasing interest in pollution has resulted in lead absorption achieving a political and emotional importance which has been quite unmerited by the facts. The EPA in their document "Health Hazards of Lead" states that "airborne lead levels in many major urban areas currently range from 2 to somewhat over 5 ug/m^3". But neither the EPA document nor the recent Report prepared by the National Academy of Sciences has produced any evidence that these levels of airborne lead are in any way harmful. Indeed, the National Academy of Sciences Report stated

bluntly in its preface "...lead attributed to emission and dispersion into general ambient air has no known harmful effects". This, of course, was not in the least surprising. It would have been astonishing to me if they had found otherwise, for the following reasons:

As I said, I have worked for a lead-acid electric accumulator organization for over 10 years. During this time there have been some 8,000 man-years at risk and I have performed some 50,000 statutory medical examinations of lead workers. But I have not seen one single case of classical lead poisoning. (Incidentally, I have only ever seen two such cases. The first was in an occupational health clinic, several weeks after the patient's exposure to lead had ceased. The other was six months ago when a woman in my medical practice complained of severe abdominal pain, tiredness, and constipation and subsequent investigation revealed a blood lead, corrected for haematocrit, of 115 ug/ 100G, due to imbibing barley water made in an improperly lead glazed earthenware jug.) The only symptoms I have seen attributable to lead in my lead workers were tiredness in some dozen or so, and mild abdominal pain in two. And most of these cases occurred before 1964. when we began to use personal air samplers and to measure blood lead concentrations for the control of lead exposure. Since that time, lead in air concentrations have mostly been maintained at less than 200 ug/m^3 for a 40 hour week, and blood leads at mostly less than 80 ug/100 G, and no health effects have been observed at these levels. Indeed, health effects may only rarely be observed at blood lead concentrations greatly in excess of 80 ug/100 G. In 1966 I published a paper ("Blood Lead and Haemoglobin in Lead Absorption", Brit. J. industr. Med 1966, 23, 105) which contained the following statement; "Sixty-seven men with blood leads greater than 90 ug/100 ml were examined clinically. One

had a low haemaglobin but none had symptoms or signs that were likely to be due to lead absorption".

As a result of this experience I believe very firmly that the exposure of male lead workers to levels of lead in air not exceeding 150 ug/m^3 for 40 hours a week never produces short-term or acute effects on health; and this belief is in agreement with that of all other experienced workers in this field that I know. But concentrations in city streets of 5 ug/m^3 are only one thirtieth of 150 ug/m^3. Even assuming differences in length of exposure, particle size and solubility, and susceptibility of women and children or during illness--no experienced toxicologist would agree that this level of 5 ug/m^3 constitutes a hazard.

A similar argument applies to long-term or chronic effects. No such effects have been demonstrated in lead workers exposed to levels of 150 ug/m^3 so it would be incredible if levels one thirtieth of this level could produce such effects in the general population due to inhalation.

Much has been written about the so-called "subclinical" effects of lead absorption. I think the word "subclinical" is without meaning until the speaker has said what he intends the word to mean. The term is used by some to mean an increase in urinary coproporphyrin or ALA or a decrease in ALA dehydratase, and these effects undoubtedly occur in lead workers with blood leads less than 80 ug/100 G and have been occurring for over a hundred years. But as there is no effect on health when blood lead is less than 80 ug/100 G, in what sense can these so-called subclinical effects be considered undesirable?

Having shown why the inhalation of current urban levels of airborne lead is perfectly acceptable, I would like briefly to consider some of the reasons which have been proposed for reducing these levels even though I have no personal

experience in these fields.

1. Lead in Greenland snow and Scandinavian moss has been increased by a detectable amount. But 2 parts in 10 thousand million is infinitesimally small, and the startling rate of increase of lead concentration in Greenland snow shown in the figure quoted in the N. A. S. Report does not correspond with the original published data. (M. K. Williams, New Scientist, 1971, 52, 235)

2. It has been claimed that airborne lead may enter food and beverages. But it is known that there has been no increase in the lead in the food we eat or the water we drink for at least 30 years.

3. It has been said that children may eat dust contaminated by lead in petrol and thereby add to an already excessive body burden. The N. A. S. Report emphasized that there is no evidence on this point.

It is well known that lead poisoning occurs in children in the U. S. A. primarily because they live in dilapidated housing, and ingest peeling lead paint. The N. A. S. Report was emphatic on this point. And experience in other countries confirms it--where dilapidated housing does not occur, lead poisoning in children is rare, and these rare cases have not been attributed to lead in petrol. The N. A. S. Report even contrasted the cost of repairs to substandard housing with the cost of treating cases of lead poisoning and showed that the two costs were comparable. But to remove lead from petrol would cost hundreds of millions of dollars for no known health benefit. Thus to remove or reduce lead in petrol to prevent childhood lead poisoning is like taking a sledgehammer and missing the nut.

Finally, I would like to consider some details of the EPA document "Health Hazards of Lead." I find it an astonishing work. The evidence for an airborne lead standard appears to be confined to the belief that "elevated blood

leads and thus excess body burdens are associated with lead levels greater than 2 ug/m^3" (Page 5, para 2). No evidence is advanced for the belief that 2 is the magic figure in this respect and on the basis of the regression formula cited (Table 7) this belief is patently untrue! Nor is any evidence advanced that elevation of blood lead at these low levels constitutes any hazard to health. The document contains many non-sequiturs, errors and misprints. There are many arithmetical errors in Table 7 alone, some of them gross (see Appendix). I cannot understand how a reputable body came to rely on such a slovenly piece of work on such an important matter. It contains not one good reason as to why airborne lead should be reduced at all.

In conclusion, although I recognize the need for further research, particularly concerning the health of lead workers, I cannot conceive how a reduction in lead in petrol emissions can be of benefit to the public health.

Appendix

Table 7 in "Health Hazards of Lead" contains many errors. Gross errors in the last column, and the omission of a minus sign, are shown ringed. Minor errors in column 5 are not shown.

TABLE 7

Relationship of Adult Blood Lead Levels and Body Lead Burdens to Airborne Lead Exposure

Air Lead Exposure	Daily Lead Absorption ug/day			Expected Blood Lead[3]	Relative Excess in Blood Lead (%)[4]	
ug/m^3	Air[1]	Diet[2]	Total	u/gl00g		
2.0	13.8	30	43.8	21.3	0%	0%
2.5	17.3	30	47.3	22.8	7%	7
3.0	20.7	30	50.7	24.3	15%	14
3.5	24.2	30	54.2	25.8	23%	21
4.0	27.6	30	57.6	27.3	30%	28
4.5	31.1	30	61.1	28.8	38%	35
5.0	34.5	30	64.5	30.3	47%	42
10.0	69.0	30	99.0	40.0	137%	(88)
20.0	138.0	30	168.0	53.8	284%	(153)
50.0	345.0	30	375.0	71.6	780%	(236)
100.0	690.0	30	720.0	87.2	1550%	(309)

1/ Assumes inhalation of 23 m^3/day and 30% lung retention.

2/ Assumes 10% gastrointestinal absorption of the average adult daily total dietary intake (300 ug) from food and water.

3/ Computed from regression formula: Blood lead = (−)69.1052 + 54.7605 x log ug Pb absorbed daily as given in Chapter 3 of Airborne Lead in Perspective by the National Research Council, National Academy of Sciences.

4/ Relative excess in blood lead is associated with ambient air exposure above 2.0 ug Pb/m^3.

LIA03838

STATEMENT BEFORE THE ENVIRONMENTAL PROTECTION AGENCY

HEARINGS ON REGULATION OF LEAD ADDITIVES IN MOTOR GASOLINE

APRIL 27, 1972

DALLAS, TEXAS

My name is Lee H. Solomon and I am a partner in the firm of Turner, Mason & Solomon, consulting engineers, Dallas, Texas. My professional background includes a Bachelor's Degree in Chemical Engineering from the University of Michigan, followed by ten years of various technical and management positions with a major domestic petroleum refining company. I then was affiliated with the parent international oil company as Senior Advisor for Latin American Refining Operations. For the past two years, I have served petroleum and chemical industry, financial and governmental clients as an independent petroleum industry consultant. In 1971 I was retained in this capacity by the Environmental Protection Agency to assist with a project dealing with the economic analysis of proposed schedules for removal of lead additives from gasoline. After the completion of my direct assignment for EPA, my firm continued to informally advise and assist with interpretations of petroleum industry problems. We have followed the cost/benefit studies conducted by The Aerospace Corporation for EPA with great interest, but found that the study scope emphasized those systems that could be expected to satisfy the exact requirements of the 1976 Federal standards. This study discounted available systems which would achieve essentially identical objectives over the decade. In our judgment, the proposed lead regulations under consideration at this hearing also do not adequately recognize the existence of alternate systems capable of producing comparable objectives.

When the proposed lead regulations were announced in the Federal Register earlier this year, my partners and I determined that we could prepare a cost/benefit study which would consider not only new emission technology which may satisfy the 1976 Federal standards, but also the application of available technology which may not satisfy the letter of the 1970 Clean Air Act requirements, but would accomplish essentially the same environmental improvements. We reasoned that such a study could be based upon data from studies sponsored by governmental agencies for the most part and would require independent analysis only for those aspects of the problem not included in the published reports. We have concluded such a study and reviewed our final report with representatives of the Environmental Protection Agency. Today I would like to offer this report into the record of the Hearing and briefly discuss the salient features of the study.

DESIGN OF STUDY

The first slide identifies our basic approach to the cost/benefit study. A reference schedule was constructed to define a future environment in which automobiles have the same characteristics as 1970 models in terms of fuel economy, emission levels, and automotive costs. This automotive definition fixed the quality and volume requirements of the future gasoline market. Mathematical models of petroleum refineries were then constructed to simulate industry investment and growth patterns. The definition of individual refinery model operations for the year 1970 is based upon information from the Bureau of Mines' Annual Mineral Industry Surveys for 1970. The future industry supply/demand patterns were based upon a recently completed study by the National Petroleum Council entitled "U.S. Energy Outlook, An Initial Appraisal 1971-85". Our basic approach in the study was to validate

the refinery models by repredicting the actual operations of the domestic petroleum refining industry in 1970. We then imposed the predicted demand for petroleum products and the available supply of raw materials upon those models for calendar years 1974, 1977 and 1980. By compositing the results generated from each individual model, we were able to determine the raw material requirements for each of the years studied, the total refinery output which would be generated, and the required investment for the petroleum refining industry in the reference environment.

A second schedule, which we have labeled the Federal schedule, incorporates the same supply/demand information from the National Petroleum Council. In this instance, the automotive fuel economy, emission levels and emission system costs reflect the use of catalytic reactor systems that meet all current and proposed Federal emission standards with one exception. We have assumed that the 1975 standards would be deferred to 1976. The Federal schedule incorporates a requirement for unleaded motor gasoline beginning in mid-1974 and the restrictions on lead content of traditional grades which are under consideration at this hearing.

A third schedule, which we have labeled thermal reactor, is predicated upon the use of thermal exhaust reactors for 1975 and later automobiles. The emission standards imposed for this schedule are identical to those specified by the California Air Resources Board. In our report we have labeled this the California schedule, but since available thermal reactors yield lower emissions than required by California, we believe the designation used on this slide is more appropriate. We have assumed that endorsement of this type of control system will result in the restoration of more efficient high-compression automotive engines in 1974 and later model cars. Further, we have incor-

porated exhaust particulate traps in 1975 to effect a reduction in atmospheric lead emissions. Our study is based upon the installation of exhaust particulate traps on all new model automobiles beginning with 1975 and the requirement that replacement exhaust systems also achieve a 70% efficiency in the reduction of exhaust particulates after January 1, 1975. We recognize that the regulation of existing automobiles is not a subject of this hearing, and we concede that such systems are not commercially available at present. However, the potential for inexpensive and effective reduction of emissions has been noted in many publications. We feel that the application of such systems is an obvious first level of control for both lead emissions and other automotive particulate discharges.

AUTOMOTIVE EMISSION SYSTEMS

A comparison of ultimate emission levels for automobiles under the three schedules is shown on the second slide. Emission data for the reference schedule have been derived from the National Academy of Science's interim report to EPA. The lead emissions shown on the slide are based upon industry studies which indicate that 75% of the lead additives in automotive fuel are exhausted to the atmosphere. The balance is retained in engine deposits, crankcase oil, or trapped in the muffler system. The emission levels for the Federal schedule satisfy the 1976 emission standards presently under consideration by the Environmental Protection Agency. We have assumed these levels would be met for 1976 and later automobiles though we know of no system which will meet these levels that has been commercialized to date. The thermal reactor emission data is from the Aerospace study sponsored by the Environmental Protection Agency. These emissions encompass a broad spectrum of thermal devices. Individual thermal reactors of a particular design will

result in lower levels of either hydrocarbon or carbon monoxide. Lead emissions under this schedule are based on the use of leaded gasoline in engines which incorporate exhaust traps that remove 70% of all particulates present in the exhaust streams. Efficiencies of this level were stated in the Aerospace report as having been demonstrated for up to 64,000 miles. Further, several developers were identified who indicate 80% to 99% effectiveness may be realized from the devices under current development. With these basic report premises established, I would like to offer a brief synopsis of the major conclusions of our study.

EFFECT ON THE ENVIRONMENT

The total automotive emissions which would be generated throughout the decade under the various schedules are shown on the next slide. I would like to note here that we do not suggest that the emissions of individual pollutants have equal impact on the environment. A projection for each individual exhaust emission under consideration is contained in the report. This slide is used primarily to illustrate the overall environmental effect of the individual schedules.

There are several observations to be made based upon this graph. First, the effectiveness of emission control systems which were imposed upon the automotive industry in calendar year 1970 is quite evident. By 1980 even the reference schedule achieves a 40% reduction in total automotive emissions from the maximum level of 146 million tons for calendar year 1967.

Second, we should note that the total level of automotive emissions for the 1970-80 period is essentially equal with either thermal reactors or catalytic systems employed in the Federal schedule. This seems a little inconsistent since we previously indicated the Federal standards are signifi-

cantly lower for automobiles of 1976 and later model years. We should note, however, that the thermal reactor schedule becomes more restrictive at an earlier date than the Federal schedule. Certainly, if continued exposure to elevated levels of these pollutants is to be a criterion in selecting the appropriate regulatory level, it would appear that the thermal reactor system offers the same promise as that proposed by the Federal Clean Air Act.

Third, I would like to make a point that may not be too obvious from this particular graph. A major contributor to automotive emissions throughout the time frame under study is the automotive population on the road at the present time. This can be emphasized by noting that even in 1980 under the Federal schedule 36% of the total automotive emissions are generated by 1971 and earlier automobiles. An additional 48% comes from 1972 to 1975 models, and only 16% of the automotive emissions are generated by automobiles which meet the more stringent 1976 requirements of the 1970 Clean Air Act. The Clean Air Act, as well as most of the regulations currently in force by the California Air Resources Board, is specifically directed at new model automobiles. We should note that this technique is not consistent with the cost effectiveness approach to environmental improvement. The continued operation of automobiles that have no emission control devices seems inconsistent with the major engineering and operational changes which are required to raise the effectiveness of future control systems from 90% to 95%.

Since the primary subject of this hearing is the regulation of lead emissions, I would like to direct your attention to the next slide, which highlights the relative automotive lead emissions from the various schedules. The appearance of this graph is different from the previous one in that no control

of lead emission is implemented at all under the reference schedule. While the use of particulate traps for reducing lead emissions in the thermal reactor schedule does not satisfy the goal expressed by the Environmental Protection Agency of a 60' reduction in exhausted lead by 1977, lead emissions do closely approach that goal by 1978. The control system employed for thermal reactors assumes the use of particulate traps which are 70% effective in reducing exhaust particulate discharge. I would like to remind you that higher efficiency lead traps have been widely discussed and, if perfected, could result in the control of lead emissions that would essentially match that promised by the total elimination of lead additives from motor fuels.

CONSUMPTION OF NATURAL RESOURCES

Now I would like to turn to observations regarding the consumption of natural resources. The primary influences on consumption of natural resources as a result of automotive emission standards result from the fuel economy penalty related to emission control systems and the increased processing severity required for the production of motor gasoline without lead additives. The relative fuel economy for the various schedules is indicated on the next slide. The significant change in fuel economy for the Federal schedule in 1976 reflects the conversion to very low compression ratio engines which will be designed to operate satisfactorily on 91 research octane number unleaded gasoline. Our study is based upon constant automotive performance. Though the 1970-72 compression ratio changes in domestic automobiles have been accompanied by a decline in automotive performance, we do not believe such a basis is valid for a long-term cost effectiveness study. If automotive consumers will tolerate reduced performance for a control situation,

they should logically accept such a penalty under the reference case also. We have based our studies on 1975-76 automobiles with the same performance characteristics as 1970 models. The net effect of the fuel penalties is incorporated in our forecast of motor gasoline sales for each of the schedules. This effect, combined with the increased severity of refinery processing, will result in the increased consumption of natural resources.

The National Petroleum Council energy forecast, to which I previously referred, indicates that all marginal requirements for petroleum in 1980 will originate in the Eastern Hemisphere. We have shown the increased requirement for natural resources as a result of emission control requirements on the next chart as additional shipments of Eastern Hemisphere raw materials into the United States. The Federal schedule requires an overall increase of 6.9 in petroleum refinery raw materials by 1980 or the equivalent of 1.2 million barrels per day of additional crude oil. This compares with an increase of 3.1 , or 529,000 barrels per day, for the thermal reactor schedule. The difference between these two requirements - 663,000 barrels per day of raw materials - represents the additional natural resource requirements for the Federal standards compared to the use of thermal reactor systems.

This increase in raw material requirements may be placed in perspective by considering petroleum industry logistical implications. An additional 663,000 barrels per day of raw materials for the Federal schedule will require about five new grassroots refineries of the average size constructed by the industry in 1970 and 1971. Moreover, these refineries will be based on imported crudes and should logically be constructed at new East Coast sites or result in even higher costs for product transportation than we have reflected

in our study. If all of the incremental Eastern Hemisphere crude is transported to the United States in 250,000 deadweight ton tankers in the year 1980, there will be eleven additional vessels of this size calling at U.S. East Coast ports each month. In terms of the typical 70,000 deadweight ton vessels currently serving U.S. ports, the increased tanker activity is an even more dramatic thirty-eight arrivals monthly. These figures do not illustrate the full impact of automotive emission standards. By 1980 only 60% of the motor gasoline will be consumed in automobiles which have incorporated the most restrictive emission control systems. The 1985 increase in natural resource consumption for the Federal schedule relative to the reference case will be approximately 2 million barrels per day, or essentially equivalent to the projected output of the Alaskan North Slope oil field.

COST TO THE CONSUMING PUBLIC

The final point I would like to discuss today is the increased consumer cost which will result from imposition of these emission control standards. The next slide indicates the cumulative 1971-80 cost under the schedules under consideration. The petroleum industry cost includes raw materials, operating costs, and capital charges related to increased volume and the changing quality of motor gasoline. The amortization of new car emission control systems is based upon an eight-year life for emission control systems at the costs estimated by the National Academy of Science in their recent report to EPA. The emission system maintenance data reflect savings under the thermal reactor schedule for reduced exhaust system maintenance and costs for replacement of catalyst systems at 25,000 miles under the Federal schedule. Such a catalyst replacement was also suggested as a logical expectation in the NAS report. The additional gasoline costs reflect marketing

and distribution costs, as well as the excise taxes, which will be collected on additional volumes of gasoline that are required by future automobiles designed to meet the two emission control standards.

We have not addressed ourselves to the health aspects of emission reduction, nor do we comment on whether an expenditure of $29 billion or $48 billion is justifiable for environmental protection in this decade. But we would like to call your attention to some cost-effective aspects of this study on the final slide. The Federal standards unquestionably yield a slightly lower absolute automotive emission level in 1980. We must concede that the performance of thermal reactor systems as documented in the Aerospace report offer little prospect of meeting the numeric automotive emission requirements of the 1970 Clean Air Act. Still, the use of thermal reactors and exhaust particulate traps will effect an almost identical reduction in the emissions of each individual pollutant as compared to the Federal schedule. The thermal reactor system, then, fails to meet the exact letter of the law, but succeeds in matching its intent at a cost savings to the U.S. consumer of almost $19 billion by 1980 and a reduction in the requirements for natural resources by almost 1 billion barrels over the same time period. It seems valid to us to question the incentives for national expenditures of this magnitude for marginal improvements in automotive emissions. Indeed, the adverse effects on consumption of natural resources, balance of payments, and increased petroleum tanker operations resulting from even imposition of thermal reactors appear to be quite severe.

We strongly urge you to give further consideration to the establishment of a lead exhaust emission standard similar to that previously selected for other automotive emissions. This type of exhaust emission requirement

could be satisfied either by the use of particulate traps or by reducing the use of lead additives in gasoline. We also suggest serious consideration of a lead emission standard for replacement exhaust systems. Incorporation of particulate traps in replacement exhaust systems could materially reduce atmospheric emissions in a few years at very little additional cost to the consuming public. Further, we would like to issue a plea for reconsideration of the emission standards that presently apply to hydrocarbons, carbon monoxide, and nitrogen oxides. The technology necessary to satisfy the thermal reactor system appears to be available at the present time, while operability of devices to meet the Federal standards is still in doubt. A prudent course of action might include the prompt implementation of available technology, followed by an evaluation of the need for further improvement. If eventual implementation of emission limits similar to those established by the 1970 Clean Air Act is required, it would appear the enactment of appropriate standards in 1980 will produce essentially the same environmental benefits as the currently proposed 1976 enforcement date.

BASIC DESIGN

- **REFERENCE SCHEDULE**
  1970 AUTOMOTIVE CHARACTERISTICS
- **FEDERAL SCHEDULE**
  CURRENT AND PROPOSED FEDERAL EMISSION STANDARDS
- **THERMAL REACTOR SCHEDULE**
  APPLICATION OF THERMAL REACTORS AND EXHAUST PARTICULATE TRAPS FOR CONTROL OF LEAD EMISSIONS

SLIDE 1

AUTOMOTIVE EMISSION LEVELS

	CVS TEST, GRAMS/MILE			
	HC	CO	NO_x	LEAD
1970 + REFERENCE AUTO	4.6	47	6.0	0.18*
1976 + FEDERAL AUTO	0.41	3.4	0.4	0
1975 + THERMAL REACTOR AUTO	1.0	9.0	1.5	0.06*

*BASED ON 2.5 GM/GALLON LEAD LEVEL

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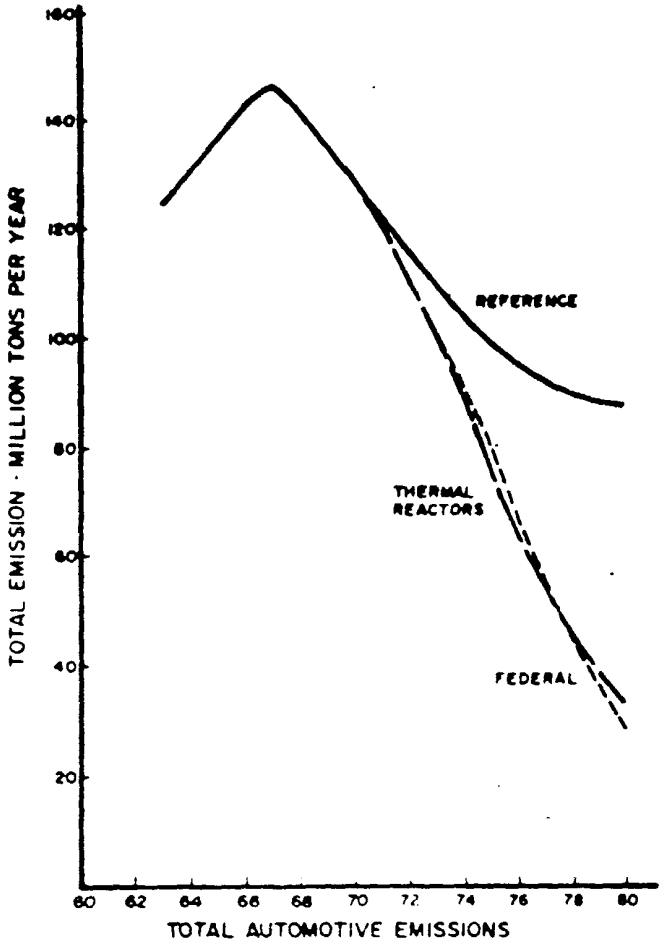
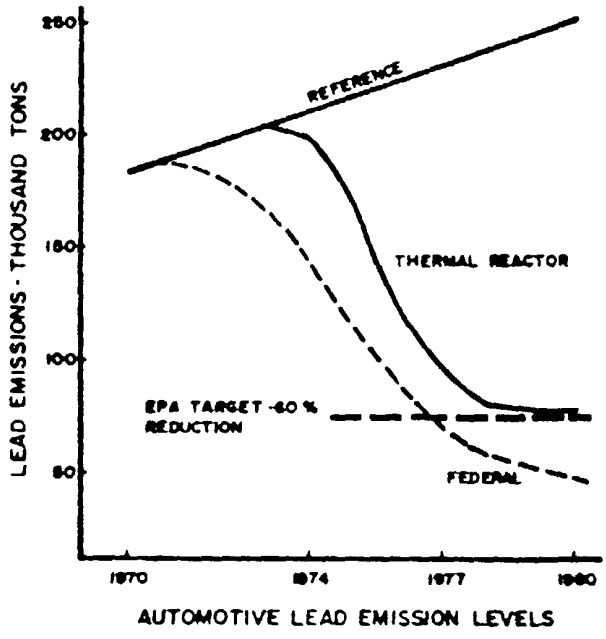
SLIDE 2



SLIDE 3



SLIDE 4

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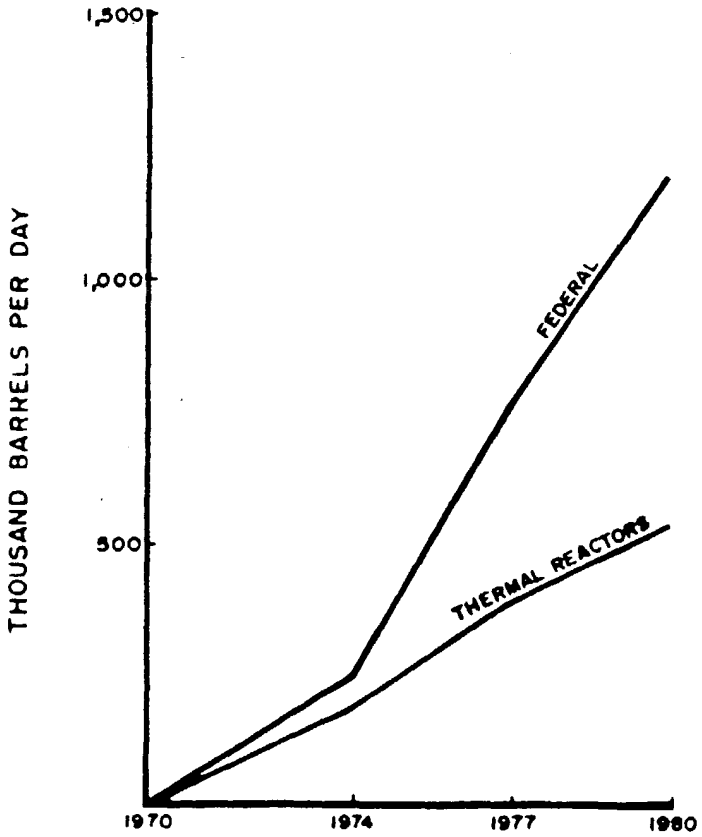
FUEL ECONOMY

REFERENCE SCHEDULE	RELATIVE FUEL ECONOMY
1970-80	1.00
FEDERAL SCHEDULE	
1971-75	0.93
1976 +	0.83
THERMAL REACTOR SCHEDULE	
1971-74	0.94
1975 +	0.92

SLIDE 5



INCREASED REQUIREMENTS FOR EASTERN HEMISPHERE RAW MATERIALS

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SLIDE 6

CUMULATIVE COST OF EMISSION STANDARDS
($ MM)

	1971-80 TOTAL	
	THERMAL REACTORS	FEDERAL SCHEDULE
ADDITIONAL PETROLEUM INDUSTRY COSTS	6,240	11,300
AMORTIZATION OF AUTO EMISSION CONTROL SYSTEMS	12,940	11,030
EMISSION SYSTEM MAINTENANCE COST/(SAVINGS)	(1,470)	7,460
ADDITIONAL GASOLINE CONSUMED:		
DISTRIBUTION AND MARKETING @ 15¢/GALLON	6,580	10,470
EXCISE TAX @ 11¢/GALLON	4,830	7,680
TOTAL CONSUMER COST	29,120	47,940

SLIDE 7

COST/EFFECTIVENESS INDICATORS

	THERMAL REACTORS	FEDERAL SCHEDULE
TOTAL EMISSIONS - 1980, MILLION TONS	32.7	28.6
1980 CONSUMER COSTS, $ MM	6.0	12.1
CUMULATIVE EMISSIONS - 1971-80, MILLION TONS	870	872
CUMULATIVE INCREASED CONSUMPTION OF NATURAL RESOURCES 1971-80, BILLIONS OF BARRELS	1.05	2.0
CUMULATIVE CONSUMER COSTS 1971-80, BILLION DOLLARS	29.1	47.9

SLIDE 8

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TURNER, MASON & SOLOMON
CONSULTING ENGINEERS

Malcolm M. Turner

1958 - B.A. Chemical Engineering - Rice University
1959 - M.S. Chemical Engineering - Rice University

Mr. Turner began his professional career with Continental Oil in Ponca City, Oklahoma. His duties included technical service, process design and economic studies related to Continental's petroleum and petrochemical facilities. He later was assigned to the Petrochemical Headquarters Department in Houston, where he participated in capital budget evaluations, development of a plant cost accounting system, and other management projects. From 1965 to 1970 Mal was associated with the consulting firm of Purvin & Gertz, Inc. He was involved in projects as diverse as the contract negotiations for the first sales of natural gas in Australia and the valuation and financial arrangements related to refinery sales in Kansas, Montana, North Dakota and New Mexico. In addition to his economic and financial assignments, Mal is experienced in all phases of low-temperature gas processing plants, including definitive process design, equipment selection and economic analysis. He has been a frequent contributor to technical journals on matters ranging from oil imports to automotive emissions. Mal has also been instrumental in the development of commercial waste treating ventures.

Harry F. Mason

1961 - B.S. Chemical Engineering - Rice University

Mr. Mason has been associated with both Tenneco Oil Company and Continental Oil Company in process engineering, economic evaluation and technical service related to natural gas, natural gas liquids, refining, and petrochemical facilities. He was associated with Purvin & Gertz, Inc., from 1967 to 1970 and was extensively involved with studies related to the utilization of liquefied natural gas and other light hydrocarbons. Harry's efforts in this area have included future market projections, basic process selection, economic evaluation, and preparation of submissions to the Federal Power Commission in support of client interests. In addition to light hydrocarbon studies, Harry participated in refinery financial evaluations, the settlement of industrial insurance claims, and as owner's representative in the development and promotion of a jointly-owned products pipeline. He is experienced in linear programming modeling techniques and has developed refinery simulation programs for use in operational and investment planning studies.

Lee H. Solomon

1957 - B.S. Chemical Engineering - University of Michigan

Upon completion of his college studies, Mr. Solomon joined Humble Oil and Refining Company in Baton Rouge, Louisiana. He served in a succession of engineering and supervisory assignments at Baton Rouge, including process design, economic planning and major project management. Lee's management assignments covered all phases of engineering, economics, manpower utilization, and both commercial and technical computer applications. In 1968, he moved to Esso Inter-America, Inc., where he was associated with technical developments and long-range planning for Latin American manufacturing operations. Lee began his consulting career in 1970 with engineering and economic studies related to the development of major new refining and petrochemical complexes in the Caribbean and the United States. He has represented clients in oil import studies, evaluation of worldwide tanker economics, and forecasting future energy markets. In 1971 he served as petroleum industry consultant to the Environmental Protection Agency in the conduct of studies related to restricting the use of lead additives in gasoline.

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PROFESSIONAL QUALIFICATIONS

Turner, Mason & Solomon is a petroleum industry consulting firm specializing in the areas of processing, transportation, and marketing of petroleum and petrochemical products. The principals of the firm have over thirty-five years of worldwide experience in these areas with direct assignments in Europe, Australia, South America and the Caribbean, as well as Canada and the United States. A list of typical assignments completed in recent years would include:

- Petroleum industry economics consultant to the Environmental Protection Agency for studies related to the use of lead additives in the manufacture of gasoline.
- Definition of current refinery capabilities and development of an optimized ten-year investment program for a major integrated U.S. oil company.
- Process selection, venture analysis, and development of financial backing for a new company to treat light industrial wastes for a major metropolitan area.
- Development of processing and transportation studies related to the importation of liquefied natural gas into the United States.
- Assisting in negotiations leading to initial sales of natural gas in Australia.
- Forecast of future availability and price of LPG in both domestic and foreign markets.
- Forecast of comparative ethylene manufacturing economics.
- Analysis of process changes required to produce unleaded gasoline in midcontinent refineries.
- Evaluation of the incentive for fuel desulfurization at a new European refinery.
- Logistical planning, process selection and economic analysis for new refining and petrochemical ventures in Europe, Midcontinent and Coastal United States, Canada and Caribbean locations.
- Analysis of foreign flag tanker economics and forecast of future bulk transportation costs.
- Evaluation and acquisition studies related to small refining and manufacturing plants.

Turner, Mason & Solomon offers expert engineering and management services that are completely independent of construction, process licensing or specific industry ties which might conflict with client interests. We are prepared to assist in corporate planning studies, either in areas of proprietary interest or in embarking on diversification efforts. This may include assessments of the economic environment, conception and development of new ventures, logistical planning, process selection, evaluation of alternate financing schemes, and major project management. Such studies are well supported by the formal training and industrial experience of each of the partners.

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