THE INNER CITY ENVIRONMENT AND THE ROLE OF THE ENVIRONMENTAL PROTECTION AGENCY

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BEFORE THE

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OF THE

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THE INNER CITY ENVIRONMENT AND THE ROLE OF THE ENVIRONMENTAL PROTECTION AGENCY

FRIDAY, FEBRUARY 4, 1972

COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON THE ENVIRONMENT,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10 a.m., in room 5110, New Senate Office Building, Hon. Philip A. Hart (chairman of the subcommittee) presiding.

Present: Senators Hart and Hatfield.

OPENING STATEMENT BY SENATOR HART

Senator HART. The committee will be in order.

The committee welcomes a distinguished group of citizens and scientists. Today they are going to discuss what is often an ignored aspect of our environmental crisis. I refer to the environmental degradation imposed on our inner cities and their residents. We hope today to examine these environmental problems and to gather information as to the present and future role of the Environmental Protection Agency in the inner city.

Last year that agency commissioned a report on the inner city environment by a task force of persons involved in the various programs for which EPA has direct responsibility. The Agency and its Administrator, William D. Ruckelshaus, certainly should be highly commended for this initiative. The subcommittee will be pleased to welcome Mr. Ruckelshaus on March 15th for a discussion of the final version of that report.

It has been said often that the environmental issue is not relevant to the inner city poor, overwhelmed as they are by such basic needs as food, housing, and adequate employment. This is probably because the issue traditionally has been defined more narrowly than is necessary or—to my mind—desirable. In the past many have tended to see in environment no more than the need for open space, for wilderness, for clean lakes. Now, as critical as these concerns are, it is understandable that the ghetto resident—who is so far removed from these luxuries—simply cannot relate to them.

If we look upon environment more broadly, however, as "The relationship between man and his physical surroundings," we must regard it as a significant issue for all segments of society—particularly for those whose surroundings have become so deficient as to be considered dehumanizing.

Staff member assigned to these hearings: Leonard Bickwit.

It is to these surroundings—the environment of dilapidated housing, peeling lead paint, uncollected garbage, and dangerously polluted air and water—that the subcommitee turns today. It is also to this environment that the forthcoming EPA Task Force Report will be addressed. Our hope is that today's testimony will better enable the subcommittee to evaluate that report when it is presented in March. It is further hoped, of course, that out of these cooperative efforts, useful proposals will emerge for legislation and the more effective implementation of existing laws.

Our first witness is Mr. Gustav Heningberg, president of the Greater Newark Urban Coalition, and a member of the Board of the National Urban Coalition, who comes to us with an impressive background of activism to revitalize our cities.

We welcome you, sir.

STATEMENT OF GUSTAV HENINGBURG, PRESIDENT, GREATER NEWARK URBAN COALITION

Mr. HENINGBURG. My name is Gustav Heningburg and I am speaking on behalf of the National Urban Coalition. I am the chairman of the National Association of Urban Coalition directors and the president of the Greater Newark, New Jersey, Urban Coalition.

I appreciate the opportunity to share the National Urban Coalition's view of the environmental problem of the inner-city resident. It is my hope that these hearings on the role of the Environmental Protection Agency and the urban environment mark an important turning point in our concern for the quality of life for the 180 million Americans living in urban areas, and will cause a serious revaluation of the priorities of Federal environmental protection efforts.

Just as social and economic problems occur in relatively manageable proportions elsewhere in our society, but occur in our central cities in crisis dimensions, so too are the environmental problems which are yet manageable in suburban and rural areas highly concentrated and of almost overwhelming magnitude in our central cities. Thus, the ghetto resident suffers not only from inadequate shelter, jobs, and educational opportunities, but must bear the added burden of residing in the most environmentally degraded real estate in the Nation.

The powerless suffer while the powerful pollute. Industrial plants, slumlords, and governmental agencies disregard the environmental consequences of their activities. Automobiles and trucks use ghetto roadways to reach suburban areas from the inner city. The black, the chicano, the white working class peoples, are abandoned to face the growing environmental problems with minimal understanding of the impact of pollution on their daily lives, and virtually no support from the public and private sectors.

Pollution to the middle class American, who has some options about where and how he lives, means DDT; or chemicals added to food products; or dirty streams and rivers. Pollution is seen, and correctly so, as a set of problems that can be solved at some point by suitable applications of technology and concerted public and private effort. There is a minimal sense of urgency, because the pollution

problems are still a matter of convenience . . . or inconvenience. The ghetto dweller however, knows the problems of pollution as a constant companion, and their solution is urgent to him because it is a matter of survival, not convenience.

The causes of what we refer to as our "urban crisis" are as different as the people who talk about them. However, no spokesman can deny the fact that the environment is a key factor in the urban crisis. The concentrated nature of our industrial facilities; the overcrowding and congestion of unregulated land use patterns, particularly in the inner city; the prevalence of highways cutting through urban neighborhoods pouring pollutants on densely populated areas for long periods of time; the sheer size of the solid waste and garbage problem in the inner cities; and of course, the most commonly cited factors which only reinforce and perpetuate the environmental degradation and insure its continuance: lack of jobs; lack of city revenues; the exodus of the middle class to the suburbs along with businesses; the lack of Federal commitment and the active "policy of apathy" on the part of many State governments.

I don't have to outline the obvious detriment of heavy pollutants on an individual's health. I might point out a few other factors which directly relate to the condition of the urban environment. If you are poor and black, you have a three times greater chance of contracting hypertensive heart disease than a white person making over $10,000 per year. Problems of undernourishment and malnutrition are rampant wit he poor and black communities of our cities. The life expectancy of nonwhite Americans is 7 years shorter than for white Americans, primarily for reasons relating to polluted environment. While city revenues are insufficient to provide adequate educational facilities for urban residents, the learning ability of children is further threatened by the frequent instances of protein deficiency in the early years.

Solid waste management is perhaps the most visible and most immediate environmental problem in the inner city. Uncollected refuse is not only degrading, it generates diseases and provides the rat population with enough food to make them the most feared ghetto residents for mothers and children. Diseases such as rat bite fever, salmonellosis and murine typhus fever are unknown in the suburbs but common in the ghetto. It has been estimated that each rat, and we have hundreds of millions of them, damages between $1 and $10 worth of food and other materials per year and contaminates five to 10 times more. Blacks and other poor people within the cities look at the modern equipment in the suburban areas and grow bitter at the prospect of garbage which often remains for days and weeks on the streets before it is hauled away to an incinerator which further pollutes the air.

Yet, neither Federal spending nor Federal actions reflect the crisis nature of the urban solid waste problem. While funding for this purpose is up from last year, there is a gross disparity between the $21 million to be spent in fiscal year 1972 on solid waste management and the $170 million in the coffers for air pollution.

The problems of abandoned cars plagues every city. Some months back it became so acute in Newark that Mayor Gibson called out the National Guard in a massive effort to remove the junked cars from

the streets and make the city a better place to live. In a total of 3 months, working weekends, the National Guard removed thousands of cars from our streets. The problem of solid waste is dramatized by these abandoned cars affecting our economic, physical, and mental well-being and is a major cause in the rapid abandonment of our cities by those who can afford to leave.

The air pollution problem within urban areas is not only a question of housewives having to shake the soot off their laundry before bringing it into the house. Central city residents breathe air containing five times more suspended particulate matter than air being breathed by people in remote areas. The difference in the lead content of polluted city air and clean rural air is 50 times. Ambient air quality standards to protect the public's health have been set for carbon monoxide, a common pollutant from auto exhaust primarily, at nine parts per million for an 8-hour maximum, desirably not to be exceeded more than once a year. This value was exceeded 70 percent of the time at a Chicago monitoring station between 1962 and 1967. On city streets, normal traffic flow frequently creates carbon monoxide levels on the order of 100 parts per million. Increasingly frequent traffic jams exacerbate this problem to crisis proportions. Carbon monoxide can act to increase the chances for developing sickle-cell anemia, to which the urban poor are particularly vulnerable. This same traffic also creates excessive noise levels, high concentrations of lead, and increased health hazards from other toxic gases.

Lead is a particularly toxic pollutant which is concentrated in urban areas, and in the bodies of its residents. Some attention has recently been devoted to testing for lead poisoning among inner city children, but no major commitment of funds has been made available to eliminate access to the lead-filled paint which hungry children eat.

A third area of environmental assaults upon the inner city is the criminally inadequate housing. The condition and size of the housing stock in this country is a national scandal. Landlord abandonment of buildings, widespread dilapidation, and the ill health and deaths of small children due to the ingestion of lead chips are characteristic of the housing environment in the inner city. I would like to quote from the Council on Environmental Quality's Second Annual Report in which they devoted a chapter to the inner city environment: "It is important to understand clearly the dual problems of abandonment and crowding in inner city housing. Abandonment pockmarks neighborhoods with dilapidated structures and rubble-filled lots. It works against the feeling of community that derives from solid blocks of homes and stores. Crowding in housing, on the other hand, affects the home environment. Abandonment and crowding go together because the loss of adequate housing forces crowded conditions in remaining low-rent structures. Thus occurs this incongruous phenomenon of lower densities per acre in the inner city caused by abandonment, but higher densities in some buildings as the poor crowd into the limited remaining housing."

Studies by Lewis Mumford and others have established a definite correlation between noise and the incidence of gastrointestinal diseases. Intense concentrations of noise can literally drive people and

animals crazy. And yet, high levels of noise from trucks, trains, sirens, horns, construction and demolition are constant companions of ghetto residents—night and day.

The picture painted here is not pretty but it is real. I have failed to even touch on the need for recreational facilities, water resources, pesticide ingestion problems, and a long list of other important environmental issues. Urban environments reflect the neglect and discrimination of the powerful who make the poor pay for their environmental crimes through poor health, inferior education, poor housing and lack of jobs. The betterment of these conditions within our cities goes hand in hand with the need for the abolition of poverty in this country, the construction of adequate housing for all Americans, adequate health care for those who cannot afford to pay, a better educational system and a restructuring of our financial and tax systems to allow our cities to be financially solvent again. These obviously are not things which any one agency can possibly tackle. These are the kinds of long-term battles both the public and the private sector must wage to get it.

The EPA is charged with responsibility for regulating and operating environmental programs in air, noise, water, solid waste and pesticides.

May I take the liberty of suggesting some broad recommendations that EPA must begin now in order to create a livable civilized environment for 80 percent of our population.

1. Education is part of the answer. EPA must "get the word out" to urban residents, particularly the urban poor, as to the cause and effects of the pollutions that are bombarding them form all sides. Special efforts must be made, for example, to educate people on the effects of the pollutants that are bombarding them from all sides.

It does little good to teach a black poor child in the city about the benefits of and the need for wildnerness protection when the child has never seen, let alone appreciates, a virgin meadow or stand of trees. This child and his parents must know, however, for survival's sake, about the pesticides that are bought in the corner store, about the autos in her street which is her playground.

The environmental movement has not gained much support from inner city residents because it has not defined the problems in ways relevant to the inner city life.

2. EPA must set its standards for air pollution, water effluent discharges, noise levels, et cetera, with a view to the special impact of *all* of these pollutants separately and in combination with each other.

Special attention must be given in the standard-setting process to the growing health effects upon inner city residents who are already weakened by inadequate health care, poor quality food and low income.

I would particularly note in this category the need for tough and strict national standards dealing with lead emissions, both from automobiles and in the ambient air.

3. EPA should be granted authority, on its own or in concert with local government, to ban all through-traffic from urban streets when population densities along traffic arteries raise above prescribed levels and air pollution levels reach danger heights.

These bans should be flexible so they can be imposed for hours or days or weeks as appropriate and necessary. Such action is not unprecedented and has been done in some areas relating to water pollution

4. Since urban solid waste problems are the most severe and since urban residents most often make up the work force which operates collection and disposal systems, methods of motivating sanitary crews to improve solid waste management procedures should be developed and implemented.

Nowhere, to my knowledge, have the obvious advantages of offering sanitary crews incentives—monetary and otherwise—to improve the system been applied, although incentive programs have been utilized for many years in Government.

A recent study completed by a professor at Newark College of Engineering was conducted jointly by the Newark Sanitation Department and the union representing the workers. These sense of involvement and participation by the workers themselves and the creative suggestions they offered made clear the wisdom of such an approach.

The collection of solid waste is by far the most inadequate aspect of the urban solid waste problem and by far the biggest consumer of the tax dollar spent in this area.

A major reason is the total inadequacy of available efficient equipment and the almost complete lack of an effective research and development program to improve it. Federal funding of a crash engineering-design program to create better equipment, get it manufactured and get it on the streets is imperative.

EPA also seems most conservative in relation to existing solid waste processing-recycling systems. We sent men into orbit and to the moon at a point in the development of that technology far less proven than the technology on which some present waste processing systems are already based.

EPA should set a goal of securing the funds for the construction of at least one hundred solid waste processing and recycling plants for urban centers within the next 12 months.

Finally, priorities must be clearly established within EPA and the thrust of all of its efforts must conform to these priorities. History and human nature suggest that without some stimulus EPA will not focus its attention on the inner city areas first. These priorities must be based on two simple criteria:

1. Developing and executing those programs first which will benefit the largest number of Americans.
2. Developing and implementing those programs first which will benefit the most adversely affected by environmental pollution.

And those most adversely affected are the urban poor.

The National Urban Coalition has devoted its existence to the redevelopment of our cities in the economic, physical and social sectors. Local efforts cannot go it alone without Federal resources and expertise. The Environmental Protection Agency has a sobering mission ahead of it—the Agency must devote new energies, attention, and priorities to the urban environment and the people who inhabit it.

Thank you.

Senator HART. Thank you very much for a very powerful statement, perhaps made more so by the fact that you never raised your voice, yet all in the room understand you feel very deeply the message you give the Congress.

The favorite question around here these days—because everybody is making speeches about priorities to be reordered—goes this way: "If you could assign a priority to the Federal environmental control program, where would you put your emphasis? What would be your top priorities both in program and money?"

Mr. HENINGBURG. It is difficult to answer that if you attempt to answer it in the technical context of air or water or solid waste or lead or noise.

I would have to establish priorities, I think, in another context, as suggested in the statement. The first priority should be the elimination of those conditions which most adversely affect the largest number of people.

That seems to me to be a very rational and reasonable criteria for establishing priorities.

Senator HART. It does.

Mr. HENINGBURG. But history tells us that rationality and reason somehow do not seem to be characteristics of our priority-setting practices.

The politics of the matter are such that the whole effort to call attention and develop institutions and resources to deal with environmental problems did not come from inner city residents, nor did it come from elected officials who represent those residents. It is my guess that the people who have some experience and technical capability in these areas who would normally comprise the staff of a Federal environmental agency probably are not center-city oriented either.

I am terribly afraid, given that combination of factors, that in setting priorities, the conservation-oriented citizens may have a great deal more influence on the direction of the agency than center-city advocates would.

Senator HART. Let me push you a little harder. Your prepared statement and your elaboration of it, I think, enable all of us to understand how you would generally fix the priorities, those things that will benefit the largest number of people and those who are most adversely affected, most heavily burdened.

Having said that, and without debating how much money could be available, but knowing only a fixed amount will be available, what one thing would you want to insure gets first attention? Is it lead poisoning? Solid waste?

Mr. HENINGBURG. I would say solid waste. The physical health and psychological impact of the solid waste problem in the inner city I think is probably most severe.

Perhaps it is useful to comment on the psychological impact of solid waste. In the case of the removal of the cars from the streets of Newark, the psychological lift which that gave residents of that section of Newark was almost as important as getting those wrecks off the streets.

Senator HART. I was going to say I won't ask you—I will, but if you know the answer you will embarrass me because I do not know. There is no reason why you should, but there is some reason why I should.

What percentage of the EPA budget is allocated to solid waste?

Mr. HENINGBURG. I am not sure of the percentage, Senator. The only figures I have are the comparison of the amount set aside for solid waste as opposed to air pollution and monitoring of air. It is 21 million versus 170 million, I think. What percentage that is of the total budget I am not sure.

Senator HART. We can and most certainly will get it.

Turning to the other end, to the people who are burdened by the environmental problems of the inner city—and you have reminded us how to define the environment when we are talking about the inner city—what can the powerless themselves do to reduce the inner city's environmental burden? Is there very much they can do?

Mr. HENINGBURG. There are some things which can be done, Senator, but I am not sure that the things the individual resident can do will have a major impact.

For example, we often hear the comment made that it was not government that put the litter on the street, it was the people who live there. In a vacuum, that is, of course, a fact.

It is also a fact, however, that the conditions under which the inner city poor live in very many cases requires that litter be put on the street simply because there is no place else to put it.

I think there could be community-based organizational efforts to clean up the block or clean up the street or clean up the neighborhood. In fact, this is going on in many locations. But unless the system develops a mechanism to complement these individual efforts we will develop another set of frustrations.

For example, if we were to organize in Newark 100 or 200 neighborhood or block associations—and we have a few at this point now—whose own motivation and sense of pride in their neighborhoods would dictate they clean their own streets up and begin to collect solid waste, and then there is nothing to come pick the debris up after they collected it and put it in a pile, such efforts won't last very long.

In terms of the educational process, if we start effective ways of communicating to the ghetto mothers of the impact of pollution on their children and themselves, and then offer no help in the solution, we have made another problem without solving one.

I guess I am saying there are things which can be done by the residents themselves, but I would certainly hope that—and I certainly do not think this was the thrust of the question—but I am responding to other experiences where governmental agencies have asked what the people are going to do for themselves when, in fact, there was virtually nothing they could do for themselves.

Any efforts to create a greater constructive involvement of the residents in solving the problems will have to be developed concurrently with methods by which those problems can be dealt with on a larger scale.

Senator HART. Which reminds us of the need—and I am sure we will remind EPA of the need for this—to design programs that will get down to the lowest level.

Mr. HENINGBURG. Yes.

Senator HART. As you began your testimony we were joined by the ranking minority member of the subcommittee, Senator Hatfield.

Senator HATFIELD. Thank you, Mr. Chairman.

I would like to second the chairman's comments regarding your testimony, Mr. Heningburg, It was very, very eloquent, and I think it will be helpful.

In fact, Mr. Chairman, I think we ought to devise a way to make sure that all of our colleagues have an opportunity to read this testimony.

You make many excellent points. One of them, concerns the problem of lead emission in the air from automobiles. I was happy to see that Mr. Ruckelshaus, in a recent interview on a New York program, indicated that they were committed to the proposition of phasing out all leaded gasoline from the marketplace, recognizing its ill effect upon human beings.

Mr. Heningburg, I come from an area, of course, which has only one or two urban centers; therefore, we are more oriented to the conservation of natural resources than perhaps we are to the conservation of human resources and the problems of the large cities.

Our largest city has a metropolitan area of only a million people, but we get some sense of this problem.

I am also very much aware that there are poor people in the rural areas of America as well as in the urban centers. And the urban centers continue to get larger and more dense including the suburban parts of metropolitan areas.

I see a problem in trying to resolve this problem by pouring more money into the urban centers, which we must do, I support such programs as you outline enthusiastically but, I think we have also neglected some of the rural and smaller communities of this Nation. This neglect contributes to the growing intensity of the urban problem, because the migration of rural people into these urban centers is great.

My thesis is that we will never solve the urban problem until we address ourselves to this national problem and retard the trend so that there is a future for young people in the smaller communities. Jobs are potentially there which will keep them from having to seek their opportunities in the city centers, although I hope people are not locked into the urban centers.

I hope they are not forever damned to have to live in some of these congested, horrible conditions.

This would not relieve us of our responsibility to correct or alleviate urban conditions. But from the standpoint of life style, no matter how many garbage collectors we are going to have, there will still be a character of impersonalism in your large centers.

We once thought we would solve the housing problem by the high-rises in New York City, but we have only compounded the problem.

We can attack these problems in the manner you outline, which I know Senator Hart is devoted to doing. But we could also help make more viable some of the smaller communities, not suburbs, but smaller communities and rural communities that would attract back

or retard the growth toward these urban centers—attract back people who left from these rural areas because there was no job?

My question is: "Do you think they will want to stay in the cities or do you think there is possibility of decentralization?"

I am running head-on into problems of building and racial prejudices and other things. I am leaping beyond the suburbs now at this point. I am thinking back to some of the areas of our country where, if they had sewer and water facilities, opportunities for businesses to locate small enterprises, quality education, housing, all these things, would there be an attraction out of some of the urban centers to what I consider the more satisfying lifestyle of the smaller communities?

Mr. HENINGBURG. I think there probably would be, and I think there is some evidence that the reverse migration has already begun.

Let me see if I can answer it, Senator, in a racial context because to a great extent where we talk about the inner cities now, we are talking about cities that are basically black/brown.

Senator HATFIELD. Yes.

Mr. HENINGBURG. The out-migration of blacks from the South, for example, has slowed down considerably over the past 10 years and in fact, has begun to reverse itself in appreciable numbers, as people have begun to decide that Newark and Chicago may not be the idyllic land that was originally believed.

If conditions had not improved from whence they came, and the option was to live badly here or there, I don't think people would begin to reexamine and pack up and move a family, or start a new lifestyle all over again.

But in the context of the question of the priorities for an agency such as EPA, I am not suggesting either/or.

I have made the assumption that we are not going to be able to produce the resources to deal with all of it at one time. I think that if we concentrate for once, and develop the technology for environmental control and protection in the cities, everything that we learn will have an application for the areas you are talking about.

Senator HATFIELD. All right.

Mr. HENINGBURG. Our tendency has been to do it the other way around. There was a recent EPA experiment, I think, in a place called Chilton, Ala. about solid waste disposal.

Well, I think that engineers and others would suggest that if you are going to test a system, you can probably get a more valid test under extreme performance conditions in a place like New York rather than the minimal pressures it would be subjected to in a little town in Alabama.

What I am saying is that it is not either/or. People will go back once the place from whence they came is a better place to go.

I would be remiss if I did not add one other comment from my own perspective.

I don't believe that blacks or Chicanos, or Puerto Ricans, are going to, of their own initiative, move into areas where they have not been before, unless the present inhabitants of those areas make a conscious effort to indicate that they are welcome, that they will be afforded equal opportunities and dignity.

While I have reached the point where I try to consider all the questions of a national nature in some context other than a racial one, I find myself invariably having to go back to that because that becomes a critical reality in our country today.

If Americans in the smaller communities would consciously say, "We are an open society, and we encourage, and will do those things necessary to do what we can to help," a lot of this would diminish.

It is not the great joy of life living in the middle of Newark. It really is not.

Consider this parallel: We have degrees of degradation in Newark. Our central ward is a disaster area. Not legally, because we can't find a way to declare it one legally, but by every standard should qualify as a Federal disaster area.

We requested the city council some time ago if they would be willing for a year, to let all of the Federal resources which come into Newark be directed into that one ward because what we are doing now is spreading the resources out over the whole city—a little in the east ward, and a little in the south ward, and a little in the north ward. The result is making virtually no impact at all on the city.

Even though all the councilmen recognized that the central ward by far, is the worst ward in the city, by every standard—housing, employment, education, everything—no one of them was willing to say, "Okay, I'll give up the little Federal money that is coming into my ward for a year, and concentrate it."

If we go for 10 years spreading that money thinly, it will never make a major impact. But the other councilmen have constituents, of course, and they have problems, so they are not going to give it up.

The parallel I am trying to make is this: I think the Federal agency has an option that city councilmen don't in this question of diverting resources, because the Federal agency staff people are not elected. They don't have an immediate constituency to deal with.

I think they can set priorities. If we take the resources made available to the EPA and say, "All right, let's uniformly spread them across the length and breadth of America," the impact will be minimal, I am afraid.

But, if we have the courage and the skill and the ability to trade off and compromise sufficiently, we can take a period of time, a 2-year, or 3-year period, whatever is necessary, to really impact on where the problem is most critical and we will develop technologies and results which will be applicable to your constituency in the nature of the State you represent and all the rest.

That is what I am asking for.

Senator HATFIELD. Well, I appreciate your response because I think we are on the same frequency. We are told that 70 percent of the Nation's population is now squeezed together on 1 percent of our geography. Excluding the racial implications, the economic and other such factors, just the bare fact of that many people on that small amount of geography intensifies pollution, human relations, and all the other problems you identify.

Again, I feel we can't sit back and say well, until we do this, we can't do that. It has to be approached in its totality.

The totality of it is, as I see it, to not only put the resources now for the immediate, urgent, long overdue problem that has not been met in the urban center, but to approach simultaneously some of the causes and factors that have helped create this and try to retard them or reverse them, or do whatever we can do.

I would perhaps differ on one thing and that was your comment about the limitation of resources.

I frankly don't think we have this problem. I think that we have an emphasis today on spending our Federal resources, on the destruction of man rather than creating the better life.

We can find the money for questionable ABM and other military weapons systems. I have often thought that if we put human priorities under the Defense budget we would get them. They scare us as to what is going on in Russia or China and that is different. But when we come to people problems, then they say we have restrictive financial problems.

I don't think that is the problem. I think it is the emphasis.

To repeat an old cliche, it is a question of priorities. We need more emphasis behind Senator Pearson's and Senator Ribicoff's Federal tax measure to create these resources within the local area, rather than taking them away from the local people and then trying to dribble them back through the Federal policy. They proposed a 10-percent tax investment credit for those companies and corporations that would create job opportunities in city centers and rural areas where high rates of unemployment now exist.

That is a good example of trying to create the opportunities for people who otherwise feel their only future is in the urban center since this has been the motivation behind their migration to the urban center.

Mr. HENINGBURG. We have no disagreement, Senator.

When I talked of limitation of resources, I was talking of the budget being allocated to EPA, not the total national resources.

I feel strongly that we have all the capabilities as a nation—human, technical and financial—to deal with all of our problems. If we would devote those resources to creating and improving the quality of life rather than creating and improving our ability to kill, we would have sufficient resources.

Senator HATFIELD. Thank you very much, Mr. Heningburg.

Thank you, Mr. Chairman.

Senator HART. Thank you, Senator.

I appreciate your commenting on the desirability of concentrating at least in the first few years of the EPA effort, on a limited number of targets, rather than as we traditionally do, by dividing the pie by 50 because there are that many States and so on.

Senator HATFIELD. And it does dribble out.

Senator HART. Those of us who have argued for these programs then get home and are confronted with what is a fact: enormous sums were devoted to the programs and nothing was changed. So it is said that the idea of the program was wrong. That does not follow at all. No fair test was made by concentrating the resources.

Whether it is money or education or whatever else we have done. it is true for all of it. We are at fault because we fiddle around to try to get 51 votes, and to do that you have to divide the pie.

Mr. Heningburg, thank you again.

Mr. HENINGBURG. Thank you, sir.

Senator HART. Next we welcome a distinguished group of real experts in their field. We have Dr. Glenn Paulson, Natural Resources Defense Council, and Dr. James Sullivan and Mr. Louis Lombardo, both of the Center for Science in the Public Interest.

I don't know how you plan to proceed, but any way that is most convenient to you is all right with me.

STATEMENT OF GLENN PAULSON, STAFF SCIENTIST, NATURAL RESOURCES DEFENSE COUNCIL AND EXECUTIVE DIRECTOR, SCIENTISTS COMMITTEE FOR PUBLIC INFORMATION; ACCOMPANIED BY JAMES SULLIVAN; AND LOUIS LOMBARDO, CENTER FOR SCIENCE IN THE PUBLIC INTEREST

Dr. SULLIVAN. If Mr. Lombardo could speak and then myself and then Dr. Paulson.

Mr. LOMBARDO. Mr. Chairman, I am Louis V. Lombardo. For the past 6 years I've worked in the Federal air pollution control program. I specialized in motor vehicle emission control. My last assignment in the Environmental Protection Agency (EPA) was as chairman of the Administrator's task force on environmental problems of the urban poor.

I am now a consultant to the Center for Science in the Public Interest on a project to obtain a court reversal of 1975 automobile emission standards which were set by EPA at less stringent levels than required by the 1970 Clean Air Act. (See Project CAVEAT, attachment A, and legal complaint, attachment B.)

Thank you for inviting me to discuss the problems of the urban environment. America once went through a period when the black population was referred to as the white man's burden. Now, as blacks increasingly recognize how much of their burden is foisted upon them, they are saying, "Off our backs."

The EPA task force on environmental problems of the urban poor found that pollution was yet another burden falling heavily on the backs of both the blacks and the poor whites. We found that pollution was robbing the poor of life, liberty, and the pursuit of happiness.

Who are our most endangered people?

One hundred and thirty million Americans now live in urban areas. Of these, nearly 8 million are central city residents existing in poverty—4.5 million white and 3.1 million black. (Poverty is officially defined for the nonfarm family of four as having an income of less than $3,968 per year.)

Many people have an income much lower than the poverty level.

Approximately another 8 million near poor have incomes slightly above the official poverty level. While not counted in the statistical 8 million poor, they suffer a similar fate.

Contrary to common belief, the urban poor are not predominantly black; they are primarily white. The mistaken belief probably stems from the fact that 25 percent of the black population lives in poverty while only 10 percent of the white population lives in poverty.

What are the conditions of poverty?

Age characteristics: (a) Of the total 8 million urban poor, 3 million are under 15 years of age; (b) another 2 million are over 60 years of age.

Thus, nearly 60 percent of the urban poor are at age levels recognized by the medical profession to be the ages most vulnerable to the effects of pollution.

Genetic characteristics: (a) Sickle cell anemia trait is carried by roughly 300,000 black urban poor (and another 700,000 black, urban, nonpoor); (b) G6PD enzyme deficiency is another inherited blood characteristic which makes the individual susceptible to pollutants, (and such common drugs as aspirin) which can result in anemia. G6PD affects 10 percent of black males and 2 percent of black females.

Health characteristics of adults: (a) Heart disease—If one is poor and black, the chance of suffering from hypertensive heart disease is three times greater than for a white with a family income over $10,000; (b) chronic conditions: Limitation of activity due to chronic illnesses such as diabetes, emphysema, respiratory disease, et cetera occurs four times more frequently in the lowest income group than in family groups with incomes over $7,000; (c) inadequate medical care, the lack of treatment or poor treatment, compounds the seriousness of the maladies of the urban poor.

Health Characteristics of Children. (a) Undernourishment and malnourishment: The preschool nutrition survey, as reported in the 1970 White House Conference on Children, found shocking nutritional deficiencies among poor children.

In the low-income quartile for children between 1 and 2 years of age, 11 percent had low hemoglobin levels, 48 percent were suffering from blood-iron deficiency, and 40 percent were suffering from vitamin C deficiency. Median vitamin A and B levels for low-income children were 25 percent lower than the medians for high-income children; and for vitamin B_2 nearly 50 percent lower.

Malnourished and undernourished children are more susceptible to the common childhood illnesses. When these illnesses are contracted, their effects are longer lasting and more damaging.

(b) Inadequate child care: In urban areas 35 percent of the black children live in broken homes. And only 50 percent of the children from poverty families receive regular medical treatment by physicians.

We often hear that our only hope lies with the youth or the upcoming generation. Not only is this concept an abdication of responsibility by the present generation—it is also unrealistic in view of the conditions into which these children are born.

These conditions of poverty make the urban poor the people most endangered by pollution. The urban poor by virtue of their extreme conditions need, more than any other population group, the protection which can be provided only by the Environmental Protection Agency.

Environmental deterioration: solid waste, air, water, and noise pollution and pesticides constitute a severe extra burden on that portion of the population already most heavily laden by chance and circumstances.

EPA, remaining completely within its mandate, can and must take a giant step toward eliminating that extra burden of environmental deterioration.

What are the environmental burdens of the urban poor?

One finding of the task force was that the solid waste problems were considered by inner city residents to be their most pressing problem.

SOLID WASTE

Rats and Garbage: A section of the Council of Environmental Quality's 1971 annual report to Congress well describes this problem:

> Strewn garbage, besides being unattractive and odorous, also invites rodents. Rats feed on easily accessible garbage and present a health problem to inner city residents. Greater than the danger of the diseases they carry is the insecurity and fear they inspire, especially in parents with small children. An estimated 60 to 90 percent of rat bites occur in inner city neighborhoods. 80 percent occur after midnight, when most victims are asleep.
>
> . . . such diseases as rat bite fever, leptospirosis, salmonellosis, and murine typhus fever are spread by rats and insects which breed in solid wastes. The young, the sick and the old are vulnerable, and especially so after midnight when rats are most active and dangerous.

Another solid waste problem is abandoned automobiles. In New York City it is estimated that 1,000 automobiles are abandoned each week—clogging traffic, contributing to increased noise and air pollution, creating a hazard to neighborhood children and motorists, and wasting the irreplaceable, valuable resources of raw materials and the time and energy required to remove stripped hulks from the streets.

AIR POLLUTION

In Los Angeles, as a public health protection measure, children are restricted from engaging in active play on days of high air pollution. On streets where the children of the urban poor live and play, levels of the highly toxic gas carbon monoxide often exceed health limits set for the safety of factory workers—50 ppm.

Traffic jams often produce carbon monoxide levels of over 100 ppm and many times levels of several hundred parts per million are recorded.

The automobiles driven by suburban commuters subject many urban poor to these levels of carbon monoxide every morning and every evening. Carbon monoxide is not only highly toxic, it is colorless, odorless, and tasteless. City dwellers don't even know they are breathing it. But the ambient levels of carbon monoxide commonly found in inner city air result in individuals living day in and day out, deprived of nearly 2 percent of their blood's oxygen-carrying capacity.

Tom Lehr's song, "Pollution" expresses what is happening:

Like lambs to the slaughter,
We're drinking the water
And breathing the air.

Urban poor who live and whose children play along heavily trafficked thoroughfares such as North Capitol Street may often be subjected to carbon monoxide levels which poison as much as 5 percent

of their blood. Lest one erroneously conclude that 2 to 5 percent deprivation of oxygen is insignificant, note the following:

1. Thirty percent of the body's oxygen is used by just one physiogicial organ—the brain.

2. Dizziness and headache result with over 5 percent deprivation.

3. Above 50 percent deprivation, death occurs.

4. The rule of thumb, often used by air pollution control officials to relate the effects with ambient concentrations is:

10 ppm—dullness of thought process.

100 ppm—dizziness.

1,000 ppm—death.

Inner city residents continually carry a heavy carbon monoxide poisioning burden. Their other environmental burdens are noise, rats, malnutrition, undernourishment, pesticides, and all the other air pollutants magnify the significance of the carbon monoxide burden. This is especially true for those urban poor with hereditary traits, such as sickle cell anemia, and the G6PD deficiency, which make them particularly vulnerable to the effects of carbon monoxide.

Inner city residents continually carry a heavy burden of carbon monoxide blood poisoning. But carbon monoxide is only one of the air pollutants poisoning their blood: nitrogen oxides, sulfur oxides, and airborne lead also add their toxic burdens.

For those urban poor who have susceptible blood systems because of hereditary traits such as sickle cell anemia and the G6PD enzyme deficiency these environmental burdens may often be unbearable. For those children of the urban poor also ingesting lead-based paints, the summation of these burdens must be crushing.

Although we have not quantified the relative percent contribution to lead poisoning we know that a significant contribution stems from airborne lead which is breathed and airborne lead which is orally ingested.

Lead-based paints, lead from water supplies passing through lead pipes, and lead from food handling utensils are other significant sources.

The significance of airborne lead which is orally ingested can be appreciated by the following quotation from an internal memorandum dated February 23, 1971, by Dr. Carl Shy, chief of epidemiology of the EPA:

> A child living with 100 feet of roadway . . . could get this much lead—(enough to cause classic lead poisoning)—by ingesting less than one-sixth of a gram of atmospheric particulate fallout daily, an amount of fallout which could be contained in one-twenty-fourth of a teaspoon. Therefore the contamination of outdoor streets and soil with lead fallout could easily be a significant hazard to a child with pica, and the hazard increases the closer his surroundings are to heavy vehicular traffic.

One-sixth of a gram (160 mg) of dust per day is difficult to envision, so we have measured this amount of street dirt and brought it here for you to see.

Senator HART. You are showing us the very limited film that is contained in this vial?

Mr. LOMBARDO. Yes.

Senator HART. That is the quantity?

Mr. LOMBARDO. Yes. That is the amount of dirt which if orally ingested by a child every day over a period of months, say 6 to 8 months, classical lead poisoning would ensue.

Now as you can see, it is very little.

Senator HART. Dirt or particular kinds of dirt?

Mr. LOMBARDO. That is just dirt, street dirt.

Senator HART. Don't we all ingest more than that quantity of dirt?

Mr. LOMBARDO. Children are far more susceptible than adults to lead poisoning. On streets with heavy traffic that amount of dirt contains 1 percent lead.

That amount of dirt (160 milligrams) would contain enough lead for a one year old child, who ingested that much dirt every day, for 8 months, to get classical lead poisoning according to Dr. Shy's estimate.

It is not the dirt that is harmful, it is the lead.

Senator HART. Senator Hatfield is going to develop a point that he made here to me.

Senator HATFIELD. I was just saying that I am glad you elaborated because I am sure that looking at this with the naked eye doesn't really tell as much as you are trying to present. A child in any normal household, not only the poor or even in the urban centers alone, is going to crawl around the floor and he will get a certain amount of dirt just from the kitchen floor.

Mr. LOMBARDO. That is right.

Senator HATFIELD. But, it is the breakdown of the dirt that you are emphasizing. Is that right?

Mr. LOMBARDO. Yes, sir.

In other words, under the conditions that the poor live, which is on city streets, heavily traveled by automobiles, spewing forth lead, that the concentrations of lead in the dirt and dust of their household reaches the order of 1 percent, which, if ingested every day for 8 months, in a 1-year old child, would result in lead poisoning.

The suburban child is ingesting the same amount of dirt, perhaps, but suburban dust and dirt generaly does not have the high concentration of lead which is found in city dust and dirt. An exception would be the suburban homes very close to heavily traveled freeways. We consider 1 percent concentration of head, high concentration.

Senator HATFIELD. What are the other sources of airborne lead besides automobile emissions?

Mr. LOMBARDO. Essentially, unless you have a lead smelter, say in downtown Portland, it would——

Senator HATFIELD. We don't have, thank goodness.

Mr. LOMBARDO. Then it would be all from automobiles, virtually all.

Senator HATFIELD. All right.

Mr. LOMBARDO. We use an estimate of about 96 percent.

Senator HATFIELD. Thank you.

Thank you, Mr. Chairman.

Mr. LOMBARDO. I would just like to reiterate this paragraph. As you can see, the amount of dirt and dust is very little. Less, in fact, than the amount of dirt which would be picked up on a nipple of a

dropped baby bottle. Is there any doubt that many urban poor infants are ingesting this amount of dirt each day?

NOISE

While communities bordering airports may be exposed to the highest levels of noise pollution, inner city area noise tends to be more continuous as well as high. Motor vehicles—cars, trucks, buses and motorcycles—are the major source of city noise.

City noise is increasing at an alarming rate of nearly 1 decibel (db–A) each year. In another 15 years it is believed that the overall noise level in our cities will have doubled.

The inner city is plagued by traffic noise because of poor city planning practices and opportunism. Consequently highways are generally constructed through these neighborhoods. In the inner city over 60 percent of the traffic noise is generated by people who live elsewhere.

Trucks, a major source of ambient noise, are more apt to be routed through the inner city areas. Older trucks and diesel-powered trucks are especially loud and their impact on the human organism is detrimental.

The long and loud noises of the city cause hearing loss and tension, but the inner city is filled with another kind of noise which can drive people to violence. This other kind of noise is noise which annoys, alarms, irritates or upsets.

Theodore Berland points out that the most annoying sounds are those that are loud, high-pitched, intermittent and irregular, produced from a hidden or moving source, inappropriate to your own activities, and unexpected.

City noises have these characteristics. For example: loudness—police sirens, fire sirens, ambulance sirens; high-pitched—screeching tires; intermittent and irregular—the rumble and roar of passing trucks; produced from a hidden or moving source—movement in the halls or rats in the walls; inappropriate to your own activities—horns honking; unexpected—garbage cans clanking or cars backfiring at dawn.

PESTICIDES

Pesticides problems in the inner city are accidental poisonings—mostly children—and the overuse and misuse of pesticides. Accidental poisonings result from the improper storage and disposal of pesticide containers.

As EPA's Dr. Norman Dyer describes these conditions:

> Substandard housing denotes dilapidated residential homes in deteriorated neighborhoods, located in the inner city. Most of these homes and/or apartments are owned by suburban landlords. They are in deplorable conditions, with holes in the screens of windows and doors or no screens at all, and cracks in floors and walls. The appalling situation results in an invasion of the premises by all kinds of pests, including flies, ants, mosquitoes, roaches, rats and scorpions; subjecting the residents to a greater exposure to disease-carrying organisms or to continuous exposure to pesticides as they attempt to eradicate their unwanted house guests. But the battle is futile, because of the housing condition, and the prevailing unsanitary local environment which is due to infrequent and improper garbage disposal, resulting in breeding grounds for rats and flies, and inadequate drainage which produces stagnant ditches of water creating hatcheries for mosquitoes.

The abusive use of pesticides under such conditions is typified in the following example which was described to the task force: A mother, frustrated by pests, begins spraying the entire apartment in the presence of her children. She soon becomes dizzy, stops for a moment, renews her spraying with a vengeance with the thought: "This stuff is strong. It must be doing some good." Meanwhile a child crawling over the powerful and persistent pesticides goes into a corner and begins sucking its thumb.

Not only are the pests dosed with poison, but so is the family.

WATER POLLUTION

Water pollution problems of the urban poor mainly stem from the hazard of children playing in or near our most contaminated waters and the deprivation of access to healthful bodies of water for recreation.

The quality of tapwater in cities is an area of concern also, but greater definition of this problem is required. Urban poor living in older houses in older sections of the city are probably obtaining water of inferior quality.

CONCLUSIONS

What is the administration doing while air pollution burns the lungs of the poor, while pesticides burn the throats of their children, while noise burns their ear drums and solid waste burns their homes? EPA fiddles.

Reproduced in The New Republic, January 29, 1972, is a quote of Philip Stern which illustrates our distorted priorities by the use of an imaginary but factually-based press release on the effect of the tax laws.

> Welfare payments averaging some $720,000 a year will go to the Nation's wealthiest families. For the poorest families—under $3,000, the welfare allowances will average $16 a year or roughly 30 cents a week.

Senator HART. Mr. Lombardo, I read that article by Phil Stern and his words are powerful.

Mr. LOMBARDO. Yes, sir.

Senator HART. But I would suggest that—maybe it is out of kindness—the real villain in this is not EPA, it is Congress.

Mr. LOMBARDO. You are talking about the tax laws?

Senator HART. Yes.

Mr. LOMBARDO. I just used that as an example of the distorted priorities which afflict the poor, and the Nation. These distorted priorities are carried over into EPA, too, in all policies of the EPA. They have not acted on the urban poor report and essentially half the period of time which was allocated to taking action and achieving results—by June of 1972—has gone by without any action.

Senator HART. We all ought to examine our own consciences. I thought I was aware of the extra-heavy burden which environmental problems imposed on the city poor, but I confess I badgered EPA more about an environmental damage problem occurring to Lake Superior, a magnificent body of water hundreds of miles away from almost everyone. I have given them more trouble about Lake Superior than I have about downtown Detroit. As I say, we are all up for criticism.

Mr. LOMBARDO. Senator, we found, in doing the background work for the task force report on EPA there were two schools of thought. Some people were saying "Well, the important things are clean mountain streams and clean lakes." Others were saying, heck, people in the cities are the ones being affected most by pollution and therefore, the priority ought to be on urban problems."

At first I found myself agreeing exclusively with the latter group. But the reality is that both should be high priority. The short-range priority should be the people suffering right now. But, certainly we should not lose the assets of Lake Superior. Such natural resources are valuable assets and we must work on saving them too. It is not an either/or situation. I do not think you were implying that.

Senator HART. No. I was just suggesting that——

Mr. LOMBARDO. I was trying to reinforce what you were saying, Senator.

Senator HART. When you say EPA fiddles——

Mr. LOMBARDO. I meant as far as EPA was concerned EPA was not carrying out the authority it already has.

Senator HART. We are all in the same orchestra.

Senator HATFIELD. I would like to follow up on that, Mr. Chairman, just to keep the record clear. I think there is a tendency in the Congress and among citizens at large to talk about the insensitive bureaucracy of Washington and somehow that is always the executive branch of Government, never the legislative.

Under the authorization of our chairman, I chaired the hearings on S. 1016, the bill relating to authorizing and empowering the EPA to move ahead on noise pollution.

Very frankly, EPA does not have the power to move effectively at this point. We in the Congress must take action to give them such power, and, this bill, we believe, does that very thing. We hope to have that bill acted upon very shortly.

So, I would not excuse EPA for any inaction where they have the authority to act. But I must point out that there are areas where they do not have authority, and, where, as the Senator from Michigan, our chairman, Mr. Hart, has said, we in the Congress must bear some of the responsibility for inaction. It is not that we say you should not point your finger, to lack of action, but point it to all the areas of responsibility, not just to EPA. Also, you should consider that the Reorganization Act brought EPA into its present structure only in 1970. With the neglect of the total environment for so many years, there was quite a backlog to undertake.

I am not carrying the torch for EPA except in terms of fair and equitable treatment. They have been given a tremendous job to do, and, in relatively short time, I think they have responded very well.

It seems to me that people from both sides of the aisle feel Mr. Ruckelshaus has moved with great speed. He has often done so with in-house resistance from various agencies and so on.

This does not prevent greater action. You would find I think that Mr. Ruckelshaus himself would be the first to say they have a job to do that has not yet been done, and they are determined to do it.

I join with the chairman in saying that we in the Congress share some of the responsibility for lack of action or inattention to much you have alluded to and pointed out today.

Mr. LOMBARDO. Senator, I would say a couple of things. First of all, the Congress may bear some responsibility but there is a heck of a lot more that EPA could be doing under the authority they presently have.

The whole urban poor report that we came up with was directed at this existing authority. There is much more they could be doing that they are not doing.

Senator HATFIELD. I think you know a task force has finished this review and will be presenting their report to this committee, or some appropriate committee. I understand it will be around the 15th of this month. So, there is not a matter of fiddling. Maybe we took you too literally. But, there was a careful study of this report and we anticipate specific recommendations within a matter of days.

Maybe there are problems that——

Mr. LOMBARDO. Fine, Senator, but I hear otherwise through the grapevine.

Senator HATFIELD. You may be right.

Mr. LOMBARDO. Our recommendations are directed along the line that this committee obtain commitments from EPA. If they are really not fiddling, when Mr. Ruckelshaus is up before you he should be willing to make the solid commitments that are recommended here.

Senator HATFIELD. The prod is good. I welcome your prod here today. And we will accept that.

Mr. LOMBARDO. Thank you.

The general recommendations are:

1. That you require Mr. Ruckelshaus' immediate presence before this committee.

2. Obtain from this Administration by March 1, 1972 a commitment to achieve substantive and specific improvements in the inner city environment by November 1, 1972.

I hark back to when I walked into this room. The chairman was saying that the voters want results when government engages in these programs. That is true. Results ought to be expected and obtained from EPA.

3. Creation of an Urban Advisory Council. Obtain a commitment from the Administrator by March 1, 1972 to create by March 15, 1972 an Urban Advisory Council to consist of members of urban activist organizations such as the Urban Coalition, the Urban League, and environmental activist organizations such as the League of Conservation Voters and Environmental Action.

The purpose of this Council would be to act as an ever-present spur to the Agency to assure that improvements in the inner city environment are accomplished.

Solid waste recommendations:

1. Obtain a commitment from this Administration to commence by June 1, 1972 an Operation Clean Sweep for the top 20 cities as proposed in the Draft Task Force Report given to the Administrator October 1, 1971.

Air pollution recommendations:

1. Get the lead out—Obtain a commitment to promulgate by June 1972 a standard which requires the complete elimination of lead in gasoline by 1977.

2. Obtain a commitment from this Administration for a review of ambient air quality standards by June 1, 1972 to determine whether a sufficient margin of safety was incorporated in present ambient air quality standards to protect the health of the urban poor. (See attachments C and D for comments of public interest groups.) They point out that an appropriate margin of safety was not included.

I might add, included in the "proposed" standards.

When the Agency promulgated the "final" standards they ignored the comments of the public interest groups and further weakened the standards. They heeded industry pressure. They ignored environmentalist pressure. So they weakened the ambient air quality standards upon final promulgation.

3. Strengthen air quality standards—Obtain a commitment for repromulgation of the ambient air quality standards by September 1, 1972 to levels equal to or lower than those proposed by EPA on January 30, 1970 prior to their weakening, in response to industrial pressure as shown in Table I.

Table I shows the degree of weakening between the proposed standards and the standards as adopted. The carbon monoxide 1-hour average was weakened by over 170 percent. The hydrocarbon for a 3-hour average was weakened 28 percent between the time it was proposed and the time of adoption. The photochemical oxidant standard between the time it was proposed and the time of adoption was weakened by 28 percent. The nitrogen dioxide standard for a 24-hour average was dropped. The degree of weakening is total.

4. Obtain a commitment from EPA that it will (a) flatly reject by March 1, 1972 any State implementation plan prepared under the Clean Air Act and submitted to the Administrator that does not guarantee the achievement of primary air quality standards for all urban areas in that State by 1975; (b) flatly reject by April 1, 1972, any State plan that does not guarantee the achievement of secondary ambient air quality standards by 1978.

5. Obtain a commitment that if motor vehicle emissions are not low enough to achieve ambient standards the EPA shall reject air implementation plans that do not provide for measures to reduce motor vehicle traffic both by restrictions on automobile use and, most importantly, by curtailment of new highway construction in urban areas.

6. Strengthen auto emission standards—Obtain a commitment for repromulgation of 1975 auto emission standards by September 1, 1972, to levels necessary to achieve ambient air quality protective of the public health of the poor by 1985 as required by the Clean Air Act of 1970.

Pesticides recommendations:

1. Obtain a commitment from the administrator to commence by April 30, 1972, a public education campaign targeted towards the urban poor on the proper use and storage of pesticides.

This is something the administrator can do now. He can do that now. Only the commitment is necessary.

2. Obtain a commitment from this administration to prepare a report to this committee by April 30, 1972, on action which can be taken (a) to require improved pesticide packaging to prevent accidental poisonings of children and (b) to improve the information on labels to assure more careful use by urban poor.

Senator HART. If there is no objection, may I suggest that we receive the testimony of the other witnesses before we question you. It might be more useful.

Mr. LOMBARDO. Yes, sir.

(The following information was subsequently received for the record:)

ADDITIONAL RECOMMENDATIONS FROM MESSRS. LOMBARDO, PAULSON, AND SULLIVAN

We urge EPA to review all state implementation plans:

(a) to ensure that the air quality for the urban poor in any American city will not be sustained at a level of contamination higher than the primary ambient air quality standards due to the construction of new major point sources (e.g., power plants) or area sources (e.g., highways) between now and 1975, and

(b) if EPA finds plans which allow such degradation, it should insist the State develop a ban on such pollution sources or (if the State fails to do this), EPA itself should step in to prevent the construction of such facilities which are incompatible with the protection of the health of the urban poor.

Since the construction of municipal secondary sewage treatment plants will, in principle, reclaim urban waterways as recreational resources for the urban poor, we urge this Committee to:

(a) Inquire of EPA whether past federal aid for the construction of such facilities has treated the urban poor fairly, based on a recognition of their special problems and needs, or has favored the cleanup of waterways less conveniently located for the urban poor; and

(b) Determine whether EPA's future plans for federal support of sewage plant construction place special emphasis on the need to speed construction of these facilities in a manner which will clearly benefit the urban poor.

TABLE I.—AIR QUALITY GOALS FOR HEALTH PROTECTION

	Senate hearings July 1970	Standards as proposed January 1971	Standards as adopted June 1971	Degree of weakening between January and June (percent)
Carbon monoxide	10,000 ug/m³ (8 hr. avg.)	10,000 ug/m³ (8 hr. avg.)	10,000 ug/m³ (8 hr. avg.)	0
		15,000 ug/m³ (1 hr. avg.)	40,000 ug/m³ (1 hr. avg.)	170
Hydrocarbons	125 ug/m³ (3 hr. avg.)	125 ug/m³ (3 hr. avg.)	160 ug/m³ (3 hr. avg.)	28
Nitrogen dioxide	190 ug/m³ (1 hr. avg.)	250 ug/m³ 24 hr. avg.)	Standard (Dropped)	Total
		100 ug/m³ (Annual avg.)	100 ug/m³ (Annual avg)	0
Photochemical oxident	125 ug/m³ (1 hr. avg)	125 ug/m³ (hr. avg)	160 ug/m³ (1 hr. avg)	28

TABLE II.—HYDROCARBON EMISSIONS IN GRAMS PER MILE ON THE 1972 (COLD START) TEST PROCEDURE

	Administration's interim 1975 goals	Administration's ultimate 1980 goal	Needed for health protection
What the Congress was told in 1970	0.50	0.25	[1] 0.14
	Administration's proposed 1975 standard	Administration's adopted 1975 standard (approx.)	Needed for health protection
What was done in 1971	0.46	0.64	0.26

[1] Not in terms of the 1972 test procedure.

Dr. SULLIVAN. I am James Sullivan. I hold a doctor of philosophy degree from the Department of Meteorology at the Massachusetts Institute of Technology. I am codirector of the Center for Science in the Public Interest, which is a nonprofit, tax-exempt organization incorporated in Washington, D.C.

I am also chairman of the Air Pollution Advisory Committee for the Department of Environmental Services in the District of Columbia.

I thank you for inviting me to testify on the problems of the urban environment. I also wish to thank Miss Mary Ellen Barnes, a student from Wells College who is helping us at the center do research in these areas.

Senator HART. Is she here?

Dr. SULLIVAN. Yes.

Wells College has a number of students involved in public interest work, and I think our country benefits greatly from their efforts.

There has probably been more said and less done about poverty in American than any other social blight. We have carefully documented the number of jobless unskilled workers, the lack of adequate education for ghetto children, the immobility of the aged, the malnourishment of infants and a litany of other afflictions imposed on the 7,760,000 people considered by economic statisticians to be the central city poor.

One set of statistics not yet compiled but which must be added to this already replete anthology of neglect is the quality of the air that is breathed daily by inner city poor.

At the Center for Science in the Public Interest, we have investigated a sample of eight cities to determine just how the poor are affected by air pollution, both on an absolute basis—that is, what concentrations low-income people are breathing—and on a relative basis—that is, how the poor's exposure to pollution compares with that of middle- and upper-income persons.

The absolute levels to which the poor are exposed are dangerous. In inner cities, where most of the poor in metropolitan areas live, concentrations of pollutants can exceed Federal air quality standards by hundreds of percent; carbon monoxide concentrations that reach 40, 50, or even 100 p.p.m. for long periods are not uncommon.

Studies by the U.S. Department of Health, Education, and Welfare indicate rampant violations of Federal air standards set by the 1970 Clean Air Act.

In Chicago, for example, the 1-hour carbon monoxide standard of 35 parts per million is exceeded 48 times per year. The 8-hour standard of nine parts per million is exceeded in Chicago 713 times per year.

Here in Washington, the 1-hour standard is exceeded 87 times per year for carbon monoxide, and the 8-hour standard 99 times. Federal law stipulates that these standards not be violated more than one time per year.

When we looked at what the poor are forced to breathe and compared it with the air breathed by the middle- and upper-class, we saw a consistent discriminatory pattern against the poor. The figures in the attachment dramatize this inequity. I have them in slide form that I would like to show you now.

(Slide.)

These are charts showing pollution levels and their relation to poverty areas.

The dotted lines are pollution levels, the dashed areas are areas considered by the Office of Economic Opportunity to be poor areas in these cities. OEO's definition of poverty is based on a variety of criteria.

So here in Baltimore we see a bulls-eye centered right on the poor area.

In Baltimore, 96 percent of carbon monoxide is produced by motor vehicles.

Here in the center of the poor area, carbon monoxide concentrations approach 9 p.p.m. on an annual basis; 9 p.p.m. is the 8-hour standard not to be exceeded for more than one 8-hour period per year.

You cannot make an absolute ratio between the levels the poor are exposed to and what higher income groups are exposed to, but the chart shows it is at least 30 percent more.

(Slide.)

In Washington, D.C. we again see this bulls-eye effect centered on the poor section. There is also another poor section off to the east of the center.

Carbon monoxide concentrations in the District go over 7 p.p.m. on an annual basis.

I remind you that 9 p.p.m. is the standard not to be exceeded for more than one 8-hour period per year.

Ninety-eight percent of the pollution in the district is automobile-produced.

Again we see the ratio of pollution levels in the poor area to pollution areas in more affluent areas to be at least 30 percent. They even reach two, three and four times the levels found in the affluent section.

Senator HART. Doctor, are you familiar with the geography of Washington, D.C.?

Dr. SULLIVAN. Relatively well.

Senator HART. Could you, on that map, indicate where the Capitol is.

Dr. SULLIVAN. I don't know if you make it into the poverty area. It is probably on the fringe.

Mr. LOMBARDO. It is in the corner.

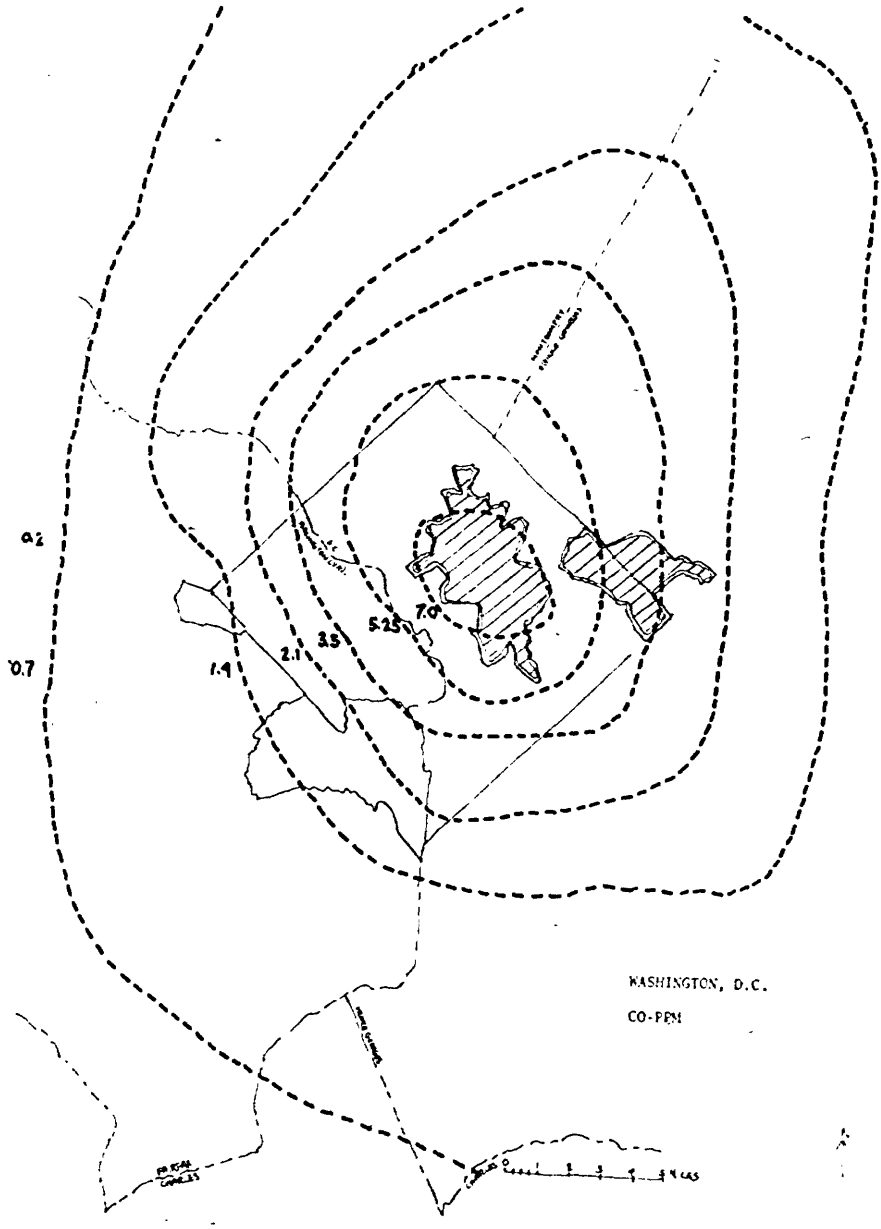
Dr. SULLIVAN. You see this little squared-out area where the Capitol is.

I might add an interesting fact, and I think all the cities are faced with it. Although the pollution levels are now high in the downtown areas, studies done by the Public Health Service show that the pollution in downtown Washington will increase 20 percent in the next 15 years. That is because the traffic there is saturated.

In suburban areas like Alexandria and Arlington areas, pollution will go up 200 to 300 percent.

What the downtown people are breathing now and what the poor are breathing now, we can all expect to be breathing in 15 years, unless something is done, of course.

(Slide.)



Next is a map of New York and New Jersey. Here the bulls-eye effect is less clear because the poor areas are more dispersed.

Senator HART. That's rather clear.

Dr. SULLIVAN. Manhattan, Bedford-Stuyvesant, Harlem, and Brooklyn, poverty areas in New Jersey, and virtually all of the poverty areas in the metropolitan district are inside the highest ring of

pollution in the New York area. In this area 95.5 percent of the carbon monoxide is automobile-produced.

Senator HART. It would be fair to say from that map, though, that rich and poor alike are breathing the same air now, not 5 or 15 years from now.

Dr. SULLIVAN. Certainly the people on the Upper East Side are breathing polluted air along with the poor. But you have to look at these maps in an average sense. They do not mean that one rich person who lives next door to a poor person breathes better air.

On an average sense, in the high income areas, the affluent are exposed to much lower levels, say, in Westchester. If you average out Manhattan and average out Westchester and do the same studies, you will see lower-income counties get higher pollution.

Senator HART. I was really thinking a little ahead of that. There is no need to blink at this. Government agencies react when the middle class and affluent become involved. It is not to defend the system, but to acknowledge what happens.

I was thinking for a moment that when Alexandria and Fairfax and Montgomery County get to that 300 percent, then we will have more muscle to correct it. It depends entirely on the awareness of the damage that's being suffered, and I suspect that the Park Avenue resident is not as yet quite aware that he is being exposed to that level.

Dr. SULLIVAN. I hope you are right. But there are a lot of smokers, and if they are not aware of the health hazards of smoking I don't know what we can do about it. I think people adapt to bad conditions. Albert Camus once said that a person could live in an old hollow tree and get used to it, if he stayed there long enough.

(Slide.)

Here is an interesting city, Detroit. Again we get back to the bulls-eye effect.

(Slide.)

I just have a few more. This is a map of Indianapolis.

Again, carbon monoxide pollution focuses right in on the poor section.

(Slide.)

The same bulls-eye effect exists in Houston, Tex.

(Slide.)

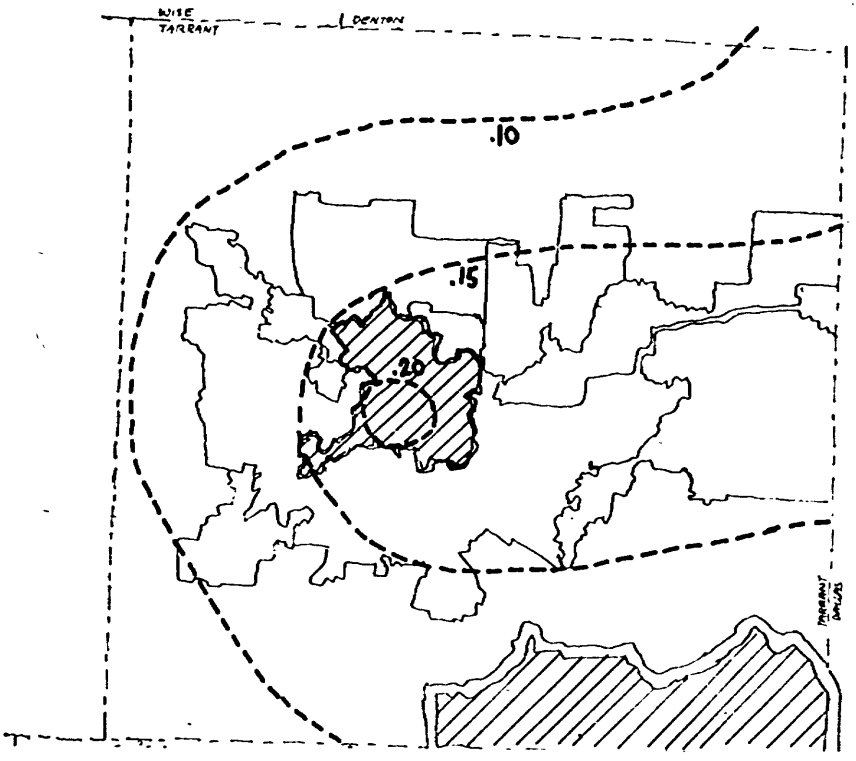
In Fort Worth, Tex. Carbon monoxide peaks right over the poor section.

Now, there are other poor sections in the area around Fort Worth, a lot of rural counties in Texas are very poor.

(Slide.)

Finally a picture of Philadelphia, Pa. Again, carbon monoxide focuses in on the poor, as you can see. Monthly CO averages in Philadelphia exceeds the 8-hour standard. The poor get the brunt of it, receiving one-third again or more pollution when compared to the affluent income groups.

Senator HART. My comment which I am sure is shared by all who watch, is that this is really just one more visual identification of the discrimination that runs against the poor. Ramsey Clark repeatedly said that if you want to find out where crime is most rampant, ask



FORT WORTH

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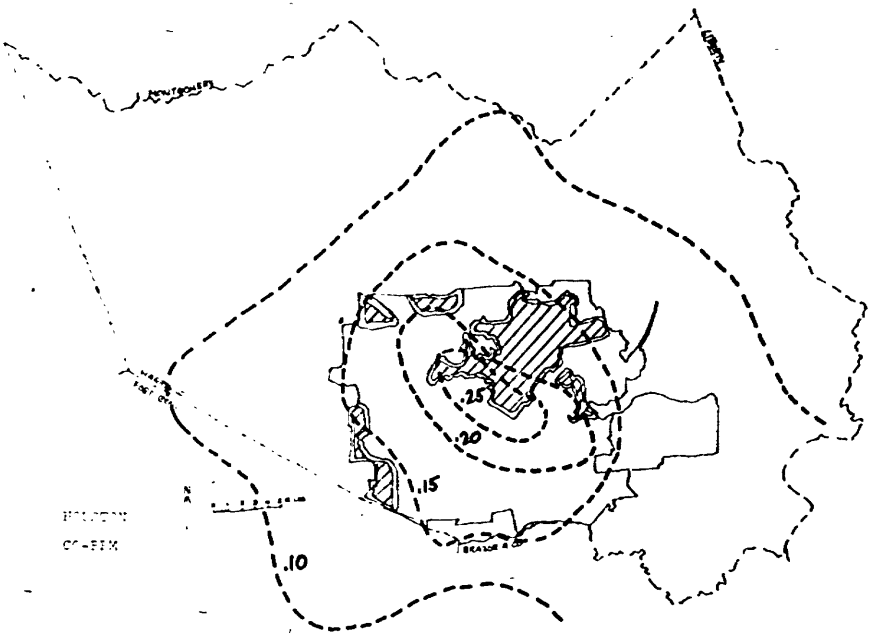
where the poor live. If you want to find out where health problems are most acute, go where the poor live. Housing is lousy and all the rest.

You are telling us where the air pollution is highest, find out where the poor live.

Dr. SULLIVAN. This is not true for just carbon monoxide; it is true for all the automotive pollutants. I use carbon monoxide as an indicator. All behave the same way, including lead, asbestos, and the rest.

Noise is the second pollutant that affects the poor more severely than it does the affluent. As the charts show, the center cities have been relegated to the poor. The primary reason for the high carbon monoxide levels in these areas is the large volume of traffic there. Studies show that traffic is also the major cause of urban noise—at 80 percent of sites tested in London, for example, traffic produced a higher level of noise than any other source.

What this means for the poor is just what we all expect—a noisier environment. Besides higher traffic levels, the poor are more noise-burdened for additional reasons.



First, in downtown areas where land is scarce, houses are built closer to the street. There are fewer trees and shrubs to absorb the noise before it reaches human ears. A typical noise level at the street side in cities often reaches 80–85 dB(A) or higher. For the same amount of traffic, this noise level could be reduced to 75 dB(A) by removing the house 25–30 feet from the street and by planting a row of shrubs along the roadway. Since noise measurements are made on a sliding scale, a reduction of 10 dB(A) corresponds to a tenfold reduction in noise intensity.

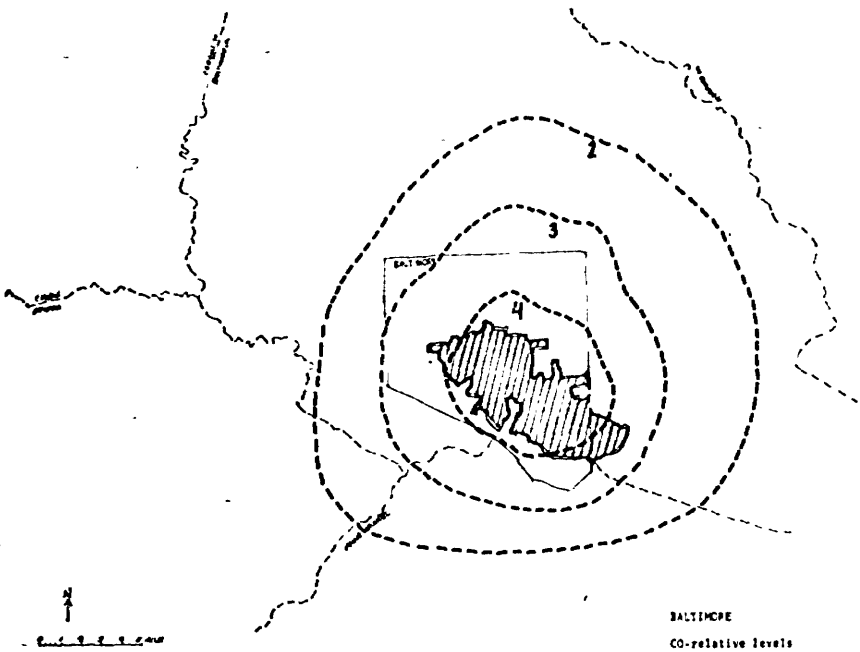
Second, the poor are exposed to more noise because in hot weather they are forced to keep their windows open. A study by the Department of Housing and Urban Development found that buildings can reduce traffic noise by 20 dB(A) if the windows are closed, but only 10 dB(A) if the windows are open.

On the sliding noise scale, this 10 dB(A) difference means the open-window poor are exposed to 10 times the noise intensity as are the air-conditioned affluent.

In one sense, the documentation of the poor's plight is adequate. We know enough about the problems to take definite action. We also have a weapon available to clear up the air of the poor and indirectly lessen their noise burden. I am speaking of the implementation plans required by section 110 of the Clean Air Act. We know that the automobile is the major producer of the air pollution health hazard imposed on the poor. We know also that over half of the poor don't even own a car.

Transportation controls must clearly be the focal point of these implementation plans. The only ways to reduce automotive pollution are, one, to have cleaner cars, or, two, to have fewer cars.

Last week at a hearing of the House Committee on Interstate and Foreign Commerce, the four auto manufacturers openly stated their inability to meet the required 1975 auto emission standards. Those of us who were in the room also felt the atmosphere of negativism and defeat that permeates the thinking of the automobile hierarchy



regarding ability to achieve a clean car. Our path of action is clear. If Detroit cannot produce a clean car, we must have fewer cars.

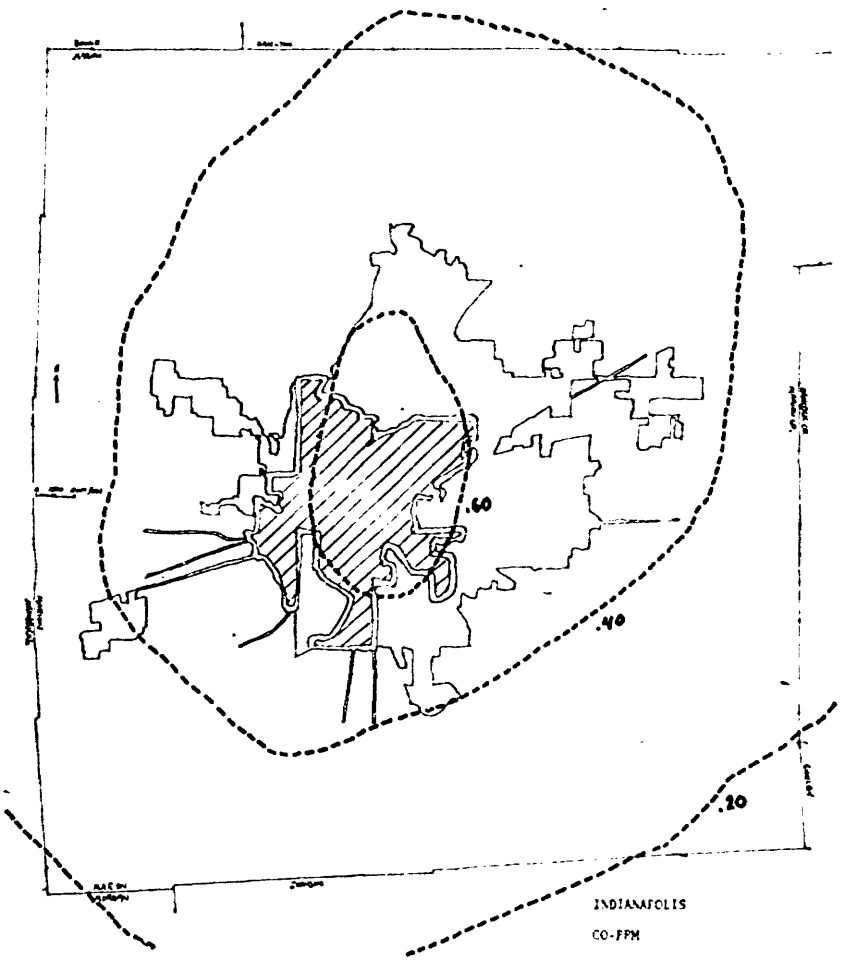
Congress should obtain from Mr. Ruchelshaus a commitment that if motor vehicle emissions are not enough to reduce air pollution, the Environmental Protection Agency will reject air implementation plans that do not provide for measures to reduce motor vehicle traffic both by restrictions on automobile use—(such as parking bans)—and most importantly, by curtailment of new highway construction in urban areas.

Traffic control measures were part of the original EPA guidelines for acceptance of implementation plans, but were deleted under pressure from the administration's Office of Management and Budget.

These provisions, namely sections 420.11(a) and 420.14(c) of the proposed guidelines (36 F.R. 6680) should be reinstated in the criteria for implementation plan acceptance.

I ask that you keep a close eye on the implementation plans. The word is circulating that EPA will not push for strict adherence to the Clean Air Act. Our automobile-air pollution crisis will be allowed to continue unabated.

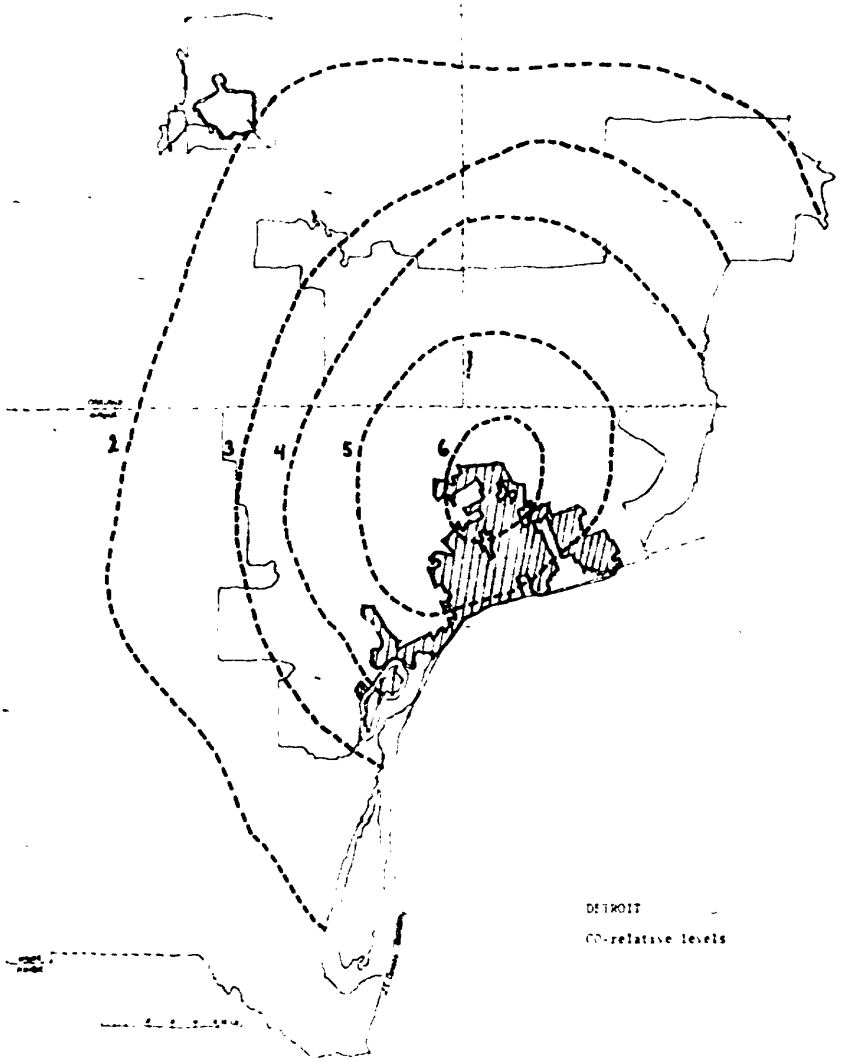
And once again, it will happen—as it happened in jobs, as it happened in education, as it happened in mobility for the aged, as it happened in abating hunger—the poor will be turned away again. The poor can then add to their list of well-documented afflictions the afflictions of noise and foul air.



Senator HART. Dr. Paulson.

Thank you, Dr. Sullivan.

Dr. PAULSON. Senator Hart, I am honored to be here today. My name is Glenn Paulson. I appear here today to discuss certain environmental hazards facing the urban poor in my two capacities as (a) staff scientist of the Natural Resources Defense Council, Inc., a public interest environmental law firm with offices in Washington and New York, and (b) executive director of the New York Scientists' Committee for Public Information, Inc., a voluntary organiza-



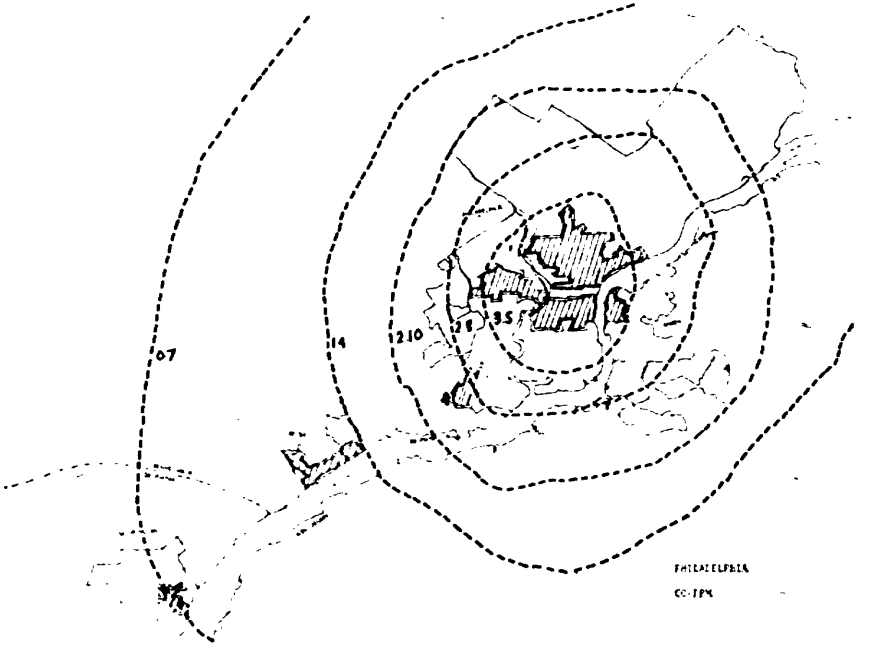
tion of research scientists, physicians and others in the New York metropolitan area.

In the interest of time, I will greatly abbreviate my prepared statement.

Senator HART. The statement in full will be printed in the record without objection.

Dr. PAULSON. I will eliminate one-third, abbreviate one-third, and greatly shorten the last portion of my prepared remarks.

You have heard that scrutiny of the environmental health problems of the rich, middle-class, and poor clearly indicates that the



poorest segments of the urban population are the most endangered groups of the city's residents. They are the most endangered for two reasons:

1. In general they suffer the highest "rates of exposure" to the various environmental hazards under discussion here today.

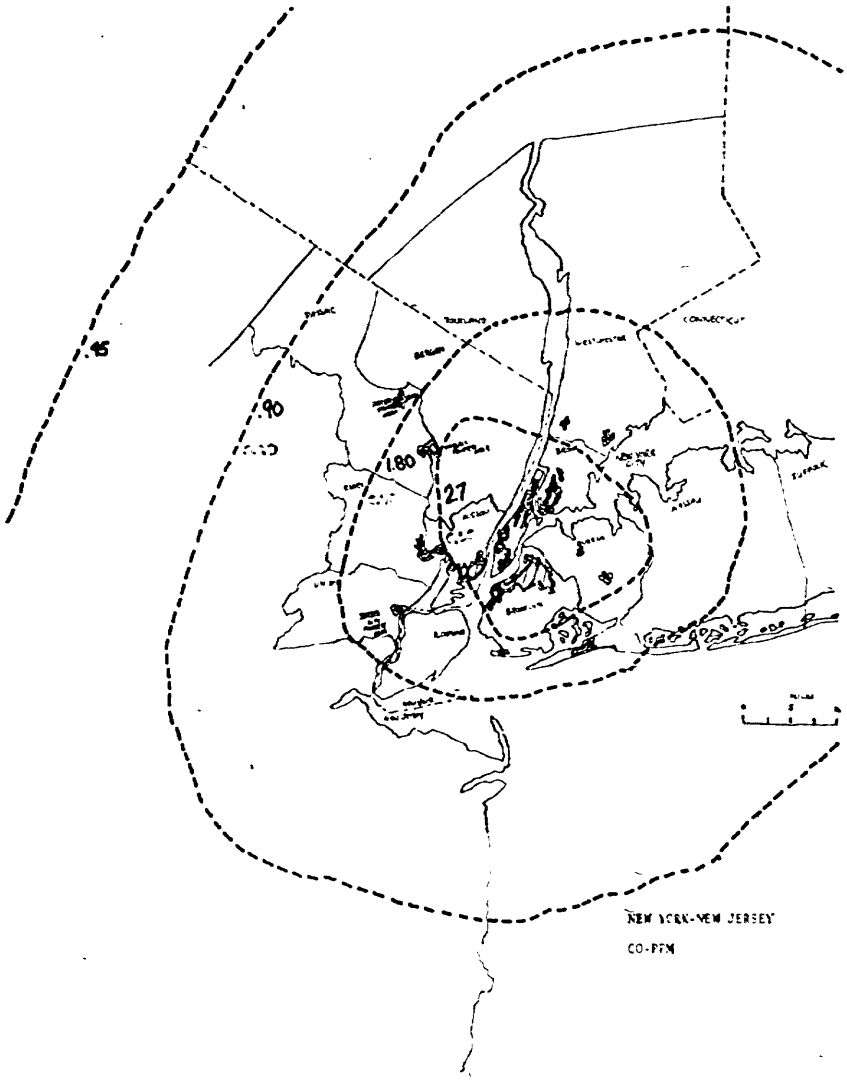
For instance, it can be clearly documented, as Dr. Sullivan has shown, that in several major American cities the areas of greatest poverty (as defined, for example, by housing statistics) tend to also have the highest levels of ambient air pollution; this is, in my opinion, almost certain to hold true for other cities which have not yet been examined from this perspective.

I would like to point out that this would also be true for sulfur dioxide air pollution levels of suspended particulate matters.

Similarly the quantities of the persistent pesticide, DDT, stored in the adipose tissue of poor people is higher than that store in middle-class or wealthy people, indicating a higher exposure rate to such substances.

Although the data are more difficult to find, it appears that the same assertion holds true for the amount of solid waste (i.e., garbage) which accumulates in poor neighborhoods; for water-borne industrial and municipal wastes which all too often render potential recreational water resources near ghetto areas unfit for swimming or other human uses; and perhaps even for the ambient noise levels to be found in the different regions of a city.

2. Precisely because of their poverty, and its attendant biological, medical and social characteristics, the urban poor are simultaneously both the least able to bear these varied environmental insults with-



out suffering a serious biological toll, and powerless to mobilize energies that would minimize these threats. That is the point you made yourself a few moments ago, Senator.

By the end of the day, you will have heard many examples of data and observations which place the great weight of hard evidence behind these generalizations. At the risk of being redundant, let me cite a few additional examples which, I hope, will clearly demonstrate that we are dealing not only with single cause-effect equations here (e.g., more garbage means more rats means more rat bites). Rather, we must attempt to comprehend extremely complex, multifactorial phenomena which are extremely difficult to define adequately in strictly scientific or medical terms.

This is unfortunately true, even for laboratory animals, let alone by the observation of existing human populations with their differing genetic compositions, biological sensitivities, patterns of life and economic status.

Let me illustrate using several examples which will demonstrate, primarily, the validity of the statement that I made above that the urban poor are very ill-equipped to absorb the environmental insults to which they are exposed.

As you will hear from others here today, it is a general rule that in most cities, the highest levels of the two common and well-studied air pollutants, sulfur oxides and particles of solid material suspended in the air, are found in the air of ghetto areas.

Indeed, the location of a residential area downwind from major sources of these pollutants, like power plants, industrial facilities such as smelters, steel mills, incinerators, and so forth, helps to make that area a slum in the first place.

It is generally understood that under certain weather conditions when unusually high levels of these two pollutants are attained, there is an increase in the rate of disease and death in the populations exposed. This has occurred several times in London, several times in New York City, in Donora, Pa., in Chicago and elsewhere. What emerges from these well-studied events, euphemistically termed "episodes," is the generalization that the most affected segments of the population are the very young, the old, and those with prior heart or lung disease.

What are the implications of this for the urban poor? Here we must deal with some specific facts. Miller, in his volume *Rich Man, Poor Man*, points out that a large proportion of the white poor in large cities are elderly, placing them in a high risk category during the air pollution episodes. It is also likely that many of the older poor urban whites are suffering from a preexisting heart or lung condition, which places them in a sort of double jeopardy.

However, the poor whites have at least one advantage: they are somewhat dispersed throughout the cities, and not necessarily concentrated in the ghettos.

The poor urban blacks, by contrast, *are* concentrated in ghettos, and thus exposed to the highest levels of these two air pollutants. Although the overall age distribution for poor urban blacks indicates that poor urban blacks have a lower average age than their white counterparts, such figures must not obscure the fact that there are, in fact, large numbers of elderly black people living in America's slums. Theoretically they deserve air as clean as any other urban resident has; in fact, the air's quality is significantly worse for them.

One might ask, what will the future bring for elderly black Americans? Here again, Miller points out a pertinent fact:

> As Negro families succeed, they tend to move out of these economically and socially depressed areas to better neighborhoods where they and their children have the opportunity to lead a better life. They leave behind the least educated and the most deprived, (among them) the aged.

This emphasizes the magnified effects of "air pollution episodes" on the urban poor relative to other urban population groups. It should be noted that there is convincing evidence that exposure to

elevated levels of sulfur oxides and particulate matter at quite low annual averages for a long period of time is also associated with increased human disease and death in the elderly, the young, and people with preexisting respiratory or cardiac disease. The impact of polluted air on a day-to-day basis thus undoubtedly parallels the consequences of the episodes discussed above.

What other factors enter into this particular situation? Obviously the urban middle and upper classes, no matter what their race, are able to escape the city (and its air) from time to time, for vacations, weekend jaunts, perhaps to a second home many weekends of the year. The poor do not have this mobility, and, as Professor Rene Dubos has pointed out, are even denied the slight protection from the effects of contaminated air which escape from the city may offer more privileged urban residents.

One last additional point deserves to be factored into this complex picture. I mentioned above that people with serious respiratory disease—emphysema, bronchitis, asthma, et cetera—are among the most sensitive to air pollution of all the groups of the population.

In this context, let me discuss the children in the ghetto for a moment. As I noted above, children are another of the groups "sensitive" to sulfur oxides and particulate matter. It is not clear whether this variety of air pollution can, by itself, cause diseases such as chronic bronchitis or asthma, but it certainly extracts a toll of suffering on people who already have these diseases.

In the late 1960s, several members of the scientists' committee for public information spent a good deal of time educating black mothers in New York City ghettos about the hazards of lead poisoning in children caused by old peeling paint. Often the conversation would turn to other health problems the mothers had seen in their children. One of the most common conditions they reported their children having was asthma.

Although I personally have never seen an exhaustive study of the incidence of asthma in ghetto children relative to that in nonghetto children, several pediatricians in hospitals which served ghetto communities told us that they felt that asthma was indeed more prevalent in ghetto children than in more affluent children.

Thus for the children as well as the elderly, those least able to bear the air pollution appear to receive a higher dose of it.

Assuming these observations by mothers and clinicians to be true, the next logical question is what causes the asthma in the first place, if it is not the air pollution?

There are many possible explanations, but at that time I saw a summary of some work done in a major Southern medical school which seemed to offer a strong indication of one cause. The paper reported that humans exposed to the dust from cockroach wings in the laboratory experienced very strong asthmatic-like reactions. To my knowledge, no further studies have been carried out along those lines. That is a pity, since the original report is so strongly suggestive.

Perhaps, in our context today, this can best be seen as yet another environmental insult (the roaches) caused by ghetto conditions (the solid waste) which helps render the children less able to biologically cope with the environmental stress of air pollution.

So far I have primarily discussed the multiple environmental insults faced by poor urban whites and blacks. I do not mean to ignore other poor urban minorities, for example, the Puerto Ricans and Mexican-Americans. The reason I am not discussing them is that so little in known in detail about the environmental conditions in which they live—except that they are roughly comparable to those of poor urban blacks—or about the types and varieties of environmental health problems which they have.

This is a serious deficiency in our knowledge, but one can safely assert that in broad outlines the problems of all urban minorities are very much like those of the poor blacks and whites I have discussed above.

The next section of my prepared statement is the one I will not discuss here, since you have heard already about carbon monoxide and lead, and will hear much more about it later in the day.

I have mentioned above the observation that poor blacks seem to have higher levels of persistent pesticides stored in the adipose tissue than other segments of the population. There has been such inadequate monitoring of human exposures to such substances by racial or economic class that, in my opinion, there is a good chance that future studies will show this to be a result of being poor, not of being black.

By the way, it has been rumored some people have considered blacks to be suffering from "biochemical racism" because they seem to have more DDT in their fat. I don't think that is true, but rather that this phenomenon affects all poor people equally.

The potential long-term consequences of this are, of course, not known, though the biochemical alterations known to occur in the livers and other tissues of birds after long-term exposure to the persistent (e.g., chlorinated hydrocarbon) pesticides certainly do not allow one to be completely sanguine.

I have been interested in the consequences of multiple environmental stresses on the mammalian organism for some years. In fact, some of my recently completed research examined the effects of long-term exposures of mice to the persistent pesticides DDT and dieldrin, followed by one or another of a series of mild physiological stresses.

I would like to briefly report some of the results. I have described a number of experiments in my prepared statement, but, in the interest of time, will discuss only one experiment, and the conclusions I have drawn from my work.

The first conclusion is an experimental demonstration in laboratory mammals that perhaps we should not be quite so certain that long-term exposure to persistent pesticides in humans will be absolutely safe, especially when additional, nonchemical stresses are simultaneously present.

The second conclusion is that it is not sufficient to deal with a single cause-effect chain of events when considering environmental insults and their potential health consequences on humans, particularly on those humans subject to a wide range of deleterious conditions.

It is always difficult to be brief when discussing one's own research, but I will try. To prove these conclusions, essentially I

proceed as follows: I fed mice rather low dietary levels of dieldrin or DDT for several weeks or months; these levels were sufficiently low that no direct toxic results were observed—growth and development were normal, no behavioral alterations were observed, and so forth.

After this exposure period, the animals were stressed in several ways. Almost without exception, the stress applied to non-pesticide-fed animals caused little or no effect; the effects in the animals previously exposed to pesticides were quite another matter, as you can see from the charts in my prepared statement, this was not true in the pesticide-fed animals. The stresses included change in dietary composition, an attempt to mimic mild disease conditions and so on.

Finally, if you will turn to the last figure in my prepared statement, you will see in figure 8 the results of one particularly interesting experiment which mimiced even more closely than I had planned the conditions in the world outside the laboratory.

An outbreak of mild infantile diarrhea of unknown origin, probably viral in nature, occurred in one of our rooms where an experiment was already in progress. In this room female mice maintained on a good or poor protein diet with different pesticide contents had been allowed to give birth and were nursing their litters. This disease occasionally occurs in infant mice and usually causes no mortality in the young if they are nursing on a mother who is receiving a good diet.

Figure 8 shows the mortality in the different groups of nursing young. None of the young nursing on mothers receiving the good diet with no added pesticide died. All other groups had significant mortality. In general, those on the poor diet suffered more than those on the good diet; those on higher pesticide intakes fared worse than those on a lower intake.

I have no explanation for the anomalous results in the 5 p.p.m. group on the good diet; perhaps the most reasonable conclusion is that it reflects the capricious nature of the biological effects of combinations of environmental and other stresses.

I do not claim these results indicate that poor urban dwellers with increased exposure to pesticides are presently suffering from the kinds of effects I observed in these mice.

On the other hand, these results certainly do not offer any assurance that serious biological consequences of a less dramatic nature do not exist. Death, after all, is a drastic end-point for a combination of stresses. Other results—for example, biochemical changes in liver function, are certainly conceivable possibilities in mice and also in humans.

As I have stated before, few if any studies are being conducted to evaluate the possibility of this type of very indirect, multifactorial effect on human health due to pesticides—or, indeed, due to the other environmental conditions we are discussing today.

In my opinion, data such as that presented by Dr. Sullivan and included in my presentation leads to an understanding of the considerations important in determining sound environmental policies for benefiting the urban poor.

First, we must use the best data and observations we have in designing policies and programs that deal effectively with the entire

range of environmental conditions threatening human health, either directly or indirectly.

Simultaneously, we must be aware that our scientific understanding of such matters is, and probably always will be, inadequate. In this sense, sound policies will always extend their effects beyond the range of current knowledge.

But if our society is serious about these environmental problems, it must deal, as a top priority, with those members of our population who are most affected by these conditions, the urban poor.

Thank you for your interest in these problems.

Senator HART. Gentlemen, thank you for the testimony that you have given us. Included were the suggestions which Mr. Lombardo gave us to have in mind and present to EPA when the agency testifies. I almost am hesitant to add another one, but this may be another. You are talking about getting rid of the lead in gasoline. There was a news story written by Elsie Carper in The Washington Post of January 27:

> Meanwhile the EPA announced that it is drafting regulations to require the sale of unleaded gas at all filling stations by mid-1974. A consultant's findings released by the EPA said that lead-free gas is essential to meet the 1975–76 standards.

Are any of you familiar with the study that is mentioned here?

Mr. LOMBARDO. Not the study, no: I have not seen that yet, Senator.

Senator HART. Or the regulation?

Mr. LOMBARDO. I think I can speak to the question though, certainly.

Senator HART. Or the regulation?

Mr. LOMBARDO. Essentially as I understand it they will make available one grade of lead-free gasoline at each gas station. They will require this by mid-1974. However, what we are asking for is a total ban in all gasoline, not just one grade, not just one pump at each gas station, but all gasoline by 1977.

Senator HART. Yes, you made that clear. I am mindful of that.

Mr. LOMBARDO. Yes, sir.

Senator HART. What really concerned me was that the story reports the EPA announcing that in mid-1974 one pump shall have nonleaded gas. Are you aware of that report or not? Is it available?

Mr. LOMBARDO. I have not received the report yet. We have heard rumors to that effect, but frankly, Senator, as you will hear in great detail later today by Dr. Fritsch and Mr. Berlin, the history or chronology of inaction by EPA on getting the lead out of gasoline is abysmal. They have not done anything. Literally they have not done anything.

We do not have a lead criteria document; we do not even have a notice of proposed rule making that they will require one grade of lead-free gasoline by 1974.

I do not want to go into this in too much detail now, because you are going to hear it later today.

Senator HART. Fine. We will wait.

Dr. PAULSON. I would like to add one additional comment, if I may. There are two dimensions to the issue of leaded gas. One is direct hazard of lead itself. The other is less direct. It is generally

agreed that the presence of lead in gasoline, irrespective of the other health hazards it poses for urban residents, will make it impossible to meet the standards for other automotive pollutants established by the Clean Air Act of 1970. It appears the removal of lead from gasoline will be necessary (but may not be sufficient by itself) to clear the air of certain other pollutants.

Thus, in addition to the lead itself, other pollutants such as carbon monoxide and oxidants are also part of the lead issue. The only other way to deal with the entire range of vehicle-related pollutants would be to reduce the number of vehicles, since we cannot be guaranteed that we will have an adequately clean vehicle by 1975.

This is an area where the EPA has urged the States to develop the initiative to handle the larger transportation problem. It is not clear what the EPA will do to solve this larger problem by way of encouraging a more varied transportation mix because of the air pollution impact of the present heavy reliance on motor vehicles.

Senator HART. All of you have made very clear your disenchantment with the automobile. I do not have to tell you that that speech is better received in some parts of the country than in Detroit, even by the poor in Detroit, for obvious reasons.

Having admitted that, and reflecting a certain nationalism, what alternatives do you have. Or are there any transportation alternatives immediately available to supplement what happens to be a national reliance on the automobile? Do we have to wait for the fixed rail systems like Metro which are expensive and very long in construction or maturing?

Dr. SULLIVAN. There is a myth, a terrible myth that exists in our country that the alternatives to more highways haven't been discovered yet.

Senator HART. This is probably Detroit's fault, too: Detroit is probably the source of it.

Dr. SULLIVAN. I do not know to what extent it is. The myth must be removed that the only alternative to the automobile is some fantastic Buck Rogers hovercraft that wisks you out of your bedroom window. That is not true. The Shirley Highway is working. Why don't we have a Shirley Highway going to Maryland? Why don't we have one in Virginia? The Metro is working—see how often you can get on one that goes to New York. Why don't we expand use of things that work?

That proves to me, at least, that alternatives are available and the only question is—the only block to our achieving those alternatives—is a decision to go with them. They are there: let's expand them. We do not have to wait.

Senator HART. For the record and the readers of it who are not familiar with the Shirley Highway, please describe that briefly.

Dr. SULLIVAN. Shirley Highway runs south of Washington into Virginia. One lane of that highway is devoted to buses. Now if you take a trip out there you will see it does not look like a lane; it looks like a rut. The lane does not extend all the way into Washington. The only vehicles allowed in that lane are buses. The idea was that people sitting in their vehicles on a congested day would see buses whiz by and convince them to take the bus.

It has been a success. With all its problems, with all the inflictions that have been imposed on it—of not running it into the District all the way and not having a good road surface—even with those problems it has been a success.

There is no reason these kinds of things cannot be expanded.

Dr. PAULSON. There is a similar situaton now concerning express buses in New York. Certain ones come from Westchester County and Long Island; they are assigned to special lanes on certain expressways. In other cases, such vehicles are the only buses allowed on roads such as the East Side Highway where normally buses are not permitted. That will be a good test as to their popularity within the next several weeks, because the fare is going to be raised by 20 percent from $1 to $1.20.

Many people who follow this field say that, unlike subway ridership which goes down when the fare goes up, people who ride the express buses will not be dissuaded by the increased fare. This fare increase will be a good test of the utility of this mechanism in dealing with the urban transportation problem in an immediate way.

Dr. SULLIVAN. They have had bus lanes in New York for 10 or 12 years. They had city street bus lanes on Staten Island. That was discontinued, I think, primarily because they could not keep cars out of the bus lane. But the buses got to their destinations in half the time that they used to.

It is not that we need tests. These things have been around a long time. It is a question of doing it.

Mr. LOMBARDO. Senator, one of the findings of the task force may be of interest on the question you just brought up; that is, that the poor have a terrible mobility problem. They need access to jobs which increasingly are in the suburbs. As much as it troubles environmentalists, the poor do need cars. As Dr. Sullivan say, 40 percent of the urban poor do not have cars.

I do not have a legislative recommendation at this point, but it seems to me it would be interesting to have a committee of Congress look into the question of how can we as a Nation, or the automobile industry, how can the industry be motivated to provide low-interest, long-term loans, let's say 5 percent, 5 years, to the poor for the purchase of a low-cost car? In other words, if an individual's annual family income is less than $5,000 a year, couldn't there be some mechanism whereby low-cost, low-interest, long-term loans are made available so the poor could purchase cars and get to where the jobs are?

I share the view of environmentalists that we do need mass transit systems. I do not want to diminish that view in any way. But the task force was told if we just rely on mass transit to serve the transportation needs of the poor, aren't we then exhibiting a certain amount of discrimination? Wouldn't we be saying that the poor can take the public transportation, while we can continue to drive around in our Mustangs or whatever?

Senator HART. I had not heard the suggestion that we develop a government program to enable poor to buy cars. My first reaction to that is negative. Like everything else, though, we ought to think about it.

Another problem we have, and I think this isn't a myth, is that you are hard put to find any bus lines that are doing anything but staying a step ahead of the sheriff now. We have to do something about that.

Dr. SULLIVAN. I believe it involves another myth. The social costs adhering to the use of automobiles as mass transit are enormous. Studies in London shows that to drive 1 mile on a highway moving at 10 miles an hour, you slow everybody on the highway to the extent that your auto trip costs $1.20 a mile.

Now if all those social costs are tallied up, $16 billion damage due to pollution, if all tallied up, you run up a bill of $5 to $10 for each commuter. You show me a bus that can't run on a $5 fare.

Senator HART. That is not a bus problem vis-a-vis the sheriff. It isn't a myth that most bus lines are in the red. You are talking about the mistaken attitude of the private car driver with respect to his cost.

Dr. SULLIVAN. That is where I think that the government should rationalize our allocation of resources to insure economic efficiency. We have a high economic inefficiency with the motorcar and the bus systems the way they are run now. One of the functions of government is to insure economic efficiency.

What it means is that we are going to have to stop subsidizing the automobile as government does now and start subsidizing mass transit to a greater extent. Take the taxes put on the automobile to pay for their social costs; feed these taxes into bus lines. In the District we have recommended that very high parking taxes be put on downtown lots to dissuade commuters from using their automobiles. Revenues from parking taxes will go to mass transit systems.

Now that is one measure that can be adopted immediately. You can use tolling systems. Various systems are available for charging motorists and there are experiments that show they are viable.

Senator HART. Tapping the highway trust fund for other than the highway construction.

Mr. LOMBARDO. Right.

Dr. SULLIVAN. Absolutely right.

Senator HART. Mr. Bickwit?

Mr. BICKWIT. Our first witness, Mr. Heningburg, added to his written text a statement to the effect that history shows that agencies of government, without some stimulus, will not concentrate on the unfortunate situation we have.

Have you a suggestion for some stimulus that would keep EPA or any other agency of the government on the track of looking at the disadvantaged and being constantly reminded of their plight?

Mr. LOMBARDO. Absolutely. The recommendation that the task force came up with for the creation of an urban advisory council—the Administrator should use his administrative power to set up an urban advisory council to himself or to the President. The Urban Advisory Council should look into what EPA is doing by having frequent meetings with officials of the various departments in the EPA bureaucracy. The officials should be required to constantly report to the Council, the progress or lack of progress of the Agency. The Council would be a continuous spur to the bureaucrats. Continuous pressure is the thing that is necessary. Congressional oversight is

not continuous. The Congress holds hearings on a given agency's performance maybe two, three times a year. The Congress does not have a sufficiently constant flow of information and expertise to be effective.

The Congress doesn't have the staying power to monitor an agency to make sure that results are achieved.

Senator Hart, when I first walked in here you were saying when you go back to the voters, the voters want to know: "you've spent a lot of my tax money, where are the results?"

As a city, Detroit is a disaster just like any other city of this country. If we are going to achieve results, somehow or other we will have to institutionalize a spur to the bureaucracy. We ought to institutionalize a spur inside the agency which constantly monitors the Agency's activities. And, if the Agency isn't doing its job, the council could come to the Congress and say, the job is not being done. The Task Force was trying to institutionalize just such a mechanism to assure results.

As you know, we have not been getting results. The voters ask the Congressmen and the Senators for results, but as far as I am able to discern, the Congress really is terribly gentle with the agencies. The Congress does not say to Mr. Ruckelshaus, "I want a commitment from you. Will you or won't you? Yes or no, Mr. Ruckelshaus. Tell us, will you do it or won't you?"

Commitments must be obtained from administrators. If a commitment is obtained, time certain, definite, specific, on actions to be achieved the Congress will have something to work with.

You can then hold the administrator accountable. The Congress is being held accountable why shouldn't the executive be? The public wants accountability in Government, and corporate responsibility, and corporate accountability as well. We have the mechanisms here in Washington. The Congress can demand accountability; it should. One way to do it on the urban environment is to create an urban advisory council. If the administrator will not of his own volition create and staff a council within his own organization; with activists not a panel loaded with foot-dragging industrialists; then I would think that the Congress would want to create such a body by legislation. Require an urban advisory council as a national policy.

Dr. PAULSON. If I may I would like to suggest another possible mechanism that may be pertinent for you to consider in view of Senator Hatfield's comments on the noise legislation pending before this subcommittee.

If you look—obviously we could talk about all Federal agencies in this way—but if you look specifically at EPA and their areas of responsibility—air, water, pesticides, radiation, and solid waste—their major legislation now is just for air pollution, the Clean Air Act Amendments of 1970. That Act, among other things, institutionalizes the access of citizens, through the citizen suit provision, to the administrator's actions and other governmental actions in a direct and immediate way when citizens feel aggrieved.

The new water legislation, of course, is not in final form yet. It would be valuable if that legislation also institutionalizes the opportunity for citizens to perform a watch dog function, through citizen

suits. This could be done by various groups of the public—citizens' groups, public interest, science, or law groups, et cetera.

I have no idea what is contained in S. 1016, but conceivably legislation defining EPA's responsibility for noise could also guarantee the access of citizens through the courts or through administrative proceedings in the same way as the air legislation.

Senator HART. I have filed an amendment to the noise bill to add that provision.

Dr. PAULSON. That is an excellent idea! I have been able to find out little about EPA's responsibilities in radiation and solid waste except for the Resource Recovery Act. It is conceivable that in these areas also similar methods could be also institutionalized so that the public at large, which suffers when the agency fails, may have a readily accessible route for the redress of grievances.

Mr. LOMBARDO. Mr. Chairman, if there is another example of inaction in Government and what it really means to us I think it will be shown by this example. I talked about the weakening of the ambient air quality standards by EPA, followed by the weakening of the auto emission standards for 1975. These facts show the industry is successfully pushing its interests with the Administration in a repeat performance of its successful efforts in California. In 1959 the California legislature passed a law empowering the State health agency to set automobile emission standards to restore the degree of air quality which existed in Los Angeles in 1940—by 1970! They wanted 1940 levels of air quality by 1970! Well, this action by the California legislature to protect the public health was in vain. The amount of emissions in Los Angeles today exceed the levels that were emitted in 1959. The law was a total failure.

Congress can sit, any legislative body can sit and legislate a policy and say, "This is what we will do in the next 10 years," but that does not assure accomplishment.

To assure achievement of national policy we have to institutionalize some mechanism to make sure that the policy is carried out, because right now it isn't being carried out. Are we, 15 years from now, to have another panel of public-interest people saying, "Well, here it is 1985 and the Congress passed a law back in 1970 calling for clean air by 1985 but the ambient air quality is roughly the same as it was back in 1970." Will that happen?

Senator HART. I can't guarantee it.

Mr. BICKWIT. You contend in your statement that a policy which hasn't been enforced is the requirement that the ambient air quality standards reflect an adequate margin of safety.

Have you any documentation for your rather strong suggestion that some of the standards that have been promulgated do not reflect that margin of safety?

Mr. LOMBARDO. I have introduced very lengthy comments by the center for study of responsive law which adequately document it. If you want me to go through it quickly, I can.

Senator HART. Is that in the materials that you have filed with us?

Mr. LOMBARDO. Yes; attachment C and attachment D; they document the inadequate margin of safety in the proposed ambient air quality standards.

When the Agency, subsequent to these comments, finally promulgated the ambient air quality standards they ignored the public interest comments and set still weaker standards. They heeded the industry comments rather than the comments submitted by public-interest representatives.

Mr. BICKWIT. Are you saying there is no adequate margin of safety with respect to all of the standards?

Mr. LOMBARDO. I believe it is true with respect to each of the standards. I won't say that for sure but I believe it to be the case.

Mr. BICKWIT. We will check for the record, thank you.

Dr. PAULSON. Let me make one additional comment that does not have to do with the primary standards for protecting human health, but with the secondary standards which were supposed to protect everything else. At the natural resources defense council, we have found evidence indicating that the standard for sulphur dioxide is set twice as high as the level at which plant damage is known to occur. We are attempting to assemble more data on that particular pollutant: perhaps we will be able to on others as well. We may then take some sort of action on our own to force a revision of that standard.

Obviously in the long run welfare is as important as health. I think it would be appropriate to protect human health first and then move on to protect the rest of the biosphere.

Senator HART. Gentlemen, thank you very, very much for your testimony.

Dr. PAULSON. Thank you.

Senator HART. It has been suggested, in part because the Senate will be voting during the afternoon, that if our witnesses can manage it we should continue until we conclude the testimony rather than recessing for lunch.

If the witnesses can do that, fine. We will take a 5-minute recess and then resume.

(Recess.)

(The statement follows:)

EDUCATION AND LABORATORY EXPERIENCE OF DR. GLENN PAULSON

Glenn Paulson graduated as co-valedictorian from the Sycamore (Illinois) High School in 1959, and from Northwestern University with a Bachelor of Arts Degree in Chemistry (with honors) in 1963. While at Northwestern, he received a Public Health Service fellowship in 1962 to study one facet of the mechanism of blood clotting in the laboratory of Prof. Lazlo Lorand.

After college, he accepted an invitation to become a Graduate Fellow at The Rockefeller University in Sew York City. He engaged in graduate studies in the areas of lipid biochemistry (with Dr. Alan Hoffmann and Prof. E. H. Ahrens, Jr.) and physical biochemistry (with Dr. George Nemethy) until taking a brief leave of absence in 1967.

In 1968, he returned to Rockefeller and joined the Department of Environmental Biomedicine, headed by Prof. Rene Dubos. His work in that laboratory concerned the interaction of physiological stress with simultaneous exposure to environmental contaminants. Specifically, he examined the toxicity in the mouse of long-term exposure to low dietary levels of dieldrin and DDT. He received his Ph.D. from Rockefeller in June, 1971.

CURRENT EMPLOYMENT

Dr. Paulson currently has two positions, which occupy roughly four days per week. These are:

Staff Scientist of the Natural Resources Defense Council, a public-interest environmental law firm with offices in New York and Washington, and

Executive Director of the New York Scientists' Committee for Public Information.

In addition, he is Adjunct Associate Professor at the City College of New York. He is also engaged in independent lecturing, writing and consulting activities.

PROFESSIONAL SOCIETIES, CIVIC ORGANIZATIONS, ETC.

Dr. Paulson is currently a member of the following professional and scholarly organizations:

American Association for the Advancement of Science,
American Chemical Society,
Air Pollution Control Association,
Council for the Advancement of Science Writing,
Phi Beta Kappa, and
Sigma Xi.

Dr. Paulson has been a member of the New York Scientists' Committee for Public Information, Inc. (SCPI) since 1964 and has served on its Board of Directors since 1966. He held the office of chairman from 1967–1970, and has been secretary in 1966–67 and 1970–1971. He is also chairman of SCPI's air pollution subcommittee, co-chairman of the subcommittee on electric power and the environment, and a member of the subcommittee on pesticides and lead poisoning in children. Currently he serves as Executive Director of this organization.

Recently Dr. Paulson has been elected to the Boards of Directors of the Scientists' Institute for Public Information (SIPI), and Citizens for Clean Air, Inc.; both of these national organizations have their headquarters in New York City.

Dr. Paulson is also one of the original members of the Mayor's Council on the Environment, found by Mayor John Lindsay in May, 1970. He is currently a member of the Health Task Force of the New York Urban Coalition, the Scientific Advisory Board of the Long Island Environmental Council, and the Advisory Board of Environmental Health Programs, Inc., in Washington, D.C.

In 1969–70, he was a member of the National Steering Committee for the nationwide observance of Earth Day, April 22, 1970. He was also a member of the New York City Cleaner Air Week Committee from 1967–69.

PERSONAL DATA

Dr. Paulson was born in Sycamore, Illinois on September 14, 1941, and spent his youth in that area of northern Illinois. During his junior year in high school, he was selected as a foreign exchange student, and spent the summer between his junior and senior years of high school in Sweden.

He married the former Loretta Fargo in 1970. They presently live on Manhattan's Upper West Side.

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Also, see Mr. Paulson's presentations in *Hazards in the Industrial Environment*, Vols *I–VIII*, 1969, 1970. Edited by A. Mazocchi. Citizenship-Legislative Department, Oil, Chemical and Atomic Workers International Union, Washington, D.C.

STATEMENT OF GLENN PAULSON, PH.D.

Mr. Chairman, members of the committee, ladies and gentlemen: I am Dr. Glenn Paulson. I appear before you today to discuss certain environmental hazards facing the urban poor in my two capacities as (a) Staff Scientist of the Natural Resources Defense Council, Inc., a public interest environmental law firm with offices in Washington and New York, and (b) Executive Director of the New York Scientists' Committee for Public Information, Inc., a voluntary organization of research scientists, physicians and others in the New York metropolitan area. (This latter organization is affiliated with the Scientists' Institute for Public Information, a national organization of similar composition and purposes.)

You have already heard today that scrutiny of the environmental health problems faced by *all* urban dwellers—rich, middle-class *and* poor—clearly indicates that the poorest segments of the urban population are the most endangered groups of the city residents. They are the most endangered for two reasons:

1. In general they suffer the highest "rates of exposure" to the various environmental hazards under discussion here today. For instance, it can be clearly documented for several major American cities that the area of greatest poverty (as defined, for example, by housing statistics) tend to also have the highest levels of ambient air pollution; this is, in my opinion, almost certain to hold true for other cities which have not been examined from this perspective. Similarly the quantities of the persistent pesticide, DDT, stored in the adipose tissue of poor people is higher than that stored in middle-class or wealthy people, indicating a higher exposure to such substances. Although the data are more difficult to find, it appears that the same assertion holds true for the amount of solid waste (i.e., garbage) which accumulates in poor neighborhoods; for water-borne industral and municipal eastes which all to often render potential recreational water resources near ghetto areas unfit for swimming or other human uses; and perhaps even for the ambient noise levels to be found in the different regions of a city.

2. Precisely because of their poverty, and its attendant biological, medical and social characteristics, the urban poor are simultaneously both the least able to bear these varied environmental insults without suffering a serious toll, and powerless to mobilize energies that would minimize these threats.

By the end of the day you will have heard many examples of data and observations which place the great weight of hard evidence behind these generalizations. At the risk of being redundant, let me cite a few additional examples which, I hope, will clearly demonstrate that we are dealing not only with single cause-effect equations (e.g., more garbage means more rats mean more rat bites). Rather we must attempt to comprehend extremely complex, multifactorial phenomena which are extremely difficult to define adequately in strictly scientific or medical terms. This is, unfortunately, true, even using laboratory animals, let alone by the observation of existing human populations with their differing genetic compositions, biological sensitivities, patterns of life and economic status.

Let me be more illustrative with several examples which will demonstrate, primarily, the validity of the statement that the urban poor are very ill-equipped to absorb the environmental insults to which they are exposed.

AIR POLLUTION—SULFUR DIOXIDE AND SOOT

As you almost certainly will have heard from others here today, it is a general rule that in most cities, the highest levels of the two common and well-studied air pollutants, sulfur oxides and particles of solid material suspended in the air (soot, flyash, dust, etc.) are found in the air of ghetto areas. Indeed, the location of a residential area downwind from major sources of these pollutants—power plants, industrial facilities such as smelters, steel mills, incinerators, and so forth—helps to make that area a slum in the first place.

It is generally understood that under certain weather conditions when unusually high levels of these two pollutants are attained, there is an increase in the rate of disease and death in the population exposed. This has occurred several times in London, several times in New York City, in Donora, Pa., in Chicago and elsewhere. What emerges from these well-studied events, euphemistically termed "episodes", is the generalization that the most affected segments of the population are the very young, the old, and those with prior heart or lung disease.

What are the implications of this for the urban poor? Here we must deal with some specific facts. Miller, in his volume *Rich Man, Poor Man*, points out that a large proportion of the white poor in large cities are elderly—placing them in a high risk category during these air pollution episodes. It is also likely that many of the older poor urban whites are suffering from a pre-existing heart or lung condition, placing them in a sort of double jeopardy. However, the poor whites at least have one advantage—they are somewhat dispersed throughout the cities, and not necessarily concentrated in the ghettos.

The poor urban blacks, by contrast, *are* concentrated in ghettos, and thus exposed to the highest levels of these two air pollutions. Although the overall age distribution for poor urban blacks indicates that they have a lower average age than their white counterparts, such figures must not obscure the fact that there are, in fact, large numbers of elderly black people living in America's slums. Theoretically they deserve air as clean as that of any other urban resident; in fact, the air's quality is significantly worse for them.

One might ask—what will the future bring for elderly black Americans? Here Miller again points out a pertinent fact: "As Negro families succeed, they tend to move out of these economically and socially depressed areas to better neighborhoods where they and their children have the opportunity to lead a better life. They leave behind the least educated and the most deprived - -(among them) the aged."

I have emphasized the probable magnified effects of "air pollution episodes" on the urban poor relative to other urban population groups. It should be noted that there is convincing evidence that exposure to elevated levels of sulfur oxides and particulate at quite low annual averages (e.g., 0.04 parts per million of sulfur oxides) for a long period of time is also associated with increased human disease and death in the elderly, the young, and people with pre-existing respiratory or cardiac disease. The impact of polluted air on a day-to-day basis thus undoubtedly parallels the consequences of the episodes discussed above.

What other factors may enter into this particular situation? Obviously the urban middle and upper classes, no matter what their race, are able to escape the city (and its air) from time to time—for vacations, weekend jaunts, perhaps to a second home many weekends of the year. The poor do not have this mobility, and, as Professor Rene Dubos has pointed out, are even denied the slight protection from the effects of contaminated air which escape from the city may offer more privileged urban residents.

One last factor deserves to be factored into this complex picture. I mentioned above that people with serious respiratory disease—emphysema, bronchitis, asthma, etc.—are among the most sensitive to air pollution of all the groups of the population. In this context, let me briefly discuss the children in the ghetto for a moment. As I noted above, children are another of the groups "sensitive" to sulfur oxides and particulate matter. It is not clear whether this variety of air pollution can, by itself, cause diseases such as chronic bronchitis or asthma but it certainly extracts a toll of suffering on people who already have these diseases.

In the late 60's, several members of the Scientists' Committee for Public Information (including myself) spent a good deal of time educating black mothers in New York City ghettos about the hazards of lead poisoning in children caused by old peeling paint. Often, the conversation would turn to other health problems the mothers had observed in their children. One of the most common conditions they reported in their children was asthma. Although I personally have never seen an exhaustive study of the incidence of asthma in ghetto children relativ to that in nonghetto children, several pediatricians in hospitals which served ghetto communities told us that they felt that asthma was indeed more prevalent in ghetto children than in more affluent children. Thus for the children as well as the elderly, those least able to bear the air pollution receive a higher dose of it.

Assuming these observations by mothers and clinicians to be true, the next logical question is what causes the asthma in the first place, if it cannot be attributed to the air pollution? There are many possible explanations, but at that time I saw a summary of some work done in a major Southern medical school which seemed to offer a strong indication of one cause. The paper reported that humans exposed to the dust from cockroach wings in the laboratory experienced very strong asthmatic-like reactions. To my knowledge, no further studies have been carried out along these lines. That is a pity, since the original report is so strongly suggestive. Perhaps, in our context today, this can best be seen as yet another environmental insult (the roaches) caused by ghetto conditions which helps render the children less able to biologically cope with one other environmental stress (the air pollution).

So far I have primarily discussed the multiple environmental insults faced by poor urban whites and blacks. I do not mean to ignore other poor urban minorities, for example, the Puerto Ricans and Mexican-Americans. The reason I am not discussing them is that so little is known in detail about the environmental conditions in which they live—except that they are roughly comparable to those of poor urban blacks—or about the types and varieties of environmental health problems which they have. This is a serious deficiency in our knowledge, but one can safely assert that in broad outline the problems of all urban minorities are very much like those of the poor blacks and whites I have discussed above.

AIR POLLUTION—CARBON MONOXIDE AND LEAD

You will hear much today about automotive air pollutants—and the highways which bring the cars into or through poor urban neighborhoods. I do not plan to repeat these facts.

Rather I wish to show a particularly clear-cut example of the range of multiple environmental insults which, if proper studies were done, might well show a tremendous impact on the human organism from a series of environmental insults, where each stress alone might have a minimal impact.

You probably know that intake of lead, no matter whether it is inhaled, eaten or drunk, may cause anemia by interfering with several of the biochemical procedures in bone marrow which produce hemoglobin, the essential oxygen-carrying pigment of the red blood cell. Much debate exists over what is the "safe" level of lead exposure, whether airborne or ingested. It does appear, however, that these biochemical steps are altered at exposures to lead much lower than was thought to be the case only three or four years ago. This provides a definite risk to people exposed to lead, since hemoglobin-deficient blood deprives all of the body's tissues of oxygen.

You have also heard about carbon monoxide, almost exclusively on automotive air pollutant. There is no debate about the threshold for biological action of carbon monoxide: exposure to *any* amount of this gas for period longer than an hour, or even less, results in the reaction of carbon monoxide (instead of the normal oxygen) with hemoglobin. Since hemoglobin binds carbon monoxide more tenaciously than it binds oxygen (by a factor of over 200 to 1) a small concentration of carbon monoxide in the ambient air can have a greatly magnified effect on the body's oxygen supply. (It should be noted that cigarettes also produce carbon monoxide; thus smokers have yet another potential impact on the oxygen supply to their vital tissues.)

And finally, focusing on the black population, it is well known that a significant fraction (about 10%) of black Americans suffer from the hereditary condition called sickle cell anemia. Under certain conditions, this results in an actual decrease in the number of red blood cells in a short period of time—another loss of the body's ability to supply its cells with adequate amounts of oxygen.

The urban poor have yet another potential source of decreased oxygen supply caused by anemia. (See footnote, next page) A wide range of nutritional deficiencies (of iron, certain vitamins, protein, etc.) can cause a partial anemia. The inadequate nutritional state of the urban poor has been well documented before the Senate and elsewhere and needs no recitation here. The important point is that *each* of these stresses is known to exist in *all* groups of the urban poor (except sickle cell anemia, which is confined essentially to black Americans). *No single* one of them may be adequate to lead to significant short or long-term consequences on these people, but the *combination* may

result in quite a different result. Unfortunately here again the ability of present scientific methods to adequately examine such multi-faceted conditions is seriously limited. But should we wait for the years of study needed to show precisely what human toll is taken by each of these stresses, and by the various combinations of them? Or should we take steps *now* to minimize as many of these threats as we can, without waiting for the final "body count"?

NOTE: For completeness, I should make two additional points about anemia. The first is that there are other hereditary conditions which result in anemia (e.g., thalassemia and glucose-6-phosphate dehydrogenase deficiency). These appear to exist uniformly throughout the population. That is, the poor appear to have them no more, but also no less often than other population groups. The second point is that prolonged moderately severe anemia is clearly known to lead to serious cardiac conditions. It is not known whether prolonged but milder anemia also leads to heart disease but it is at least a likely possibility.

PRESISTENT PESTICIDES AND THE URBAN POOR

I have mentioned above the observation that poor blacks seem to have higher levels of persistent pesticide stored in their adipose tissue than other segments of the population. There has been such inadequate monitoring of

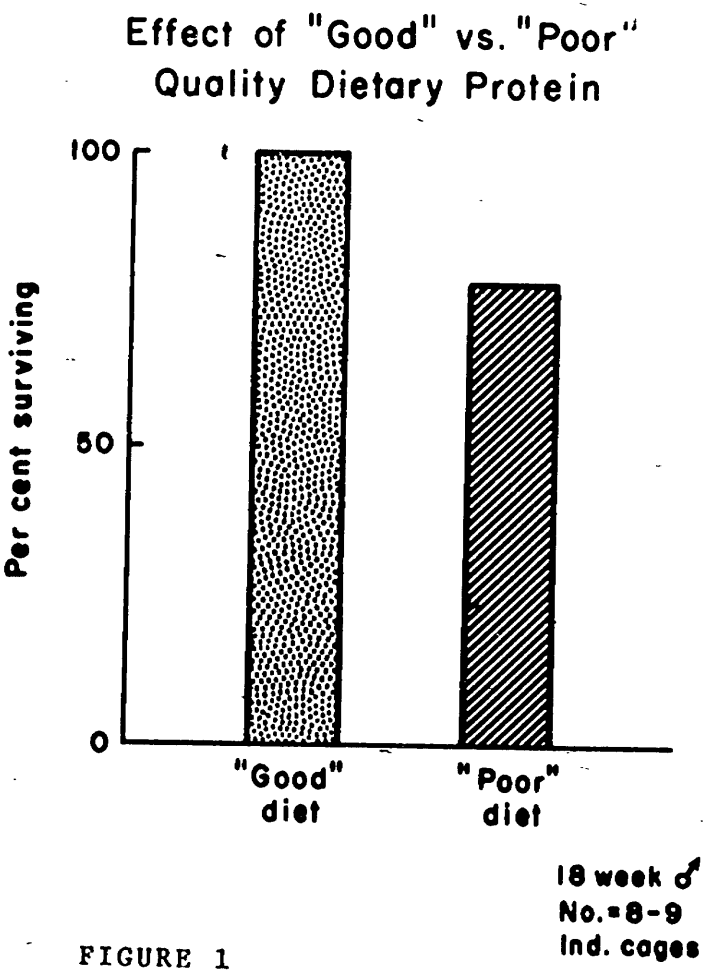

FIGURE 1

human exposures to such substances categorized by racial or economic class, that, in my opinion, there is a good chance that future studies will show this to be a result of being poor, not of being black.

The potential long-term consequences of this are, of course, not known, though the biochemical alterations known to occur in the livers and other tissues of birds after long-term exposure to the persistent (e.g., chlorinated hydrocarbon) pesticides certainly do not allow one to be completely sanguine. I have been interested in the consequences of multiple environmental stresses on the mammalian organism for some years. In fact, some of my recently completed research examined the effects of long-term exposure of mice to the persistent pesticides DDT and dieldrin, followed by one or another of a series of mild physiological stresses. (This research was carried out in the Department of Environmental Biomedicine at the Rockefeller University under the direction of Professor Rene Dubos.)

I would like to briefly report some of the results, since they clearly demonstrate two points, one specific and one general. The first point is an experimental demonstration in laboratory mammals that perhaps we should not be so certain that long-term exposure to persistent pesticides in humans will be absolutely "safe," especially when additional, nonchemical stresses are simultaneously present. The second point is that it is simply not adequate to deal with a single cause-effect chain of events when considering environmental insults and their potential health consequences on humans, particularly on these humans subject to a wide range of deleterious conditions.

It is always difficult to be brief when discussing one's own research, but I will try. Essentially, I fed mice rather low dietary levels of dieldrin or DDT for several weeks or months; these levels were sufficiently low that no direct toxic results were observed—growth and development were normal, no behavioral alterations were observed, and so forth.

After this exposure period, the animals were stressed in several ways. Almost without exception, the stress applied to non-pesticide fed animals caused little or no effect; the effect in the animals previously exposed to pesticides

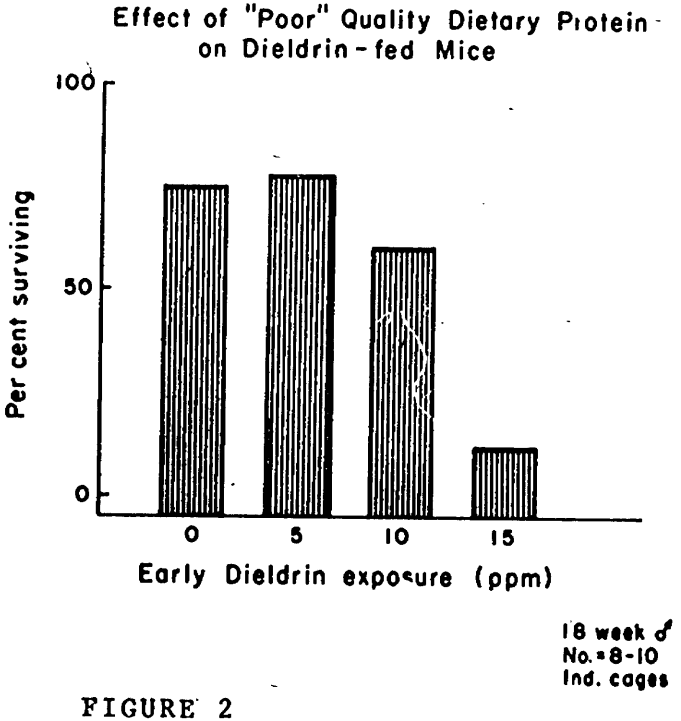

FIGURE 2

was quite another matter. In these experiments, I purposely selected physiological stresses that either are identical to, or very closely resemble those that occur in humans, particularly in the poor.

One type of stress common in the urban poor is an inadequate dietary intake of one or another nutrients; in the extreme, this results in complete food deprivation. I examined the effects of both of these stresses in dieldrin-fed animals. Figure 1 shows the mortality experience in male mice maintained on either a "good quality" protein diet or a "poor quality" protein diet for several weeks; both diets contained 5 parts per million dieldrin. After this period, the animals were stressed by placing them in "uncomfortable" cages known to produce mild physical discomfort. (It does not seem appropriate to include information on the strain of mice used, exact dietary compositions, statistical tests of significance and so forth in this statement; I would, however, be pleased to provide them on request.)

Figure 1 shows the mortality in each group. All of the animals on the "good" diet survived, while about one-fourth of those on the poor diet did not.

Another group of animals kept on the poor diet containing different amounts of dieldrin was similarly stressed after several weeks. About the same fraction of the non-pesticide fed animals and those fed 5 ppm died, while more of these fed 10 and 15 ppm, respectively died.

Finally, the mortality in animals completely deprived of food for several days, then fed, then deprived, etc., is shown in Figure 3. The results speak for themselves. The control animals were very resistant to this stress, while those exposed to 5 or 15 ppm dieldrin earlier in their lives were very sensitive.

Another combination of events used to stress pesticide-fed animals was exposure to a bacterial toxin (to mimic a mild bacterial disease) followed by a brief period of food deprivation. Young animals, exposed to the persistent pesticide for only 6 weeks, survived this well. (See Figure 4) Somewhat older animals, on the other hand were much more sensitive to both stresses, as shown in Figure 5.

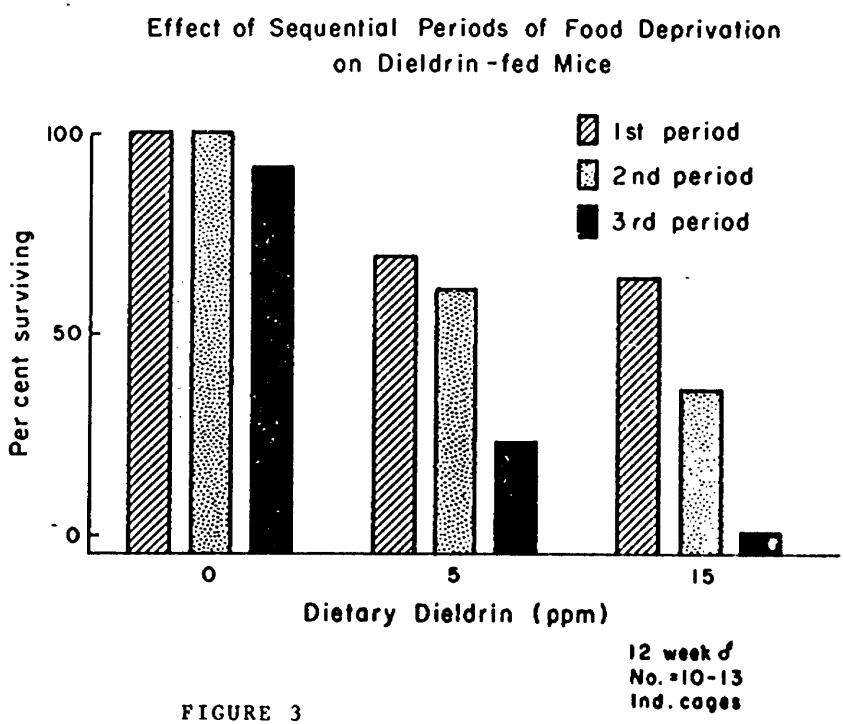

FIGURE 3

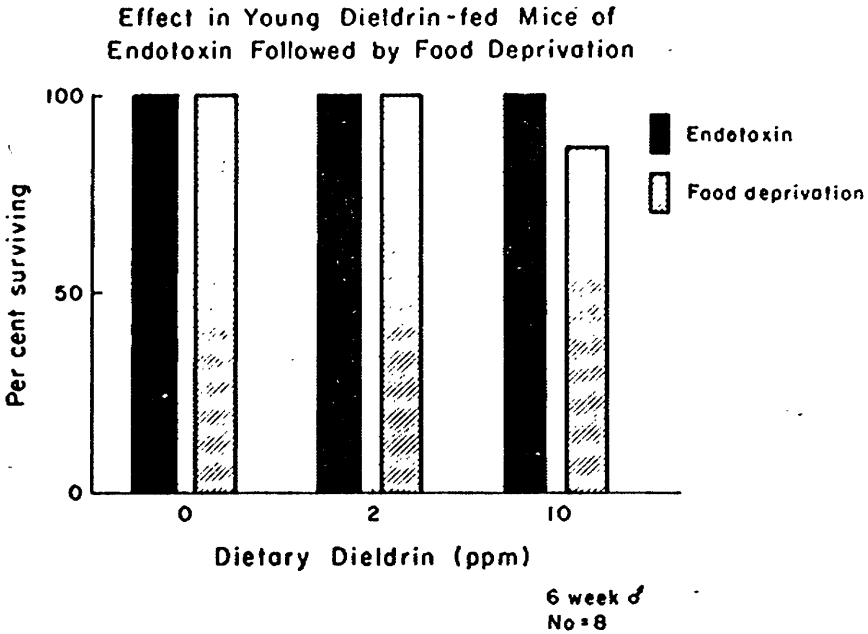

FIGURE 4

Somewhat older animals, on the other hand were much more sensitive to both stresses, as shown in Figure 5.

The cumulative mortality experience for both age groups is shown in Figure 6.

A strictly analogous experiment was conducted in animals fed DDT, with the same stresses imposed on one group after 6 weeks and a second group after 15 weeks. These results, shown in Figure 7, are less striking, but still strongly suggestive. This is particularly so since DDT is known to be much less toxic than dieldrin—as well as a more widely spread environmental contaminant.

Finally, one particularly interesting experiment mimiced even more closely than I had planned the conditions in the world outside the laboratory. An outbreak of mild infantile diarrhea "of unknown origin," probably viral in nature, occurred in one of our rooms where an experiment was already in progress. In this room female mice maintained on a good or poor protein diets with different pesticide contents had been allowed to give birth and were nursing their litters. This disease occasionally occurs in infant mice and usually causes no mortality in the young if the mother is receiving a good diet.

Figure 8 shows the mortality in the different groups of nursing young. None of the young nursing on mothers receiving the good diet with no added pesticide died. All other groups had a significant mortality. In general, those on the poor diet suffered more than those on the good diet; those on higher pesticide intakes fared worse than those on a lower intake. (I have no explanation for the anomalous result in the 5 ppm group on the good diet; perhaps the most reasonable conclusion is that it reflects the capricious nature of the biological effects of combinations of environmental and other stresses.)

I do not claim these results indicate that poor urban dwellers with increased exposure to pesticides are presently suffering from the kinds of effects I observed in these mice. On the other hand, these results certainly do not offer any assurance that serious biological consequences of a less dramatic nature do not exist. (Death, after all, is a drastic end-point for a combination of stresses. Other results—for example, biochemical changes in liver function—are certainly conceivable possibilities.)

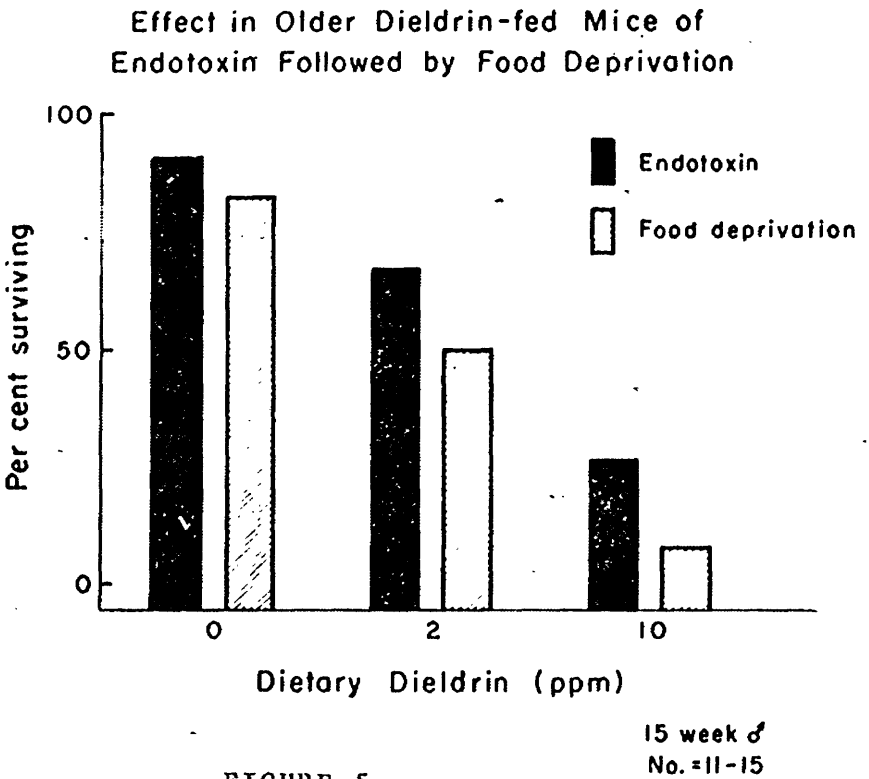

FIGURE 5

As I have stated before, few if any studies are being conducted to evaluate the possibility of this type of very indirect, multi-factorial effect on human health due to pesticides—or indeed due to the other environmental conditions we are discussing today.

CONCLUSION

We must use the best data and observations we have in designing policies and programs that deal effectively with the entire range of environmental conditions threatening human health, either directly or indirectly. Simultaneously, we must be aware that our scientific understanding of such matters is, and probably always will be, inadequate. But if our society is serious about these environmental problems, it must deal, as a top priority, with those members of our population who are most affected by these conditions, the urban poor.

Thank you for your attention.

Attachment A

PROJECT CAVEAT

CAVEAT, a Clean Air Vehicle Assurance Team to create a scientific counterforce to ever-present industry pressure for weaker pollution control standards.

THE PROBLEM

In 1970, history's most intensively fought legislative battle between environmentalists and the automobile industry was won by the public. Congress decided that to protect the public health it was necessary to write into law

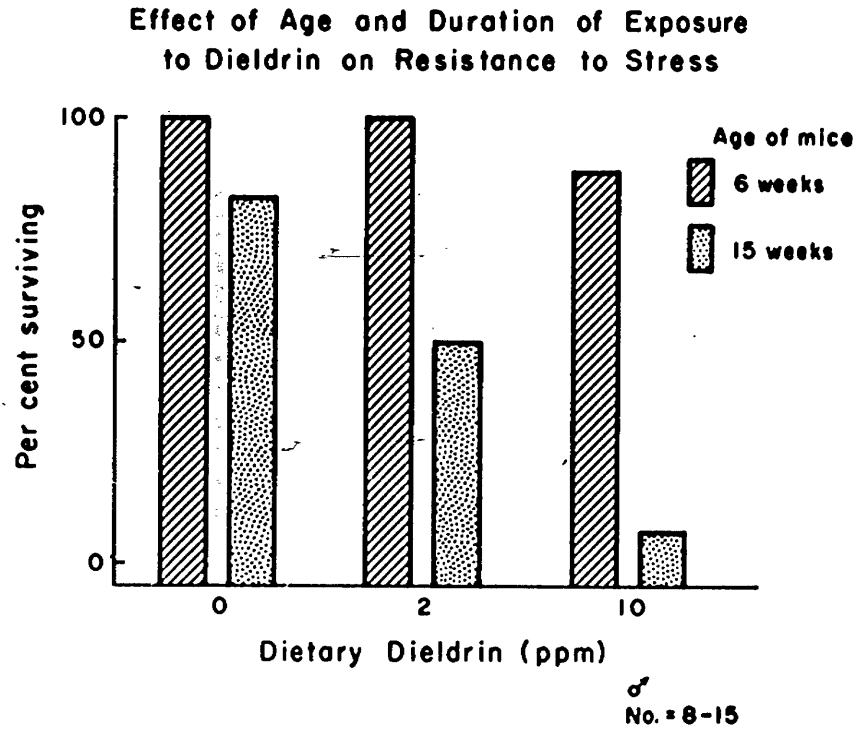

FIGURE 6

standards for 1975 model year automobiles requiring "a reduction of at least 90 per centum from emissions . . . allowable . . . in model year 1970." The subsequent regulations promulgated by EPA to implement this provision of the Act, however, do not require a 90 percent reduction of hydro-carbon (unburned gasoline) emissions. The adopted regulations permit more than twice as much hydrocarbon emissions as envisioned by Congress and necessary for the protection of the public health. The problem for the public and its only advocate, the environmentalists, is: How does the nation insure that the law will be met and the public health protected?

FACTS BEARING ON THE PROBLEM

1. Congress envisioned a standard of 0.22 grams per mile of hydrocarbon emissions from 1975 and later model year vehicles (as measured on the then new "closed cold" test procedure.) They correctly understood this standard to be necessary for protection of the public health. Yielding to industry pressure, EPA subsequently proposed an emission standard of 0.46 grams per mile hydrocarbons (also on the "closed cold" test procedure.) The Natural Resources Defense Council and the Center for the Study of Responsive Law protested, but industry pressure in the opposite direction was much stronger. EPA yielded still further to industry pressure and finally promulgated a standard supposedly comparable to 0.46 grams per mile but with a different numerical value of 0.41 grams per mile hydrocarbons. The new lower number looks like a more stringent standard but in reality is an even weaker standard because of a change in the measurement test procedure from a "cold" test to a "cold plus hot" test procedure.

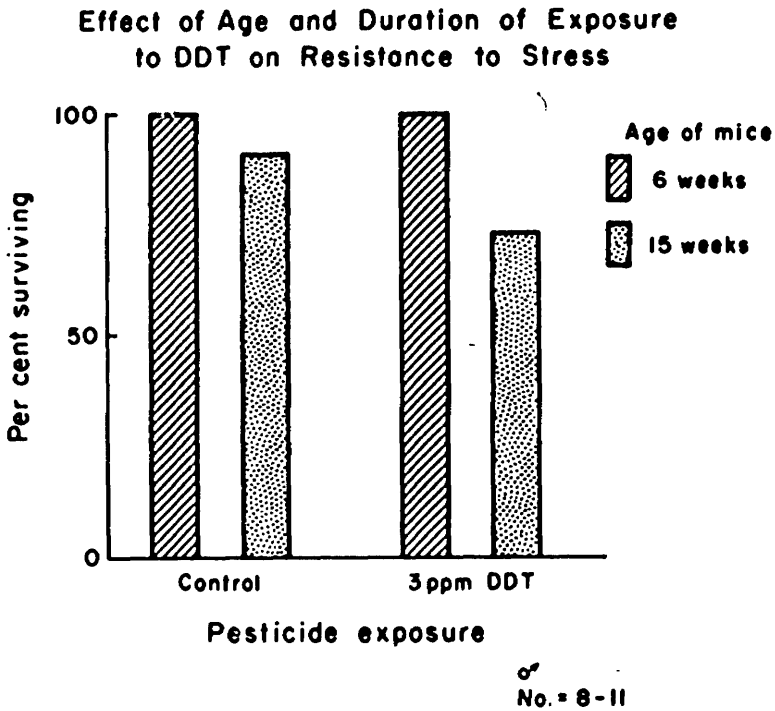

FIGURE 7

2. The latter "cold plus Hot" test procedure further increases the amount of pollution permissible from 1975 vehicles. This can be understood by a comparison with the previous closed cold test procedure. The closed cold procedure collected and measured only the emissions generated during a cold start (a vehicle started from room temperature or "cold" generates far more emissions of hydrocarbons and carbon monoxide than a vehicle started from a fully warmed up or "hot condition.) The new "cold plus hot" procedure also measures the high emissions generated during a cold start, but instead of stopping there and using these emssions as the measure of a vehicle's pollution characteristics, the new procedure goes on to measure the low emissions of a hot start and then average the two together to yield a lower measurement value. This average value of course creates the appearance that the vehicle emits less while actually permitting an increase in the mass quantity) of allowable emissions. The averaged value will always be much less than the high (undiluted) cold start value.

3. The significance of "cold" versus "cold plus hot" measurements can be appreciated with an understanding of the photochemical smog phenomenon.

The phenomenon of photochemical smog results when hydrocarbons and oxides of nitrogen emitted into the atmosphere are baked by the radiant energy of sunlight for several hours. The emissions generated during the morning hours by millions of automobiles on a sunny day results in the corrosive photochemical smog which reaches a peak in the early afternoon hours. These emissions caused by morning commuters are primarily cold start emissions. Cars which have been sitting dormant overnight are "cold" and the heaviest emissions are created during the morning startup. Thus, the aim historically has been to reduce cold start emissions to the point where there would not be enough chemicals in the atmosphere to support the photochemical reaction—the solution to the smog problem.

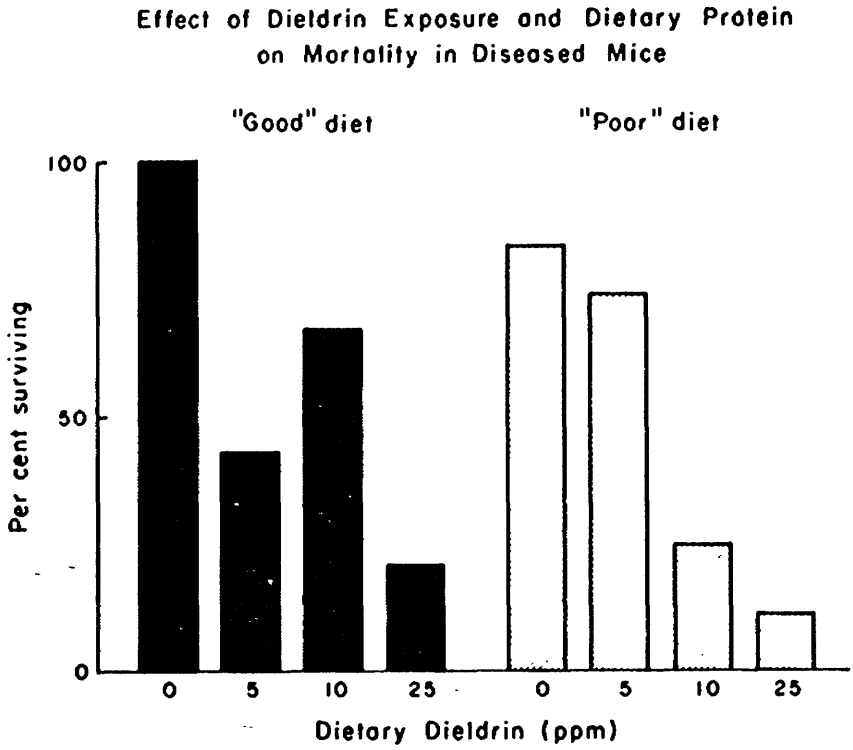

FIGURE 8

Prior to EPA's new regulation, during the entire twenty year history of motor vehicle pollution control efforts, standards were in terms of strictly cold start emissions. Hence the new EPA procedures, successfully pushed for by the automobile industry will control pollution to a far lesser degree than intended by Congress and not to the degree necessary to protect the public health.

4. Further efforts to erode the effectiveness of the 1970 Clean Air Act Amendments are also in progress by the automobile industry. EPA officials privately admit that they are about to allow 25,000 mile replacement of catalysts for 1975 model year vehicles rather than the 50,000 miles specified in the Clean Air Act and far less than the 100,000 miles needed by the public and originally sought by the Congress. EPA officials also have evinced a fatal wait-and-see approach toward the problem of assuring the durability and effectiveness of 1975 emission control systems. That this is fatal can be seen from the fact that vehicles built by Detroit are now exceeding the standard after only 4,000 miles, rather than meeting the standards for 50,000 miles as required. Fatal also because it is now estimated that more than 10% of the annual deaths in New York City can be attributed to air pollution.

DISCUSSION

The above facts show that the industry is pushing its own interests in a repeat performance of its successful efforts in California. In 1959 the California legislature passed a law empowering the State health agency to set automobile emission standards to restore the degree of air quality which existed in Los Angeles in 1940—by 1970!

That this action by the California legislature to protect the public health was in vain can be seen from the following figures:

ESTIMATED EMISSIONS FROM MOTOR VEHICLES IN TONS PER DAY, LOS ANGELES

	1940	1959	1970 [1]
Carbon monoxide	2,500	8,500	8,500
Hydrocarbons	600	1,800	1,500
Oxides of nitrogen	125	390	730
Total	3,225	10,690	[2] 10,730

[1] These estimated 1970 emissions are based upon the old open cycle test procedure and therefore substantially underestimate actual emissions by an undetermined factor which may be as high as two (2).
[2] Or 22,000?

The same evisceration of standards that went on in California during the 1960's is now, in the '70's, proceeding apace at the Federal level. If it continues unabated we will find in 1984, when the Congress envisioned we both could and should have clean air, we will be breathing at best the same amount of poisons in the air as we do today.

So much for the facts of the problem and their implications. The question now becomes what can and should be done to rectify the problem.

Project CAVEAT will produce the scientific evidence necessary to force EPA to carry out its responsibilities under the Clean Air Act. CSPI is exploring legal methods to require EPA to enforce the law. The scientific community will be challenged by CSPI to examine EPA's actions and support efforts to obtain emission standards and test procedures capable of attaining the air quality levels necessary to protect the public health.

Attachment B

In the United States District Court For the District of Columbia

Civil Action No.

NATURAL RESOURCES DEFENSE COUNCIL, INC., 1600 TWENTIETH STREET, N.W., WASHINGTON, D.C. 20009, AND CENTER FOR SCIENCE IN THE PUBLIC INTEREST, 1346 CONNECTICUT AVENUE, N.W., ROOM 812, WASHINGTON, D.C. 20036, PLAINTIFFS,

v.

WILLIAM D. RUCKLESHAUS, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C., DEFENDANT.

Complaint
(Mandamus; Declaratory Judgement)

1. This is a civil suit to require the Administrator of the Environmental Protection Agency (EPA) to promulgate regulations requiring a reduction, sufficient to comply with the mandate of Public Law 91-604, the Clean Air Amendments of 1970, in emissions of hydrocarbons from automobiles and automobile engines manufactured during or after model year 1975.

2. This Court has jurisdiction of this action under 5 U.S.C. §§ 701-706, 28 U.S.C. §§ 1331, 1337 (Commerce Regulation), 1343 (Civil Rights), 1361 (Mandamus), 2201-2202 (Declaratory Judgements), and section 304 of the Clean Air Act, as amended (sec. 12, Public Law 91-604, 84 Stat. 1706).

3. The amount in controversy, exclusive of interest, fees, and costs, exceeds ten thousand dollars.

4. PLAINTIFF NATURAL RESOURCES DEFENSE COUNCIL, INC. (NRDC), is a nonprofit corporation organized under the laws of the State of New York, with offices at 36 West 44th Street, New York, New York, and 1600 Twentieth Street, N.W., Washington, D.C. NRDC is a national organization dedicated to the preservation and defense of the human environment and natural resources of the United States. NRDC's Board of Trustees is composed of lawyers, scientists, and other citizens interested in protecting the environment. Among NRDC's objectives are: (a) to provide a central, national focus for

lawyers, scientists, and concerned citizens in an effort to make our courts and administrative agencies effective instruments of environmental protection; (b) to undertake environmental cases which have a potential for establishing widely applicable precedent or for saving or reclaiming some important aspect of our national endowment; (c) to provide legal advice and assistance, where appropriate, to conservation groups and environmental lawyers throughout the United States; and (d) to monitor the federal departments and regulatory agencies to ensure that the public interest in protecting the environment is fully considered in their administrative actions.

In carrying out the last of these objectives NRDC sponsors the Project on Clean Air, a national program to enfure effective federal and State enforcement of the Clean Air Amendments of 1970, and promotes the broadest and most informed public participation in preparation of State implementation plans under the Clean Air Amendments. The Project in consultation with the Scientists' Institute for Public Information, a national coalition of distinguished scientists across the country, has submitted public Comments on six separate EPA rule making proposals under the Clean Air Amendments. One of these Comments dealt specifically with the subject matter of this action and two other Comments concerned additional aspects of automotive emissions.

5. Plaintiff CENTER FOR SCIENCE IN THE PUBLIC INTEREST (CSPI) is a non-profit tax-exempt organization incorporated under the laws of the District of Columbia. CSPI is dedicated to providing unbiased scientific and technical information to the public and has focussed particularly on environmental and consumer protection issues. Included in CSPI's activities relating to air pollution are a project to identify the major industrial sources of fluorides air pollution throughout the United States, studies presented to EPA regarding the phasing out of lead in automotive fuels, and studies presented to the Federal Trade Commission regarding the posting of octane number on retail gasoline pumps. Dr. James B. Sullivan, a director of CSPI also serves as the Chairman of the Advisory Committee for Air Pollution Control in the District of Columbia.

6. Plaintiffs sue on their own behalf and as representatives of a class consisting of all persons in the United States who are or may be exposed to concentrations of hydrocarbons or photochemical oxidants in the ambient air at levels in excess of the primary or secondary national ambient air quality standards promulgated by EPA pursuant to the Clean Air Act, as amended (42 U.S.C. 1857 *et seq.*). As a result of defendant's acts and omissions alleged in this complaint, this class and each individual member thereof will continue to suffer exposure to above mentioned air pollutants at levels causing or contributing to the endangerment of public health or welfare in deprivation of rights, privileges, and immunities secured by the Constitution of the United States and the Clean Air Act, as amended.

7. Plaintiffs represent a class of persons to so numerous that joinder of all is impracticable. They complain of acts and refusals to act on the part of defendants in ways which affect all members of their class similarly. There exist questions of law and fact common to each member of the class. The claims of the representative parties are typical of the claims of the class which they represent. The representative parties will fairly and adequately protect the interest of each member of the class represented.

8. Defendant William D. Ruckleshaus is Administrator of the Environmental Protection Agency. He is required by section 202 of the Clean Air Act, as amended by the Clean Air Amendments of 1970 (sec. 6, Public Law 91-604, 84 Stat. 1690) to promulgate regulations requiring the control of emissions of air pollutants from new motor vehicles and new motor vehicle engines.

GENERAL ALLEGATIONS

9. Section 109 of Title I of the Clean Air Act, as amended by the Clean Air Amendments of 1970, P.L. 91-604, 84 Stat. 1679 (hereafter the Clean Air Act) requires the Administrator to promulgate regulations establishing National Ambient Air Quality Standards (hereafter Air Quality Standards) for each air pollutant for which air quality criteria have been issued. Primary Air Quality Standards are required to be set at levels adequate to protect human health. Secondary Air Quality Standards are required to be set at levels adequate to protect the public welfare.

10. Title I, Section 110 of the Clean Air Act, (84 Stat. 1680) requires each State to prepare and submit to the Administrator for approval a plan which provides for the attainment within the State's boundaries of the Air Quality Standards prescribed by the Administrator.

11. Section 202 of the Clean Air Act requires the Administrator to prescribe standards for emissions from new motor vehicles. Emission standards are required for any air pollutant which "causes or contributes to, or is likely to cause or contribute to, air pollution which endangers the public health or welfare." (84 Stat. 1690). Section 202 of the Clean Air Act further requires the Administrator to prescribe standards for emissions of carbon monoxide (CO) and hydrocarbons (HC) from model year 1975 light duty motor vehicles (hereafter "automobiles"). These latter standards must be set at levels (1) which represent a reduction of at least 90 per centum from emissions allowable under the standards applicable to model year 1970 automobiles, and (b) which (without regard to steps such as automobile inspections or restriction on automobile use, taken by the States pursuant to Title I of the Clean Air Act to control automobile emissions) insure the attainment of the corresponding Primary Air Quality Standards established pursuant to Title I of the Clean Air Act. Thus, the Administrator is required to promulgate a standard for HC emissions from model year 1975 automobiles which is sufficiently stringent to insure that the Primary Air Quality Standards for HC and for Photochemical Oxidants will be met when all automobiles are in compliance with the standard.

12. On April 30, 1971, the Administrator established by regulation (36 Fed. Ref. 8186) Primary Air Quality Standards for HC and for Photochemical Oxidants as follows:

Pollutant	Primary standard
Photochemical oxidants	160 micrograms per cubic meter (0.08 p.p.m.) maximum 1 hr. concentration not to be exceeded more than once per year.
Hydrocarbons	160 micrograms per cubic meter (0.24 p.p.m.) maximum 3 hr. concentration (6 to 9 a.m.) not to be exceeded more than once per year.

13. On July 2, 1971, the Administrator prescribed by regulation (36 Fed. Reg. 12657) the standard for exhaust emissions of HC from model year 1975 automobiles as follows:

HC=0.41 grams per mile (gm./mi.)

14. The standard of 0.41 gm./mi. for HC is too high to insure the attainment of the Primary Air Quality Standards for HC or for Photochemical Oxidants as required by section 202 of the Clean Air Act.

15. The failures as alleged in paragraphs 13 and 14 of the Administrator to perform acts and duties under the Clean Air Act which are not discretionary with the Administrator have caused plaintiffs and those they represent to suffer and to continue to suffer injury for which there is no adequate remedy at law.

16. On August 1, 1971 Plaintiff Natural Resources Defense Council, Inc. gave notice to the Administrator of its intention to bring this action pursuant to section 304 of the Clean Air Act (84 Stat. 1706).

Prayer For Relief

A. DECLARATORY JUDGEMENT

Wherefore plaintiffs respectfully pray that:

17. This Court declare that the emission standard for HC for model year 1975 automobiles promulgated by the Administrator fails to achieve the automotive emission reductions mandated by § 202 of the Clean Air Act (84 Stat. 1690) and is, therefore, null and void.

B. MANDAMUS

Further plaintiffs respectfully pray that:

18. This Court direct the Administrator to establish an emission standard for HC for model year 1975 automobiles consistent with the mandate of the Clean Air Act, as amended, 42 U.S.C. §§ 1857 *et seq.*

C. COSTS

Further, plaintiffs respectfully pray that:

19. This Court award costs of litigation (including reasonable attorney and expert witness fees) to the Palintiffs.

Finally, plaintiffs respectfully pray that:

20. This Court grant such other and further relief as shall be deemed necessary and proper.

Respectfully submitted,

DAVID G. HAWKINS,
EDWARD L. STROHBEHN, JR.,
Attorneys for Plaintiffs,
Natural Resources Defense Council, Inc.
1600 Twentieth Street, N.W., Washington, D.C. 20009.
(202) 387-2855.

JOHN ESPOSITO,
Of Counsel

Attachment C

CENTER FOR THE STUDY OF RESPONSIVE LAW
Washington, D.C., March 15, 1971.

OFFICE OF THE ACTING COMMISSIONER,
Air Pollution Control Office,
Environmental Protection Agency,
Parklawn Building,
Rockville, Md.

DEAR COMMISSIONER: Enclosed please find comments (in triplicate) concerning the proposed primary and secondary ambient air quality standards (42 CFR 410) for your careful consideration.

Sincerely yours,

RALPH NADER.

COMMENTS CONCERNING PROPOSED PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARD: (42 CFR 410)

GENERAL CONSIDERATIONS

Section 109 of the Clean Air Act (Public Law 91-640), as amended December 31, 1970, requires that the Administrator of the Environmental Protection Agency promulgate national primary ambient air quality standards based upon (1) the findings contained in the Air Quality Criteria documents regarding the adverse health effects of specific pollutants and (2) an allowance for an "adequate margin of safety" between the figures in the criteria documents and those proposed as standards.

The same section of the Act requires that national secondary ambient air quality standards shall be based upon the Criteria documents and that they shall protect the nonhealth related aspects of public welfare from any known or anticipated adverse effects of the various pollutants.

These guidelines grew out of a recognition by Congress of the limitations of the Air Quality Criteria documents. Generally, the proposed standards fail to reflect adequate attention on the part of the Administrator to these guidelines in the following ways:

1. Often they do not provide for an adequate margin of safety which is necessary because of the incomplete knowledge concerning the full extent of the hazards presented by various pollutants.

2. In some cases they overlook documented evidence of special dangers presented to particularly susceptible groups such as the very young, the aged or persons with illnesses.

The report of the Senate Committee on Public Works on the National Air Quality Standards Act of 1970 (91st Congress, Second Session, Report No. 91-1196) is quite explicit about the need to include adequate margins of safety in the air quality standards. The Report states, on p. 9:

In setting such air quality standards the Secretary [now the Administrator] should consider and incorporate not only the results of research summarized in air quality criteria documents, but also the need for margins of safety. Mar-

gins of safety are essential to any health-related environmental standards if a reasonable degree of protection is to be provided against hazards which research has not yet identified.

The criteria documents themselves emphasize the limitations of their conclusions. Five of the six documents issued to date conclude with a paragraph which is identical or virtually identical to the following, excerpted from the Criteria document for nitrogen oxides (Chapter 11M):

It is reasonable and prudent to conclude that, when promulgating ambient air quality standards, consideration should be given to requirements for margins of safety that would take into account possible effects on health, vegetation, and materials that might occur below the lowest of the above levels.[1]

The Senate report also made it clear that primary ambient air quality standards should be formulated with reference to members of the most sucepti-ble groups. The report stated, on p. 10, that,

. . . the Committee emphasizes that included among those persons whose health should be protected by the ambient standard are particularly sensitive citizens such as bronchial asthmatics and emphysematics who in the normal course of daily activity are exposed to ambient environment.

THE PROPOSED PRIMARY AIR QUALITY STANDARDS

. . . in 1971, not one grain of dust, not one liter of gaseous pollution has yet been removed from the atmosphere of this Nation as a direct result of the 1967 air legislation. (Speech before the National Press Club, Washington, D.C., January 12, 1971 by William D. Ruckelshaus, Administrator, Environmental Protection Agency)

It is suggested that unless the proposed standards are drastically revised, the same speech could be made in 1975 with reference to the 1970 Amendments to the Clean Air Act. Virtually all of the proposed standards are inconsistent with the guidelines and considerations outlined above. In addition, they fail to respond to the policy considerations outlined in the 1967 and 1970 air pollution legislation. Those pieces of legislation were intended to provide federal leadership in the establishment of air pollution control standards and clean-up plans. Therefore, it is ironic that the proposed standards very often represent a retreat from standards which have already been adopted by the states and submitted to the federal government for approval.

Sulfur oxides:[2] The proposed maximum 24 hour concentration of SO_x is 365 $\mu g/m^3$. This figure is on its face only slightly below the Air Quality Criteria for sulfur oxides. The Criteria document states, at Chapter 10βld (with Errata sheet): "At concentrations rising from *300 g/m³ to 500 g/m³* [i.e. starting at 288 $\mu g/m^3$ when corrected to a reference temperature of 25° C] of sulfur dioxide (24-hour mean), present for 3-4 days with low particulate levels, *increased hospital admissions* of older persons for respiratory disease may occure; *absenteeism* from work, particularly with older persons, may also occur." (Emphasis in original.) When a 24 hour maximum is calculated from the 4 day overaging time, using the Larsen model, the range in which effects could be possible is 369 to 443 $\mu g/m^3$.[3] The proposed standard would permit ambient air levels of 365 $\mu g/m^3$ for a 24 hour maximum; this allows an infinitesmal margin of safety of 4 $\mu g/m^3$. The standard should be revised to provide a margin of safety that can appropriately be termed adequate.

The proposed annual arithmetic mean standard for SO_x is 80 $\mu g/m^3$. The Criteria document (Chapter 10βlg) indicates that adverse health effects have been observed at concentrations of 97.5 $\mu g/m^3$ (this figure corrected for new

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[1] One exception is the Criteria document for hydrocarbons. That report does not close with a version of the paragraph quoted above. The reason for this exception is not clear. However, since hydrocarbon pollution is a matter of public concern primarily because of the relationship between hydrocarbon levels and levels of photochemical oxidants, the omission is unimportant. The Criteria document for photochemical oxidants does close with a paragraph identical to the one quoted in the text.

[2] The proposed standard for sulfur oxide as it appears in the *Federal Register* Vol. 36 No. 21, January 30, 1971 indicates that all measurements of air quality are corrected to a reference temperature of 20° C and to a reference pressure of 760 mm of mercury. We were informed by a staff member of APCO in Durham that the temperature correction should have been 25° C. The Criteria document for SO_x utilizes numbers based on a reference temperature of 0° C. In order to convert the criteria level numbers comparable to the proposed standard, the following APCO formulation was utilized: at 25° C and 760 mm of Hg. 1 ppm SO_x = 2618 ug/m³.

[3] Per R.J. Freeman, APCO, Durham, 2/16/71 chart of "Aerometric Relationships for Specific Sulfur Oxide Criteria Values."

reference temperature; 105 $\mu g/m^3$ at 0° C). The proposed standard appears to be uncomfortably close to the figure contained in the Criteria document at which an increased level of respiratory disease has been noted. In addition, the 80 $\mu g/m^3$ standard [at 25° C] is more permissive than any standard proposed and/or adopted by 25 air quality control regions as of December 16, 1970. In a number of cases many states have already set standards which are nearly twice as stringent as the proposed federal level. This appears to be a diminution of the extremely modest federal leadership which has been exercised since 1967.

Particulates: The proposed annual geometric mean standard for particulates is 75 $\mu g/m^3$. As is the case with SO_x this proposed standard is only slightly below the health effect level cited in the Air Quality Criteria. That document states, at Chapter 12Bg (with (Errata): "Where concentrations range from *80 $\mu g/m^3$* to *100 $\mu g/m^3$* for particulates (annual geometric mean) with sulfation levels of about 0.3 $\mu g/cm^2$ mo., *increased death rates* for persons over 50 years of age may occur." In addition the proposed standard is more permissive than the standards proposed and/or adopted in 16 air quality regions which had submitted their standards as of December 16, 1970.

Carbon monoxide: The proposed maximum 8 hour concentration for carbon monoxide is 10 mg/m^3. The Criteria report states, at Chapter 10K: "An exposure of 8 or more hours to a carbon monoxide concentration of 12-17 mg/m^3 (10-15 ppm) will produce a blood carboxyhemoglobin level of 2.0-2.5% in nonsmokers. This level of blood carboxyhemoglobin has been associated with adverse health effects as manifested by impaired time interval discrimination." Given these findings, concern for an adequate margin of safety would have led to proposing a more stringent standard for more susceptible groups such as victims of heart disease, smokers, and persons who suffer from respiratory illness.

Photochemical oxidants: The maximum 1 hour concentration for photochemical oxidants is 125 $\mu g/m^3$. Here again the difference between the number contained in the Criteria document and the proposed national standard is so small as to be insignificant. Inadequate consideration has been given to the need for a margin of safety in view of one of the major conclusions of the photochemical oxidant Air Quality Criteria document: "Under conditions prevailing in the areas where studies were conducted, adverse health effects, as shown by the impairment of performance of student athletes, occurred when the hourly average oxidant concentrations exceeded 130 $\mu g/m^3$ [Chapter 10L.]" The proposed standard is more permissive than the one hour maximum concentration standards for photochemical oxidants proposed and/or adopted in 18 out of 23 air quality regions as of November 16, 1970.

Hydrocarbons: The proposed maximum 3 hour concentration (6-9 a.m.) for hydrocarbons is 125 $\mu g/m^3$. The Criteria document states that under certain meteorological conditions a 3 hour hydrocarbon concentration of 200 $\mu g/m^3$ might produce an average 1 hour photochemical oxidant concentration of up to 200 $\mu g/m^3$. The document indicates that measurements were confined to 200 $\mu g/m^3$ because of instrumentation limitations. However, it goes on to read "If the functional relationship between the hydrocarbon and photochemical oxidant measurements were extended to include the lowest levels at which photochemical oxidant has been observed to adversely affect human health, the corresponding hydrocarbon concentration would be approximately 130 $\mu g/m^3$ [Chapter 8I with Errata] . . ." The proposed standard provides an extremely slim margin of safety.

Nitrogen dioxide: The proposed 24 hour maximum is 250 $\mu g/m^3$ and the proposed annual arithmetic mean is 100 $\mu g/m^3$. The corresponding figures from the Criteria documents are 284 $\mu g/m^3$ and 117 $\mu g/m^3$ respectively [Chapter 11M]. The Criteria report for nitrogen oxides indicates that at these approximate levels an increased incidence of acute respiratory disease can be expected in family groups. Again, the adequacy of the margin of safety must be questioned.[4]

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[4] In a February 1, 1971 memo to the Director of the Division of Air Quality and Emission Data, J. B. Clements stated that "It is quite true . . . that the use of micrograms per cubic meter is difficult and on occasion is technically incorrect . . . It is my opinion that workers will continue to use volume per unit measurement by converting $\mu g/m^3$ to ppm."

This appears to place an unnecessary and time-consuming burden on workers in the field—and on citizens who may want to testify—that could easily be overcome by APCO's expressing standards in both ppm and μ/m^3, as is done in most of the Criteria documents. In that way, data on gaseous air pollutants would be more readily comparable and fewer errors might be made in converting figures.

PROPOSED SECONDARY AMBIENT AIR QUALITY STANDARDS

The proposed primary ambient air standards provide unacceptable protection from potential adverse health effects and will therefore require revision in order to conform to the requirements of the Clean Air Act. The process of revision and re-evaluation will necessarily entail a corresponding revision of the proposed secondary standards, many of which seem to be set at levels which would generally be acceptable for use as primary standards.[1] But the levels are unacceptable as secondary standards. For instance, the proposed secondary standard (annual geometric mean) for particulates is 60 $\mu g/m^3$. The Criteria document for particulates notes non-health related effects beginning precisely at the same point, 60 $\mu g/m^3$. The report states [Chapter 12B4] that "At concentrations ranging from *60 $\mu g/m^3$* (annual geometric means), to *180 $\mu g/m^3$* for particulates (annual geometric mean), in the presence of sulfur dioxide and moisture, corrosion of *steel and zinc* panels occurs at an accelerated rate." The proposed secondary ambient air standards for SO_x (national 24-hour concentration) is 260 $\mu g/m^3$. The criteria report for SO_x states [Chapter 10B2] that "At a concentration of *285* $\mu g/m^3$ [i.e. 262 $\mu g/m^3$ when corrected for temperature] of sulfur dioxide, with comparable concentration of particulate matter in relative humidity of 50%, visibility may be reduced to about 5 miles."

For the four other pollutants, secondary standards have not been set at levels more stringent than the primary standards since "adverse welfare effects have not been observed at levels below the levels of the proposed primary standards" (*Federal Register*, Vol. 36, No 21). This is totally inconsistent with Sec. 109 of the 1970 Clean Air Amendments which states that the Administrator of EPA should set secondary standards at levels that he judges are necessary to "protect the public welfare from any *known or anticipated* adverse effects" of a pollutant. [Emphasis added]

The proposed standards evidence a tendency on the part of the Administrator to consider the conclusions in the various Air Quality Criteria Reports as the final word concerning the dangers of air pollution. However, the Criteria potential effects. The Criteria are essentially compilations of those studies reports were intended to summarize the best *available* studies of the effects of pollution. The reports do *not*—indeed they could not—document all of the which already have been conducted and do not take account of effects which are not easily measured (e.g. genetic effects) or those for which data is incomplete.

The weight of increasing scientific evidence is that what we know about air pollution is only a fraction of what must be learned, and the trend of the evidence is that new findings will be even more troublesome than existing knowledge.

The Administrator's duty in this context is to exercise the greatest degree of administrative caution by revising the proposed standards to include wider margins of safety, and to take into account reasonably anticipated adverse effects of the various air pollutants.

Attachment D

NATURAL RESOURCES DEFENSE COUNCIL, INC.

(By Richard E. Ayres, Mar. 16, 1971)

The Clean Air Amendments of 1970 represent one of the strongest statements of public policy ever adopted by a Congress. Seldom does Congress

[1] In fact, many regions had already proposed or set standards by December 1970 that are as stringent or more stringent than the Federally proposed secondary levels:

Standard	Number of regions proposing standards as stringent or more stringent than the federally proposed secondary levels	
Sulfur oxides	17	[Annual arithmetic mean]
Particulates	8	[Annual geometric mean]
Carbon monoxide	8	[Maximum 8 hour concentration]
Photochemical oxidants	13	[Maximum 1 hour concentration]
Hydrocarbons	15	[Maximum 3 hour concentration]

express its desires so clearly and unequivocally, and with such force as it did in this Act. It is thus of the utmost importance that the administrative regulations promulgated under the Act, such as the national ambient air standards, implement embody the full force of the Congressional mandate. Although the proposed standards do go much further than might have been imagined a few years ago, they do not take full advantage of the authority to rid the air of pollution granted in the Act.

I. LEGISLATIVE MANDATE

To show how much further the standards should go requires an examination of the statute and its legislative history. The statutory section under which the proposed standards were promulgated, §109(b)(1) and (2) of the Act, 42 U.S.C. §1857 et seq., as amended (1970), requires that the Administrator of EPA set national "primary" ambient air standards which, "allowing an adequate margin of safety, are requisite to protect the public health;" and that "secondary" standards be promulgated sufficient to "protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air."

Congress made it clear that these values were to prevail over considerations of cost and inconvenience, not to be balanced against them, as under previous pollution control legislation. In the Report accompanying the Senate bill, which is the major expression of Congressional intent regarding the Act as finally enacted, the Committee stated:

"The protection of public health . . . will require major action throughout the Nation. Many facilities will require major investments in new technology and new processes. Some facilities will need altered operating procedures or a change of facilities. Some facilities may be closed.

"If the Nation is to continue to depend on individual use of motor vehicles, such vehicles must meet high standards . . . As much as seventy-five percent of the traffic may have to be restricted in certain large metropolitan areas if health standards are to be achieved within the time required by this bill." *Senate Committee on Public Works*, National Air Quality Standards Act of 1970, *S. Rep. No. 91-1196, 91st Cong., 2d Sess.* 2 (1970).

1. "Public health". In adopting public health as the primary criterion for setting standards, Congress made quite clear that it meant this term to be construed broadly for the benefit of the people. The Senate Committee Report, accompanying the Senate bill (with the same standard), made clear that by protection of health the Act meant the safeguarding of all persons who are not so sick or young or otherwise susceptible as to require special artificial environments, even those who have diseases rendering them especially vulnerable to airborne pollutants:

"The Committee emphasizes that included among those persons whose health should be protected by the ambient standard are particularly sensitive citizens such as bronchial asthmatics and emphysematics who in the normal course of daily activity are exposed to the ambient environment." *Sen. Rept.* 10.

2. "Public Welfare". Secondary standards were adopted to protect other values besides health from deterioration. Welfare was intended to be given the broadest possible reading:

". . . effects on soils, water, vegetation, manmade materials, animals, wildlife, visibility, climate, and economic values." *Sen. Rept.* 11.

And in describing the research efforts to be undertaken to discover the effects of pollution on welfare values, the Committee said:

"The bill would provide for furtherance of knowledge on welfare effects, including effects on vegetation, animals, wildlife, buildings, structures, and materials. This research effort should extend into welfare effects and aesthetics in their broadest definition, including the economy, visibility, weather, and climate." *Sen. Rept.* 7.

3. Compensation for Lack of Knowledge. Congress recognized that to a considerable extent, it must legislate while the full effects of air pollution were only beginning to be understood, and at a time when air pollution effects were being discovered at ever lower levels of pollution. Thus the Act directs that error be made on the side of caution. Primary ambient standards are to be set so as to give an "adequate margin of safety". Secondary standards are to protect the public from "known or *anticipated*" effects [emphasis added]. Standards are to be reviewed regularly:

"The Committee believes that criteria and control technology documents should be periodically reviewed and re-issued to ensure currency." *Sen. Rept.* 9.

In short, the Act requires the Administrator to go further than merely to protect the health and welfare of the general public against presently known hazards. For the most part, the proposed standards would accomplish this goal. But the Act requires more. It requires that even the least tolerant groups in society, so long as they must expose themselves to the ambient air, must be protected against harm. And it adopts the most prudent position possible for dealing with our present dearth of knowledge: namely, that standards should provide a considerable margin beyond what is now known to be necessary to protect health and welfare, and that knowledge should be gained as rapidly as possible, and incorporated quickly into the national ambient air quality standards.

II. GENERAL COMMENTS

The ambient air standards ultimately promulgated by the Administrator will comprise an extremely important document—the basis from which federal and State enforcement will begin. Much of the detail which will govern the actual effect of the statute will be part of the federal implementation plan, and therefore should not appear in the standards document. But certain additional provisions should be included in the national air quality standards document to make it clear that the standards will be administered in the spirit which pervades the Act.

First, the regulations should explicitly provide for regular review and revision at stated intervals—perhaps yearly or every two years. Earlier review and revision should, of course, remain possible as soon as warranted by new information.

Congress recognized that much remained to be learned about the effects of air pollution in particular about the effects of long term exposure to pollutants. In §103 of the Act it provided funds to be spend for this purpose. The use of terms such as "anticipated effects" and "margin of safety" demonstrate Congress' fear that harmful effects might occur at concentrations well below those now considered dangerous. One of the clearest implications of the survey study by The Scientist's Institute accompanying these comments is that much more research must be done before we know the full price we pay for polluted air, and therefore that standards adopted now must be reviewed periodically as findings accumulate. Providing a definite review time, while it would not prevent earlier review, would help assure that the results of new studies were continuously integrated into the national ambient air standards.

Second, the regulations should explicitly note that the proposed standards are maxima, and do not license states to allow pollution of presently less polluted areas. A statement of this sort contained in the standards document would be a further step towards implementing the intent of Congress described by the Senate Report in its comments regarding the setting of national air quality standards:

"In areas where current pollution levels are already equal to, or better than, air quality goals, the Administrator should not approve any implementation plan which does not provide, to the maximum extent practicable, for the continued maintenance of such ambient air quality." *Sen. Rept.* 11.

In furtherance of this intent, the ambient air quality standards should explicitly state that because of the legislative history of the Act, in air quality regions where present levels of pollutants are lower than the national standards the present levels shall constitute the federal standards of ambient air quality for those regions.

Finally, the regulations should make explicit what is now only implicit in the manner of stating the standards: that these standards are to be observed regardless of meteorological conditions (such as inversions). Where inversions would cause a region to exceed the maximum concentration for any pollutant more than the "once per year" provided for in the standards, the standards should make it clear that emergency procedures, including temporary shutting down of manufacturing plants, traffic controls, or other measures provided for in implementation plans must be taken to ensure that the maxima are not exceeded. The standards should make it clear that they are not merely goals, but rather commands, which cannot legally be exceeded except during the period allowed by a duly authorized implementation plan and in compliance with the schedule contained in such a plan.

III. SPECIFIC COMMENTS

A. *Primary Standards.* According to the statute, primary standards must "protect the public health" and give an "adequate margin of safety." As the accompanying report of The Scientist's Committee suggests, for the purposes of the proposed standards, this statutory command appears to have been interpreted to mean that the highest allowable concentrations of each pollutant should be set at or slightly below the level shown by presently available research to produce adverse health consequences. It is doubtful whether such standards can meet the statutory mandate.

The Senate made it quite clear in Committee what they meant by protecting "health." They meant, as pointed out above, that the protection was to extend to the most sensitive groups (among those exposed to the ambient air) in the public. The Senate bill did not contain any provision for a "margin of safety." In the Conference version of the bill, the conferees added to the language of the Senate bill the proviso that ambient air standards should give an "adequate margin of safety." Thus the Act as passed means that any ambient air standard should provide an adequate margin of safety beyond the level necessary to protect the health of the most susceptible groups.

Of course, the levels of pollutants which produce adverse health effects in the most susceptible groups are in most cases now known. In the absence of data about how much more susceptible groups such as asthmatics and emphysematics are, however, the intent of Congress throughout the act—to err on the side of health[1]—plus the requirement of a margin of safety, should dictate standards substantially more protective than the lowest levels known to be hazardous to less susceptible groups.

For these reasons, we suggest that, until enough research has been done to establish clearly what will be necessary to protect the more susceptible members of society, no standard should allow a concentration of any pollutant more than 75% of the concentration known to be harmful to the health of normal people. Of course, research should go forward immediately to determine what levels are hazardous to susceptible groups: neither industry nor the public should be penalized because of insufficient knowledge.

Primary Standards—Other comments

(1) *Particulate Matter Standards.* The standard for particulate matter does not include any standard concerning the size of particles which are permitted. As the attached Scientist's Institute paper points out, the harmful effect on health of particulate matter in the air depends heavily on the sizes of the particles. A standard which controls only the total mass or number of particles may fail to protect public health. Instead, the air quality standard should specify, perhaps by graph, an allowable frequency distribution of various sized particles as well as the maximum quantity of particulate matter allowed.

(2) *Sulfur Dioxide Standards.* Any standard setting a maximum level of exposure, as the proposed standards do, only protects health adequately if the measuring time given in the standard is the same as the shortest period within which adverse effects on health have been documented. With respect to sulfur dioxide, damage to life functions has been shown to occur with as little as one hour of exposure. For this reason, the standard for sulfur dioxide should include a maximum one hour volume as well as the present twenty-four hour maximum and yearly mean.

The findings of Larsen, cited in the accompanying Scientist's Institute document, also raise serious general questions about the standard for sulfur dioxide. Larsen's work is one of the few attempts to estimate statistically the magnitude of the health hazard to humans from a pollutant. Larsen's study covered, of course, only two quite atypical cities—London and New York—but it does provide the basis for some reasoned estimate of the impact of sulfur dioxide. Using the proposed standards, The Scientist's Institute has calculated, using Larsen's equation, that the primary standards would permit 22 excess deaths in New York or London during an air episode in which pollution levels rose to the maximum 24 hour concentration permitted by the standards. Extrapolating from such calculations is very hazardous—no one knows

[1] The Senate Report, for example, suggests that the "anticipated" as well as "known" health effects were to be considered in setting primary standards. *Sen. Rept.* 11. It is certainly proper to anticipate that adverse health effects will be found at lower levels among susceptible people than within the population at large.

whether Larsen's equation is accurate in smaller cities. Yet his data and conclusions raise serious questions about whether the once a year peak values, and even the yearly averages, for sulfur dioxide can be said to protect public health so long as the standards do not prevent "excess deaths" altogether.

B. *Secondary Standards.* The Act requires that secondary standards be set as to protect public welfare from all known or anticipated effects of pollutants. The word "welfare" was meant to include essentially all environmental values other than human health. The Senate Report, quoted above, made clear that under this part of the statute, it was expected that projection would be provided for "soils, water, vegetation, man-made materials, animals, wildlife, visibility, climate, and economic values." *Sen. Rept.* 11, and elsewhere included aesthetic values, buildings, climate and weather. *Sen. Rept.* 7.

The proposed secondary standards, like the proposed primary standards, appear to have been set at or slightly below the pollution level which has been demonstrated in existing literature to be harmful to one or more of the values listed. In the case of carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen dioxide, primary and secondary standards have been set at the same level, on the grounds that "adverse wlefare effects have not been observed to occur at levels below the levels of the proposed primary standards." 36 *FR* 1502, (Jan. 30, 1971).

It is questionable whether this method of setting the standard satisfies the statute. To say that no adverse effects have been observed is not to say that none can be anticipated. Indeed, in the past, new research has almost always revealed harm at ever-decreasing concentrations of pollutants. In view of past history, and the relatively small amount of research so far done, the most reasonable anticipation to make would be that harm to welfare values occurs at concentrations lower than has theretofore been demonstrated.

The secondary standards also ignore synergism, which is known or suspected with good reason to occur with sulfur oxide and photochemical oxididants,[2] and with nitrogen oxides and sulfur dioxide or photochemical oxidants.[3] The results of research to date should be sufficient to make synergism a "known or *anticipated*" effect of air pollution, and appropriate adjustments downward in the concentrations allowed by the standards should be made.

(3) *Photochemical Oxidants.* As the accompanying Scientists' Institute document relates, the secondary standard for photochemical standards has been set well above the level at which synergistic effects have been noted between ozone and various other pollutants.[4] Work with peanuts and tobacco plants by several experimenters has demonstrated effects at extremely low concentrations of these mixed pollutants.

In view of the studies cited there, the maximum allowable concentration of photochemical oxidants should be considerably reduced. The air quality standards cannot fulfill the statutory standard if they fail to protect against synergistic effects, since these are now either "known" or "anticipated."

IV. SUMMARY OF RECOMMENDATIONS

1. The national air quality standards should explicitly provide for view and revision at regular intervals—perhaps yearly or every two years—to assure that the results of new studies, especially of long-term effects, are continuously integrated into the air quality standards. This provision should not preclude earlier review and revision, but should set an outer limit to the time a standard may be put in effect without review. P.5.

2. The air quality standards should explicitly state that the values given are maxima, and that, because of the legislative history of the Act, in any air quality region which is presently less polluted, present levels shall constitute the federal standards which may not be exceeded.

3. The national air quality standards should explicitly state that they are to be observed regardless of special meteorological conditions, subject only to exception during the period allowed by a duly authorized implementation plan and in compliance with the terms of the schedule for compliance contained in such plan. The regulations should state that energy procedures provided for in

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[2] *The Scientists' Institute for Public Information,* "The Proposed National Primary and Secondary Ambient Air Quality Standards: An Analysis," 10, 16, 4. (Hereinafter SIPI Rept.)

[3] Id. at 10, 16.

[4] SIPI Rept., 10-11.

implementation plans, such as shutting down plants, traffic controls, and other measures, must be taken where necessary to prevent exceeding the maxima. P. 7.

4. No primary air quality standard should exceed 75% of the concentration presently known to be harmful to the health of normal (i.e. non-specially susceptible) people. P. 6–7.

5. The primary air quality standard should specify (perhaps by graph) an allowable frequency distribution of various-sized particles as well as the maximum quantity of particulate matter allowed. P. 10.

6. The primary air quality standard for sulfur dioxide should include a maximum one hour concentration as well as the presently proposed twenty-four hour maximum and yearly mean. P. 10.

7. The primary air quality standard for sulfur dioxide should be re-evaluated in light of the findings of Larsen suggesting that 22 excess deaths could occur in New York during an episode in which concentrations of sulfur dioxide reached those allowed under the proposed eight-hour maximum, in light of the reasonable interferences these findings give rise to, and in light of the statutory command and safeguard the "public health," "allowing an adequate margin of safety." P. 11.

8. The secondary air quality standards should be revised to provide greater protection, in view of the reasonably anticipated effects of the six major air pollutants, including known or anticipated the effects of synergism among certain of them. P. 12–13.

9. The secondary air quality standard for photochemical oxidants should be revised to provide greater protection, taking into account the available findings as to the harmful effects of ozone when mixed with other pollutants. P. 14.

Attachment E

Comments Concerning Proposed 1975 Emission Standards For Hydrocarbons (42 CFR Part 1201)

(By Ralph Nader)

HYDROCARBONS

Section 202(b) of the Clean Air Act, as amended, (Public Law 91-604), requires, *inter alia*, that the Administrator promulgate "regulations . . . applicable to emissions of carbon monoxide and hydrocarbons from light duty vehicles and engines manufactured on or after model year 1975 [which] shall contain standards which require a reduction of at least 90 per centum from emissions of carbon monoxide and hydrocarbons allowable under this section applicable to light duty vehicles and engines manufactured in model year 1970." [1] The proposed 1975 standard for hydrocarbons (HC), announced on February 22, 1971, fails to comply with this legislative mandate. A new test procedure for measuring emissions from vehicles has been utilized in a manner which defeats the clear purpose of Section 202.

The Environmental Protection Agency (EPA), has anticipated criticism on this score and included the following explanation in its announcement of the proposed standard:

"The proposed standards are based on 130 tests on 1970 model year vehicles to determine the equivalency between the test procedure to be used beginning with the 1972 model year and the test procedure actually used for the 1970 model year. Based upon these tests, it was determined that the 1970 standards of 2.2 grams per vehicle mile hydrocarbons . . . [was] . . . equivalent to 4.6 grams per vehicle mile hydrocarbons . . . using the new test procedure. Therefore, a 90 per centum reduction using the new test procedure would produce the proposed standards set forth herein. It is emphasized that the higher numerical values reflect only the change in test procedure and not any decrease in stringency." [2]

Utilizing the new test procedure, EPA determined that HC emissions for cars meeting the 1970 standards are 4.6 gm/mi—rather than 2.2 gm/mi as measured by the test currently in use. A 90% reduction of 4.6 yields 0.46, the proposed 1975 HC standard.

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[1] 42 USC 1857 f-1, as amended by the Clean Air Amendments of 1970, 84 Stat. 1676, 1690, Public Law 91-604, December 31, 1970.

[2] *Federal Register*, Vol. 36, No. 39, February 26, 1971.

However, neither the text of Section 202 nor any of the supporting legislative history indicate anything less than what the words of Section 202 clearly require: a 90 percent reduction of the 1970 standard, without "equivalancy" based upon the new test procedure. As will be shown below, Section 202 requires a 1975 HC standard more than twice as stringent as the EPA proposed standard—0.22 gm/mi. instead of 0.46 gm/mi.

THE MEANING OF "90 PER CENTUM" HYDROCARBON REDUCTION

Section 202(b) of the Clean Air Act represents a departure from the previous federal attempts to control automotive air pollution. By enacting this section, Congress clearly expressed its intention that "technological and economic feasibility" no longer act as a brake on standards-setting—as it had under the legislation which Section 202(b) superceded. This intention was expressed by quite specifically limiting the discretion which had been allowed the administrative agency under the earlier legislation. In introducing the concept Senator Edmund S. Muskie, the author of Section 202(b), told the Senate, ". . . we have learned that tests of economic and technological feasibility applied to these standards compromise the health of our people and lead to inadequate standards. It is clear that the long-range proposal for emission standards will only be adequate if the timetable is accelerated." [3]

At the time these words were spoken on the floor of the Senate on September 21, 1970, the "timetable" for emission control was apparent to all observers. Almost one year earlier, on November 20, 1969, at a meeting of the Environmental Quality Council, the Administration announced its interim (1975) and ultimate (1980) automotive emission goals. Representatives of the automobile industry attended this announcement and gave the goals their tacit support on the understanding that there would not be additional "harassing" emission standards set for intervening years. The goals proposed by the Administration were:

	1975	1980
Hydrocarbons	0.5	0.25
Carbon monoxide	11.0	4.7
Nitrogen oxides	0.9	0.4
Particulate matter	0.1	0.0

On September 17, 1970, the Senate Public Works Committee reported out a bill containing the language which was later to become Section 202(b). On the Senate floor, September 21, 1970, Senator Muskie explained the effect of the Section: ". . . the emission standards for carbon monoxide, hydrocarbons, and nitrogen dioxide which have been projected for 1980 must be met earlier. This bill would require that this be done by 1975."* [4] Anyone hearing the Senator's words on September 21, 1970, would have concluded that the anticipated HC standard for 1975 would be about 0.25—*i.e.*, the original 1980 standard.

Announcements by the National Air Pollution Control Administration on July 15, 1970 led to the first public knowledge of the new test procedures to be applied beginning with the 1972 model year. A detailed press release issued on the same day indicates that the Senate had no knowledge that the new test procedure would affect the numerical value of the standards (when it enacted Section 202).[5] NAPCA's press release explained that the new system revealed that mass emissions for uncontrolled (pre-1968) vehicles were actually greater than had been believed. While the present test method indicated uncontrolled HC emissions of 11.2 gm/mile, the 1972 test revealed emissions of 14.6 gm/mile.

This underestimate had naturally carried over to controlled vehicles. NAPCA found that the 1970 HC standard of 2.2 gm/mile had achieved only a 69% re-

[3] *Congressional Record*, S16090, September 21, 1970.
* As finally enacted by Congress, the law requires that the originally proposed 1980 standards for nitrogen dioxide be met by 1976 instead of 1975.
[4] *Ibid.*, S16091.
[5] *HEW News*, July 15, 1970.

duction, instead of the intended 80% reduction.* In other words, the new test procedure showed that HC emissions for 1970 model year cars are 4.0 gm/mile instead of 2.2 NAPCA explained its new findings and proposed standards as follows:

"PUBLICATION OF 1975 MODEL YEAR EXHAUST STANDARDS

"On February 10, 1970, the Secretary of Health, Education, and Welfare announced the Department's intention to propose more stringent exhaust standards for hydrocarbons and carbon monoxide to be effective with the 1975 model year. The proposed regulations carry out that intent. The proposed new standards will be 0.5 grams per vehicle mile for hydrocarbons . . . *Compliance with these standards will be determined using the proposed new procedures.*" (Emphasis added)

This statement was issued on July 15, 1970.

Therefore at the time the Senate amendments were adopted—on September 22, 1970, NAPCA had already announced the new test procedures and indicated that they would not result in a more permissive HC number for 1975. The general understanding was that, without any change in the law, the HC standard for 1975 was to be 0.5 gm/mile (the same figure that had been proposed at the 1969 meeting of the Council on Environmental Quality) with compliance determined by using the proposed new procedures. The passage of the Senate amendments—later adopted by the House—was generally understood as adoption of Senator Muskie's plan to accelerate the standards by five years, i.e. to leapfrog the proposed 1975 standards and to require compliance with the proposed 1980 standards by 1975. In view of these facts, it would be unreasonable to infer that after one of the major legislative battles of 1970, Congress intended to reduce the 1975 HC standard by an infinitesimal amount (0.04) below the originally-proposed level (from the originally understood level of 0.5 to EPA's proposed level of 0.46).

In addition, it is important to note the reason for the adoption of the new test procedure. In its July 15, 1970 announcement, NAPCA explained that the new test would be more efficient "because more of the gases are sampled, because the driving cycle is more realistic, and because the new instruments are more accurate." [6] The inadequacy of the old test—and the auto industry's consequent poor performance in emission control—is now the basis for relieving the industry from its full resonsibility to reduce pollution. This ironic result is clearly inconsistent with the legislative history of Section 202.

The Senate Report is the most explicit piece of legislative history on this subject and there is no reason to assume that the Report meant anything less than what was clearly stated. In its discussion of the meaning of the "90 per centum reduction" language, the Report clearly indicates an intention that the originally-proposed 1980 standards for three of the major auto pollutants should be moved up to 1975. In its discussion of these pollutants, the Report says: [7]

"A. . . . To achieve the public health ambient standard would require emission controls placed on automobiles permitting emissions of only *5 grams per mile [of carbon monoxide], a figure which represents the 1980 emission requirement as proposed by the Administration.*

* * * * * * *

"B. . . . To achieve such ambient standard [for photochemical oxidants, of which hydrocarbon is a chemical precursor] would require *a reduction of hydrocarbon emissions from automobiles from the 1970 standard of 2.2 gm/mile to an emission level of 0.2 gm/mile. This last figure is the approximate equivalent of the proposed 1980 emission standard.*

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* Of course, even the new percentage of "control" overstates the case since the figures are hypothetical for cars actually in use. NAPCA tested only a handful of prototype vehicles for certification purposes and has acknowledged many times that the failure rate for cars actually in use is enormous.

[6] *Ibid.*

[7] National Air Quality Standards Act of 1970, Senate Report No. 91-1196, 91st Congress, 2nd Session, p. 25. The Conference Report said of Section 202: "The conference substitute follows substantially the Senate amendments . . . Carbon monoxide and hydrocarbon emissions from light duty vehicles for 1975 model year and thereafter are to be deduced at least 94 per centum over 1970 standards . . ." (Conference Report, "Clean Air Amendments of 1970," House of Representatives, 91st Congress, 2nd Session, Report No. 91-1783, December 1970, p. 49.

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"C. . . . To achieve the health standard would require a *reduction from the proposed 1973 emission standard of 2.0 gm/mile [of nitrogen oxides] to an emissions requirement for automobiles of 0.45 gm/mile, or approximately the proposed 1980 standards.*

Section B of the Report excerpt indicates a 1975 standard approximately equivalent to the 1980 standard of 0.25 and makes no mention of the standards being adjusted in the light of the new test procedures. In fact since the NAPCA announcement of July 15, 1970 had indicated that the new test procedures would not affect the originally-proposed 1975 standards, there is every reason to believe that the Senate, and ultimately the House (which made no independent inquiry into Section 202)believed that the new HC standard under Section 202 would be about 0.25 grams per mile, utilizing the test procedures.

It is important to note that the Congressional decision to accelerate the 1980 standards to 1975 was not an arbitrary one. Rather it was based on the results of scientific research done by the National Air Pollution Control Administration. The Senate report states that "[I]nformation provided that Committee by the Administration indicated that, under the existing new vehicle emission control program . . . it would be 1990 before the ambient levels of motor vehicle related pollutants would be brought down to the level necessary to protect the health of persons." [8] The Report goes on to indicate that this conclusion was based upon a paper by Delbert S. Barth, Director of the Bureau of Criteria and Standards, National Air Pollution Control Administration.[9] The Barth paper computed automobile emission goals based upon desired levels of air quality. The conclusion for hydrocarbon emission goals was that, assuming a 1980 target date, the desired standard would be 0.14 gm/mile, a figure which is even more stringent than the Administration's goal of 0.25 gm/mile. The discrepancy between these two figures may or may not be important, depending upon the importance of the fact that reduced emissions would come five years earlier than anticipated. However, NAPCA's finding that 1970 vehicles have not achieved the intended degree of control makes it all the more imperative than the EPA standard be as close to the Barth number (0.14 gm/mi.) as is possible under law.

It is clear from the response of the automobile industry to news of the impending Senate Public Works Committee's action that the industry understood that the "90 per centum" language would mean a 1975 hydrocarbon standard of about 0.25. For example, on August 27, 1970, Thomas C. Mann of the Automobile Manufactures Association complained to the Secretary of HEW about the information provided the Committee:

". . . This bill in its present form proposes a drastic reduction in auto emission levels for 1975 as compared with the already stringent HEW goals for 1975 . . .

"It is our understanding that the information from HEW contained in this document was reported in a paper entitled "Federal Motor Vehicle Emission Goals for CO, HC and NOx based on Desired Air Quality Levels" which I understand was used in a presentation by D. S. Barth, J. C. Romanovsky and E. A. Schuck of your Durham office at a June 16, 1970 annual meeting in St. Louis of the Air Pollution Control Association. It was made manifestly clear in the paper that the measurements, math models, data analysis, and conclusions are of a developmental or a preliminary nature and not intended to be construed as final or adequate for establishing legal standards.

It is also our understanding that the information supplied by HEW staff is currently being evaluated by NAPCA and should not be considered definitive or official until after review and the required publications in the *Federal Register.*

"We are concerned that major legislative proposals concerning emissions standards embodying serious social and economic consequences are based on technical information supplied by HEW staff which has not received the rigorous technical scrutiny customary in HEW. We respectfully request that you

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[8] Senate Report, p. 25.

[9] Delbert S. Barth, "Federal Motor Vehicle Emmission Goals for CO, HC and Nox Based on Desired Air Quality Levels," *Air Pollution Control Association Journal*, Vol. 20, No. 8, August, 1970.

personally review the material supplied by your department to Senate staff and, if you share our views concerning the nature of the data, that you promptly inform Senator Muskie.

On September 2, 1970, Acting Secretary of HEW, John G. Veneman sent a reply to the AMA. The reply reaffirmed the need for standards as stringent as the Administration's ultimate 1980 goals and agreed that the degree of control called for in the bill was consistent with the Administration's 1980 emission levels:

". . . The paper entitled "Federal Vehicle Emission Goals for CO, HC, and NOx Based on Desired Air Quality Levels," prepared and presented by personnel of the National Air Pollution Control Administration, is intended to show, within the limits of existing data, the relationship between motor vehicle emission reductions and improvements in air quality. More specifically, it seeks to demonstrate that further reductions in such emissions, beyond those we have proposed for 1975, will be necessary, and that the order of magnitude of the needed reductions is consistent with the goals we previously announced for 1980."

During the Congressional debates concerning the 90 percent reduction, Mr. L. A. Iacocca, now President of the Ford Motor Company, emerged as one of the industry's leading spokesman against the impending legislation. A pamphlet discussing the automotive sections of the Clean Air Act amendments was issued from his office on September 9, 1970. The figures and arguments employed by Mr. Iacocca in his attempt to defeat the "90 per centum" provision are quite revealing, he said, "[t]hese proposed standards [the original HEW 1975 standards] *using the Federal government's present test procedures, would reduce* hydrocarbon exhaust emissions by 95 percent from pre-control level . . . These latest proposed standards [Section 202] would result in exhaust emission reductions from pre-1968 levels of 98 percent in hydrocarbons." (Emphasis added.) [10] Mr. Iacocca anticipated that, despite the fact a new test would be applied beginning with model-year 1972, the percentage reduction required by Section 202 was to be applied against the 1970 standards without "equivalency"—*i.e.*, Mr. Iacocca anticipated an HC standard of about 0.25.

Mr. Iacocca's pamphlet does not indicate formulas used to arrive at the 95% (original HEW) and 98% (Section 202) reductions. However, it is clear that the 95% reduction was derived as follows:

$$\frac{{}^{1}11.2 - {}^{2}0.5 \times 100}{11.2} = 95.6\%$$

[1] Old uncontrolled figure.
[2] Originally proposed 1975 standard.

The 98% reduction figure was based on either the old uncontrolled figure (11.2) or the uncontrolled figure announced on July 15, 1970, *but the anticipated standard could only have been the originally proposed 1980 figure (0.25):*

1. Old uncontrolled basis:

$$\frac{11.2 - 0.25\ [1980] \times 100}{11.2} = 97.8\%\ (98\%\ \text{rounded})$$

2. July 15, 1970 basis:

$$\frac{14.6 - 0.25\ [1980] \times 100}{14.6} = 98.3\%\ (98\%\ \text{rounded})$$

These calculations indicate that at least one major auto industry spokesman anticipated a 1975 HC standard of 0.25 when Section 202 was enacted into law.

CONCLUSION

The intention of Section 202 was to mandate a 1975 HC standard approximately equivalent to the originally proposed 1980 standard of 0.25. For pur-

[10] Statement by L.A. Iacocca, Executive Vice President, Ford Motor Company, Dearborn, Michigan, September 9, 1970, "Concerning Pending Senate Changes to the Clean Air Act."

poses of legislative draftsmanship Section 202 employed the "90 percentum" language rather than adopting a specific number standard. Literally applied, Section 202 requires a 1975 standard of .22 gm/mi. There is no evidence that Congress anticipated that the use of a new test would alter the 1975 standard. On the contrary, all information available to the Senate, where the section was drafted and fully explored, indicated that the new test procedure would not result in the "adjusted" 1975 HC number now proposed by EPA. The final standard for HC should be .22 gm/mi.

Attachment F

STERN COMMUNITY LAW FIRM,
2005 L STREET N.W.,
Washington, D.C., April 27, 1971.

Re 45 CFR Part 1201—1975 Emission Standards for Hydrocarbons and Carbon Monoxide Applicable to Light-Duty Vehicles (Published at Federal Register, Vol. 36, No. 39, P. 3528—Friday, February 26, 1971).

Mr. WILLIAM D. RUCKELSHAUS,
Administrator, Environmental Protection Agency (Attention: Air Pollution Control Office, Rockville, Md.).

DEAR MR. RUCKELSHAUS: The following comments are submitted on behalf of the undersigned and on behalf of other individuals and groups similarly affected.

THE PROPOSED 1975 EMISSION STANDARDS VIOLATE SECTION 202(b)(1)(A) OF THE CLEAN AIR ACT.[1]

A. Section 202 b)(1)(A) Must Be Interpreted Consistently with the Basic Intent of the Clean Air Amendments of 1970.

The basic goal of the Clean Air Amendments of 1970 is to insure the achievement within the next five years of a level of air quality that will have no adverse effects on the health of persons in the United States.[2] In bringing the bill which became, substantially unchanged, Public Law 91-604, before the Senate, Senator Muskie stated, "Our responsibility is to establish what the public interest requires to protect the health of persons."[3] Senator Spong stated, "Under the pending bill the Secretary [now Administrator] would set standards on the basis of the degree of control necessary to insure health-related ambient air quality levels."[4] Section 109 of the Act requires the promulgation of national primary ambient air quality standards sufficient to protect the public health. Section 110 requires each State to develop implementation plans which provide for the attainment of the primary standards within three years of the plan's approval. Section 202 (b) is an integral part of the national primary ambient air quality standards programs. It will function as a federally-preempted component of each State's implementation plan. Thus the standards set under Section 202 (b) must be compatible with the attainment of the national ambient air quality standards.

B. The Basic Intent of Section 202 (b)(1)(A) Was to Mandate That Emission Standards for Automobiles of 1975 and Subsequent Model Years be Set at a Level Capable of Achieving Ambient Air Quality Protective of the Health of Persons.

Section 202 (b)(1)(A) speaks in terms of a mandatory "reduction of at least 90 per centum" from emissions allowable under 1970 standards. This formula is an attempt to communicate in a compact, comprehensible form the mandate that emissions from automobiles be reduced by model year 1975 to a level permitting the achievement of health-related ambient air quality. The section has its source in communications between the staff of the Subcommittee on Air and Water Pollution of the Senate Committee on Public Works and the

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[1] 42 USC 1857 f-1, as amended by the Clean Air Amendments of 1970, 84 Stat. 1676, 1690. Public Law 91-604, December 31, 1970.
[2] See Cong. Record, S 16090, Sept. 21, 1970. (Statement of Senator Edmund Muskie).
[3] *Ibid.*, S 16091.
[4] *Ibid.*, S 16109. (Statement of Senator William B. Spong, Jr.)

National Air Pollution Control Administration (NAPCA).[5] The Subcommittee staff requested NAPCA to provide it with data identifying ambient air standards for motor vehicle related pollutants and determining the automobile emission levels necessary to achieve these standards.[6] The staff summarized the information provided by NAPCA as follows:

"JUNE 11, 1970.

"From: Staff.

"Subject: Automobile Emissions Control and Achievement of the Ambient Air Standard necessary to protect health.

"Communications were held with the National Air Pollution Control Administration for the purpose of determining how long it would take to achieve a national ambient air standard related to health, with particular emphasis on the relationship of automobile emissions to the achievement of such standard. Automobiles contribute three particular pollutants in great quantities (a) carbon monoxide, (b) photochemical oxidants (hydrocarbons), and (c) oxides of nitrogen.

"A. The *ambient standard* necessary to protect the public health from *carbon monoxide is 8-10 ppm.* This compares to *existing ambient air in Chicago, for instance, of 44 ppm.* The 1970 Federal emission standard for automobiles for carbon monoxide is 23 gm/mile. To achieve the public health ambient standard would require emission controls placed on automobiles permitting emissions of only 5 grams per mile; a figure that represents the 1980 emission requirement as proposed by the Administration. In order to achieve sufficient replacement of automobiles with autos having the emission controls meeting 1980 standards it will take an estimated ten years. Therefore on assumptions of present programs it will be 1990 before carbon monoxide levels will be brought down to the public health ambient standard. This is premised, it must be emphasized, on reliance exclusively on automobile emission controls and reliance upon proposed levels of controls and their rate of application.

"B. The ambient air health standard for photochemical oxidants (hydrocarbons) is 0.06 ppm. To achieve such ambient standard would require a reduction of hydrocarbon emissisions from automobiles from the 1970 standard of 2.2 gm/mile to an emission level of 0.2 gm/mile. This last figure is the approximate equivalent of the proposed 1980 emission standard. With the replacement factor and again relying exclusively on emission control it would be 1990 before the ambient health standard could be achieved.

"C. The ambient health standard for NO_x is anticipated to be about 0.10 ppm. This compares with an ambient condition found in most metropolitan of 50.0 to 60.0 ppm. To achieve the health standard would require a reduction from the proposed 1973 emission standard of 3.0 grams per mile to an emissions requirement for automobiles of 0.45 grams per mile, or approximately the proposed 1980 standard. The replacement factor would again, if reliance is placed only upon emission control of this character, result in ambient health standards not being met until 1990."[7]

Essentially the same information was reprinted in the Report of the Senate Committee on Public Works to accompany S. 4358 (which set forth the concept of the "90% reduction" eventually enacted as Section 202 (b)(1)(A)).[8]

NAPCA further provided a summary document focussing on reductions in automobile emissions which would insure air quality protection of health.[9] This document stated:

"The National Air Pollution Control Administration has estimated that new motor vehicles must achieve a minimum reduction of emissions from a no-control baseline (pre-1968 models) of the following orders of magnitude to insure attainment of health-related air quality levels:

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[5] See Letter of August 27, 1970 from Thomas C. Mann, President Automobile Manufacturers Association, Inc., to Elliot L. Richardson, Secretary of Health, Education, and Welfare, printed in Appendix to Air Pollution 1970, Hearings before the Subcommittee on Air and Water Pollution of the Committee on Public Works United States Senate, 91st Cong. 2d Sess., p. 1576. (Hereinafter cited Air Pollution—1970.)

[6] See Staff Memorandum "Automobile Emissions Control and Achievement of the Ambient Air Standard necessary to protect health." Printed in Air Pollution—1970, p. 1576.

[7] *Id.*

[8] National Air Quality Standards Act of 1970, Senate Report No. 91-1196, 91st Cong., 2d Sess., p. 25.

[9] *Ibid.*, 25-27.

	Percent
Carbon monoxide	92.5
Nitrogen oxides	93.6
Hydrocarbons	99.0

These reductions were derived in a paper by Dr. D. S. Barth, et al., of NAPCA,[10] presented in June, 1970 at the annual meeting of the Air Pollution Control Association and available to the Senate Committee on Public Works and the entire Congress.

Most importantly, pursuant to a request from Senator John Sherman Cooper's staff, NAPCA provided the following table:[11]

AUTO EMISSIONS

[All figures in grams per mile]

	Hydrocarbons, new test	Carbon monoxide, new test	Nitric oxides, old test	Particulate matter, old test
Uncontrolled	14.6	116.3	4.0	0.4
1970 Standard	2.9	37.0		
Proposed 1975 standard	.5	11.0	.9	.1
Proposed 1980 standard	.25	4.7	.4	.03
Bill language (90 percent reduction of 1970 or uncontrolled)	.29	3.7	.4	.04

This table was understood to reaffirm earlier NAPCA statements that a "90% reduction from allowable emissions for 1970" would enable the achievement of health-related air quality when all vehicles were so controlled. The table identified in concrete terms the standards that would be set under the bill language of a "90% reduction." That the Senate Subcommittee on Air and Water Pollution and the full Committee on Public Works relied on this table is evident in the remarks of Senator Cooper as he read the table into the Congressional Record:

"Mr. COOPER. Mr. President, I know there is wide interest in the emission standards for automobiles required by the bill developed by the committee. During consideration in subcommittee and the full committee, we referred to a summary table of automobile emissions, which contains the figures in grams per mile comparing uncontrolled emissions, the 1970 standard, the proposed 1975 standard under present law, the 1980 goal put forward by the administration, and the level proposed in the bill. I ask unanimous consent that the table be printed in the Record for the information of Members, because I am sure that these facts will be referred to during the debate."[12]

The printing of the table in the Record brought it to the attention of the full Congress.

The proposed 1980 emission standard referred to in the Subcommittee staff memo and the table inserted by Senator Cooper are the "HEW ultimate goals for vehicle emissions" first articulated in an Environmental Quality Council meeting of November 20, 1969,[13] made public in February, 1970, and conveyed to Senator Muskie and the full Senate Public Works Committee in Spring, 1970.[14] These goals indicated that the achievement of health-related ambient air quality depended on the reduction of automobile emissions to the following levels:

	Grams per mile
Hydrocarbons	0.25
Carbon monoxide	4.7
Nitrogen oxides	0.4
Particulate matter	0.03

[10] D. S. Barth, et al., "Federal Motor Vehicle Emission Goals for Carbon Monoxide, Hydrocarbons, and Nitrogen Oxides Based on Desired Air Quality Levels." Reprinted at Air Pollution—1970, p. 1639.

[11] Cong. Record, S 16113, Sept. 21, 1970

[12] *Ibid.*, S 16112.

[13] See Letter of September 2, 1970 from Acting Secretary of Health, Education, and Welfare, John G. Veneman to Thomas C. Mann, President, Automobile Manufacturers Association, Inc. Reprinted at Air Pollution—1970, p. 1596.

[14] Air Pollution—1970, pp. 361–62.

The understanding of the Senate Public Works Committee and of the Congress which enacted the reported bill was that the Administration's proposed 1980 emission goals represented a reduction in the level of automobile emissions sufficient to achieve ambient air quality with no adverse health effects due to vehicle-related pollutants. The Committee felt that these health-related standards should be applied earlier than the Administration date of 1980: "On the basis of information and hearings in 1964, 1965, 1967, and 1970, the committee concluded that 1975 would be the earliest possible date for application of the proposed standards."[15] This intent was recognized by Secretary of Health, Education, and Welfare, Elliot Richardson.[16]

In addition to statements in the Senate Committee Report and the Air Pollution—1970 Subcommittee Hearings referred to above, the legislators repeated numerous times in the Congressional Record that the 1975 standards were formulated with the achievement of health-related ambient air quality as their focus. "We are saying in this bill that this is what the public health requires. We are saying to the country, this is what the automobile ought to be measured against."[17] "We are the only ones who can say to the automobile industry, and make it stick, 'The public health requires this.' That is what this bill says, and nothing more."[18] This intention was alternatively referred to as pushing forward the 1980 proposed goals:

"In order to maintain those standards set under title I—standards which are necessary to protect the public health and which must be met in the next 5 years—the emissions standards for carbon monoxide, hydrocarbons, and nitrogen oxides which have been projected for 1980 must be met earlier. This bill would require that this be done by 1975."[19]

All the above material makes it abundantly clear that the primary question the legislators were concerned with when drafting Section 202 (b) (1) (A) was "How low must auto emissions be set in order to achieve health-related ambient air quality?" A subsidiary question was "How best to phrase the statutory language to guarantee the desired result?" As Senator Cooper's insertion into the Record[20] makes clear the table provided by NAPAC gave the legislators reason to believe that the "at least 90% reduction" formula was adequate to insure that 1975 model year automobiles would emit pollutants below levels sufficient to generate adverse health effects in the ambient air.

C. The Proposed 1975 Emission Standards for Hydrocarbons and Carbon Monoxide Will Not Permit the Achievement of Health-Related Ambient Air Quality and are Above the Levels That Congress Intended Be Set Pursuant to Section 202 (b) (1) (A).

The proposed exhaust emission standards of 0.46 grams per mile of Hydrocarbons (HC) and 4.7 grams per mile of Carbon Monoxide (CO) are not low enough to insure achievement of health-related ambient air quality. The prediction methodology endorsed by HEW,[21] the former parent agency of NAPCA (predecessor of APCO), is detailed in a paper by Dr. D. S. Barth et al. of APCO which the Senate Public Works Committee referred to and relied on in drafting Section 202(b) (A).[22]

"The paper entitled "Federal Motor Vehicle Emission Goals for CO, HC, and NO_x Based on Desired Air Quality Levels," prepared and presented by personnel of the National Air Pollution Control Administration, is intended to show, within the limits of existing data, the relationship between motor vehicle emission reductions and improvements in air quality. More specifically, it seeks to

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[15] *Supra* note 8, p. 27.

[16] "The Senate bill would require . . . that certain automobile emissions be reduced by 90 percent from the 1970 levels by 1975.

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The objective of these provisions is to accelerate substantially the current timetable for controlling automobile emissions. The Senate bill does this by making effective in 1975 the standards administratively projected to take effect no later than 1980." Letter of November 17, 1970, from Secretary of Health, Education, and Welfare, Elliot Richardson to Senator Jennings Randolph, Chairman, Senate Committee on Public Works.

[17] Cong. Record, S 16094, Sept. 21, 1970. (Statement of Senator Muskie.)

[18] *Ibid.*, S 16095. See also S16091; S16109.

[19] *Ibid.*, S 16091. See also S16094-95; S16109; S16221; S16223; S20598; S20600; S20608.

[20] See notes 11 and 12 *supra* and accompanying text.

[21] See Letter, *supra* note 13.

[22] See Air Pollution—1970, p. 1576. See also statement of Senator Robert P. Griffin, Sept. 22, 1970, Cong. Rec. S 16222.

demonstrate that further reductions in such emissions, beyond those we have proposed for 1975, will be necessary, and that the order of magnitude of the needed reductions is consistent with the goals we previously announced for 1980.

"The methods employed in analyzing the data are widely used in calculating emission reductions needed to insure attainment of given air quality levels. It appears to me that the paper makes responsible and constructive use of such data and methods as a means of determining what the Nation must do in order to reduce the threat of air pollution in years to come, particularly in view of the alternative, which is to postpone making projections and decisions for several years in order to produce more definitive data from which more precise conclusions could be drawn." [23]

Investigations currently active in APCO and the Environmental Protection Agency (EPA) indicate that it is not clear whether the proposed standard for CO is low enough to insure attainment of the desired air quality and that the standard for HC is definitely too high to permit the achievement of health-related photochemical oxidants levels. EPA General Counsel and assistant administrator for standards and enforcement, John R. Quarles, and his staff have been briefed to this effect within the past week. Since the ambient levels of CO and Photochemical Oxidants stipulated in the Barth paper as consistent with desired air quality are substantially identical to the proposed National Primary Ambient Air Quality Standards for these contaminants,[24] the proposed emission standards violate Sections 109 and 110 as well as Section 202 of the Clean Air Act. They are inconsistent with the attainment of these Ambient Air Quality Standards.

The proposed NC and CO emission standards are above the levels which would be set under the "90% reduction" formulation according to the table probided by NAPCA to the Senate Public Works Committee. This table, which the Committee relied on and which was brought to the attention of the full Congress by Senator Cooper, stated that the levels which would be set under the bill language of an "at least 90 per cent reduction" were 0.29 grams per mile for HC and 3.7 grams per mile for CO.[25] These figures were based on the new "closed-cycle" procedure which is the bias of the proposed exhaust emission standards. This table, which demonstrated the relatively close relations between standards to be set by the bill language and the proposed "ultimate" federal 1980 standards served to assure the committee that the 90% reduction formulation was adequate to achieve health-related ambient air quality. The proposed standard for HC at 0.46 grams per mile is nearly double the projected 1980 federal goal of 0.25 grams per mile.

D. The Proposed 1975 Emission Standards For Hydrocarbons and Carbon Monoxide Must Be Revised to Comply with the Intent of Congress.

As elaborated above the primary intent of Congress in passing Section 202 (b)(1)(A) was to mandate that beginning with model year 1975, automobiles would not emit levels of HC and CO which were incompatible with the attainment of ambient air quality protective of the health of persons. Congress was informed that the "90% reduction" language was adequate to convey its intent. To the extent that the "90% reduction" formula is not adequate, EPA must apply the statutory language, "reduction of *at least* 90 per centum" [26] (emphasis added) in a manner that complies with the congressional intent of setting 1975 automobile emission standards compatible with health-related ambient air quality. Since the Congress proceeded on the assumption that a "90% reduction" produced standards of 0.29 grams per mile for HC and 3.7 grams per mile for CO, the 1975 standards for HC and CO must be at least that low. To the extent that standards of even lower levels are determined to be necessary to insure the achievement of health-related ambient air quality, standards at such lower levels must be promulgated.

There is no inconsistency between the language of Section 202 (b)(1)(A) and the intent of Congress. The language specifies a reduction of *at least* 90 per centum from emissions allowable under 1970 standards. The intent of Con-

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[23] Letter, *supra* note 13. For the text of the paper [Hereinafter Barth paper] see Air Pollution—1970, p. 1639.

[24] Compare Barth paper at Air Pollution—1970, p. 1643 to proposed 42 CFR Sections 410.8 and 410.9, 36 Fed. Reg. 1503, Jan. 30, 1971.

[25] See notes 11 and 12 *supra*, and accompanying text.

[26] Section 202 (b)(1)(A), note 1 *supra*.

gress was that the standards for 1975 model year automobiles be low enough to permit the attainment of ambient air quality protective of the health of persons.

Respectfully submitted,
DAVID G. HAWKINS*

Attachment G

ENVIRONMENTAL PROTECTION AGENCY,

AIR POLLUTION CONTROL OFFICE,
Durham, ~~N.C., February~~ 23, 1971.

Subject: Addendum to Appendix 5 of Statement on "Health Hazards of Atmospheric Lead"
To: Assistant Director, BCS

In Appendix 5 of the statement of "Health Hazards of Atmospheric Lead," we discussed the potential contribution of lead fallout from vehicular emissions to daily lead absorption by a child with pica. The lead dose from vehicular emissions in a high exposure situation was estimated from a measurement of lead in New York City street sweepings, in which a concentration of 2650 μgPb/g was found. I have since obtained data from much more extensive dustfall sampling to support the above estimate.

From September through December, 1969, our Branch collected dustfall samples in 77 midwestern cities selected to range in population size from 100,000 to 1,000,000 persons. (This study was reported by W. F. Hunt, Jr., C. Pinkerton, O. McNulty and J. P. Creason at the Fourth Annual Conference on Trace Substances, University of Missouri, Columbia June 23-24, 1970 in a paper entitled "The 77 Midwestern City Study: A Study of Trace Element Pollution of the Air.") Monthly dustfall samples were collected in a residential, commercial and industrial area of each city for four months. Lead in dust was measured by atomic absorption spectrometry. Results were averaged for the 77 cities and are given below:

Sector of city	Total dustfall (g/m²/mo)	Lead content (μg/m²/mo)	Lead concentration (μg/g dust)
Residential	3.935	6436	1636
Commercial	6.774	16346	2413
Industrial	10.262	15518	1512

Lead dustfall concentrations in the commercial areas agree closely with the 2650 μgPb/g reported in New York City street sweepings.

In a recently prepared manuscript from our Branch (Creason, J. P. McNulty, O., Heiderscheit, L. T., Swanson, D. H. and Buechley, R. W. "Roadside Gradient in Atmospheric Concentration of Cadmium, Lead and Zinc"), dustfall content was reported from four sites adjacent to roadways in Cincinnati. At each site, a collection bucket was placed within 25 feet and another within 100 feet of the roadway. Results were as follows for August, 1969:

Site and distance from roadway	Total dustfall (g/m²/mo)	Lead content (μg/m²/mo)	Lead concentration (μg/g dust)
No. 1:			
25 feet	7.637	19771	2589
100 feet	4.976	10820	2174
No. 2:			
25 feet	4.213	17690	4199
100 feet	3.983	14800	3716
No. 3:			
25 feet	5,594	13230	2365
100 feet	4,148	7810	1883
No. 4:			
25 feet	[1] 6.157	[1] 27310	4436
100 feet	[1] 3.553	[1] 12466	3538

[1] Sample from July 1968.

* Member of N.Y. Bar.

At a distance of 25 feet from the roadway, the average lead concentration in dustfall was 3397 μg/g, and at 100 feet 2825 μg/g.

Finally, data given in a personal communication (Edward Ferrand, Ph.D., Director, Bureau of Technical Services, Department of Air Resources, New York City) recorded an average lead content from 15 samples of street sweepings in New York City taken between June 10 and 16, 1969 of 4.8 mgPb/μsq. ft. This represents a lead load of 297 mg/m/, and if one assumes a total dustfall fallout of 10 g/m²/mo (as we found in the industrial sectors of the 77 midwestern cities), the average lead concentration from the 15 samples would be 5160 μg/g dust. Thus data from the three sources cited above showed a lead concentration ranging from 2413 to 5160 μg/g in the fallout near roadways.

The possible health impact of this fallout on a child with pica can be extrapolated from the classical experiments of Robert A. Kehoe (The Metabolism of Lead in Man in Health and Disease. The Harben Lectures, 1960. J. Roy. Inst. Pub. Health and Hyg. 24:81; 101:129:177, 1961) An adult man fed 3000μg lead daily, in addition to the usual amount in his diet, achieved a blood lead level after four months of 50 μg/100g whole blood. It was estimated that he would have achieved a "toxic" level of 80 μgPb/100g whole blood if feeding had continued for 4 additional months. Assuming this subject weighed 70 kg, the supplemental daily 3000 μgPb amounted to 43 μg/kg body weight. If a one year old child weighing 10 kg absorbed ingested lead to the same degree as this experimental subject, we could assume that a daily supplement of 40 μg lead would produce toxicity within 8 months. A child living within 100 feet of roadway (lead concentration: 2825 μg/g dust) could get this much lead by ingesting less than one-sixth of a gram of atmospheric particulate fallout daily, an amount of fallout which could be contained in one-twenty fourth of a teaspoon. Therefore the contamination of outdoor streets and soil with lead fallout could easily be a significant hazard to a child with pica, and the hazard increases the closer his surroundings are to heavy vehicular traffic.

CARL M. SHY, M.D.
Chief, Epidemiology Section.

Attachment H

[TRB from Washington, Jan. 29, 1972]

THE NEW REPUBLIC

DOLE FOR RICH FOLKS

Four of the men we admire most were testifying almost unseen in a hearing room in the Senate Office Building last week before indefatigable Senator Proxmire, two representatives, an audience of maybe 30 lost in the spectators' chairs, and one tired motion picture camera (CBS News) intermittently taking pictures. Since it was about taxes and Mr. Nixon's whopping deficit the talk inevitably turned to Jean Paul Getty.

Getty is the expatriate American who is possibly the richest man in the world, worth a billion or a billion-and-a-half dollars (after the first billion, who cares?). He receives a cozy daily income of around $300,000. The men who were testifying were probably the top tax experts in America, Joe Pechman and Ben Okner of Brookings, Stanley Surrey of Harvard, plus Phil Stern, author of *The Great Treasury Raid* and sponsor of the fund for investigative journalism that financed the Mylai massacre revelations.

All the group wanted to do was to show how the Treasury could save $60–$70 billion in leaked taxes. Naturally there were few there, and little interest.

The federal graduated income tax goes up to a theoretical rate of 70 percent and under it Getty would presumably write a check every April 15 for the Internal Revenue Service of around $70 million. But Getty is an oil man with all sorts of escape hatches, and President Kennedy told a couple of senators back in the early sixties that Getty's tax, at least at that time, was no more than a few thousand dollars.

The tax witnesses took it up from there. After all, what is more fun than watching the rich get richer? Surrey came up with this cheerful example. Congress wants to stimulate community development and home ownership, so it gives a tax deduction on mortgage interest payments estimated to have cost

(in lost taxes) $5.7 billion in fiscal 1971. Because the federal income tax is graduated, the rebate is worth $70 per $100 for a taxpayer in the top, 70 percent, bracket. It is worth only $14 to the taxpayer in the lowest bracket. It is worth nothing at all to the poor man who isn't in the income tax scheme. As a consequence of using a tax instrument to provide assistance, about 70 percent of the total goes to individuals with incomes over $10,000. The law puts no limit on the value or number of residences for which a taxpayer may receive aid. Billionaire Getty may have a dozen residences, a modest chateau here, a little castle there, who knows?—all with satisfactory tax deductible loans. It is an example of the jolly brutality of our present tax system.

Congress has been boring loopholes into the tax laws for years; it is doubtful if it has known what it was doing; many of the escape holes were set up for desirable purposes but, in the aggregate, turning the federal income tax into what Representative Henry Reuss called a swiss cheese. All told, Proxmire has identified at least $60-70 billion in subsidies. And there's not a loophole that can't be gouged wider by a good tax lawyer.

In most cases it would be vastly cheaper to give simple, direct federal grants. Take tax-exempt bonds, for example. Cities and states finance themselves by selling bonds to the rich that are like church indulgences, sold in the Middle Ages, to keep a loved one out of Purgatory. Only these are tax indulgences. The poor today can't afford to buy them—it takes money to escape taxes. As Surrey figures it the Treasury pays a dollar in tax benefits to a top-bracket taxpayer so that he will pass along 75 cents in interest rate benefits to the state or city issuing the bond—a 133 percent commission.

Three thousand families in America have an annual income of $1,000,000 or more. The experts explained the lovely bargain-counter subsidies, tax shelters and rebates open to the top 3000—America's fiscal elite. They are in fields like oil drilling, stock farming, equipment-leasing and the like. Poor people can't shop here; few of the 12 million shabby families with incomes under $5000 go into these Tiffany shops.

Tax incentive rebates are only one form of subsidy but it is amusing to consider them in this light. It turns a lot of things upside down. For example, the 1971 act gives a tax credit for political gifts, a worthy objective it seems, amounting to a credit of one-half of the contribution, up to $25 on a joint return. Thus if a taxpayer sends $25 to a candidate, the government in effect will also send $25—the result of allowing half the amount off in taxes for a $50 contribution.

But if poor people contribute money the government refuses to match funds. Poor people don't pay income taxes; they are below the taxable level for participating.

It's all very complicated, of course, and hard to follow! Phil Stern tried to put it in simple terms. Suppose, he said you read an imaginary AP dispatch from Washington saying that "Congress today completed action on a revolutionary welfare program that reverses the usual pattern and gives huge welfare payments to the super-rich but only pennies per week to the very poor."

You would rub your eyes, but that is the way, he says, the system works. Under the fictitious new program, Stern's imaginary dispatch continues. "Welfare payments averaging some $720,000 a year will go to the nation's wealthiest families. For the poorest families (under $3000) the welfare allowance will average $16 a year, or roughly 30 cents a week. The program, enacted by Congress in a series of laws over a period of years would give America's most affluent families added weekly take-home pay of about $14,000. Total cost of the program—the most expensive welfare program ever voted—comes to $77.4 billion a year."

Stern, of course, means that present tax subsidies and shelters now actually amount to this huge total; many of them of social value but in the aggregate giving a staggering benefit to the rich. The burlesque dispatch quotes affluent economists as saying "this is just what America has needed to bring jobs and prosperity to all" and a spokesman for the Yacht Builders Association of America predicting "a great resurgence in the yacht industry." The satirical dispatch concludes with Washington reporters pressing the Senate sponsor on whether the new law carries a "worn requirement," like most welfare bills: "The Senator seemed puzzled by the question, 'The rich? Work?' he said 'Why, it hadn't occurred to me.'"

Incidently, Phil Stern (45), magna cum laude Harvard, onetime aide of the great Paul Douglas, is a multimillionaire.

Senator HART. The committee will be in order.

We resume to recieve the testimony of Dr. Nicholas R. Di Luzio. Dr. Di Luzio is chairman of the department of physiology, Tulane University.

STATEMENT OF DR. NICHOLAS R. DI LUZIO, CHAIRMAN, DEPARTMENT OF PHYSIOLOGY, TULANE UNIVERSITY

Dr. DI LUZIO. Thank you, Senator Hart.

Senator HART. Welcome, sir.

Dr. DI LUZIO. We have heard this morning the situation of the increased incidence of infections as well as the unique and novel infections which occur in the urban children and also their status toward ill health. We have heard of the problems relative to lead and I would like to today discuss our research endeavors which tend to relate these two factors, and is the problem of lead and bacterial infections and the consequences of their interaction which might well offer an explanation of the ill health status of our children.

Hopefully by understanding the interrelationship of lead and bacterial products, which we call endotoxins, we can hopefully treat this problem which I will describe.

I should like to indicate our findings are not exclusive insofar as the inner city child is concerned, but are applicable to all our citizens.

As background, I am, as you mentioned, professor and chairman of the department of physiology. I have roughly 22 years of experience in medical research and have published approximately 300 papers relative to various research dimensions.

Before I begin my prepared text I would like to indicate that the problem we are going to discuss in lead today is a dimension which has not been previously considered. In other words, it is a new research area. The clinical significance and implications which we can predicate are also extremely recent and in essence there is no epidemiological data to support postulates which we might make.

Because our research is rather new, I would like to define what might be its limitations; namely, we are dealing with today in the experiments, which I will describe, with acute single dose lead exposure of experimental animals. That is one single dose of lead given to perfectly normal animals of varying species.

In view of the nature of our findings we do plan to undertake chronic studies, but at the moment our data is strictly limited to one single dosage of lead.

The most prominent aspects of lead intoxication have in the past been related to three organ systems; namely, the central nervous system, the hematopoietic or blood component and the kidney. Studies which have recently been conducted in our laboratory by Rafael Trejo, M.D., have provided a new dimension in the problem of lead induced injury. What we would like to concern ourselves with today is a new, problem of lead induced injury.

This facet concerns the toxic effects of lead on the functional activity of the reticuloendothelial system. We abbreviate that by calling it RES. This system is composed of cells, classified as macrophages, which are widely scattered throughout the body in such

locations as liver, lung, spleen and bone marrow. The predominant location of these cells is, however, the liver.

The reticuloendothelial system functions in defense of the host against bacteria, tumor cells, virus particles and foreign agents by the process of phagocytosis and intracellular destruction; that is, they actually eat or ingest these materials. They then have the capability, or the power in the case of bacteria to kill them. You might describe the RES as the fundamental defense system of our body.

In addition, this is one of the primary systems in the medication of immunity, In essence this system can be regarded as, if you will, a control system which regulates major phases of the internal environment of the body.

Research studies in our laboratory have been concerned with the role of macrophage cells in endotoxin shock. Endotoxins are complexes which are formed by certain bacterial species widely present in our environment. Indeed they are present in our intestinal tract.

The endotoxin preparation is highly toxic and exerts profound cardiovascular effects. With appropriate endotoxin doses animals will die due to a progressive failure in the circulation which is classified as shock. In addition, pronounced metabolic, morphological and pathological changes can be induced by endotoxins.

Studies conducted in several laboratories have demonstrated that the defense mechanisms which the body possesses against endotoxin is in part mediated by the reticuloendothelial system. In other words, a functional intact RES will protect the body against the assault of these endotoxins. Thus any agent exerting an injurious effect on this important host defense system would be anticipated to have serious consequences to the continual well being of the organism, rendering it more susceptible to endotoxin shock, bacterial infections, and other disease entities, such as tumor growth and development.

Recently it was initially demonstrated by Hanse Selye in Montreal and confirmed by our laboratory and other investigators that the intravenous injection of lead to experimental animals resulted in a profound enhancement in their susceptibility to a wide variety of endotoxin preparations. Indeed the increase in susceptibility approximates 100,000-fold. Thus, in the presence of one single dose of lead, the lethal dose of endotoxin in reduced dramatically, i.e., the lethal dose in a lead-treated animal would be 1/000,000 of the endotoxin dose needed to produce death in normal animals. Indeed we know now that pathological changes essentially occur at one-millionth of the dose. This is really biologically fantastic when you consider the degree and magnitude of the changes.

This enhancement in toxicity following endotoxin administration is rather specific for lead. The molecular mechanism by which lead exerts its deleterious action is presently not known.

The dose of lead employed in these studies is one which produced no detectable disturbance in behavior of the animal, although we now know from more recent research that functional, biochemical as well as ultrastructural alterations occur in acute lead-treated animals.

Additional research studies have revealed that the normal ability of macrophages to inactivate or detoxify endotoxin preparations is

greatly compromised in lead-treated animals. Thus the enhanced endotoxin sensitivity induced by lead is due in part to failure in endotoxin detoxification.

Additionally we have found the single dose of lead has been found to decrease the ability of macrophage cells to remove from the blood stream various foreign colloidal and particulate materials. Thus it can be postulated that the functional failure of macrophage cells induced by lead would increase the susceptibility to bacterial infection as well as promoting endotoxin sensitivity.

The question as to whether our studies in lower mammalian species—which are really rats and mice—have carry-over value to man is one which has concerned our group. Studies currently in progress at Tulane by Lawrence Brettschneider, M.D., associate professor, and Klaus Holper, M.D., surgical fellow, of the Department of Surgery have demonstrated that subhuman primates treated with lead also show increased susceptibility to endotoxin preparations.

Our studies accent the possible subclinical effects of lead on the reticuloendothelial systems which regulates, to a major extent, host environment and host resistance. We say subclinical and use that term in the sense that there is no overt toxicity of the lead at the dose employed.

Thus lead-induced impairment to bacteria and endotoxins would be anticipated to promote a variety of disease states. The unique property of lead to inactivate macrophage mediated protective mechanisms clearly merits further consideration in the expanding dimensions of the biological effects of lead.

Therapeutic measures to counteract this rather unique and profound toxicity induced when lead and endotoxins interact are now being developed. I can say we have positive data in that regard, so there is hope.

These composite studies, properly pursued, will not only contribute to an appreciation of the dimensions of the biological effects of lead, but will also aid in defining mechanisms of host resistance to endotoxins.

Thank you.

Senator HART. I am sure you have dealt with laymen before.

Dr. DI LUZIO. It is my first venture here in Washington.

Senator HART. I am sure we have a problem, as you know. As I get it, the low lead levels—let me try that again.

Your studies show that in the presence of a rather low level of lead in these cells the harmful effect of certain bacteria is greatly increased?

Dr. DI LUZIO. That is correct.

Senator HART. And that you know the way by which this harmful effect occurs?

Dr. DI LUZIO. Right. We have data on that. I think we can postulate that what really happens is that lead actually localizes in these macrophage, so-called host defense cells that we have in our bodies and actually produces, you might say, intercellular injury to where these cells can no longer respond in a proper fashion to bacteria such as the endotoxins we have described.

The consequences would be that we would anticipate not only increased incidence of infectious diseases but also increased severity

of the disease state, and if there is enough endotoxin or enough lead present simultaneously, rapid, and very acute death would occur.

Senator HART. Does this same phenomenon—if that is what you call it—occur with lead only? Do other elements do the same thing?

Dr. DI LUZIO. Very interestingly this has been looked at. Not by our laboratory, but by Dr. Selye in Canada who has examined 13 different metals and the findings which we have described, that is, this fantastic potentiation of endotoxin shock and mortality, is an exclusive property of lead. No other metal possesses that ability. At least no other metal as yet tested possesses that ability.

Senator HART. Now, I think this is a slow ball, and obviously a layman's question, but what does it mean to man? You described it in the animals.

Dr. DI LUZIO. As I mentioned, the findings are relatively new. We can indicate on the basis of animal data and data on subhuman primates, which we have, that I think we in the medical area will have to evaluate the question as to whether the liver changes we see in the animals following lead exposure relate to the development of so-called acute lead encephalopathy or the manifestations we see in acute lead poisoning. They may well be mediated in part by liver injury and indeed by lead itself.

Secondly, we can postulate that an episode of acute lead ingestion or pica in a child, in the presence of a bacterial infection which would not be observed in any fashion or produce illness of the child, could lead to severe cardiovascular consequences and indeed acute death. That is, if we have the right situation where this child has a very minimal infections state and there is a superimposition of a very small acute dose of lead, these events could culminate in rapid death.

Thirdly, we now know that the endotoxins if they are not properly detoxified by the liver, increase infectious states, that is, viral and bacterial infections become quite pronounced.

In other words, there is a possibility that imposition of lead and endotoxins could have serious consequences on the well being of all of us.

I feel the most relevant episode would be the combination of lead exposure in children through ingestion of lead and the coexisting infectious state leading to essentially acute death. It could well be—although it has not been looked at yet—that the so-called sudden death in children, crib deaths (sudden infant death syndrome—SIDS) might be in part related to this episode. I do not know, it is only an assumption. We will have to look at that.

Our need from the medical end is to really examine this area very critically now and come up with additional answers because of the newness of this discovery, of the combination of lead and endotoxin or bacteria leading to a fantastic potentiation and death.

Senator HART. If investigation does establish that crib death is caused by this phenomenon, would that put you closer to a cure for crib death?

Dr. DI LUZIO. Right, if we have the epidemiological data which affirms the concept we would be able to develop means to prevent it. For example, there are techniques now where we could completely

prevent the lead-endotoxin-induced mortality in our experimental animals. So there is no reason it could not be taken over to the human situation once it has been identified as a major problem.

Senator HART. Thank you.

Mr. BICKWIT. Can you give us any idea of what levels of lead you are talking about?

Dr. DI LUZIO. Our animals—again I predicated the initial discussion, that we are using one single dose of lead given intravenously. In our rats we can give them a milligram of lead, which is a milligram of lead given intravenously to a 100 gram rat, and get these consequences. That is, this is one of the lowest lead levels we have done so far. We have not gone beyond that level and really established that response. But we do find this lead localizes very rapidly in the liver. We have not done blood lead level as yet.

Mr. BICKWIT. How would that relate to the dose needed to cause anticipated effects from lead in these rats?

Dr. DI LUZIO. It would be on the order of 10- to 15-foldless. That is, to get overt lead toxicity in our rats where we observe behavioral modification and central nervous system effects we would have to increase our dose by 10- to 15-fold.

Mr. BICKWIT. So you are talking of 1/10 to 1/15.

Dr. DI LUZIO. Right. This is in the subhuman primate, the monkey as well as the rats that we are talking about.

Mr. BICKWIT. What do you anticipate will be the next step in your research?

Dr. DI LUZIO. We hope to look at the chronic lead exposure aspect which you might say would be more identical to what we see in our environment, as well as looking at additional methods of prevention of this syndrome of acute death, induced by lead and endotoxins; and overt health status would be one we would look at also, as well as therapeutic means; dietary additions could be worked out as well as drug means to prevent the occurrence of this acute death.

Mr. BICKWIT. Do you have anything in the way of cure?

Dr. DI LUZIO. Right.

Mr. BICKWIT. Could you elaborate at all on that? What cure is there for this?

Dr. DI LUZIO. There are two techniques at the moment. One is by giving cysteine which contains a SH-grouping which can prevent lethality of the lead-endotoxin combination. So it would appear the lead is exerting its harmful effects by acting upon sulfhydrl-containing enzymes.

Another agent which we have found to be protective is one of the steroids. Steroid administration will prevent this lethality. So there are techniques to prevent toxicity of lead-endotoxin interaction.

As I say, we look at it positively. If there is a problem, we have an answer. Now it is a matter of identifying the problem in the clinical area.

Mr. BICKWIT. Thank you very much.

Senator HART. Doctor, thank you.

Our next and concluding witnesses are Dr. Albert Fritsch, Center for Science in the Public Interest and Edward Berlin, Environmental Defense Fund.

STATEMENT OF DR. ALBERT FRITSCH, CENTER FOR SCIENCE IN THE PUBLIC INTEREST; ACCOMPANIED BY EDWARD BERLIN, ENVIRONMENTAL DEFENSE FUND

Mr. BERLIN. I am Edward Berlin.

Senator Hart, rather than expose the severe limitations on my technical competence, with your indulgence, I prefer to make general observations and turn the hard work over to Dr. Fritsch.

Senator HART. You know how I react to that. I am sure I will understand you better than the doctor.

Mr. BERLIN. I would like to begin by expressing the very deep gratitude of the Environmental Defense Fund to you, not only for calling and chairing these hearings, but much more significantly for serving as the catalyst in bringing together environmental groups, inner-city groups, national poverty groups, unions and citizen groups generally in an effort directed at focusing the attention of all concerned on the very critical problems of the environment.

Without your commitment, the dialogue never would have begun and as a result of your commitment people are joining together and moving forward in the right and necessary direction.

There indeed was a rather severe danger, that many of us in the so-called movement perceived some time ago, of a developing rift between citizen groups generally, particularly between citizen groups that had their main focus on poverty questions and the so-called national environmental groups.

It was felt by the poverty groups that the environment movement was inconsistent, or at the least indifferent, to the problems of the inner-city disadvantaged.

I think it has now been demonstrated that that is not a true evaluation of the environmental movement, that the movement is not solely concerned—although it may well have been 4, 5, 10 years ago—with the preservation of wilderness areas that only a few members of the affluent portions of society ever get to enjoy, but that the environmental movement, and particularly EDF I am proud to say, recognizes now that the most severe problems are where population problems are most intense, namely, in the inner-city areas.

It is because of this concern that EDF, back in May 1970, launched a campaign against automotive leading emissions.

Our scientists were convinced at that time, after very careful study, that the more than 500 million pounds of lead which we as a nation emit from our automotive exhausts each year is most prejudicial to the health of those who are most exposed to those emissions, namely, the persons who must and do live in the inner-cities of our Nation.

We were concerned about the red blood cell development problem, about the implications to the lungs, to the kidneys, to the liver, and most importantly, we were concerned about the growing evidence that lead toxicity and even lead exposure at levels far below recognized toxic levels may well have implications from the standpoint of retardation in children and be responsible for mental deficiency and the lack of adequate and appropriate development of mental capabilities.

The price that we as a Nation pay for that type of tragedy can never be justified. Indeed, the consequence to one child alone can never be justified.

When the only justification that can be offered is to permit the production more cheaply of higher octane gasoline for unnecessarily high-compression engines, then the result must be judged by any reasonable man to be a national tragedy.

The tragedy must not go unabated and it was this conviction that moved the EDF, joined by the Center for Science in the Public Interest, to call first on the Secretary of HEW, and more recently on the Administrator of the EPA, to have them take prescribed steps to minimize and eventually eliminate the unnecessary, critical hazard of mounting lead accumulations, particularly in inner city environments.

We have submitted, for your reference, a copy of our filing with the Environmental Protection Agency.

You have been advised earlier today that EPA recently has transmitted to the Office of Management and Budget a proposal to at least partially meet the lead problem.

My understanding is that that, in fact, has happened within the last week or 10 days.

That proposal, if finally implemented, will eventually lead to the availability of one grade of unleaded gasoline, 91 octane or higher.

Eventually, it is our understanding that will preclude lead in the lower octane grades of gasoline with the exception of trace amounts.

I understand, however, that the EPA proposal would not touch at all, over any time frame, the premium gasolines which now contain the highest levels of lead.

There is a basic question that we could with some justification explore—that of responsibility.

I am troubled by the fact that after EPA finally resolved the difficult scientific question, it remains necessary to seek the concurrence of OMB before EPA can take effective steps leading to the amelioration of this tragic health problem.

One can question whether OMB, under the Federal Reports Act, isn't really subverting the intent of Congress which underlies that act enacted in 1942.

It is a growing concern among several Members of the Senate, including yourself, I know, Senator, about whether or not OMB should be playing as prominent a role in curtailing efforts by expert agencies to solicit reports and to effectuate programs once they are determined to be necessary.

Leaving aside that problem, it is important to recognize that there is a great deal that EPA can do beyond the one proposal that is now over at OMB.

We all hope that comes out quickly, even though it is only a partial solution.

Let me give you one simple example that the EDF and the Consumer Federation of America were jointly concerned about back in May 1970.

American consumers, unfortunately, purchase higher octane gasoline, by and large, than is required to run their particular automobiles.

They do so because they are totally ignorant as to the octane requirements of their vehicles, generally being denied that information by the domestic manufacturers.

Now, the consequences of this are twofold: the obvious environmental one need not be gone into in detail.

The less obvious one, important particularly in these days of mounting inflation, is the fact that there is an economic impact associated with purchasing unnecessarily high octane gasoline.

We asked HEW and EPA to do something about this beginning in May 1970. Shortly thereafter, the Secretary of Health, Education and Welfare wrote to the automobile manufacturers and said, "How do you feel about this proposal?"

We have yet to get a constructive response.

Now, certainly, that is a rather basic step that could be taken that would not only result in great economic savings to the American consumer, but would reduce drastically our consumption of the higher octane gasolines which compound the lead toxicity problem and all of the additional problems associated with automotive exhaust at the present time.

Having exhausted my technical competence in the area, with your indulgence, I would like to turn the microphone over to Dr. Fritsch.

Senator HART. Thank you very much. Thanks for coming here with your personal comments.

Doctor, we welcome you. This is a different committee, but I remember you.

Dr. FRITSCH. Thank you, Senator Hart. I also would like to thank you for the work you have done in the lead pollution area.

Senator HART. I must interrupt. I had hoped we could forestall this, but there is a Fulbright amendment that we have to deal with. We will recess subject to the call of the Chair.

(Recess.)

Senator HART. The committee will be in order.

Again, my apology to our witnesses.

In view of the delay caused by the Senate vote, and my being buttonholed in the hallway, without objection, the testimony that has yet to be received will be printed in the record.

And questions to our witnesses from the committee will be addressed to them in writing and their replies will then be added to the record.

Dr. FRITSCH. My name is Albert J. Fritsch and I am codirector of the Center for Science in the Public Interest. I have been engaged in a gasoline additive research project for more than a year and have been interested in the use and effects of lead antiknock agents. Recently our center has joined the environmental defense fund in a petition before the Environmental Protection Agency. Among the actions listed in the petition include the issuance of a lead criteria document, the promulgation of an atmospheric lead ambient air standard and the development of a national program to achieve total elimination of automotive lead emissions by 1976.

The reason why we have taken the action before the EPA is quite clear: that agency has failed to take the steps necessary to protect the American public from the hazards of environmental lead. The

development of our reasoning for taking this action now is outlined in the supplementary material (appendix 1).

The facts are well established: atmospheric lead levels are higher in urban areas and many inner city areas have lead airborne concentrations in excess of 2 μg lead/m^3; dust on the streets in many cities approach 1-percent lead and this is bound to rise if present consumption patterns continue unchanged; over 95 percent of the airborne lead comes from antiknock additives; 80 percent of antiknock lead finds its way directly from the automobile into the urban air. The most shocking fact is that after all the talk about lead-free gasoline, the decreasing trend in tetraethyl lead consumption noted in the fall of 1970 and the winter of 1970–71 has now been reversed. As you will note from the numbers listed in appendix 2, November, 1971 (the latest statistics) was the highest month for lead antiknock consumption in a year and a half.

Lead is highly toxic to man and the atmospheric lead is absorbed in the blood faster than dietary lead (25 to 50 percent as opposed to 5 to 10 percent). In heavily polluted regions airborne lead is becoming a major contributor to the body burden of lead; except for certain workers in high risk occupations (policemen, service station operators, etc.) the small infants and children of our inner cities are more seriously affected by lead pollution.

Leaded antiknock additives are not only the cause of more particulate emissions, but they also contribute to engine deposits, increased hydrocarbon emissions, foulded catalytic emission devices and they are highly toxic in themselves. These additives require other associated additives which are likewise highly toxic and are potential environmental hazards (scavengers, dyes, deposit modifiers, detergents).

There has been some controversy in recent months as to whether blood lead levels of inhabitants in heavily polluted inner city areas are directly proportional to the lead concentrations. However, circumstantial evidence indicates that there are increased blood lead levels in more heavily congested areas. Since tissue lead rather than blood lead is far more indicative of lead hazards, the definitive research on human subjects is harder to perform; however, every scientific study points to a reasonable doubt as to the safety of lead antiknock agents.

A study by Dr. James L. Wolfe of Mississippi State University indicates that roadside rice rats and cotton rats have an accumulation of around 50 μg lead/gram (dry weight) of liver tissue as compared to around 5 $\mu g/g$. in livers of individuals living away from the moderately traveled roads (appendix 3). This work has important implications as to the affects of tetraethyl lead emissions on human inhabitants living near heavily traveled highways and streets.

The threat of hazards arising from higher aromatic gasoline used to replace leaded additives has never been proved. Higher aromatic concentrations have not been proved to be more smog forming; the prediction of a rise in the concentrations of carcinogenic polynuclear aromatics (PNA) is negligible during the years prior to enforcement of the 1975 standards, especially in view of the fact that about

90 percent of the PNA in the atmosphere originates from nongasoline sources.

The best arguments which can be mustered for lead additives are that these chemicals are the cheapest means of raising the octane ratings and that these conserve our natural resources of petroleum (through better mileage from leaded gasoline). However, there are strong economic arguments against leaded gasoline, including increased cost of automobile maintenance. All of this is really of minor consideration when compared to the health and safety of the American people. Our only conclusion is that an immediate phaseout of lead from gasoline must be started at the earliest possible moment. The phaseout should begin in cities where the lead concentrations are higher.

Senator HART. Gentlemen, thank you, and we are adjourned.

Dr. FRITSCH. Thank you.

Mr. BERLIN. Thank you.

(The appendices follow:)

Appendix 1

THE LEAD POLLUTION PROBLEM: SUPPLEMENTARY MATERIAL

(By Albert J. Fritsch, Ph. D.)

Lead has been known for thousands of years to be a highly toxic material. The disease, sometimes called plumbism or saturnism was first described over 2000 years ago by the Greek physician Nicander. This disease was not understood among the Romans and the accidental ingestion by upper-caste citizens of the Empire of lead from pottery and metal cups has been considered a cause of the decline of Rome. Franklin in the 1700's knew that people could be poisoned from rainwater collected from lead covered roofs on which acidic leaves had fallen. Industrial workers in the 19th and 20th centuries have frequently experienced "wrist drop," nausea, and other symptoms of lead poisoning.

We have been made aware in the past few years of children with pica suffering irreparable brain damage and sometimes dying from eating lead paint chips from the interiors of old buildings; likewise, we know that people drinking illicitly distilled lead-contaminated whiskey have been known to suffer from lead poisoning. Very recently unglazed pottery, sold chiefly in small art shops, has given rise to cases of lead poisoning.

No one doubts the heavy weight of medical evidence demonstrating the toxicity of lead; the question is whether a small amount of lead is hazardous. In the absence of overwhelming documentation on the toxicity of small amounts of lead, we must decide whether this nation wishes to take chances on living with ever-increasing amounts of lead until such time as the safety of small amounts of lead is conclusively proved or disproved.

The average American ingests or inhales approximately 100 to 500 micrograms of lead per day. Typically, about 20 μg/liter is ingested from drinking water and about 300 μg is ingested in food. Between 5 to 10% of ingested lead is absorbed (Kehoe 1961). Thus the average daily dietary contribution of lead to the body burden is about 10 to 30 μg.

The airborne lead intake varies considerably, ranging from less than one μg Pb/day in rural areas to 8–23 μg Pb/day in central city areas (Engel 1971). This is based on 15 m^3 air/day and a 25 to 50% absorption rate. One study reports that 22 to 63% of 0.1 to 1.0 micron diameter particles were deposited in the lungs (Nozaki 1966). In another study 14 to 45% of 0.2 micron particles were deposited with more than 90% of the deposited particles retained by absorption (Hursh 1969). Lead in air is almost entirely derived from leaded gasoline additives.

Lead is not one of the essential elements needed by the human body. Yet lead accumulates in the human body with prolonged and repeated exposure. American urban dwellers carry significantly more lead than do people living in

rural areas and by members of pre-industrial cultures. Patterson has estimated that 200 mg of lead that reside in an average adult American human body is about one hundred times greater than the natural load. He concluded that "[t]his clearly and strongly suggests that the average resident of the United States is being subjected to severe chronic lead insult" (Patterson 1965).

Any amount of lead accumulating in the body is undesirable. It can possibly cause harm to the central nervous system and brain damage to children. It is most important that we cease speaking of "average" or "standard" men. Some people have too much lead already. Certain subgroups of the society may be exceptionally sensitive to insults; examples are special age groups and persons with particular diseases or genetic characteristics.

Lead Content in Blood

Studies on human adult volunteers have indicated that blood lead content may serve as an index of the degree of current or recent absorption of lead. However, blood levels are not the only criteria. A three and a half year old child had normal blood lead (5–30 μg/100 ml of whole blood) and normal urinary lead (25 μg/liter) and yet he suffered from peripheral neuropathy (general weakness, foot drop, etc.). X-rays showed heavy deposits of lead in the bones and investigation showed a history of pica (Seto 1964).

Blood levels do serve as a reasonable index of high levels of lead intake. Virtually all cases of fatal encephalopathy contain blood lead concentrations of 150 μg/100 g or more of whole blood.

Blood lead concentrations are higher in urban areas than in rural areas. Parking lot attendants in Cincinnati were found with up to 34 μg/100 g, over three times that of suburban nonsmokers in Philadelphia (11 μg/100) (California 1967). Blood lead levels of Frankfurt, Germany street cleaners were found to be significantly higher than those of the general population. Although no clinical lead poisoning was apparent, urinary delta-aminolevulinic acid (ALA) levels were dangerous in about 15% of the cases (Lehnert 1970). Hernberg and co-workers have shown a direct relation between the concentration of lead in the blood and the activity of ALA dehydrase (Hernberg 1970, 1970a). No amount of lead is so small that it does not decrease ALA-dehydrase to some extent (Chisolm 1971). It is generally conceded that the interpretation of these *in vitro* findings is highly pertinent to the question of airborne lead (NAS 1971, p. 145).

High blood levels of lead have been found in large numbers of children living in poor urban areas. Recent surveys of large city children indicate that many have blood lead concentrations in the range of 40–60 μg/100 of whole blood. The high blood lead concentrations have often been attributed to indoor house paint but the possibility is real that it is also due in part to inhalation of airborne lead derived from leaded fuels, or from street dust (lead concentrations reaching 2,000 μg/g) (NAS 1971, p. 328). Simon of the N.Y. Department of Air Resources reports this year that samples have been found in midtown Manhattan to consistently have lead concentrations in the high range of 13 to 18 μg/m³ (N.Y. Daily News 1971). The blood samples of small children, the most affected age group, in well-maintained Manhattan apartments have been found to sometimes reach 40 μg/100 ml of blood (NYT 1971; Medical World 1971).

The effects of high levels of lead on the body are well known: high levels of lead damage the brain and nervous system; lead can affect the liver and kidney, causing chronic nephritis, a disease characterized by a scarring and shrinking of kidney tissue; chronic over-exposure to the metal can result in peripheral nerve disease, affecting primarily the motor nerves of the extremities; it is associated with the development of artherosclerosis.

With reference to possible brain damage Dr. Patterson states:

"The course of human events is determined by the activities of the mind. Intellectual irritability and disjunction are associated with classical lead poisoning, and it is possible, and in my opinion probable, that similar impairments on a lesser but still significant scale might occur in persons subjected to severe chronic lead insult." (Patterson, 1965)

Dr. H. Schroeder of Dartmouth Medical School, an expert on toxic effects of heavy metals states: "there can be little doubt that exposure of mothers to lead has a damaging effect upon fertility, the course of pregnancy, and the development of the fetus." (Schroeder 1970)

It is highly possible that low concentrations of lead can help cause mental retardation in children. R. K. Byers, a pediatric neurologist states:

"I think that many children get chronic encephalitis from lead, as well as acute . . . This group of children deteriorates gradually without ever having had any acute lead encephalitis . . . I think that lead does something to the growing brain which is different from what it does to the adult brain." (Byers 1958)

Dr. Harriet L. Hardy has expressed the opinion that: "There must be a departure from the present U.S. attitude that prevention of occupational disease is the only requirement of those responsible for the use of toxic agents as lead." (Hardy 1965)

Increased Lead Concentration in Atmosphere

Since atmospheric lead concentrations are higher in urban areas and greater numbers of our people live in these congested areas, the amount of exposure to high lead concentrations is increasing. Amounts of lead in urban atmosphere range from 0.1 to 20 $\mu g/m^3$ dependent upon sampling sites and climatic and seasonal conditions. Most normal urban areas average between 0.5 and 2.0 $\mu g/m^3$ but some congested areas far exceed this range. Preliminary reports from the "Seven Cities Study" show that at 19 sampling locations in cincinnati, Los Angeles and Philadelphia at which ambient lead levels were measured both for 1961–2 and 1968–9 the later levels were higher at most sites: in Cincinnati (13–33%); in Los Angeles (33–64%); and in Philadelphia (2–26%) (Tepper 1971).

The National Academy of Science's "Airborne Lead in Perspective" study fails to mention this analytical data. Instead the study says:

"In view of the disparate results from different cities, it is not possible to make any generality about trends (increase or decrease in lead concentrations). But it is possible to say that, if there are any upward trends, they are not very substantiated." (NAS 1971, p. 24)

A few pages on in the study we find:

"In spite of the rapid increase in the consumption of lead alkyls used in automobile fuels, however, the concentration of lead in urban air is, in general, rising only slowly, presumably because of dispersal." (NAS 1971, p. 32)

In the conclusion of the study it is stated that the average lead content in the air over major cities has not changed greatly over the last 15 years. This statement is inconsistent with the comparative measurements of the "Three Cities Study" and the "Seven Cities Study", referred to above. It is also inconsistent with the findings of Chow (1970) in San Diego and Bove' (1970) in New York. (This last important reference was omitted from the Academy report.)

Chow and co-workers have recently shown that there is an increase in lead concentrations from mid-oceanic atmosphere to remote mountains, to seashore, to light suburban traffic, to heavy urban traffic (Chow 1970). Polar snow strata record steadily increasing fallout of lead aerosols since the beginning of the industrial revolution and Greenland has recent snow with lead concentrations 400 times above natural levels (Murozumi 1969). The Greenland ice studies have received strong support from an independent study in Scandinavian mosses. These mosses can absorb airborne nutrients, and serve as sensitive indicators of air pollution (Bryce-Smith 1971; Ruhlung 1969). Chow has found that oceans are being contaminated with industrial lead at ten times the rate of introduction by natural weathering (Chow, in press).

Increased Lead Fallout in Soil and Plants

Lead has long been known to be a natural constituent in soils. Concentrations average about 16 ppm (Goldschmidt 1954). Cholak has reported lead content in soils near repainted buildings to range from 16.4 to 360 ppm (Cholak 1961). Some lead concentrations in soils near smelters can reach several thousand parts per million (USPHS 1965). Besides the weathering of outdoor painted surfaces and accumulations from lead processing, a major contributor of lead in soils (especially very near highways) is auto emissions (Purves 1967; Page 1970; Cannon 1962; Darnes 1970).

The question whether lead translocates from soils to plants has puzzled scientists for years. Additive manufacturers have gone to great length to show that edible portions of certain plants obtain their lead from naturally present lead and that these plants are insensitive to marked changes in lead concentrations in the soil (Ethyl 1970; Ter Haar 1970). In some circumstances

plants in areas remote from highways and insecticide use have been found with high lead concentrations (Allaway 1968). Uptake of lead is highly dependent both on type of soil and species of plants considered.

Lead concentrations due to direct fallout of airborne lead on food plants (leaves, flowers and fruits) can reach serious levels. California lettuce less than 100 yards from a highway had lead of mean concentrations of 0.91 ppm (washed 0.48) and 100 yards or more 0.51 (washed 0.12) (California 1965). Airborne lead materials from automotive exhausts accumulate in heavy amounts on grasses near highways (Dedolph 1970) and can add to the body burden of lead in cattle and herbivorous animals. Lagerwerff emphasizes the important contribution of lead contamination of plants by deposition from atmospheric rather than by uptake from the soil (Lagerwerff 1967). Studies in England show that there are twenty times more radioactive Pb^{210} originates from aerial contamination (Hill, 1965).

As with other heavy metals lead from soil is more concentrated in the roots and stems than in the flower and fruit (Motto 1970). With rapid changes in agricultural technology soils can be vastly modified and new plants introduced. In such cases root and stem crops could accumulate unusual amounts of lead which would raise the total intake when consumed by man. Patterson has expressed concern about the magnitude of the differential between actual and permissible values of various food products (Patterson 1965). We may observe increasing amounts of lead in and on edible plants in the coming decade due to airborne lead pollution.

Source of Lead Contamination

Antiknock additives are the second largest use of lead in industry. About 540,000,000 pounds of lead are consumed each year as antiknock additives (either tetraethyl lead or tetramethyl lead) and about 80% of this enters the environment as emission products in varying sized particulate matter.

Coal combustion is not a major source of lead pollution. Savul reports that lead in coal varies from 0.005 to 1.67 ppm (Savul 1958). Abernethy and coworkers estimate that the weighted average of 7 ppm of lead in coal (Abernethy 1969). This means that coal combustion contributes less than a thousand tons of lead to the atmosphere as contrasted to about 180,000 tons from leaded gasoline.

There has been little change in lead consumption in the past year. The no-lead grades introduced by various companies have small sales (about 2% of total) and are often made by draining gasoline from the high octane pool. More lead is then used to bring the depleted residual low octane stock up to sales demand (Sullivan 1970). Officials of the Lead-Zinc Producers Committee admit that the 1970 figures were higher than ever and that sales of leaded gasoline additives are holding very strong this year. This is confirmed by the monthly sales as recorded in Mineral Industry Surveys (Bureau of Mines 1971).

Economic Factors

Prior to 1923 all gasoline was unleaded and since that time some has always been lead-free. Thus leaded gasoline is not necessary for today's automobile. Several specific problems raised by lead interests must be treated:

(1) Quality of Gasoline—It is argued that unleaded fuels will cost more, will be of lower quality, and will demand unnecessary waste of petroleum resources. Even though the normal lead additive costs about a half a cent per gallon, change in processing will cost about a cent depending on the size of the refinery and the speed of the conversion schedule (Bonner and Moore 1971). Lead is at present the cheapest way to increase octane number.

Present processing methods require about 5% more crude stock of gasoline for unleaded over leaded gasoline. Universal Oil Products (a processing equipment company) states that processes are available that require no increase in crude petroleum stock (Universal Oil Products 1970). This company has argued that gasoline mileage increases 11% using high-octane lead-free gasoline, or a net reduction in total gasoline consumption. A recent report to the EPA by the consulting firm Bonner and Moore indicates a 12% reduction in mileage. The effect of lead-free gasoline upon automobile mileage is not yet certain, but at most is only a few percent.

(2) Engine Troubles—A report by the Mobil Research and Development Corp. states that operation of current passenger car engines on unleaded gasoline

can cause excessive valve wear and failure of exhaust valves and seats, due to lack of the solid lubricating effects of lead ash (Mobil 1970). American Oil contests this report and said customers do not drive at speeds and loads used for the tests (American 1970). However, the fact that traces of lead have been found by state investigators (Maryland, New York, and Wisconsin) in "certified free" unleaded Amoco may complicate the findings.

However, there is no doubt that leaded additives and the associated scavengers (ethylene dibromide and ethylene dichloride) and deposit modifiers are very toxic and have caused excessive damage to automobile parts. Ethylene dichloride is considered the worst offender.

"That corrosion is caused by the products of combustion is not surprising; analysis of exhaust gas showed the presence of hydrochloric, sulfuric, sulfurous, hydrobromic, phosphic, and carbonic acids. The presence of compounds of elements not found in petroleum is due to the use of additives; for instance, the compounds of chlorine, bromine, and phosphorous trace directly to the lead scavengers and the surface ignition suppressors added to gasoline. Statements have been made in which ethylene dichloride has been blamed for much of the corrosive action under discussion here; it has been known for many years that ethylene dibromide is less harmful." (Gruse 1967)

Though ethylene dichloride (used for economic reasons) is more dangerous to the automobile, ethylene dibromide has its share of the problems:

"Corrosion of valve heads and seats by bromine compounds from the tetraethyl lead fluid is a relatively common variety of valve trouble. It is likely to be induced in an engine in which the mixture temperature is too low to give good distribution. The usual course of this type of difficulty is general corrosion of both the valve head and the valve seat until a channel forms in one of the seating surfaces. Gas leakage and valve burning result." (Fraas 1948)

There are possible savings in maintenance costs that might accrue to the average consumer if scavengers were done away with. Spark plug fouling, engine lead scavengers and their removal can have appreciable effect:

"It is generally accepted . . . that engine rusting with leaded gasoline is due corrosion, and exhaust system deterioration are major detrimental effects of to the chlorine- and bromine-containing scavengers required by the lead antiknock compounds, rather than the lead compounds themselves. Reducing scavenger concentration reduced rusting severity. In our tests, eliminating the scavengers (by omitting the lead antiknocks) showed even greater improvement." (Pless 1970)

Tetraethyl lead antiknocks may eventually be seen as a technical short-cut with shortcomings, covered by a patchwork of less than effective remedies. Removal of lead may turn out to be a great blessing to the consumer. Taliaferro *et al.* (1970) estimated that savings of 3.5 to 4.8 cents/gallon on controlled fleet service and 1.8 cents/gallon in consumer-type service, may be possible.

One reason given for retention of small amounts of lead in gasoline is the need for such lead in pre-1971 cars. This need is limited to certain makes and models and is due primarily to the metals used in valve seats; there are other non-leaded remedies.

"All vehicles after 1972 models and most of the 1972 models, will be able to use the same fuel as will probably be required for 1975. The pre-1971 cars will need either some lead or other anti-scuff additive to prevent valve deterioration." (Heinen 1971)

Leaded gasoline will most likely be substituted by gasoline of higher aromatic concentrations (provided octane numbers remain relatively constant). The much publicized Bureau of Mines report (Bureau of Mines 1970) which indicated higher aromatic emissions from unleaded gasoline has been questioned by the EPA itself (NAPCA 1970). The CTAB report discounts the worries about increased aromatic emissions:

"Polynuclear aromatics probably rise with the concentration of aromatics in the fuel, but they also appear to fall with the elimination of lead. The net effect is probably not substantial.

"Automotive sources currently constitute between two and ten cents of total PNA emissions nationally depending upon the specific basis used for analysis. Most of this is present in the fuel before combustion and passes through the engine unchanged. It is important to note, however, that any concern over PNA's emanating from auto exhausts should be short-lived. Incorporation of exhaust gas treatment systems, especially a catalytic system, will result in selective decreases in polynuclear aromatics." (Commerce Dept. 1971)

Through PNA (especially benzo(a) pyrene) is cancer-causing, far more comes from coal and fuel oil burning than from elevated contents of aromatics in gasoline.

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Appendix 2

CONSUMPTION OF LEAD IN ANTIKNOCK ADDITIVES IN THE UNITED STATES (SHORT TONS)

Month	1969	1970	1971
January	20,818	25,997	21,344
February	18,831	22,927	19,941
March	21,589	25,876	20,254
April	22,017	23,926	21,636
May	21,655	24,167	22,363
June	23,562	24,630	22,886
July	23,828	26,360	22,182
August	22,789	23,059	23,152
September	23,436	22,533	23,371
October	24,193	20,510	22,506
November	21,777	17,199	23,457
December	26,653	21,295	

Reference: Mineral Industry Surveys Bureau of Mines.

Appendix 3

MISSISSIPPI STATE UNIVERSITY,
State College, Miss., October 27, 1971

DR. ALBERT J. FRITSCH,
Center for Science in the Public Interest, 1346 Connecticut Avenue NW., Washington, D.C.

DEAR DR. FRITSCH: As yet we have no publications available on our studies of the effects of auto exhaust on roadside mammals. Our monitoring work indicates an accumulation of around 50 μg/g (dry wt) of lead in the livers of roadside rice rats (*Oryzomys*) and cotton rats (*Sigmodon*) as compared to around 5 μg/g in livers of individuals collected away from highways. Blood carbon monoxide is likewise higher, around 20% in roadside animals as compared to 3% in others.

The levels for the roadside animals (these are rural, moderate-use federal highways) are well below the levels of acute toxicity for laboratory rats and mice. Our studies are now oriented toward reaching for possible chronic effects or behavior or ecology of the animals.

I will keep your address and keep you informed of further results.

Sincerely,

JAMES L. WOLFF,
Associate Professor of Zoology.

Appendix 4

Lead vapors last only briefly in the atmosphere, they quickly convert from the vapor to the solid particle form. But lead vapors are of concern because they are estimated to be ten times more toxic than lead particles. Automobiles emit most of the lead found in urban air. (roughly 90 percent). Lead emissions from tailpipes are a by-product of the combustion of leaded gasoline.

Lead Air Standards.—Recently, California adopted an ambient air quality standard for lead of 1.5 μg/m³ over a 30 day averaging time. The data in

Table 4 of the following page indicate that this level is often exceeded in urban areas and that urban lead levels have increased during the 1960's.

Lead Air Standards Exceeded.—Every day millions of U.S. citizens are breathing air which is contaminated to levels beyond these standards. Residents of urban areas breathe air with annual average concentrations of lead ranging from 1 $\mu g/m^3$ to 3 $\mu g/m^3$. In a current report, Colucci, Begeman and Kulmer recorded an annual average of 7.9 $\mu g/m^3$ at Herald Square, New York City. Recent NASN data show 11 cities exceeding California's 1.5 $\mu g/m^3$ level 30 day standard all year long as follows:

11 Cities	*Annual Average Lead ug/m³*
Phoenix	2.0
San Francisco	2.0
Oakland	2.07
Burlington C., N.J	2.08
Fairbanks, Alaska	2.12
Detroit	2.42
Scranton	2.50
Long Beach	2.60
Glendale	2.80
Omaha, Nebraska	2.80
Los Angeles	3.10

Data on localized in-traffic or near-freeway conditions reveal much greater exposure to atmospheric lead. In a review of this data, Landau, Smith, and Lynn reported "Lead concentrations measured in traffic have been about an order of magnitude higher than those measured at off the road sampling cities . . . in a 1967 study designed to determine the levels of lead in cars in rush hour traffic, ½ hour averages in the 5–25 $\mu g/m^3$ range were found."

Dr. Goldsmith testified that monthly average values in excess of 5 $\mu g/m^3$ have been recorded in Los Angeles and individual samples obtained near heavily traveled roadways contained concentrations in excess of 50 $\mu g/m^3$.

"Our Urban Environment and Our Most Endangered People," EPA, September 1971.

Supplemental Petition for Immediate Action Under the Clean Air Act and Other Authority Directed at Eliminating Automotive Lead Pollution from the Atmosphere

INTRODUCTION

On May 5, 1970, in an effort to alert the responsible officials of the Department of Health, Education and Welfare of the serious human health problems posed by atmospheric lead, and in an effort to generate appropriate administrative responses, the Environmental Defense Fund, Inc. (EDF) filed its original Petition (Exhibit 1). On June 17, 1970, representatives of EDF met with representatives of the Secretary and of the then National Air Pollution Control Administration. Exhibits 2a, 2b and 2c to this Supplemental Petition outline the understandings reached at that meeting. An updating of discussion is provided in Exhibit 3.

Essentially it was agreed, back in June, 1970, that, at a minimum, the following administrative action would be taken: (1) a lead criteria document would be finalized by January 1, 1971; (2) the Department would act to establish a lead emission standard as soon as the Congress were to enact the Clean Air amendments that were then pending (and subsequently were enacted on December 31, 1970); (3) serious consideration would be given to the request that the disclosure of octane requirements be made mandatory; and (4) that the government should act to reduce the use of leaded gasoline in vehicles which it owns or operates.

Simulfaneously, the Center for Science in the Public Interest has carried on extensive efforts to obtain an appropriate administrative response to the atmospheric lead menace. Exhibit 4 contains its correspondence with the responsible administrative officials and the replies thereto.

To date, with the exception of limited action on the fourth request, the Department of Health, Education and Welfare and now the Environmental Protection Agency, has totally failed to take any significant action directed at

protecting the public from the serious health hazards associated with atmospheric lead.

This inaction is particularly shocking in light of the following three facts:

(*a*) in October, 1967 the prestigious Technical Advisory Board to the Department of Commerce recommended that "The Federal Government should *immediately* establish standards for the lead content in gasoline which will prevent any further increase in the total quantity of lead emitted to the atmosphere" (emphasis added) (see Exhibit 5a);

(*b*) the authority and responsibility of the Environmental Protection Agency to take decisive action was clarified by the 1970 amendments to the Clean Air Act, and the explicit recognition by the White House of the health implications of atmospheric lead and of the necessity of reduction of automotive lead emissions;

(*c*) on March 24, 1970 Secretary Finch of the Department of Health, Education and Welfare, in an effort designed to underscore the necessity of reducing and eventually eliminating automotive lead emissions, wrote to the chief executives of the nation's petroleum companies urging them to work toward the production of lead free gasoline (see Exhibit 5b).

Only two semblances of action have occurred in response to the EDF Petition. One related to the request that automobile manufacturers be required to disclose the octane requirements of automobiles and merely called upon automobile manufacturers for their advice as to this recommendation. (See Exhibit 6a). The second action took place on October 26, 1970, when the President responded affirmatively to the EDF request that the use of leaded gasoline in vehicles owned or operated by the Federal government should be restricted. The President explained the basis of his action in a letter which he transmitted to the Governor of each state calling for comparable action at the state level (see Exhibit 6b). By way of further explanation of the President's action, Chairman Russell E. Train of the Council on Environmental Quality acknowledged, at a press conference, that lead emissions represent a health problem (see Exhibit 6c).

No further action has been taken, not even the elementary step of initiating a notice of proposed rule-making so that interested members of the public outside of the affected industries would know of the pendency of the EDF suggestions and be afforded the opportunity of submitting comments. [An "advance" notice of proposed rulemaking, directed at the possible eventual regulation of the lead content of gasoline, was announced in mid-January 1971. However, this action is without legal content. (See Exhibit 7, EPA memorandum stating why this mechanism was employed).]

The prejudicial consequences of this total failure to take meaningful administrative action are particularly acute since, if EPA had acted, it would have been difficult for the Federal Trade Commission to twice postpone the implementation of their promulgated rule. EPA's inaction encouraged industry to seek delays of the FTC rule (see Exhibit 8).

There has been absolutely no follow-up action. Delay no longer can be tolerated. The Congress has responded affirmatively to the Administration's request that it be "authorized to regulate the use of additives in motor vehicle fuels." As a result of the 1970 amendments to the Clean Air Act that authority, indeed that responsibility, rests with EPA. Section 211(c)(1) provides:

The Administrator may, from time to time on the basis of information obtained under subsection (b) of this section or other information available to him, by regulation, control or prohibit the manufacture introduction into commerce, offering for sale, or sale of any fuel or fuel additive for use in a motor vehicle or motor vehicle engine (A) if any emission products of such fuels or fuel additive will endanger the public health or welfare, or (b) if emission products of such fuel or fuel additive will impair to a significant degree the performance of any emission control device or system which is in general use, or which the Administrator finds has been developed to a point where in a reasonable time it would be in general use were such regulation to be promulgated.

In the case of lead each of these findings has informally been made by the EPA. There can be no excuse for further delay in formalizing the consequences which must, as a matter of law, flow from those findings. As was established in EDF's original Petition, the addition of lead to gasoline both represents a serious human health hazard, particularly to children, and decreases

the effectiveness of mission control devices designed to minimize the adverse consequences of the other major automotive pollutants—carbon monoxide, hydrocarbons and oxides of nitrogen. For detailed discussion of the health implications of atmospheric lead see Exhibits 1, 3 and 9.

The fact that lead decreases emission control system effectiveness was established by the automotive industry itself. Further, our concern as to the health implications of lead has been heightened, since May 1970, by the results of the "seven cities" studies on atmospheric lead (see Exhibit 10).

In these circumstances, the complete abdication of responsibility to act to protect the public health by giving meaning to the letter and spirit of the Clean Air Act no longer can be tolerated. To rectify the serious consequences of its past inaction, EPA must, as an absolute minimum, take the following steps:

(1) Issue, by January 1, 1972, a lead criteria document in compliance with Section 107(b)(1) of the Air Quality Act of 1967.

Responsibility for the issuance of that document has existed since enactment of the Clean Air Act of 1963 and, as already noted, assurances had been given that it would be issued by January 1, 1971.

(2) Pending the complete elimination of automotive lead emissions on the most expedited schedule feasible, promulgate by January 1, 1972 an atmospheric lead ambient Air Quality Standard of not in excess of 1.5 microgram/m^3.

(3) Notify the public, through prominent advertising by January 1, 1972, of areas with known ambient lead levels exceeding 1.5 micrograms/m^3 (30-day average). Notification should be followed by reduction of lead levels to less than 1.5 microgram/m^3 on the most expeditious schedule feasible. In the case of those urban areas identified as having atmospheric lead levels in excess of 1.5 microgram/m^3 EPA should restrict, after July 1, 1972, the sale in those areas of gasoline the lead content of which exceeds 0.5 grams per gallon. Exhibit 11 demonstrates that there are no technological barriers which would preclude realization of that objective. If the Administrator disagrees he should state the basis for his disagreement, rank urban areas according to the severity of their atmospheric lead concentrations and take all necessary action to encourage the dedication of available non-leaded and low-leaded gasoline to those areas where the atmospheric lead concentrations are highest.

(4) Promulgate, by January 1, 1972, a deliberate national phase-out program of lead in gasoline to achieve total elimination of automotive lead emissions by January, 1976 at a rate not less than 20% per year beginning no later than March 31, 1972.

(5) Promulgate, by January 1, 1972, an automotive lead emission standard for the control of lead emissions from 1973 and later model year automobiles.

The authority to so act is now clear under Section 202 of the 1970 amendments to the Clean Air Act. Again, the requisite showing necessitating administrative action ("air pollution which endangers the public health or welfare") cannot be disputed. See Exhibits 1, 3 and 9.

(6) Promulgate, by January 1, 1972, an automobile labeling regulation requiring 1973 and later model year vehicles to be posted with both the octane rating and lead content of the fuel recommended by the manufacturer.

(7) Issue, by January 1, 1972, a directive to automobile manufacturers instructing them to disclose prominently to the consuming public, through advertising and by mailing labels for owners' manuals, both the octane and lead requirements of all vehicles manufactured in accordance with federal regulations for the control of automotive emissions (1968 and later model year vehicles).

(8) Promulgate by January 31, 1972, a gasoline pump posting regulation requiring the listing of lead content of dispensed fuel in grams per gallon, to be effective nation-wide no later than March 31, 1972.

(9) Commence a public education campaign to encourage the use of low-lead and lead-free fuels and to discourage excess emissions resulting from overbuying of unnecessarily high octane fuel.

CONCLUSION

We request that the Administrator act, within the next 60 days, either to finally implement each of the above proposals or to initiate the administrative steps necessary to permit their expeditious implementation. In the absence of

an expression that appropriate and effective action will be taken within the next 60 days to meet the most serious problem presented by atmospheric lead, Petitioners intend to seek judicial relief.

It is fervently hoped that judicial intervention will not be necessary to secure discharge of the responsibilities entrusted to the Administrator by the Clean Air Act. As in the past we stand willing and eager to cooperate with the implementation of any well intentioned administrative program. However, unnecessary delay can no longer be tolerated.

Accordingly, we request a response to this petition by no later than January 1, 1972.

INDEX OF EXHIBITS

1. EDF Petition.
2a to 2e. Correspondence between Mr. E. Berlin and EPA.
3. The Lead Pollution Problem: Supplementary Material.
4a to 4f. Correspondence between Center for Science in the Public Interest and EPA.
5a. The Automobile and Air Pollution. A Program for Progress. p. 25.
5b. Secretary Finch's letter of March 24, 1970.
5c. Press Release of Secretary Finch's letter.
6a. J.T. Middleton's letter of September 3, 1970 to automotive manufacturers.
6b. White House Statement of October 26, 1970 on use of low-lead or unleaded gasoline in federally-owned vehicles.
6c. Russell E. Train's explanation of White House action of October 26, 1970.
7a. Advance Notice of Proposed Rulemaking—Briefing Memorandum of Jan. 22, 1971.
7b. Advance Notice of Proposed Rulemaking (January 30, 1971).
7c. Press Release of August 16, 1971 on proposed rulemaking.
8. "Octane Maneuvers Bleed Motorists" by Jack Anderson (Oct. 9, 1971).
9. "Health Hazards of Environmental Lead," by R. E. Engel.
10. "Seven-city Study of Air and Population Lead Levels. An Interim Report," by L. B. Tepper.
11. "An Economic Analysis of Proposed Schedules for Removal of Lead Additives from Gasoline," Bonner & Moore Associates, Inc. (June 25, 1971), p. 4-15.

Exhibit 1

Petition for Action Under the Clean Air Act and other Authority Directed at Eliminating Automotive Lead Pollution from the Atmosphere

The Environmental Defense Fund, Incorporated (EDF), is a non-profit, public benefit membership corporation organized under the laws of the State of New York. It is comprised of scientists, lawyers and other citizens dedicated to the protection of man's environment from harmful and unnecessary intrusions. Because it is concerned that automotive lead emissions constitute a dangerous health problem threatening man with serious physiological effects including the retardation of full mental development, EDF hereby petitions the Secretary for the following action on behalf of its membership and the public generally:

1. The immediate formulation and announcement of atmospheric lead air quality criteria;
2. The establishment of an automotive lead emission standard that makes it unlawful to emit lead from automotive exhausts;
3. The immediate issuance of a directive to automobile manufacturers instructing them to disclose prominently to the consuming public the octane requirements of new and old automobiles and the disadvantageous environmental and economic consequences of using excessively high octane gasoline.
4. The immediate prohibition of the use of leaded gasoline in vehicles owned or operated by federal departments and agencies; and
5. The immediate implementation of the Fuel Additives Registration provision of the Air Quality Act.

In view of the high atmospheric concentrations of automotive lead emissions and the urgency of the human health problem, we request that action on this petition be taken immediately. A memorandum in support of the petition is attached.

MEMORANDUM IN SUPPORT OF PETITION FOR ACTION UNDER THE CLEAN AIR AND OTHER AUTHORITY DIRECTED AT ELIMINATING AUTOMOTIVE LEAD POLLUTION FROM THE ATMOSPHERE

INTRODUCTION

Blood lead concentrations in average Americans today exceed one fourth of those considered diagnostic for lead poisoning in adults. Americans are unusual among the world's peoples in that they accumulate lead throughout their entire lives. Lead poisoning can produce liver, kidney and brain damage and deterioration of the central nervous and reproductive systems. Children are especially susceptible to lead poisoning, mental retardation being one of many possible effects.

The health implications of lead are not confined to the effects of acute exposure. Chronic exposure at levels typical of urban environments is known to produce biochemical changes in healthy adults. In animal experiments, injury has been observed at lead exposure levels typical of those experienced by urban Americans. Decreased longevity was found in chromium deficient mice with lead body burdens typical of Americans. Americans are thought to be chromium deficient.

At least one third of the lead body burden of urban dwelling Americans is attributable to lead emitted from automotive exhausts. It is therefore imperative that this wholly unnecessary source of atmospheric lead pollution be eliminated. The detrimental effects of lead in the biosphere have long been recognized, both in this country (California 1965, USPHS 1965, 1966)[1] and especially abroad (Danielson 1970, Rizonov 1963)

A. The health problem

Lead poisoning (plumbism, saturnism) is one of man's earliest self-inflicted diseases. The extent of the problem has been recognized in a report prepared under the sponsorship of the Department of Commerce (Morse 1967):

Lead has been known to be toxic for over two thousand years and in spite of its recognition as an industrial poison, it continues to be the cause of numerous outbreaks of chemical intoxication of industrial or accidental origin . . . Lead is so widely used in modern technology that occupational health and public health authorities must always be alert to controlling the hazard.

Lead poisoning first became a major problem in Roman times, when lead became widely available as a byproduct of silver smelting. The Roman difficulties stemmed from the custom of using lead as a lining material for containers of food, water and wine and from its use as an actual ingredient of wine and medicines. It has been suggested that lead poisoning was a major factor in the decline of the Roman Empire (Gilfillan 1965).

During the early years of the twentieth century, lead was widely used in paint. In 1918, it was estimated that 40% of all painters showed evidence of lead poisoning (Sollman 1967).

Today obvious symptoms of lead poisoning are most frequently found in ghetto children, who ingest peeling paint and putty and are exposed to especially high concentrations of atmospheric lead from automotive emissions.

Between 1954 and 1967 2038 children were treated for lead poisoning in New York City, of whom 6.3% (128 children) died (Jacobziner 1966). It has been estimated that abnormally high blood lead concentrations occur in as many as 225,000 children (Oberle 1969) (See also Elwin 1968; English 1969).

According to Hardy (1968), see also Hardy(1965; 1966; 1969) lead produces . . . a variety of changes in practically all portions of the nervous system, some of which are unquestionably harmful. The effect of acute lead poisoning on the brain is extreme. Central nervous system damage caused by lead is marked by destruction of various types of brain cells and degeneration of capillaries and blood vessels throughout the entire structure of the brain.

Lead encephalopathy can cause brain hemorrhage, accumulation of fluid, swelling or shrinking of the brain and atrophy of the convolutions. There are serious and widespread disturbances of blood circulation throughout the brain

[1] In this memorandum scientific sources are cited by the first author listed or by organization together with date of publication. These references are listed alphabetically in an appendix to the memorandum. Testimony and legal references are cited by footnotes.

in acute cases. Lead damage to the brain can cause convulsions, delirium, or coma. It can result in severe headaches, blindness, paralysis, mental retardation, or death.

Goldsmith (1969) recently reported that "inorganic lead in sufficient amounts is implicated as a causative agent in . . . liver and kidney damage." The "sufficient amounts" of which Goldsmith speaks may be either a single acute dose or repeated low level exposure. The most common kidney related effect "seems to be a deterioration of the arteries of the kidney, which in time can produce a crippling atrophy of the organ. (Hardy 1968).

Lead toxicity is implicated as a source of reproductive failure. Hardy (1965) reported on lead-induced injury in both male and female germ cells. Cantrow and Trumper (1944) say "(t)here can be little doubt that exposure of mothers to lead has a damaging effect upon fertility, the course of pregnancy and the development of the fetus."

Geochemical evidence (Patterson 1965) has shown that in a natural environment human lead concentrations were a factor of 100 below current levels. Human activities have introduced lead into areas as remote as the Greenland ice sheets (Muruzumi 1969) (see also Chow 1966; 1969). In Greenland lead levels rose from below 10 micrograms/ton of snow in the pre-Christian era to more than 200 micrograms/ton of snow today. Almost all of the increase in lead concentration occurred within the last 50 years. The sharp rise in lead level corresponds closely with the introduction of tetraethyl lead into gasoline in 1923.

Lead is now used as an additive in 90% of all motor gasoline made in the United States.[1] The amounts added range from 2 to 4 cm^3/gallon. In 1968 in the United States about 300,000 tons of lead were used as gasoline additives, which is about 25% of the total lead used in the United States.

In 1966 motor vehicles discharged 190,000 tons of lead into the atmosphere (Morse 1967). Recently, it was estimated [1] that the removal of lead from automotive fuel would eliminate(s) the 500 million pounds of lead which is currently being emitted from the exhaust pipe of the nation's automotive fleet. A substantial portion of the lead in humans is attributable to automotive emissions.

Urban air pollution levies for lead range from about 1 to 3 micrograms/m^3, but atmospheric measurements taken near automobile traffic may extend to above 40 micrograms/m^3, depending on proximity to traffic and traffic density (USPHS 1965). In mid-Manhattan daily averages of 7.5 micrograms/m^3 are found (Bove 1970). In San Diego the average atmospheric level is increasing by 5% per year, and week long averages of 8 micrograms/m^3 now occur (Chow 1970). Urban atmospheric lead levels (Morse 1967) and lead in rainfall (Lazrus 1970) are correlated with local gasoline sales.

The average person breathes about 20 m^3 of air daily and the efficiency at which the body absorbs inhaled lead approximates 40%, whereas only 10% of ingested lead is absorbed by the body. (Patterson 1965; Kehoe 1959; 1960; 1964a; 1964b).

The amount of lead that is absorbed from the atmosphere is a function of the size of the lead particle inhaled. Lead emitted from automobile exhausts is particularly suited for retention in the atmosphere and eventual absorption by the body. About 75 percent of particulate lead from automobile gasoline combustion is less than 0.90 microns in mean diameter, a size that easily reaches the alveoli of the lungs (USPHS 1965; Habibi 1970; Nozaki 1966).

The most common test for measuring the body lead burden measures the blood lead concentration. In adults, the industrial toxicological guideline blood lead level associated with lead poisoning is 0.8 ppm (parts per million; 0.080 mg/100 ml blood; Kehoe 1960; 1969). The mean blood level in the United States is in the vicinity of 0.20 ppm (California 1967; Goldwater 1967; Cantrow 1944) with higher levels demonstrated in persons who work or live in close proximity to automotive traffic (USPHS 1965).

Analysis of measured blood lead levels in Americans shows a direct correlation with exposure to atmospheric lead (Goldsmith 1967; Craig 1970). At least one-third of the lead in urban-dwelling Americans is directly attributable to automotive emissions. Additionally, an appreciable portion of the lead in

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[1] Testimony of Richard C. Glogau, Senior Vice President Engelhard Minerals & Chemicals Corp., before the Senate Committee on Public Works, March 25, 1970.

food may originate from fallout of lead introduced into the atmosphere by automobiles. Lead concentrations in plants along highways often exceed 100 ppm (Chow 1970b) and levels as high as 3000 ppm have been recorded (PSAC 1965).

Americans, in contrast to citizens of foreign countries, are not in lead balance (Schroeder 1968). Lead is accumulated in Americans throughout their lives. The lack of equilibrium is borne out by studies of lead concentration in teeth, which show an exponential increase as a function of subject age (Strehlow 1969).

Low lead exposure to lead is known to produce biochemical changes in man. A negative correlation between blood lead concentration and delta-aminolevulinic acid dehydrogenase (an enzyme involved in hemoglobin synthesis) has been found in healthy males with no known occupational exposure to lead (blood lead levels in the range 0.05–0.33 ppm) (Hernberg 1970).

It is well documented that lead toxicity has a substantial inhibiting effect on red blood cell development. The Morse Report recognized this fact. The hemoglobin problem from chronic exposure was summarized by the California Department of Health (1965):

There is evidence that exposure to moderately low lead levels may produce abnormalities in the synthesis of porphyrins (substances necessary for the production of hemoglobin and other compounds in the human body). With moderately high occupational exposures, a considerable increase in delta-amino-levulinic acid (a substance from which porphyrins are formed by the body) in blood and urine can be detected prior to other clinical or biochemical symptoms. With a loss in capacity of reticulocytes (young red blood cells) to synthesize porphyrins, hemoglobin concentration is altered (thus, perhaps, the transport of oxygen and carbon dioxide). Survival time of red blood cells is also lessened. Some decrease in other porphyrin structures, cytochromes, myoglobin, peroxidase and catalese may be expected. The most specific, but not the only, site of damage by lead in porphyrin biosynthesis is the inhibition of aminolevulinic acid dehydrase (an enzyme essential to the body's production of aminolevulinic acid). Increases in blood and urine levels of aminolevulinic acid immediately reflect this inhibition while blood and urine lead levels may remain unchanged even as accumulation in organs and bones take place. Indeed, in rats treated with alkyl lead, organ lesions have been shown to occur when other indications of intoxication were not present.

This low level exposure effect was recently underscored by John R. Goldsmith (1969) of the California Department of Public Health when he reported that:

There is evidence that exposure to moderately low lead levels may produce abnormalities in the synthesis of porphyrins. The most specific, but not the only, site of damage in porphyrin biosynthesis is the inhibition of delta-aminolevulinic acid dehydrase. This inhibition leads to increased blood and urine levels of delta-aminolevulinic acid; this increase may appear before any change is noted in blood or urine lead levels.

Studies of animals have demonstrated toxicity associated with chronic exposure to lead at levels similar to those experienced by man. Gusev (1960) found that rabbits and white rats exposed to atmospheric lead oxide at a concentration of 10–11 micrograms/m^3 for 6 hours daily for 6 months experienced physiological and patho-anatomical changes. Pathologic and histologic changes were observed in the brain and spinal cord of exposed rats, and disturbed porphyrin metabolism in rabbits. Six and Goyer (1970) have found elevated delta-aminolevulinic acid levels in calcium deficient lead fed rats. No changes were noted in rats that were not calcium deficient. In an extended series of experiments Schroeder and Associates (Schroeder 1964; 1965; 1968a; 1970) found decreased longevity in chromium deficient rats with body lead levels comparable to those found in Americans. Chromium is often deficient in the American diet (Schroeder 1962; 1968b). These synergistic effects play an important role in man's sensitivity to lead exposure.

Children are especially susceptible to lead poisoning (Pearlstein 1955; Roffman 1969; Berman 1969). The California Department of Health (1965) has reported that:

Children are much more susceptible to lead intoxication than adults. Encephalopathy and mental deterioration in lead-poisoned children have been well documented. One study disclosed that 200 small children had blood lead

levels of 0.014 to 0.030 milligram per 100 grams [0.14 ppm to 0.3 ppm] while 100 mentally defective children showed 0.04 to 0.08 per 100 grams of blood [0.4 ppm to 0.8 ppm]. Aminolevulinic acid levels in the blood of these latter children were also high. It has been stated that an upper limit for blood lead in children should be 0.04 milligram per 100 grams [0.4 ppm]. This figure already borders on the lower value found in affected children, though general population studies of children have not been done.

Hardy indicated that childhood "mental retardation . . . follows not only acute lead encephalopathy but perhaps chronic lead absorption" (USPHS 1965). Joseph Cinino, M.D., (affidavit) Medical Director of New York City's Poison Control Center has concluded that chronic sub-toxic level lead poisoning is responsible for under-achievement of children in many areas.

Delayed physiological effects have been observed in children poisoned by lead. In febrile disease and in disturbance of calcium-phosphorous metabolism, lead may be mobilized from the skeletal system (which is the major long-term lead reservoir) and cause recurrences many years later (Byers 1943). A classic case of this sort occurred in Australia (Henderson 1954). Water from veranda roofs painted with lead-containing paint was consumed by children, with no immediate ill effect. These children suffered rhenal disease, gout and uremia at age 25-30 years.

Blood lead levels in children from low income areas in Chicago are substantially above those found in adult populations (Blanksma 1969; see also Jacobziner 1966). Of 68,800 children tested during 1967–1968, 5.8% had blood lead levels of 0.5 ppm or higher. These children were referred for treatment for lead poisoning. The proportion of children exhibiting high blood lead levels showed a seasonal variation, with minimum levels occurring in January and maximum levels during the summer. Much of the lead responsible for these high levels thus appears to have been acquired outdoors, with automotive effluent a likely contributing source.

At least one-third of the blood-lead level of urban Americans is of gasoline additive origin. Removal of this source of lead would lower American blood lead-levels, thereby lowering the extent of the damage now being inflicted upon children, as well as upon other members of our society who may be particularly sensitive to this entirely unnecessary environmental stress.

B. Lead emissions aggravate other automotive pollution problems

Automotive lead emissions not only pose a serious health threat in their own right, but they also aggravate other automotive pollution problems. As stated by Assistant Commissioner Megonnel of NAPCA, "to add insult to injury, lead in gasoline tends to build up in the internal combustion engine with the result that hydrocarbon emissions are increased."[2] Recently it was estimated that "lead deposits in automobile engines may account for a gradual increase of 30 to 40 parts per million in hydrocarbon emissions" (Grundy 1969).

Lead interferes with the removal from automotive emissions of carbon monoxide, hydrocarbons and the oxides of nitrogen. To establish this fact we need only look to the experts, the automobile manufacturer, the petroleum producer, and the manufacturer of the catalytic muffler. Representatives of each appeared recently before the Senate Committee on Public Works and told an identical story: automotive pollutants cannot be eliminated so long as leaded gasoline is utilized.

The representative of General Motors stated:

We are concerned with the removal of lead only because of the need to achieve the much more stringent and desirable emission control levels of the future. Research shows that without lead in gasoline, long-life exhaust catalytic converters could become technically feasible. Exhaust manifold reactors and exhaust gas recirculation systems to control oxides of nitrogen also would have longer lives.[3]

The Ford Motor Company agreed:

Today the petroleum industry and the automobile industry jointly face a new, and in some ways, more difficult challenge: to develop the right combination of fuel and engine conducive to vital elimination of vehicle emissions. This problem has many difficult aspects, perhaps the most serious resulting

[2] Statement of November 18, 1969; see also Morse Report, Part I, p. 23, Part II, p. 45.
[3] Testimony of Dr. Paul F. Chenea, Vice President, Research Laboratories, General Motors Corporation, before the Senate Committee on Public Works, March 25, 1970.

from the existence of lead additives in gasoline. As a matter of fact, we are convinced that control of this additive is *essential* if we are to meet future emission standards.[4]

After indicating that the presence of lead both increases automobile emissions and renders emission control systems ineffective, the Ford representative concluded that, "It is simply vital to continued progress in emission control that essentially all lead be removed from gasoline." [4]

A leader in catalyst technology conceded that while catalytic emission control devices have been demonstrated to be capable of permitting automobiles to operate within the proposed 1980 emission standards for carbon monoxide, hydrocarbons and oxides of nitrogen, "the lead component of ordinary fuel poisons the catalysts [making it] imperative that they operate in a lead-free environment." [5]

The testimony of Standard Oil Company of Indiana was most persuasive. That company "tested more than 200 catalysts, particularly those useful in reducing emissions of nitrogen oxides, and found none that performed satisfactorily with leaded fuels. [It] did find a number of catalysts that work effectively for extended periods of time, but only with unleaded gasoline." [6]

Nevertheless, oil companies have resisted developing the refining capability needed to produce unleaded gasoline allegedly because of the economic cost to the consumer. The economics, however, are open to question. Assistant Commissioner Megonnel has observed:

. . . it is a well advertised fact that leaded gasoline shortens the life of the spark plugs, and that the halogens added to gasoline to scavenge the lead, shorten the life of tailpipes and mufflers. It poisons catalysts which hold promise in achieving very low emissions. When we compare what the American Petroleum Institute has established as the additional cost of lead-free gasoline, with what we estimate the consumer would save in spark plug and exhaust system replacements, we figure the consumer would be out of pocket about $1.50 per year for lead free gasoline, and lead-free lungs.[7]

C. Several decisive actions are required without delay

All scientific work is incomplete—whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time (Hill, 1965).

At best, knowledge of the scientific and medical realities of atmospheric lead pollution is incomplete. Existing knowledge demands decisive, expeditious action, however, for it compels but one conclusion: atmospheric lead, at levels now common in urban areas, is a human health hazard and serves no necessary purpose. This being the case it is incumbent upon the Secretary to do the following:

1. Atmospheric Lead Air Quality Criteria Must be Formulated and Announced.

The Air Quality Act of 1967 provides that

The Secretary shall, after consultation with appropriate advisory committees and Federal departments and agencies, from time to time, *but as soon as practicable*, develop and issue to the states such criteria of air quality as in his judgment may be requisite for the protection of the public health and welfare; [Section 107(b)(1) 42 U.S.C. 1857c-2(b)(1) emphasis added].

While the specific language has undergone some change, the Secretary has had that responsibility since the enactment of the Clean Air Act of 1963 (Public Law 88-206). Air quality criteria are—an expression of scientific knowledge [and] indicate quantitatively and qualitatively the lowest known levels of exposure at which specific deleterious effects have been reported for a given pollutant or combination of pollutants of inorganic, organic, bacteriological, or radioactive nature. *This means that the criteria reflect evidence per-*

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[4] Testimony of Herbert L. Misch, Vice President, Engineering, Ford Motor Company, before the Senate Committee on Public Works, March 25, 1970 (emphasis in original)

[5] Testimony of Richard C. Glogau, Senior Vice President, Engelhard Minerals and Chemicals Corporation, before the Senate Committee on Public Works, March 25, 1970.

[6] Testimony of Robert C. Gunness, President, Standard Oil Company of Indiana, before the Senate Committee on Public Works, March 25, 1970.

[7] Statement of William H. Megonnel, November 18, 1969.

taining not only to so-called normal healthy adults but also to those individuals such as the young, elderly, and impaired who may be sensitive to certain effects of air pollution.[8]

As expressions of scientific knowledge, air quality criteria "define health and welfare effects of air pollution [but] do not take into consideration the technological and economic feasibility of achieving such air quality."[9]

Air quality criteria are, as characterized by the House Committee on Interstate and Foreign Commerce, "The *sine qua non* to effective air pollution control . . . the issuance of such criteria is among the prerequisites for the development of air quality standards by the States. . . ."[10]

Congress was particularly concerned that criteria be promulgated expeditiously for the "subtler, less dramatic long-range effects of air pollution [which] are of much more serious consequence to the population as a whole than the occasional major tragedy."[8]

Atmospheric lead represents such a threat. Children are particularly vulnerable to its metabolic and biological effects and large segments of the population have already accumulated body lead levels approaching one-half the generally accepted level of industrial toxicity. The promulgation of atmospheric lead criteria must not be postponed; more than three years ago the Congress was assured that they would be forthcoming.[11]

Criteria should be promulgated which detail the dangers of toxicity at present atmospheric lead levels and which make it clear that the only air quality standard which can be adopted is one that compels cessation of lead discharged into our atmosphere.

The Russian standard for atmospheric concentrations of lead is noteworthy. Riazanov (1963) has stated "only a concentration less than 1 mkg/m^3 [microgram/m^3] should be regarded as harmless for the population. This is why in the U.S.S.R. 0.7 mgk/m^3 has been established as maximum permissible in the air of inhabited localities." This may be compared with the concentrations in New York City which often exceed 7.5 microgram/m^3 (Bove 1970).

2. Automotive Lead Emission Standards Must Be Established Which Make It Unlawful to Emit Lead from Automotive Exhausts.

Section 202(a) of the Air Quality Act directs the Secretary to . . . by regulation, giving appropriate consideration to technological feasibility and economic costs, prescribe as soon as practicable standards, applicable to the emission of any kind of substance, from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause or contribute to, or are likely to cause or contribute to, air pollution which endangers the health or welfare of any persons, and such standards shall apply to such vehicles or engines whether they are designed as complete systems or incorporate other devices to prevent or control such pollution.[12]

The underscored language, which represents the amendment made to the provision by the 1967 legislation, emphasizes that the Secretary is under a mandate to establish standards expeditiously, including lead emission standards.

Not only is the statute itself clear (speaking as it does of "the emission of any kind of substance . . . likely to cause or to contribute to, air pollution which endangers the health or welfare of any persons") but the authority of the Secretary with respect to tetraethyl lead specifically was considered by the Senate Committee on Public Works:

. . . The Secretary presently has authority to set standards for emissions from motor vehicles. Should he find that any fuel additive emitted from motor vehicles is presenting a threat to health and welfare, he has the authority to act pursuant to that title.

Among the substances widely used as fuel additives, tetraethyl lead has been identified as a compound of major concern to the public health.[13]

Recently the California Air Resources Board, after receiving the report of its Technical Advisory Committee on Leaded Gasoline, recommended to the

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[8] Senate Report No. 403, 90th Cong., 1st Sess. p. 26 (emphasis added); see also p. 9.
[9] Id at p. 27; see also House Report No. 728, 90th Cong., 1st Sess. p. 16.
[10] House Report No. 728, *supra*, pp. 14, 16; see also Senate Report No. 403 *supra*, pp. 28, 43-44.
[11] See Senate Report No. 403, *supra*, pp. 26, 27.
[12] 42 U.S.C. 1857f-1, underscoring added.
[13] Senate Report No. 403, 90th Cong., 1st Sess. p. 35.

State Legislature that it enact a timetable for the end of leaded gasoline. By January 1, 1970, at least one grade of 90 or better R.O.N. (Research Octane Number) gasoline, containing not more than 0.5 grams of lead per gallon, would have to be available at every service station and no gasoline would be permitted to contain more than 2.0 grams per gallon. By January 1, 1974, service stations would be obliged to market at least one grade of 90 or better R.O.N. lead-free gasoline, and after January 1, 1977 all gasoline would have to be lead-free.

This is not the most expeditious timetable. It is, nevertheless more protective of the consumer than is the Secretary's March 24 recommendation to the petroleum industry which fails to preclude the use of lead in premium grade gasoline, permitting "up to four grams per gallon of lead [in 97 or better octane gasoline] so long as the demand for such gasoline exist[s]."

We recognize that legislative proposals presently under consideration would expand the Secretary's authority to set standards for gasoline. Under present statutes, however, clarification is unnecessary and there can be no justification for delaying action. The authority of the Secretary has been guaranteed by the National Environmental Policy Act of 1969 in which Congress declared that "to the fullest extent possible . . . the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act. . . ."[14] Congress described those policies as follows: (Section 101)

The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

Since lead additives in gasoline are a human health hazard and serve society only by providing cheap octane numbers, the Secretary is required to act decisively and immediately to secure the elimination of these additives from all automotive gasolines.[15]

Air quality criteria heretofore requested should make it clear that continued contamination of our atmosphere by automotive lead emissions cannot be tolerated. The States will then be put on notice that they will have to take action against lead in gasoline. We are confident that the States, if apprised of the full extent of the problem and advised of how it can be met, will act. If the Secretary can be said to have any mandate under the Clean Air Act it is to disseminate information to the States so that they can move against environmental pollution.[16] It is therefore incumbent upon the Secretary to fully inform the States of the lead problem and of the need for action paralleling that which has been recommended in California.

3. Automobile Manufacturers Must be Directed to Disclose Engine Octane Requirements

Since the higher octane gasolines generally contain increased amounts of lead it is important that the demand for and utilization of these grades be re-

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[14] Public Law 91-190, 83 Stat. 852, Section 102.

[15] It should be noted that Russia, Sweden, Switzerland and Japan already have moved to eliminate or control the amount of lead in gasoline.

[16] The House Committee on Interstate and Foreign Commerce discussed the importance of this information function as follows. (House Report No. 728, 90th Cong., 13th Sess. p. 15):

Since the prime purpose of controlling air pollution is to protect public health and welfare, it is essential that scientific knowledge of the adverse effects of air pollutants be available in a form which can help control agencies develop and adopt standards and regulations. To this end, a requirement that the Secretary develop and issue air quality criteria was included in the Clean Air Act of 1963.

duced. The consumer gains no benefit by using a higher octane gasoline than is required in his automobile. Indeed, such use exacerbates our air pollution problem and wastes consumers money. Most owners, however, do not know the octane requirements of their vehicles.

The automotive industry should be directed (1) to disclose prominently (for example both in some appropriate place on the vehicle and in the owner's manual), the octane requirement of each new automobile, the absence of any benefit resulting from the use of a higher octane gasoline and the adverse consequences (environmental and economic) of utilizing gasoline with excessively high octane and (2) to suitably convey similar information to the owners of existing automobiles. The Federal Trade Commission presently is considering promulgation of a rule which would require service stations to prominently display the octane number for all gasoline which they market. Although this is desirable it can accomplish its intended objective only if the consumer is aware of his automobile's octane needs.

4. The Secretary Must Prohibit the Use of Leaded Gasoline in Vehicles Owned or Operated by Federal Departments or Agencies.

The National Environmental Policy Act imposes upon federal departments and agencies the responsibility for taking the leadership in pollution abatement. This responsibility was underscored by the President on March 5 when he affirmed that "The Federal Government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life" and instructed federal agencies to "initiate measures needed to direct their policies, plans and programs so as to meet national environmental goals." (Executive Order 11514).

If this objective is to be realized the Secretary must prohibit the use of leaded gasoline in vehicles owned or operated by federal departments or agencies. The Clean Air Act authorizes the Secretary to take such action. Congress, distressed over the failure of the Federal Government to take the leadership in cleaning up its own pollution, authorized the Secretary in 1963 to "establish classes of potential pollution sources for which any Federal department or agency having jurisdiction over any building, installation, *or other property shall, before discharging any matter into the air of the United States, obtain a permit from the Secretary for such discharge*, such permits to be issued for a specified period of time to be determined by the Secretary and subject to revocation if the Secretary finds pollution is endangering the health and welfare of any persons." [17]

It is incumbent upon the Secretary to declare automotive lead emissions a pollution source in accordance with Section 111(b) and to prohibit their discharge by any vehicle under federal control without the prior issuance of a permit.

5. The Registration of Fuel Additives Provision of the Air Quality Act Must Be Implemented Without Delay.

Section 210 of the Air Quality Act (42 U.S.C. 1857f-6(c) authorizes the Secretary to collect information about automotive fuel additives. To date no effort has been made to implement that section. It is incumbent upon the Secretary to immediately initiate a program for the expeditious collection of that necessary information so that public health and welfare can be protected as envisioned by the Congress.

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[17] Section 111(b), 42 U.S.C. 1857f(b). See also Senate Report No. 638, 88th Cong. 1st Sess. p. 11.

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Exhibit 2a

ENVIRONMENTAL PROTECTION AGENCY,
Washington, D.C., February 4, 1971.

EDWARD BERLIN,
Berlin, Roisman & Kessler, Washington, D.C.

DEAR MR. BERLIN: This is in response to your letter of December 17, 1970, in which you urge prompt action on the Environmental Defense Fund's earlier recommendation that auto makers be required to disclose prominently the octane requirements of new and old automobiles. I welcome this opportunity to bring you up-to-date on the status of your recommendation.

The purpose of your recommendation was to reduce the amount of lead emitted into the atmosphere. You stated that high-octane (premium) gasoline contains more lead than does lower octane (regular) gasoline, and that needless overbuying of higher octane fuels thus results in greater emissions of lead than would otherwise occur.

In the past, the difference in lead content of premium and regular gasolines was not great—about 2.8 gm/gal in premium, and 2.3 gm/gal in regular, on the average. However, with low-lead (0.5 gm/gal) and even some lead-free gasolines of lower than premium octane grade now coming on the market, a far greater benefit in terms of reduced lead emissions can be realized if overbuying can be avoided. Clearly, then, there is merit in any scheme that can reduce overbuying.

Our Air Pollution Control Office, last fall, informally requested auto makers' comments on the idea of labeling new cars as to their octane requirements. Their responses and other materials are now being reviewed to determine if meaningful octane labeling regulations can be proposed. Consideration is also being given to a requirement that new vehicles be labeled as to the amount of lead-if any-that is needed in their fuel. These considerations will be completed in the near future.

In conclusion, let me emphasize that I admire the thoughtful and responsible methods by which the Environmental Defense Fund pursues the same objectives that the Environmental Protection Agency has been established to achieve. We welcome your efforts and support.

Sincerely yours,

WILLIAM D. RUCKELSHAUS,
Administrator.

Exhibit 2b

BERLIN, ROISMAN AND KESSLER,
Washington, D.C., June 23, 1970.

ROGER STRELOW, Esq.,
Office of the Secretary, Department of Health, Education and Welfare, Washington, D.C.

DEAR ROGER: As I stated at the conclusion of last Wednesday's meeting, we appreciated the opportunity for a frank exchange of views. It is unfortunate that so often groups like the Environmental Defense Fund are viewed, at least so far as the public is concerned, as being antagonistic to HEW when in point of fact they should have common cause.

If I may, I should like to summarize the conclusions that were reached with respect to the EDF Petition. As to the formulation of criteria, we were advised that the Department intends to finalize its criteria document by January 1, 1971. In view of that fact, I indicated that EDF would be advised to defer to that schedule and not press, at this time, for an earlier release date. It is our understanding, from Dr. Barth, that Dr. Paul Craig will be permitted to comment on the draft document before it is finalized.

With respect to the announcement of an automotive lead emission standard the Departments timing concerns were discussed. It was agreed that if the Department was convinced that there were policy reasons militating against a response at this time, action would be deferred until late summer, unless the legislative intentions of the 91st Congress are earlier clarified.

As to requiring the disclosure of octane requirements, all agreed that the proposal makes sense. The only question raised by staff people related to HEW's authority to proceed as requested. As you know I believe HEW's au-

thority is clear. Indeed, comparable requirements have already been imposed. In this connection I call your attention to the labeling regulation promulgated on December 9, 1969, a copy of which is enclosed. As you will observe the information which must be disclosed to the automobile user is quite similar to the additional information we would have disclosed (see particularly the requirement that tuneup specifications be disclosed).

Finally, all present seemed to be in agreement that the federal government should exercise its leadership responsibility by prohibiting the use of leaded gasoline in vehicles which it owns or operates. It is my understanding that we can expect that request to be implemented in the immediate future.

Thank you again for inviting us to meet with you.

Yours very truly,

EDWARD BERLIN.

Exhibit 2c

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
OFFICE OF THE SECRETARY,
Washington, D.C., June 26, 1970.

EDWARD BERLIN
Berlin, Roisman and Kessler, Washington, D.C.

DEAR ED: Thank you for your June 23 letter, which I believe well summarizes the conclusions and agreements reached at our recent meeting to discuss the Environmental Defense Fund petition concerning atmospheric lead emissions.

I share your appreciation for the frank and cordial exchange of views and information during that meeting. I am sure the other HEW participants agree with me that such communications with EDF and similar organizations are desirable and important. I hope and trust that we will continue to have such meetings, as well as more informal communications, on other issues of mutual concern.

To follow-up on the understandings expressed in your letter, I am requesting appropriate officials within the Department to do the following:

(1) Prepare a detailed position paper on the legal or other constraints against endeavoring prior to 1975 to control automotive lead emissions through existing authority to impose automotive emissions standards. (As you know, we have announced for 1975 the first standard limiting particulate emissions from automotive exhausts. This move is based on present estimates of technological capability and would significantly affect lead emissions—assuming they are not then already controlled by fuel regulations—since lead is a significant portion of automotive particulate emissions.)

(2) Prepare a detailed position paper to outline the regulatory and/or exhortatory options available to HEW to either require or strongly suggest the disclosure by the automobile companies of octane requirements.

(3) Prepare a plan of action for maximum use of NAPCA's statutory (section 111(b) of the Clean Air Act) and Executive Order (E.O. 11507) authority to minimize as soon as possible the use of leaded or high-lead gasoline in Federal vehicles.

I will be in California on vacation July 1-15, but will contact you when I return to discuss where we stand on these matters. In the meantime, if you have questions, I would suggest that you contact Mr. Charles Gregg, Special Assistant to the Assistant Secretary for Health and Scientific Affairs (96 34525).

Thank you again for your cooperativeness and I look forward to talking with you after the 15th.

Sincerely,

W. ROGER SIBELOW,
Assistant to the Secretary.

THE LEAD POLLUTION PROBLEM: SUPPLEMENTARY MATERIAL

Lead has been known for thousands of years to be a highly toxic material. The disease, sometimes called plumbism or saturnism was first described over 2000 years ago by the Greek physician Nicander. This disease was not understood among the Romans and the accidental ingestion by upper-caste citizens

of the Empire of lead from pottery and metal cups has been considered a cause of the decline of Rome. Franklin in the 1700's knew that people could be poisoned from rain water collected from lead covered roofs on which acidic leaves had fallen. Industrial workers in the 19th and 20th centuries have frequently experienced "wrist drop," nausea, and other symptoms of lead poisoning.

We have been made aware in the past few years of children with pica suffering irreparable brain damage and sometimes dying from eating lead paint chips from the interiors of old buildings; likewise, we know that people drinking illicitly distilled lead-contaminated whiskey have been known to suffer from lead poisoning. Very recently unglazed pottery, sold chiefly in small art shops, has given rise to cases of lead poisoning.

No one doubts the heavy weight of medical evidence demonstrating the toxicity of lead; the question is whether a small amount of lead is hazardous. In the absence of overwhelming documentation on the toxicity of small amounts of lead, we must decide whether this nation wishes to take chances on living with ever-increasing amounts of lead until such time as the safety of small amounts of lead is conclusively proved or disproved.

The average American ingests or inhales approximately 100 to 500 micrograms of lead per day. Typically, about 20 μg/liter is ingested from drinking water and about 300 μg is ingested in food. Between 5 to 10% of ingested lead is absorbed (Kehoe 1961). Thus the average daily dietary contribution of lead to the body burden is about 10 to 30 μg.

The airborne lead intake varies considerably, ranging from less than one μg Pb/day in rural areas to 8–23 μg Pb/Day in central city areas (Engel 1971). This is based on 15 m^3 air/day and a 25 to 50% absorption rate. One study reports that 22 to 63% of 0.1 to 1.0 micron diameter particles were deposited in the lungs (Nozaki 1966). In another study 14 to 45% of 0.2 micron particles were deposited with more than 90% of the deposited particles retained by absorption (Hursh 1969). Lead in air is almost entirely derived from leaded gasoline additives.

Lead is not one of the essential elements needed by the human body. Yet lead accumulates in the human body with prolonged and repeated exposure. American urban dwellers carry significantly more lead than do people living in rural areas and by members of pre-industrial cultures. Patterson has estimated that 200 mg of lead that reside in an average adult American human body is about one hundred times greater than the natural lead. He concluded that "[t]his clearly and strongly suggests that the average resident of the United States is being subjected to severe chronic lead insult" (Patterson 1965).

Any amount of lead accumulating in the body is undesirable. It can possibly cause harm to the central nervous system and brain damage to children. It is most important that we cease speaking of "average" or "standard" men. Some people have too much lead already. Certain subgroups of the society may be exceptionally sensitive to insults; examples are special age groups and persons with particular diseases or genetic characteristics.

Lead Content in Blood

Studies on human adult volunteers have indicated that blood lead content may serve as an index of the degree of current or recent absorption of lead. However, blood levels are not the only criteria. A three and a half year old child had normal blood lead (5–30 μg/100 ml of whole blood) and normal urinary lead (25 μg/liter) and yet he suffered from peripheral neuropathy (general weakness, foot drop, etc.). X-rays showed heavy deposits of lead in the bones and investigation showed a history of pica (Seto 1964).

Blood levels do serve as a reasonable index of high levels of lead intake. Virtually all cases of fatal encephalopathy contain blood lead concentrations of 150 μg/100 g or more of whole blood.

Blood lead concentrations are higher in urban areas than in rural areas. Parking lot attendants in Cincinnati were found with up to 34 μg/100 g, over three times that of suburban nonsmokers in Philadelphia (11 μg/100) (California 1967). Blood lead levels of Frankfurt, Germany street cleaners were found to be significantly higher than those of the general population. Although no clinical lead poisoning was apparent, urinary delta-aminolevulinic acid (ALA) levels were dangerous in about 15% of the cases (Lehnert 1970). Hernberg and co-workers have shown a direct relation between the concentration of lead

in the blood and the activity of ALA dehydrase (Hernberg 1970, 1970a). No amount of lead is so small that it does not decrease ALA-dehydrase to some extent (Chisolm 1971). It is generally conceded that the interpretation of these *in vitro* findings is highly pertinent to the question of airborne lead (NAS 1971, p. 145).

High blood levels of lead have been found in large numbers of children living in poor urban areas. Recent surveys of large city children indicate that many have blood lead concentrations in the range of 40-60 μg/100 g of whole blood. The high blood lead concentrations have often been attributed to indoor house paint but the possibility is real that it is also due in part to inhalation of airborne lead derived from leaded fuels, or from street dust (lead concentrations reaching 2,000 μg/g) (NAS 1971, p. 328). Simon of the N.Y. Department of Air Resources reports this year that samples have been found in midtown Manhattan to consistently have lead concentrations in the high range of 13 to 18 μg/m³ (N.Y. Daily News 1971). The blood samples of small children, the most affected age group, in well-maintained Manhattan apartments have been found to sometimes reach 40 μg/100 ml of blood (NYT 1971; Medical World 1971).

The effects of high levels of lead on the body are well known: high levels of lead damage the brain and nervous system; lead can affect the liver and kidney, causing chronic nephritis, a disease characterized by a scarring and shrinking of kidney tissue; chronic over-exposure to the metal can result in peripheral nerve disease, affecting primarily the motor nerves of the extremities; it is associated with the development of artherosclerosis.

With reference to possible brain damage Dr. Patterson states:

"The course of human events is determined by the activities of the mind. Intellectual irritability and disjunction are associated with classical lead poisoning, and it is possible, and in my opinion probable, that similar impairments on a lesser but still significant scale might occur in persons subjected to severe chronic lead insult." (Patterson, 1965)

Dr. H. Schroeder of Dartmouth Medical School, an expert on toxic effects of heavy metals states: "there can be little doubt that exposure of mothers to lead has a damaging effect upon fertility, the course of pregnancy, and the development of the fetus." (Schroeder 1970)

It is highly possible that low concentrations of lead can help cause mental retardation in children. R. K. Byers, a pediatric neurologist states:

"I think that many children get chronic encephalitis from lead, as well as acute . . . This group of children deteriorates gradually without ever having had any acute lead encephalitis . . . I think that lead does something to the growing brain which is different from what it does to the adult brain." (Byers 1958)

Dr. Harriet L. Hardy has expressed the opinion that: "There must be a departure from the present U.S. attitude that prevention of occupational disease is the only requirement of those responsible for the use of toxic agents as lead." (Hardy 1965)

Increased Lead Concentration in Atmosphere

Since atmospheric lead concentrations are higher in urban areas and greater numbers of our people live in these congested areas, the amount of exposure to high lead concentrations is increasing. Amounts of lead in urban atmosphere range from 0.1 to 20 μg/m³ dependent upon sampling sites and climatic and seasonal conditions. Most normal urban areas average between 0.5 and 2.0 μg/m³ but congested areas far exceed this range. Preliminary reports from the "Seven Cities Study" show that at 19 sampling locations in Cincinnati, Los Angeles and Philadelphia at which ambient lead levels were measured both for 1961–2 and 1968–9 the later levels were higher at most sites: in Cincinnati (13–33%); in Los Angeles (33–64); and in Philadelphia (2–26%) (Tepper 1971).

The National Academy of Science's "Airborne Lead in Perspective" study fails to mention this analytical data. Instead the study says:

"In view of the disparate results from different cities, it is not possible to make any generality about trends (increase or decrease in lead concentrations). But it is possible to say that, if there are any upward trends, they are not very substantiated." (NAS 1971, p. 24)

A few pages on in the study we find:

"In spite of the rapid increase in the consumption of lead alkyls used in automobile fuels, however, the concentration of lead in urban air is, in general, rising only slowly, presumably because of dispersal." (NAS 1971, p. 32)

In the conclusion of the study it is stated that the average lead content in the air over major cities has not changed greatly over the last 15 years. This statement is inconsistent with the comparative measurements of the "Three Cities Study" and the "Seven Cities Study", referred to above. It is also inconsistent with the findings of Chow (1970) in San Diego and Bove' (1970) in New York. (This last important reference was omitted from the Academy report.)

Chow and co-workers have recently shown that there is an increase in lead concentrations from mid-oceanic atmosphere to remote mountains, to seashore, to light suburban traffic, to heavy urban traffic (Chow 1970). Polar snow strata record steadily increasing fallout of lead aerosols since the beginning of the industrial revolution and Greenland has recent snow with lead concentrations 400 times above natural levels (Murozumi 1969). The Greenland ice studies have received strong support from an independent study in Scandinavian mosses. These mosses can absorb airborne nutrients, and serve as sensitive indicators of air pollution (Bryce-Smith 1971; Ruhlung 1969). Chow has found that oceans are being contaminated with industrial lead at ten times the rate of introduction by naural weathering (Chow, in press).

Increased Lead Fallout in Soil and Plants

Lead has long been known to be a natural constituent in soils. Concentrations average about 16 ppm (Goldschmidt 1954). Cholak has reported lead content in soils near repainted buildings to range from 164 to 360 ppm (Cholak 1961). Some lead concentrations in soils near smelters can reach several thousand parts per million (USPHS 1965). Besides the weathering of outdoor painted surfaces and accumulations from lead processing, a major contributor of lead in soils (especially very near highways) is auto emissions (Purves 1967; Page 1970; Cannon 1962; Darnes 1970).

The question whether lead translocates from soils to plants has puzzled scientists for years. Additive manufacturers have gone to great length to show that edible portions of certain plants obtain their lead from naturally present lead and that these plants are insensitive to marked changes in lead concentrations in the soil (Ethyl 1970; Ter Haar 1970). In some circumstances plants in areas remote from highways and insecticide use have been found with high lead concentrations (Allaway 1968). Uptake of lead is highly dependent both on type of soil and species of plants considered.

Lead concentrations due to direct fallout of airborne lead on food plants (leaves, flowers and fruits) can reach serious levels. California lettuce less than 100 yards from a highway had lead of mean concentrations of 0.91 ppm (washed 0.48) and 100 yards or more 0.51 (washed 0.12) (California 1965). Airborne lead materials from automotive exhausts accumulate in heavy amounts on grasses near highways (Dedolph 1970) and can add to the body burden of lead in cattle and herbivorous animals. Lagerwerff emphasizes the important contribution of lead contamination of plants by deposition from atmospheric rather than by uptake from the soil (Legerwerff 1967). Studies in England show that there are twenty times more radioactive Pb^{210} originates from aerial contamination (Hill, 1965).

As with other heavy metals lead from soil is more concentrated in the roots and stems than in the flower and fruit (Motto 1970). With rapid changes in agricultural technology soils can be vastly modified and new plants introduced. In such cases root and stem crops could accumulate unusual amounts of lead which would raise the total intake when consumed by man. Patterson has expressed concern about the magnitude of the differential between actual and permissible values of various food products (Patterson 1965). We may observe increasing amounts of lead in and on edible plants in the coming decade due to airborne lead pollution.

Source of Lead Contamination

Antiknock additives are the second largest use of lead in industry. About 540,000,000 pounds of lead are consumed each year as antiknock additives (either tetraethyl lead or tetramethyl lead) and about 80% of this enters the environment as emission products in varying sized particulate matter.

Coal combustion is not a major source of lead pollution. Savul reports that lead in coal varies from 0.005 to 1.67 ppm (Savul 1958). Abernethy and co-workers estimate that the weighed average of 7 ppm of lead in coal (Abernethy 1969). This means that coal combustion contributes less than a thousand tons of lead to the atmosphere as contrasted to about 180,000 tons from leaded gasoline.

There has been little change in lead consumption in the past year. The no-lead grades introduced by various companies have small sales (about 2% of total) and are often made by draining gasoline from the high octane pool. More lead is then used to bring the depleated residual low octane stock up to sales demand (Sullivan 1970). Officials of the Lead-Zinc Producers Committee admit that the 1970 figures were higher than ever and that sales of leaded gasoline additives are holding very strong this year. This is confirmed by the monthly sales as recorded in Mineral Industry Surveys (Bureau of Mines 1971).

Economic Factors

Prior to 1923 all gasoline was unleaded and since that time some has always been lead-free. Thus leaded gasoline is not necessary for today's automobile. Several specific problems raised by lead interests must be treated:

(1) Quality of Gasoline—It is argued that unleaded fuels will cost more, will be of lower quality, and will demand unnecessary waste of petroleum resources. Even though the normal lead additive costs about a half a cent per gallon, change in processing will cost about a cent depending on the size of the refinery and the speed of the conversion schedule (Bonneo and Moore 1971). Lead is at present the cheapest way to increase octane number.

Present processing methods require about 5% more crude stock of gasoline for unleaded over leaded gasoline. Universal Oil Products (a processing equipment company) states that processes are available that require no increase in crude petroleum stock (Universal Oil Products 1970). This company has argued that gasoline mileage increases 11% using high-octane lead-free gasoline, or a net reduction in total gasoline consumption. A recent report to the EPA by the consulting firm Bonner and Moore indicates a 12% reduction in mileage. The effect of lead-free gasoline upon automobile mileage is not yet certain, but at most is only a few percent.

(2) Engine Troubles—A report by the Mobil Research and Development Corp. states that operation of current passenger car engines on unleaded gasoline can cause excessive valve wear and failure of exhaust valves and seats, due to lack of the solid lubricating effects of lead ash (Mobil 1970). American Oil contests this report and said customers do not drive at speeds and loads used for the tests (American 1970). However, the fact that traces of lead have been found by state investigators (Maryland, New York, and Wisconsin) in "certified free" unleaded Amoco may complicate the findings.

However, there is no doubt that leaded additives and the associated scavengers (ethylene dibromide and ethylene dichloride) and deposit modifiers are very toxic and have caused excessive damage to automobile parts. Ethylene dichloride is considered the worst offender.

"That corrosion is caused by the products of combustion is not surprising; analysis of exhaust gas showed the present of hydrochloric, sulfuric, sulfurous, hydrobromic, phosphoric, and carbonic acids. The presence of compounds of elements not found in petroleum is due to the use of additives; for instance, the compounds of chlorine, bromine, and phosphorous trace directly to the lead scavengers and the surface ignition suppressors added to gasoline. Statements have been made in which ethylene dichloride has been blamed for much of the corrosive action under discussion here; it has been known for many years that ethylene dibromide is less harmful." (Gruse 1967)

Though ethylene dichloride (used for economic reasons) is more dangerous to the automobile, ethylene dibromide has its share of the problems:

"Corrosion of valve heads and seats by bromine compounds from the tetraethyl lead fluid is a relatively common variety of valve trouble. It is likely to be induced in an engine in which the mixture temperature is too low to give good distribution. The usual course of this type of difficulty is general corrosion of both the valve head and the valve seat until a channel forms in one of the seating surfaces. Gas leakage and valve burning result." (Fraas 1948)

There are possible savings in maintenance costs that might accrue to the average consumer if scavengers were done away with. Spark plug fouling, engine

corrosion, and exhaust system deterioration are major detrimental effects of lead scavengers and their removal can have appreciable effect:

"It is generally accepted . . . that engine rusting with leaded gasoline is due to the chlorine- and bromine-containing scavengers required by the lead antiknock compounds, rather than the lead compounds themselves. Reducing scavenger concentration reduced rusting severity. In our tests, eliminating the scavengers (by omitting the lead antiknocks) showed even greater improvement." (Pless 1970)

Tetraethyl lead antiknocks may eventually be seen as a technical short-cut with shortcomings, covered by a patchwork of less than effective remedies. Removal of lead may turn out to be a great blessing to the consumer. Taliaferro *et al.* (1970) estimated that savings of 3.5 to 4.8 cents/gallon on controlled fleet service and 1.8 cents/gallon in consumer-type service, may be possible.

One reason given for retention of small amounts of lead gasoline is the need for such lead in pre-1971 cars. This need is limited to certain makes and models and is due primarily to the metals used in valve seats; there are other non-leaded remedies.

"All vehicles after 1972 models and most of the 1972 models, will be able to use the same fuel as will probably be required for 1975. The pre-1971 cars will need either some lead or other anti-scruff additive to prevent valve deterioration." (Heinen 1971)

Leaded gasoline will most likely be substituted by gasoline of higher aromatic concentration (provided octane numbers remain relatively constant). The much publicized Bureau of Mines report (Bureau of Mines 1970) which indicated higher aromatic emissions from unleaded gasoline has been questioned by the EPA itself (NAPCA 1970). The CTAB report discounts the worries about increased aromatic emissions:

"Polynuclear aromatics probably rise with the concentration of aromatics in the fuel, but they also appear to fall with the elimination of lead. The net effect is probably not substantial.

"Automotive sources currently constitute between two and ten cents of total PNA emissions nationally depending upon the specific basis used for analysis. Most of this is present in the fuel before combustion and passes through the engine unchanged. It is important to note, however, that any concern over PNA's emanating from auto exhausts should be short-lived. Incorporation of exhaust gas treatment systems, especially a catalytic system, will result in selective decreases in polynuclear aromatics." (Commerce Dept. 1971)

Though PNA (especially benzo(a) pyrene) is cancer-causing, far more comes from coal and fuel oil burning than from elevated contents of aromatics in gasoline.

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Exhibit 4a

FEBRUARY 2, 1971.

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

DEAR MR. RUCKELSHAUS: We are seriously concerned about the elimination of lead from motor vehicle gasolines and urge you to consider the points raised in the accompanying article. We would be happy to answer any questions you might have.

Sincerely,

JAMES B. SULLIVAN, Ph.D.

Getting the Lead Out

(By James B. Sullivan and Albert J. Fritsch)

The scramble by the major oil companies to produce unleaded and low lead gasoline does not offer the assurance of clean air that the public expects. Producing low lead and unleaded gasoline may increase the amount of total lead pollution of our atmosphere, for almost every oil company marketing low lead and unleaded gas will at the same time increase the amount of lead that goes into its leaded gasoline. The reason is technical but not incomprehensible.

Unless you use gasoline of sufficient octane for your automobile engine, the fuel will burn unevenly. This causes knock and damages the engine. There is a limited amount of high octane gasoline directly distilled from petroleum -- straight-run gasoline -- which oil companies are using in their unleaded and low lead grades. Most gas has lead added to it to fuel powerful American cars, lead being the simplest and cheapest way to raise the octane level. A more expensive way, primarily used by *Amoco*, is to alter the octane level chemically. Industry's conversion to this process will take at least two years and $4 to billion, and will pose another danger: a serious increase in hydrocarbon pollution with its cancer-causing potential.

Currently there is not enough high octane, straight-run gasoline to de-lead all gasolines. As larger amounts of the straight-run gas are siphoned off to the low lead and unleaded grades, the supply is reduced for the other, leaded products. Industry must then fill this gap with increased lead additions. The consequence is a rise in the *average* lead level of gasolines.

Over 200,000 tons of lead enter the earth's atmosphere each year, 95 percent of it from automobile exhaust. Atmospheric lead can penetrate deeply into the respiratory system and be retained and absorbed. Some Americans now have one-half as much lead in their bodies as it takes to cause acute lead poisoning -- gastrointestinal disorders, vascular diseases and nerve palsy. According to the National Air Pollution Control Administration, city dwellers continuously exposed to heavy automobile fumes are showing evidence of the biochemical abnormalities that precede critical lead poisoning.

There are things the individual can do to reduce lead pollution. He can continue to use low-lead gasoline. But he can do more, with the help of the oil companies. Most car owners use too high-octane a gas. The lower the octane, the less lead and smog-forming hydrocarbons released into the air. But there is no way now to tell what octane gas you are buying -- or whether the octane number in a particular blend of gas is standard every time you fill up at the same pump. Octane standards should be uniform within the industry, and octane numbers should be posted on gasoline pumps. The blend pump which Sun Oil uses allows many octane grades of gas, instead of the two or three which other companies offer.

Industry has bitterly opposed these reforms, just as it once opposed unleaded gas. Posted octane ratings would make the consumer aware of the arbitrariness of gasoline prices. Major oil companies regularly exchange gasolines, so there is no reason to buy a major, rather than a cut-rate brand. Also, buying a lower octane gasoline would cut into the excess profits companies make on premium grades.

Substantial support for the fight against lead pollution has come from the federal government, which, so far, has shown inadequate foresight. For example, the Public Health Service properly supports low lead and unleaded gasoline. Yet it approves very high lead allowances in leaded gasoline -- up to 4 cc. per gallon. And even this maximum has no binding legal force; it is now overstepped without penalty. Total lead pollution will increase if unleaded gasolines are not accompanied by restrictions on the amount of lead allowed in leaded gas. President Nixon's order that federal vehicles use unleaded or low lead gas when practical, and a contemplated tax on leaded gasoline, will not solve the problem of lead pollution.

The government should require an orderly, year by year, reduction in the *average* lead concentration of all gasolines produced by a company, as well as a systematic regulation of all fuel additives, with annual reports to the Federal Trade Commission. Octane numbers should be standardized and appear on gas tanks. The Federal Trade Commission has the authority now to require this labelling.

More fundamental: The government is not able to forecast the levels of atmospheric lead pollution for the future. No pollution control study has yet been undertaken to assess the oil industry's capacity to convert to unleaded fuel without increasing the lead content of their leaded gasoline. This has got to be done.

A growing consensus among the nation's leading scientists and engineers is that the only realistic solution to the auto emissions problem is something other than the internal combustion engine. Until an alternative power source is utilized, it seems probable that lead and hydrocarbon pollution are going to increase, no matter what we buy at the gas station. To expect that anti-pollution devices will be a panacea is self-deluding.

Recent disclosures by the National Air Pollution Control Administration indicate that between 75 and 80 percent of so-called "clean" vehicles on the road fail to meet existing, low federal standards. Since 1968 the American people have paid an estimated one to one-and-a-half billion dollars for tack-on devices which do not work. As anti-pollution standards are made more stringent and more sophisticated control devices are developed by the expected date of 1975, there is no reason to believe they will work successfully either. Only one tankful of leaded fuel can destroy many of these devices. Also, because present high octane automobiles will not be scrapped until they wear out, auto pollution will continue long after the introduction of scheduled low octane cars and tack-on devices.

Individual members of the Commerce Department's Technical Advisory Board Panel on Automobile Fuels and Air Pollution doubt that pollution will be under control by 1975. Privately, they admit that the government is hamstrung by the commitments industry has made to clean up the internal combustion engine and by its consequent neglect of the development of an alternative such as steam or electric power.

As the Ethyl Corporation exhorts: "Let's do something about pollution. But let's do the *right thing*." It's time to get serious about lead and hydrocarbon pollution, before we suffocate in our own exhausts.

Exhibit 4b

ENVIRONMENTAL PROTECTION AGENCY,
AIR POLLUTION CONTROL OFFICE,
Rockville, Md., February 22, 1971.

DR. JAMES B. SULLIVAN
Center for Science in the Public Interest, 1126 Sixteenth Street NW., Washington, D.C.

DEAR DR. SULLIVAN: This is in response to your letter to Administrator Ruckelshaus of February 2, 1971, in which you ask that we consider the points raised in a November 21, 1970 article in *The New Republic* entitled "Getting the Lead Out," and offer to answer questions we may have.

In general terms, the position of the Environmental Protection Agency is the same as the points of view expressed in the article. There are a few areas in which we may differ as regards the approach that should be pursued to solving the problems; however, in an informal discussion with the authors of the article, at least some of these have been resolved. For example, the article recommends that the average lead content of gasoline produced by a company be limited; in our view, the problem must be approached on an industry-wide basis, with limitations on lead content of gasoline related to factors other than any one company's production mix. Also, even though we are agressively pursuing the developments of alternatives to the present-day internal combustion engine, as a form of insurance if it indeed turns out to be impossible for industry to clean up that engine, we are not yet convinced of—as the article states—"that the only realistic solution to the auto emissions problem is something other than the internal combustion engine." Nor can we agree with the contention that industry's commitment "to clean up the internal combustion engine" means that "the government is hamstrung" and that as a consequence we "neglect the development of an alternative such as steam or electric power."

But these are minor points of difference, inevitable in an article written by advocates of a point of view who are not limited in the positions that they

can take by having to be responsible for carrying out a program. I think that a review of the attached documents will assure you that the EPA is indeed committed to the pursuit of the same goals that the article espouses.

Sincerely yours,

ERIC O. STORK,
Acting Director, Mobile Source Pollution Control Program.

Enclosures.

Exhibit 4c

CENTER FOR SCIENCE IN THE PUBLIC INTEREST,
Washington, D.C., March 10, 1971.

OFFICE OF THE ACTING COMMISSIONER,
Air Pollution Control Office, Environmental Protection Agency, Rockville, Md.

DEAR SIR: The hope of the American people for unpolluted air is based on the recently amended Clean Air Act. But, most importantly, the Act is only as strong as it is interpreted to be. For this reason it was extremely disappointing to see that many toxic substances (lead, fluorides, polynuclear organic matter, odors, etc.) were not included on the list of air pollutants published for comment in the Federal Register of January 30, 1971.

Section 108(a)(1) of the Clean Air Act, as amended December 31, 1970 (Public Law 90-604), directs the Administrator of the Environmental Protection Agency to publish, no later than January 30 1971, and from time to time thereafter revise, a list that includes each air pollutant which in his judgment has an adverse effect on public health or welfare, which is present in the ambient air as a result of emissions from numerous or diverse mobile or stationary sources, and for which no air quality criteria were issued prior to the enactment of the amendments.

Certainly, lead and other subsiances have an adverse effect on the public's health and welfare. EPA recognized this in statements before the Senate Subcommittee on Air and Water Pollution (*Air Pollution-1970*, Part 1, page 428):

"On the basis of available knowledge, however, it appears that certain groups may be in high risk categories, either because of their repeated exposure to the elevated levels of lead in the air in areas of heavy traffic (for example, police, taxi drivers), or because of age or various biomedical factors (for example, children, pregnant women, persons afflicted with blood diseases). . . . From 1961 to 1968, the amount of lead contained in gasoline increased from 261 million pounds to 434 million pounds. Annual emissions of lead into the air currently are about 200,000 tons. And the advent of low- and unleaded gasolines seems only to have increased the amounts of lead being emitted into the atmosphere. This fact was brought to your attention in a letter to Administrator Ruckelshaus on February 2, 1971.* This lead increase can be seen by examining recent refinery blending records. The Lead-Zinc Producers Committee confirms that lead sales for antiknock additives are at an all time high."

Furthermore, the Clean Air Act's legislative history † states that:

"Other contaminants of broad national impact include fluorides, oxides of nitrogen, polynuclear organic matter, lead and odors."

Crippling fluorides, cancer-causing polynuclear organic matter and irritating odors are health hazards that are completely ignored, on the pollutant list. This neglect flaunts the very Act which was to be the people's safeguard: it must be immediately remedied. A nation choked in its foul air can hardly afford further delays.

In a time when federal credibility is seriously questioned, every effort must be expended in getting the lead out—not a reckless silence or neglect which is résulting in increased lead emissions and other hazards to the public's health.

Sincerely,

ALBERT J. FRITSCH, Ph.D.
JAMES B. SULLIVAN, Ph.D.

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* See the *New Republic*, November 21, 1970: "Getting the Lead Out"
† Senate Report No. 91-1196, page 9, September 17, 1970

Exhibit 4d

ENVIRONMENTAL PROTECTION AGENCY,
AIR POLLUTION CONTROL OFFICE,
Rockville, Md., March 12, 1971.

ALBERT J. FRITSCH, Ph.D.,
JAMES B. SULLIVAN, Ph.D.,
Center for Science in the Public Interest, 1126 Sixteenth Street NW., Washington, D.C.

DEAR DRS. FRITSCH AND SULLIVAN: Thank you for your comments on the proposed national ambient air quality standards published January 30 in the *Federal Register*.

It will not be possible for us to reply separately regarding our evaluation of each set of comments submitted. You may be sure, however, that your comments, along with the others we receive, will be reviewed and taken into account prior to final promulgation of the national standards.

As you know, promulgation of these national ambient air quality standards is an initial step toward a far-reaching Federal-State attack on the problem of air pollution in all parts of the Nation. Accordingly, your interest in this matter is deeply appreciated.

Sincerely yours,

JOHN T. MIDDLETON,
Acting Commissioner.

Exhibit 4e

APRIL 21, 1971.

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

DEAR MR. RUCKELSHAUS: We read with great interest the notice concerning alkyl lead additives in gasoline published on January 30, 1971 in the *Federal Register* and were encouraged to see the EPA making efforts to reduce lead pollution. However, the anticipated regulations for "general availability by July 1, 1974, of lead-free gasoline of an octane quality suitable for 1975 and subsequent model year light duty vehicles, and for reduction of the lead content of the current 'regular' and 'premium' grades of gasoline from their present average levels of approximately 2.5 grams per gallon to no more than 0.5 grams per gallon; such reduction to be achieved as quickly as is technologically possible," are, in our opinion, dilatory and insufficient to protect the public's health.

We urge the EPA to promulgate regulations that will effectualize the following:

(1) The immediate reduction of lead in gasoline to 0.5 grams per gallon in regions where average lead concentrations in the atmosphere have exceeded 1.5 micrograms per cubic meter;

(2) Scheduled reduction of lead everywhere to 0.5 grams per gallon by July 1, 1972 and to 0.0 grams per gallon by July 1, 1975;

(3) Immediate public notification when average air concentrations exceed the limit of 1.5 micrograms per cubic meter.

These steps are necessary because of the well known toxicity of lead and because of the increase of atmospheric lead produced by automobiles since the recent government-industry action to market low and unleaded gasolines (while not regulating lead levels in the other grades). Public Health Service surveys show that atmospheric lead levels in many urban areas already exceed that which is considered safe (1.5 ug/m^3). There is no proof that lead is necessary as an additive in motor fuels. This fact coupled with the health hazard posed by lead forces the logical conclusion that lead should be completely removed and not merely reduced.

The deadlines we suggest, according to the Commerce Department's Technical Advisory Board, would give industry more than enough time to make the necessary equipment changes. Thus, the technological feasibility of this approach cannot be denied.

Finally, the public must be informed of the quality of the air they breathe and delay can only generate mistrust of the Federal regulatory process. Results of the recent EPA studies of lead concentrations in the atmosphere and in human blood should be released immediately.

Time is passing in silence. Since the issuance of the proposed rule making in the *Federal Register*, 120,000,000 pounds of lead have contaminated our atmosphere. That is over one-half pound per person in the United States. The nation, and especially its children, can ill afford delay in adopting adequate safeguards for its health.

Respectfully yours,

JAMES B. SULLIVAN,
(for himself, Albert J. Fritsch and Michael F. Jacobson).

Exhibit 4f

ENVIRONMENTAL PROTECTION AGENCY,
OFFICE OF AIR PROGRAMS,
Rockville, Md., May 26 1971.

Mr. JAMES B. SULLIVAN,
Center for Science in the Public Interest, 1126 Sixteenth Street NW., Washington, D.C.

DEAR MR. SULLIVAN: This is in response to your letter dated April 21, 1971, to the Administrator regarding the Environmental Protection Agency's announcement of its intention of regulating the use of lead additives in gasoline. I am quite pleased to know of your interest in this matter.

The notice published January 30, 1971, was intended to reaffirm the Environmental Protection Agency's intention of regulating the use of lead additives under section 211 of the Clean Air Act, as amended. A schedule for phasing out the use of lead additives remains to be worked out.

As you know, section 211 requires us to undertake and complete certain studies and make certain findings before regulatory action can be consummated. A high priority is being placed on getting this work done.

Thank you for your expression of support of our efforts to deal with the problem of environmental lead contamination.

Sincerely yours,

JOHN T. MIDDLETON,
Deputy Assistant Administrator for Air Programs.

Exhibit 5a

THE AUTOMOBILE AND AIR POLLUTION—A PROGRAM FOR PROGRESS—PART I

Definitive quantitative data regarding the effects of lead in all these areas of concern may not be available for many years. The processes involved are extremely complex and the early isolation of this single variable to determine past, present, cumulative, and synergistic effects is unlikely. Once this is realized, the question becomes one of identifying the risks and the selection among alternative strategies in view of these risks.

If the risks are very low, then the easiest, or lowest cost strategies may be selected without hesitation until all the relevant evidence has been gathered. However, the growing rates of lead emissions into the atmosphere present a potentially serious problem. The controversy in the medical profession regarding the dangers to public health is an indication that the problem cannot be dismissed without concern. The possibility is real that long-term harmful effects may be masked and detected too late to prevent serious damage.

These uncertainties, with their corresponding health and economic impacts, dictate immediate action if the risks are to be reduced. As a minimum, steps should be taken to assure that current atmospheric lead levels are not exceeded. This goal can be achieved in the face of a rising motor vehicle population because satisfactory engine performance is possible with lower lead levels in gasoline. Non-leaded fuels with adequate performance characteristics can be produced through a modification of existing refining processes. It has been estimated that the elimination of lead from gasoline, on the basis of current engine design and fuel requirements, would involve an approximate $4 billion in-

vestment by the petroleum industry and an increase of about 20% in the manufacturing cost of gasoline.[6] It should be emphasized that these estimates are based on octane levels required by the current internal combustion engine. If engines are designed and used which can perform adequately at lower octane levels, some or all of this cost may be avoided.

The Panel recommends the following:

RECOMMENDATION 5

The Federal Government should immediately establish standards for the lead content in gasoline which will prevent any further increase in the total quantity of lead emitted to the atmosphere. The Department of Health, Education, and Welfare should begin an intensive study of the long-term health effects of lead in the atmosphere to determine requirements for future action.

Exhibit 5b

THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE
Washington, D.C., March 24, 1970.

As the President noted in his recent Message to Congress on the Environment, automobile manufacturers are preparing to market cars in the near future that are capable of using low-octane, unleaded fuels.

These manufacturers have stated that to meet the emission standards I intend to prescribe for the 1975 models they must have unleaded fuel. They have also stated that to meet interim Federal and California standards for nitrogen oxides, they must have at least a low-lead fuel.

A number of the petroleum companies have recognized the need to move toward unleaded fuels. Some have already announced plans or a willingness to make unleaded fuels available.

The interstate nature of automobile use and fuel marketing demands a consistent National strategy for dealing with motor vehicle fuels in terms of reducing air pollution. Many firms in the petroleum industry have recognized the need for Federal leadership. In the Administration's proposed amendments to the Clean Air Act, currently pending before the Congress, we have requested that the Secretary of HEW be authorized to regulate the use of additives in motor vehicle fuels.

I am hopeful, however, that progress can be made in advance of legislation. As the Cabinet official responsible for the Federal clean air program, I am writing to solicit your views on some of the unresolved questions—such as the timing of lead removal and the number and types of fuels to be marketed. In addition, I would welcome information on your present plans, resources, and problems.

In particular, I invite your comments on one suggested course of action that has been made:

1. After July 1, 1971, gasoline marketed in the United States would contain no more than 0.5 grams per gallon of lead unless its octane rating were at least 97;

2. After July 1, 1974, gasoline marketed in the United States would contain no lead unless its octane rating were at least 97;

3. Gasoline of 97 or greater octane levels would contain up to four grams per gallon of lead so long as the demand for such gasoline existed.

Such a course of action would encourage the marketing of low-lead and then unleaded "regular" grade gasoline which could meet the needs of approximately 60 percent of existing vehicles and an increasing percentage of vehicles as older cars are replaced by new ones with lower octane requirements.

I look forward to receiving your comments on the issues raised in this letter and any alternative proposals consistent with the objective of providing motor vehicles with fuels which will help to ensure the greatest and most rapid reduction in air pollution at the lowest possible cost to the public. I would appreciate a response by April 10.

Sincerely,

ROBERT H. FINCH,
Secretary.

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[6] Lawson, S. D.; J. F. Moore, and J. B. Rather, Jr., "*A Look at Lead Economics in Motor Gasoline,*" *American Petroleum Institute, Division of Refining, Reprint No. 36-67, 32nd Midyear Meeting, Los Angeles, California, May 16, 1967, 35 p.*

Exhibit 5c

NEWS RELEASE FROM U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, TUESDAY, MARCH 24, 1970

HEW Secretary Robert H. Finch confirmed today he has urged the chief executives of the Nation's petroleum companies to work toward production of a lead-free gasoline for motor vehicles.

In letters to the executives mailed earlier this week, Secretary Finch said:

"The interstate nature of automobile use and fuel marketing demand a consistent national strategy for dealing with motor vehicle fuels in terms of reducing air pollution.

"In the Administration's proposed amendments to the Clean Air Act, currently pending before Congress, we have requested that the Secretary of HEW be authorized to regulate the use of additives in motor vehicle fuels.

"I am hopeful, however, that progress can be made in advance of legislation."

Secretary Finch stressed that his objective is to provide motor vehicles with fuels which will help to ensure the greatest and most rapid reduction in air pollution at the lowest cost to the public.

The Secretary also asked for comments on a suggestion which would involve the marketing of low-lead "regular" gasoline from July 1, 1971 to July 1, 1974, and after that, an unleaded "regular" gasoline.

A leaded premium would continue to be marketed for cars which require high octane gasolines. Automobile manufacturers plan to market vehicles with low octane requirements in the near future.

Secretary Finch noted that a number of the petroleum companies have recognized the need to move toward unleaded fuels and many have recognized the need for Federal leadership in this area.

Copies of the Secretary's letter were also sent to automobile manufacturers and to the heads of companies producing lead additives.

Exhibit 6a

J. T. MIDDLETON LETTER TO AUTOMOTIVE MANUFACTURERS—SEPTEMBER 3, 1970

The purpose of this letter is to solicit your views and comments on a recent proposal made to us that we require automobiles to be prominently labeled as to their fuel octane requirements.

As you know, not only we, but also the general public has in recent months, become increasingly concerned about the emission of lead into the atmosphere from automobile exhausts. The most direct attack on this problem is the reduction and eventual elimination of lead from gasolines used in automobiles; and as you also know, we are pursuing this objective. However, even at best, that objective will be several years in being achieved.

There is general agreement that there is a substantial amount of 'overbuying' of premium gasolines, which contains an average amount of 2.8 grams of lead additives per gallon, by automobile owners whose vehicles would be equally well served by regular gasoline, which contains an average of 2.3 grams of lead per gallon. Since we look forward to early general availability of lower-leaded regular gasolines, with about 0.5 grams of lead per gallon, overbuying may soon become an even greater source of unnecessary lead emissions.

The reasons for overbuying are difficult to pin-point, but presumably they arise out of many motorists believing that 'you get what you pay for', and they want the best. A clear label on each automobile as to its octane requirements thus has potential for reducing 'overbuying', especially if it is coupled—in owners manuals and through other communications media—with an explanation that the motorist gains nothing when he pays for more octane than he needs.

The Federal Trade Commission has for some time been considering a requirement that gasoline pumps be labeled as to the octane rating of the fuel they dispense. If such a requirement is finally established, there would appear to be an even stronger case for labeling of each automobile as to its octane requirements, for then the automobile owner would be in a better position to take advantage of such information.

With this background, I would appreciate hearing from you as to what difficulties—if any—would would foresee in the labeling of your automobiles as regards their octane requirements, and in providing an explanation to the vehicle owner as regards the meaning of the octane requirements. Any information that you can provide us on this issue would be helpful to us in formulating a comprehensive program to attack the problem of lead emissions from automobile exhausts.

Exhibit 6b

STATEMENT BY THE PRESIDENT, OCTOBER 26, 1970

At my request, the Administrator of General Services today issued the attached regulation which requires that federally-owned vehicles use low-lead or unleaded gasoline whenever this is practical and feasible. The purposes of this regulation are two-fold: to reduce air pollution and to increase the market for low-lead and unleaded gasoline, in order to make such fuels more generally available.

I have also today written to the Governors of our fifty States suggesting that they take similar steps in their Administrations. If all government agencies—Federal, State, and local—were to adopt this policy, we could not only reduce pollution, but we could also provide a sizeable incentive for production and distribution of low or unleaded fuels and thus make them more readily available.

Exhibit 6c

CHAIRMAN RUSSELL E. TRAIN'S EXPLANATION OF PRESIDENT'S ACTION

Aside from the need to reduce lead for these control devices, there is evidence that hydrocarbon emissions can be reduced seven percent to 20 percent by using lead-free gasoline in both existing and new automobiles.

Lead emissions also represent a potential problem. About 95 percent of emissions of lead in the air is from the use of lead in gasoline and the small size of these lead particles permits them to penetrate deeply into the lungs and to be absorbed by blood.

There is evidence that lead affects the formation of red blood cells and hemoglobin.

* * * * *

The new GSA policy should encourage the petroleum industry to expand its refinery and distribution capability to provide low-lead or unleaded gasoline.

If a number of States also act in response to the President's request, the incentive would be even stronger. And while providing this incentive, hydrocarbon and particulate air pollution from these vehicles will be reduced.

Exhibit 7a

5600 FISHERS LANE,
Rockville, Md., Jan. 22, 1971.

ADVANCE NOTICE OF PROPOSED RULEMAKING—LEAD IN GASOLINE

Briefing memorandum.

THE ADMINISTRATOR:

1. There is attached for your signature an Advance Notice of Proposed Rulemaking that advises the affected industry that EPA intends to move in the direction of reducing the lead content of gasoline from the current levels of about 2.5 ml/gal to a maximum of 0.5 gm/gal, and that EPA intends to assure the general availability of unleaded gasoline of an octane rating suitable to serve the needs of 1975 and subsequent model year vehicles by July 1, 1974.

2. The reasons for pursuing these goals are stated in the Advance Notice itself, and are not repeated here. It is, however, important, that you consider certain issues related to the issuance of the Advance Notice:

(*a*) Widespread clamor for the reduction and eventual elimination of lead from gasoline began about a year ago. APCO has been in the forefront of this campaign. We have repeatedly announced that we were awaiting passage by Congress of the fuel regulatory authority, and that lead would be the first fuel additive to be regulated.

(b) The regulatory authority, as passed by Congress, places upon the Administrator severe obstacles to its use. Certain specific findings will have to be made and published; public hearings have to be held; and, of course, any rulemaking that finally ensues would be subject to court challenge. The economic interests at stake are so great that it is a foregone conclusion that at least some elements of the affected industry will exhaust all possible administrative and judicial remedies prior to acceding to lead removal.

(c) EPA cannot do anything of a substantive nature until the prescribed studies and findings have been completed. That will take a good deal of time. We are working on a plan to undertake them, but have not yet been able to complete such a plan.

(d) We sense a real need for EPA to take a public stand on this issue at this time, partly to help inspire public confidence in the Agency. Also, the larger refiners, on the whole, are believed to be willing to make the necessary investments *if* they can be given some assurance that the government really means what has been said all last year, and if they believe that their competitors will have to do the same.

(e) The Advanced Notice of Proposed Rulemaking recommended for promulgation by this memorandum really has no legal status. There is no provision in law for such an Advance Notice. However, the technique has been used before, most recently on February 10, 1970, to announce the goals for the 1975 model year vehicles. In spite of its insignificant legal status, the Advance Notice can be expected to have a very significant impact. It will be taken more seriously than anything else we have said so far in speeches and testimony on this issue.

(f) It has been suggested that the same purpose can be served by a Press Release. In a legal sense, this is entirely correct. In a context, however, the Advance Notice will be taken more seriously.

3. On balance, issuance of the Advance Notice appears to be the most useful course of action we can pursue at this point. I recommend that you sign the enclosed document at Tab A.

JOHN T. MIDDLETON,
Acting Commissioner.

Exhibit 7b

[From the Federal Register, Saturday, January 30, 1971]

ENVIRONMENTAL PROTECTION AGENCY

[42 CFR Part 179]

REGULATION OF FUEL ADDITIVES

Advance Notice of Proposed Rule Making

Section 211 of the Clean Air Act, as amended December 31, 1970 (Public Law 91-604), authorizes the Administrator of the Environmental Protection Agency to regulate any motor vehicle fuel or fuel additive which produces emissions that will endanger public health or welfare, or which produces emissions that will significantly impair the performance of any emission control system or device which is generally used or which the Administrator determines would be generally used within a reasonable time if the fuel or fuel additive in question were to be regulated. Before he prescribes such regulations, the Administrator is required to consider scientific data on the need for regulation of such fuel or fuel additive and, in certain situations, to make findings on the technological and economic feasibility and consequences of such regulations.

An extensive body of information exists which indicates that the addition of alkyl lead to gasoline, for the purpose of increasing the octane of that fuel, results in automobile exhaust emissions of lead particles that pose a threat to public health; and that these particles also render inoperative catalytic converters, which are devices currently being developed to enable the internal combustion engine to meet the emission standards for hydrocarbons and carbon monoxide required to be prescribed under section 202(b)(1)(A) of the Clean Air Act, as amended.

Notice is hereby given that the Agency, in accordance with the requirements of section 211, is considering available relevant scientific, medical, economic,

and technological data concerning the use of alkyl lead in motor vehicle gasolines, with the intention of proposing controls or prohibitions on the use of that additive on the earliest date possible. It is anticipated that regulations will be proposed which provide for general availability by July 1, 1974, of lead-free gasoline of an octane quality suitable for 1975 and subsequent model year light duty vehicles; and for reduction of the lead content of the current "regular" and "premium" grades of gasoline from their present average levels of approximately 2.5 grams per gallon to no more than 0.5 grams per gallon: such reduction to be achieved as quickly as is technologically possible. Although no schedule for reduction of lead content of "regular" and "premium" grades of gasoline has been developed, the Agency intends that gasoline of an octane quality suitable for vehicles currently in use will be allowed to be sold for as long as the demand exists, insofar as that is consistent with the goal of a maximum lead content of 0.5 grams per gallon.

This advance notice of proposed rule-making is published with the intention of informing the public of the Agency's actions and plans in this important area of concern, and for the purpose of providing the automobile and refining industries notice of impending regulation relevant to their immediate and long-range planning.

Dated: January 27, 1971.

WILLIAM D. RUCKELSHAUS,
Administrator.

Exhibit 7c

EPA STUDIES ECONOMIC IMPACT OF LEAD-FREE GAS RULES

Lead-free gasoline apparently could be made generally available by 1975 at an increase in cost to consumers ranging from two-tenths to nine-tenths of a cent per gallon, according to a study done for the Environmental Protection Agency. The variation in cost would depend upon how soon industry would have to provide the lead-free gasoline and whether it would have to be for all grades. However, it will be 1976 before all gasoline grades could be made lead-free, the study reported.

The Agency announced in January its intention to propose regulations on the use of lead additives in gasoline. EPA added today that it anticipates that enough information will be collected in time to allow publication of a notice of proposed rule-making by mid-December, 1971, on allowable levels of lead in the various grades of gasoline, including a proposed schedule for achieving these levels.

The Clean Air Act authorizes EPA to regulate the uses of fuel additives on the basis of their adverse effects on public health and welfare, or on the performance of motor vehicle emission control systems.

To meet its responsibilities under the Act, the Agency is evaluating available information on health and welfare effects of environmental lead. It is also analyzing:

The cost-benefit aspects of emission control systems that are and are not adversely affected by leaded gasoline.

The extent to which regulations limiting the use of lead additives might result in fuel modifications that would produce other harmful emissions.

As part of its effort to develop information, the Agency commissioned a seven-month study of the economic and technical implications of various hypothetical schedules for the regulation of lead additives. The study was performed by Bonner & Moore Associates of Houston, Texas.

The Bonner & Moore study envisaged the availability of a lead-free grade of gasoline having a research octane rating of 93. Gasoline having a research octane rating of 93 is adequate for cars made in 1971 and later. The 93-octane gas would be an addition to the conventional regular and premium leaded gasolines.

Using this three-fuel approach, the study said, various regulatory strategies could be devised to remove the lead from gasoline at different rates of speed.

Findings as to the probable economic effects of some of these hypothetical strategies, as well as a two-fuel approach that was tested in comparison, are summarized on the attached table:

Copies of the full Bonner & Moore report may be obtained from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Va. 22151. The publication number is NTIS-PB-201033. Microfiche copies will cost 95 cents. The price for document copies has not yet been set, but is expected to be around $4.

NOTE.—EPA Press Office has a limited number of copies available for the press.

Exhibit 8

THE WASHINGTON MERRY-GO-ROUND—OCTANE MANEUVERS BLEED MOTORISTS

(By Jack Anderson)

The big-brand gas companies are squeezing millions of dollars out of the motorists by delaying and distorting the facts about octanes.

Here's the latest report on the games the gas lobby plays:

Last Dec. 30, the Federal Trade Commission announced that gas octanes would have to be posted on service station pumps by June 27. The socalled "research" rating system, used by many auto firms as a guide to new owners on the best octane for their cars, was prescribed.

The octane is important. The use of unnecessarily high octane costs the average motorist $50 extra a year for gas that has no additional benefits. Worse, octane that is too high for the car spews lead emissions into the air. On the other hand, too low octane belches out hydrocarbons and nitrogen oxides.

Therefore, economizers and conservationists alike hailed the FTC's ruling. But the politically powerful oilmen know there's more than one way to skin a bureaucrat.

Texaco quietly persuaded the bureaucrats at the FTC that company scientists had developed a better way to rate octanes. Implementing the Texaco plan meant not only delaying the rating requirement for months but also confusing the consumers who were accustomed to the old rating system.

Yet the FTC scrapped the June 27 deadline and announced on Aug. 19 that the Texaco plan would become the law of the land unless the consumers put forward some insurmountable arguments.

The Consumer Federation of America, Environmental Defense Fund, and Center for Science in the Public Interest raised some loud, if not insurmountable, arguments. The FTC staff is now going over all the new data in secret. Then the entire review process by the commissioners must begin all over again.

The postponement of the octane postings, meanwhile, is saving the oil companies an estimated $25 million a month, which comes out of the pockets of the motorists who overbuy their octanes.

NADER VS. HOLIFIELD

Ralph Nader and Rep. Chet Holifield (D-Calif.) have traded angry charges over the establishment of a federal consumer protection agency.

The flashing, young consumer advocate accused the crusty, old congressional veteran of gutting the agency's powers. In Nader's view, Holifield sought to make the consumer agency a hollow symbol at President Nixon's bidding.

"(Holifield) has been playing the White House's game," snapped Nader.

"Nader's cry of 'wolf, wolf' against anyone who disagrees with him will soon cease to cause alarm or attention," Holifield growled back.

Our own behind-the-scenes investigation bears out Nader's charges. The 67-year-old Holifield, once a flashing young liberal himself, has grown gray and grumpy and has lost his former zeal for reform.

When they were both young California congressmen, Holifield and Mr. Nixon slugged it out in many House battles and political campaigns. But this summer, they flew to California together, the best of buddies, on the luxurious presidential Air Force One.

As they winged across the country, the President urged Holifield to water down the bill setting up a consumer protection agency.

Holifield was so certain he could railroad a weak bill through his Government Operations Committee that he wrote a press release about the committee vote before it was taken.

PREMATURE RELEASE

The release began: "The House Committee on Government Operations today approved unanimously . . ." But when seven of the members either voted against reporting out the bill or merely voted "present," Holifield had to have his press release changed in handwriting.

He also tried to pressure Speaker Carl Albert into accepting the watered-down bill at a secret meeting in the speaker's ornate office. Albert kept insisting he wanted "the strongest possible bill" and urging "I would like to get the bill out on the floor."

At one point, Holifield thought he had wangled a commitment from Albert to accept the milquetoast measure. "Well," blurted Holifield, "then can I tell the President that you will support the bill?"

This was an inadvertent slip that Holifield, indeed, was working with the White House as Nader had charged.

Footnote: The Democrats who sold out the consumer behind closed doors besides Holifield were Congressmen L. H. Fountain, N.C.; John Monagan, Conn.; Don Fuqua, Fla.; and, notably, Ed Garmatz, Md., whose power almost matches Holifield's and who failed to show up for a single vote, simply turning over his proxy to Holifield.

The GOP assault against the consumer was led by John Erlenborn, Ill. A formerly fervent Republican supporter of a strong bill, Rep. Flo Dwyer, N.J., collapsed in the clutch. Two courageous Republicans, Ogden Reid, N.Y., and Paul McCloskey, Calif., cast most of their votes for the consumer, and Gilbert Gude, Md., sided with them on several key issues.

Exhibit 9

HEALTH HAZARDS OF ENVIRONMENTAL LEAD

(Dr. Ronald E. Engel)

HEALTH HAZARDS OF ENVIRONMENTAL LEAD

This report presents a position on the contribution of atmospheric lead to the endangerment of public health and is based on published scientific reports Endangerment to public health is considered over a full spectrum of biological responses, from increased body burden through physiologic changes to overt clinical illness. The back-up information for each statement may be found in the Appendix under the appropriate heading.

I. Body Burden

Lead accumulates in humans with prolonged or repeated exposure to high environmental lead levels. The evidence for this accumulation is most strongly documented from the experience of highly exposed occupations in which leaded materials are processed. Blood lead levels slightly above those in the general population are also generally found in groups having incidental exposure to high atmospheric lead concentrations, as noted in studies of garage workers, auto mechanics and traffic policemen. In one study conducted on selected segments of the population living in three cities, elevated blood lead levels were found in residents of communities with high exposure to lead in the ambient air. Blood levels progressively increased on comparing samples taken from rural, suburban and central residents. These differences were confirmed on comparing blood lead levels in persons living within 250 feet of expressways with persons living at least one mile from expressways. However, a recent preliminary oral statement from an as yet unpublished study of selected segments of the population living in seven cities did not confirm the association between ambient air lead and blood lead levels. Other studies have shown increasing lead concentrations in bones obtained from individuals at progressively older ages, suggesting, but not proving, progressive lead accumulation in bone with age. Blood lead levels increased in individuals experimentally exposed by the respiratory route to elevated concentrations of lead. These data support the conclusion that high atmospheric exposure to lead, by direct or incidental occupational exposure to lead in air, can increase the body burden of lead. There is evidence that non-occupational exposures to elevated ambient air lead con-

centrations may increase the body burden of lead, though this evidence has not been confirmed in all studies.

II. Lead Exposure and Absorption

The relative contribution of dietary and atmospheric sources of lead to the total body burden of lead has not been thoroughly studied. Reasonable estimates based on biological data have been made. In a population exposed to no unusual sources of lead, that is, by ingestion of leaded paint or occupational lead exposure, 90 percent or more of the total lead intake is likely to be dietary an 10 percent or less will be inhaled. However, only 5 to 10 percent of dietary lead will be absorbed into the blood stream, while 25 to 40 percent of inhaled lead may be so absorbed. Therefore, under usual conditions the respiratory route is likely to contribute approximately one-eighth to one-third of total lead absorption into the blood stream. In this sense, atmospheric concentrations of lead can contribute a substantial proportion of the total body burden of lead.

III. Physiologic Effects

Blood lead levels below those at which acute toxic symptoms are manifested have been associated with interference in the formation of heme. This biochemical substance combines with the globin molecule to carry oxygen within red blood cells to body tissues. One measure of this interference is excess urinary excretion of delta aminolevulinic acid (ALA), a metabolic precursor of heme. In one study, a significant increase in the mean urinary ALA excretion was observed when mean blood lead levels exceeded 30 μg Pb/100 gm whole blood. Other studies showed significant increases in ALA excretion only at higher blood lead levels exceeding 50 μg Pb/100 gm whole blood. Another measure of this interference is the inhibition of the activity of delta aminolevulinic acid dehydratase (ALAD), an enzyme controlling the rate of formation of metabolic precursors of heme. The activity of this enzyme as measured in lysed red blood cell samples is progressively inhibited with increasing blood lead levels from 5 to 95 μg Pb/100 gm whole blood. This inhibition of itself has not been shown to be deleterious to human health. However, the possibility of physiologic disturbances at elevated blood lead levels even in the "normal" range is distinctly present. There is presently no evidence that lead is an essential trace element or has any beneficial biological effect.

IV. Clinical Effects

Environmental lead, primarily from ingestion of leaded paint by children and from occupational exposure by adults, has produced acute toxic manifestations, both reversible and irreversible, under conditions of prolonged or recurrent excessive exposure. These manifestiations include one or more of the following, some of which can terminate fatally: anemia, abdominal colic, and injury to the kidney, nerves, and brain. In occupationally exposed adult, males, acute clinical toxic symptoms have not been reported at blood lead levels below 80 μg Pb/100 gm whole blood. Symptoms compatible with early lead poisoning especially in children, may be associated with blood lead levels in the range of 50 to 80 μg Pb/100 gm whole blood. The range of blood lead in healthy children and adults without undue exposure to lead, either by ingestion of leaded paint or by direct processing of lead-bearing materials, is 10 to 40 μg Pb/100 gm whole blood. If occupational groups, such as garage workers and traffic policemen, who have close contact with automobile exhaust are excluded, the usual range of blood lead levels in the community is 10 to 30 μg Pb/100 gm whole blood.

V. Hazards to Children

Any addition to the total body burden of lead is undesirable for any group and is particularly hazardous for certain high risk groups. In number, the largest of these groups are infants and young children with pica (habitual eating of nonfood substances). The concentrations of lead found in selected outdoor streets and soil in commercial, industrial and residential areas is sufficient to produce poisoning in a child who ingests as little as one-sixth of a gram of the dustfall daily over a period of four to eight months. This hazard increases for those children living in close proximity to heavy vehicular traffic,

where the amount of lead dustfall is significantly greater. Most cases of lead poisoning in children have been explained by ingestion of leaded paint in old, deteriorating homes. However, the elevated body burden of lead due to respiratory absorption of air lead and/or to oral ingestion of soil contaminated with lead fallout will inevitably increase the risk of clinical poisoning when an additional ingestion of leaded paint is superimposed. The high background of environmental lead produced by vehicular emissions through air transport may be the margin of difference between lead ingestion causing overt clinical disease and lead ingestion without overt clinical disease. This line of reasoning is based on theoretical considerations and has not been documented by actual studies of lead poisoning in children. The supposition that respiratory absorption and particulate fallout of air lead does not make a significant clinical contribution to total body burden of lead in poisoned children remains to be proven by actual studies. The magnitude of the problem hardly justifies a "wait and see" attitude, for acute poisoning is associated with a high percentage of irreversible central nervous damage in children and repeated exposure to high environmental levels of lead greatly increases the risk of irreversible damage.

VI. Conclusions

Lead is a biologically nonessential metallic element, is clearly toxic under conditions of prolonged and excessive environmental exposure and accumulation in persons exposed to high atmospheric concentrations. Atmospheric lead can contribute substantially to the total body burden of lead in both suspended and deposited particulate, i.e. lead fallout through air transport. Physiologic changes of unknown significance may be demonstrated as a result of this increased body burden. Any increase in the body burden or lead is undesirable in high risk groups particularly children with pica who live in areas of close proximity to heavy vehicular traffic and who live in old dilapidated housing. The need to prevent all unnecessary environmental lead exposure clearly follows from these conclusions.

Appendix

I. Body Burden

Epidemiological investigations of industrial exposure to lead have implicated airborne lead as an important contributing factor to the total body burden and the causation of lead poisoning. (1, 2, 3) Where clinical toxicity has been reported, a positive correlation between the atmospheric lead concentration and the number of affected workers was observed. (1, 2) In one investigation of workers in a storage battery plant (3), personal air samplers were used to determine the airborne lead exposure of 39 men. Both blood and urine lead concentrations were positively correlated to the air lead concentration in the working environment. Controlled experimental exposure of 4 normal adults for 2 to 3 years to progressively increasing doses of atmospheric lead has resulted in a corresponding gradient of increasing blood lead concentration in all subjects. (4)

Industrial exposure to lead in the early part of the century, when severe prolonged exposure was common, was related to failure to conceive, spontaneous abortion (5, 6), and an excess number of deaths from cerebrovascular accidents. (7) However, with the institution of modern industrial controls, effects of lead on reproduction (8) and cerebrovascular disease (8, 9) have not been observed.

Investigations of the relationship of ambient lead to blood lead have yielded conflicting results. (10, 11) The difficulty in obtaining consistent data appears in part to be related to the much greater contribution of ingested lead to the body burden, where no unusual source of exposure is involved.

In an investigation conducted in Cincinnati, Los Angeles, and Philadelphia from June 1961 to May 1962, which involved air monitoring and blood sampling, a general trend toward an increase in the concentration of lead in the blood of groups of persons as they varied in their places of residence and work from rural to central urban areas was noted. (10) The average annual ambient concentration reported for this study ranged up to 3 μg Pb/m^3. Twenty-five male population groups were selected with respect to their supposed ex-

posure to varying concentrations of atmospheric lead. When these groups were arranged in order of mean blood lead concentration, there appeared to be an orderly progression in values according to the most likely atmospheric lead concentrations to which these groups were exposed, with the lowest blood lead concentrations found in downtown employees, and the highest concentrations found among drivers of cars and parking attendants (Table 1). However, a preliminary verbal statement on a study (11) involving seven U.S. cities has failed to show a relationship between annual ambient lead concentrations as high as 3.4 μg Pb/m^3 air and blood lead concentration.

Persons living within 250 feet of expressways were found to have higher blood lead concentrations than those living at least one mile from expressways ($P < 0.006$), when men and women were compared respectively. (12) These differences remained even when each group was reevaluated by age, history of occupational exposure to lead, current smoking habits, number of years at present residence and ethnicity. These same observations were made from a similar study conducted in another city. (13)

Bone lead concentration increases in both sexes with age. (14, 15, 16). In one investigation (15) involving tissue sampling from 150 cases of accidental deaths from 9 major U.S. cities, the bone lead concentration increased with age up to the fourth decade and declined thereafter. However, sample sizes decreased and were less reliable after the fourth decade. In another study (16) based upon tissue samples obtained from 69 post-mortem examinations derived from a population group of northwest England, bone lead concentration was observed to increase with age throughout all age groups studied. A 5-fold increase in bone lead concentrations was noted when tibial samples from males 80 years of age were compared with those from males 20 years of age.

II. LEAD EXPOSURE AND ABSORPTION

There are three portals of entry for lead into the body: oral, respiratory and skin. Generally, ingestion is the major contributor to the lead body burden and inhalation contributes to a lesser extent. The skin is not a usual route for lead entry into the body, becoming a factor only where there is exposure to organic lead compounds (occupational). (17, 18)

The U.S. adult daily intake of lead from the diet has been estimated to range between about 120 and 350 μg. (17), with the average daily intake varying between 300 and 300 μg. (17, 18, 19, 11). Between 5 and 10 percent of ingested lead is absorbed. (17) Thus, in the adult the average daily dietary contribution of lead to the body burden is about 10 to 30 μg.

The fate of inhaled particles is determined by their size. Most inhaled particles larged than 1.0 μg in diameted are deposited in the upper respiratory tract, then rapidaly cleared by ciliary action and swallowed. (20) Twenty to 60 percent of inhaled particles 0.1 to 1.0 μ in diameter are deposited in the alveoli, (21) from which some are cleared by macrophage and subsequent ciliary action, but many are retained and absorbed. Atmospheric lead particles have an average mass median diameter of 0.25 μ, with a range of 0.16 to 0.43 μ. (22, 23) One study reported that 22 to 63 percent of 0.1 to 1.0 inhaled lead particles were deposited in the lung (24), while another investigation reported 14 to 45 percent deposition of 0.2 particles with more than 90 percent of the deposited particles retained for absorption. (25) It has been estimated that 25 to 50 percent of inhaled lead is absorbed (18), though the upper limit may be somewhat less. (21)

The National Air Surveillance Network (NASN) has been measuring the atmospheric lead concentration in 141 urban and 27 nonurban areas throughout the United States. (26) In 1966 the annual mean ambient concentration was 0.1 μg Pb/m^3 air for the nonurban regions and 1.1 μg Pb/m^3 air for the 141 urban regions. Assuming that the normal adult exchanges about 15 m^3 air/day and that he absorbs 25 to 50 percent of inhaled lead particles, the contribution of atmospheric lead to the total body burden is about 0.4 to 0.88 μg day in nonurban regions and 4 to 8 μg/day in urban areas. However, when lead levels in the central portions of the larger urban areas are considered, annual concentrations of 2 to 3 μg Pb/m^3 air are common. (10) In these areas about 8 to 23 μg

Pb/day is added to the body burden through inhalation (based upon 15m³ air/day and 25 to 50 percent absorption).

The average dietary lead intake for children between 1 and 3 years old has been estimated to be 130 μg/day. (27, 28) When considered on the basis of dose per kilogram body weight, a dose of 300 μg Pb in an average 70 kg man is 4.5 μg Pb/kg body weight, while a dose of 130 μg Pb in an average 10 kg one-year-old child is 13 μg Pb/kg body weight. This proportionally higher dose in young children is related to their high metabolic rate, requiring a greater intake of food and beverage. On a metabolic basis, a one-year-old child weighing 10 kg would metabolize 1000 calories on the average and inhale 5 to 6 m³ of air. (29) The younger the infant, the higher the metabolic rate and the greater the difference between adult and child on the basis of body weight. Under conditions of comparable environmental exposure, such a child would inhale two to three times as much of a given pollutant as would an adult on the basis of body weight.

III. PHYSIOLOGIC EFFECTS

Lead is not presently known to be an essential trace element, and no useful biological function in man has been demonstrated for lead. (17) Lead is well known as the enzyme inhibitor, and several studies have shown that lead, at concentrations found in the blood stream of normal populations, can interfere with certain basic human metabolic reactions. Inhibition of heme synthesis has been reported in association with blood lead levels considered to be within the normal range of 10 to 40 μg Pb/100 gm whole blood. In one study, this inhibition, as measured by excess urinary excretion of delta aminolevulinic acid (ALA), became significant at blood lead concentrations exceeding 30 μg Pb/100 gm whole blood. (30, 31) Other studies have shown significant increases in urinary ALA only at blood lead concentrations exceeding 50 μg Pb/100 gm whole blood. (32, 33, 34, 35) Several reports state that increased urinary excretion of ALA appears to be more closely correlated than blood lead with lead intoxication. (33, 36, 37) In persons with an increased body burden and lead poisoning urinary excretion of ALA appeared to provide the best index of the quantity of lead that will be mobilized when chelating agents are administered and therefore, the best index of the metabolically active reaction of body lead. (36, 37, 38) One study, however, suggested that urinary ALA excretion was not a dependable indicator of lead poisoning in children. (39)

Interference with heme synthesis may also be measured by the activity of delta aminolevulinic acid dehydratase (ALAD), the enzyme controlling the rate of conversion of ALA to the succeeding step in heme synthesis. A close relationship between the level of ALA in urine and ALAD in blood has been demonstrated by several investigators. (40, 41) ALAD activity appears to be a very sensitive indicator of lead absorption. In one study the activity of this enzyme derived from lysed red blood cells of human adults was progressively diminished over the entire range of blood lead levels between 5 and 95 μg Pb/100 gm whole blood. (35) A similar significant negative linear correlation ($r=-0.81$) between blood lead levels of hospitalized children and ALAD activity was shown over the range of 2 to 50 μg Pb/100 gm whole blood. (42) In workers having high occupational exposures to lead and in patients with clinical evidence of lead poisoning, ALAD activity was inversely correlated with blood lead, lead in urine, ALA in urine and duration of lead exposure. (41)

Since measurement of ALAD activity of lysed red blood cells is an *in vitro* test, it may bear no relationship to the enzyme activity in the intack cell. This opinion is not supported by experimental data. Furthermore, it is inconsistent with the relationship of red cell ALAD activity to blood lead and urinary ALA excretion, both of which are indices of the metabolically active lead fraction. Even though the red blood cell is not the site of synthesis of heme, ALAD in the red cell may well reflect ALAD activity at the cellular sites of heme synthesis.

Lead is a potent inhibitor of essential cellular processes other than heme synthesis. Lipoamide dehydrogenase, an important enzyme component of cellular oxidation in animal and human tissues, is markedly inhibited by lead concentrations as low as 6.5×10^{-6} M in a tissue assay system. (43) This potent inhibitation *in vitro* suggests that lead may disrupt cellular oxidation within

the intact organism. Lead also interacts with ribonucleic acid (RNA) *in vitro* and *in vivo*, causing inhibition of incorporation of amino acids into transfer RNA. (43) These results have important implications in regard to transmission of genetic information and various basic biochemical synthesis. They must be evaluated by focusing more attention on chronic effects of the body burden of lead rather than on the hematopoietic consequences of adult occupational lead exposure.

IV. CLINICAL EFFECTS

Lead poisoning is variously manifested by one or more of the following acute symptoms: anemia, abdominal colic, acute encephalopathy, peripheral neuropathy and lead nephropathy. Chronic excessive exposure is characterized by a clinical course of acute symptoms and superimposed on a background of slowly progressive renal insufficiency and cerebral incompetence. (44-48) Acute encephalopathy, the most severe clinical manifestation of lead poisoning, may present precipitously with sudden onset of intractible seizures followed by coma and death. One-third to one-half of children with acute encephalopathy may also manifest acute renal injury. (49, 50) Symptoms may abate if the subject is removed from gross exposure; however one-fourth to one third of young children who survive episodes of acute-enchephalopathy sustain permanent brain damage (28, 51, 52), possibly because of recurrent excessive lead ingestion. Motor coordination, sensory perception and learning ability are severely impaired in these children.

Studies in human adult volunteers fed known amounts of lead indicate that blood lead levels may serve as an index of recent lead absorption (47). However, at any point in time blood lead concentrations represent an equilibrium between the amount currently absorbed from the lung and gastrointestinal tract and that already stored in body tissues as a result of past exposure-but capable of being mobilized into the systemic circulation. (53) Since the biological half life of lead in bone has been estimated to be 10 years, (54) blood lead does not reflect the size of chronicity of the body's lead burden. Use of chelating agents which mobilize lead from body tissues demonstrates a variable body burden associated with the same blood lead level in different individuals. (53)

While most clinical reports agree that classical acute lead poisoning in adult males is not observed as blood levels below 80 g Pb/100 gm, (47) symptoms compatible with mild lead poisoning may be associated with blood lead levels in the range of 50 to 80 μg Pb/100 gm. (33, 55) This is especially true for children. (56) Blood lead levels in the latter range may increase if body stores of lead are excessive and if lead mobilization occurs. Tissue lead rather than blood lead is far more helpful in judging the hazards of environmental exposure to lead. (53, 57) There are no human or animal studies attempting to associate the total body burden of lead with possible harmful effects of chronic exposure to environmental levels below those causing immediate clinical poisoning. The interaction of nutritional deficiencies or intercurrent illness with the development of lead intoxication has not been investigated. Until these issues are resolved, the safety of any elevated blood lead level is questionable and extrapolation from occupational exposures to the general population is unwarranted.

In populations not known to have excessive direct occupational exposure to lead, blood lead levels range from 10 to 40 μg Pb/100 gm whole blood. (58) This range of values was obtained from a population which included groups such as commercial drivers and garage workers incidentally exposed to high levels of automobile exhausts. The latter groups accounted for most of the blood lead values in the ranage of 25 to 40 μg Pb/100 gm whole blood.

Blood lead levels associated with acute toxicity are, therefore, two to eight-fold higher than levels in the "normal" range. However, a two to eight-fold increase in lead exposure will not increase the blood lead of an individual to the toxic level. The mode of lead ingestion, absorption, rate of excretion and duration of exposure will determine the amount of lead added to the total body burden. The average dietary intake of lead is approximately 300 μg Pb per day. (17) In an adult, a blood lead level of 80 μg Pb/100 gm whole blood may be slowly achieved over a period of 5 years when the dietary intake os 2000 μg Pb per day, or 6.7 fold greater than the average lead content of the daily diet.

A diet of 3300 μg Pb per day, or 10 fold above average, would produce a lead concentration of 80 μg Pb/100 gm whole blood in eight months. (17)

V. HAZARDS TO CHILDREN

The association of lead poisoning in children with ingestion of lead-bearing paints from old deterioratig residential housing surfaces is well documented. (59-65) Concentrations of lead in these paints generally exceed one percent. In a survey of 100 randomly selected blocks of dwellings in Baltimore, lead in excess of one percent in paint was found in 70 percent of 667 dwelling units. (66) Similar results were obtained in surveys of old housing in Philadelphia (63) and London (67).

Return of a child who has suffered an attack of acute lead encephalopathy to the same home environment greatly increases the risk of permanent brain damage. (28, 52) Among 425 children studied six months to ten years after an initial diagnosis of lead poisoning or asymptomatic elevated blood lead levels, 39 percent showed irreversible central nervous system damage including mental retardation, seizures, cerebral palsy or optic atrophy. (68) Even children whose initial episode was manifested by abdominal colic without encephalopathy had a high risk (31 percent) of subsequent permanent central nervous system injury. In another follow-up study, 19 of 20 children who did not have evident encephalopathy but sustained recurrent bouts of acute poisoning during the pre-school years, had permanent subnormal mental function. (62) The possibility of permanent though subtle injury to the central nervous system of children with asymptomatic elevated blood lead levels clearly exists, but no long term study on such children has been reported.

Contamination of roadside soil, vegetation and dustfall with lead has been documented. (69-72) In downtown San Diego the average daily dustfall of 113 mg m^{-2} contained 0.84 percent lead, yielding a daily lead fallout of 950 μg m^{-2}. A more distant monitoring station in La Jolla was found to have a lead fallout of 65 μg/m^{-2}, or one-fifteenth of the San Diego fallout (69). While the lead content of the earth's crust is between 10 and 15 μg Pb/g dry weight (73), superficial soil samples taken 8 meters from a busy roadway (Washington-Baltimore Parkway: 48,000 cars per 24 hours) yielded lead concentrations of 540 μg Pb/g dry weight soil (70). Soil samples taken 32 meters from the same roadway had lead concentrations of 140 μg Pb/g dry weight. For the period 1940 to 1967 it has been estimated that lead fallout in Los Angeles County from the combustion of 47 billion gallons of leaded gasoline has amounted to 15 metric tons per square mile, assuming uniform distribution of vehicular emissions (69). In New York City, street sweepings yielded 2650 μg Pb/g dry weight. (72)

With these data four different theoretical background levels of lead absorption were calculated for varying intensities of exposure to vehicular emissions. (Table 2) The average 2-year-old child inhales about 6 m^3 of air/day (29) and takes in about 130 μg Pb/day through his diet. (28, 67) The assumption was made that a one-year old with pica might ingest one gram of roaddust daily under each of the four exposure conditions. The calculated theoretical contribution of vehicular emissions to the daily body lead burden of such children was then compared to that of a child ingesting one gram flakes of one percent leaded paint daily. The calculations of Table 2 indicate that heavy vehicular emissions could add substantially (25 percent) to the lead absorbed from the diet and flakes of leaded paint. No or light vehicular emissions would add only 0.1 to 0.4 percent to the lead absorbed from diet and flakes of point. Since ingestion of roadside dust by children with pica and actual concentrations of lead in roadside dust under varying traffic intensities have not been reported, the data of Table 2 are necessarily speculative and based on isolated reports not dealing directly with the subject of lead ingestion. The point of the calculations in Table 2 is to present evidence that the high background level of lead produced by heavy vehicular emissions of lead may substantially contribute to the total amount of lead absorbed by children who are at significant risk of lead poisoning, especially in cases where ingestion of leaded paint flakes would otherwise be of only marginal clinical significance.

From September through December 1968, the Community Studies Branch, Division of Effects Research, collected dustfall samples in 77 Midwestern cities selected to range in population size from 100,000 to 1,000,000 persons. (75)

Monthly dustfall samples were collected in a residential, commercial and industrial area of each city for four months. Lead in dust was measured by atomic absorption spectrometry. Results were averaged for the 77 cities and are given below:

Sector of city	Total dustfall (g/m² mo)	Lead content (μg/m² mo)	Lead concentration (μg/g dust)
Residential	3.935	6436	1636
Commerical	6.774	16346	2413
Industrial	10.262	15518	1512

Lead dustfall concentrations in the commercial areas agree closely with the 2650 μgPb/reported in New York City street sweepings.

Dustfall content was reported from four sites adjacent to roadways in Cincinnati (76) At each site, a collection bucket was placed within 25 feet and another within 100 feet of the roadway. Results were as follows for August 1969:

Site and distance from roadway	Total dustfall (g/m² mo)	Lead content (μg/m² mo)	Lead concentration (μg/g dust)
No. 1:			
25 feet	7.637	19771	2589
100 feet	4.976	10820	2174
No. 2:			
25 feet	4.213	17690	4199
100 feet	3.983	14800	3716
No. 3:			
25 feet	5.594	13230	2365
100 feet	4.148	7810	1883
No. 4:			
25 feet	[1] 6.157	[1] 27310	4436
100 feet	[1] 3.553	[1] 12466	3528

[1] Sample from July 1968

At a distance of 25 feet from the roadway, the average lead concentration in dustfall was 3397 μg/g, and at 100 feet 2825 μg/g.

An average lead content from 15 samples of street sweepings in New York City taken between June 10 and 16, 1969, of 4.8 mgPb/sq. ft. was recorded. (77) This represents a lead load of 297 mg/m², and if one assumes a total dustfall fallout of 10g/m²/mo (as we found in the industrial sectors of the 77 midwestern cities), the average lead concentration from the 15 samples would be 5160 μg/g dust. Thus data from the three sources cited above showed a lead concentration ranging from 2413 to 5160 μg/g in the fallout near roadways.

The possible health impact of this fallout on a child with pica can be extrapolated from classical experiments. (17) An adult man fed 3000 μg lead daily, in addition to the usual amount in his diet, achieved a blood lead level after four months of 50 μg/100g whole blood. It was estimated that he would have achieved a "toxic" level of 80 μgPb/100g whole blood if feeding had continued for 4 additional months. Assuming this subject weighed 70 kg, the supplemental daily 3000 μgPb amounted to 43 μg/kg body weight. If a one year old child weighing 10 kg absorbed ingested lead to the same degree as this experimental subject, we could assume that a daily supplement of 430 μg lead would produce toxicity within 8 months. A child living within 100 feet of roadway (lead concentration: 2825 μg/g dust) could get this much lead by ingesting less than one-sixth of a gram of atmospheric particulate fallout daily, an amount of fallout which could be contained in one-twenty fourth of a teaspoon. Therefore the contamination of outdoor streets and soil with lead fallout could easily be a significant hazard to a child with pica, and the hazard increases the closer his surroundings are to heavy vehicular traffic.

TABLE 2.—POSSIBLE CONTRIBUTION OF VEHICULAR EMISSIONS TO LEAD ABSORPTION AMONG CHILDREN WITH PICA INGESTING 1 GRAM FLAKE OF 1 PERCENT LEADED PAINT DAILY

Sources of lead intake	Daily intake (micrograms)	Daily absorption [1] (micrograms)	Total daily lead absorption (micrograms)
A. "Typical" diet	130	13	(A and B) 1013.
B. 1 gram flake of 1 percent leaded paint [2]	10,000	1,000	
C. Heavy vehicular emissions [3]			
1. Ingestion of 1 gram road dust	2,500	250	(25 percent of A and B) 256.
2. Inhalation of 6 cubic meters air at 4 micrograms lead per cubic meter.	24	6	
D. Moderate vehicular emissions [4]			
1. Ingestion of 1 gram road dust	250	25	(3 percent of A and B) 23.
2. Inhalation of 6 cubic meters air at 2 micrograms lead per cubic meter.	12	3	
E. Light vehicular emissions [5]			
1. Ingestion of 1 gram road dust	25	2.5	(0.4 percent of A and B) 4.0.
2. Inhalation of 6 cubic meters air at 1 microgram per cubic meter.	6	1.5	
F. No vehicular emissions [6]			
1. Ingestion of 1 gram road dust	10	1	(0.1 percent of A and B) 1.1.
2. Inhalation of 6 cubic meters air at 0.1 microgram per cubic meter.	0.6	0.1	

[1] Assumes 10 percent absorption from gastrointestinal tract and 25 percent absorption from respiratory tract.

[2] The American Standards Association limits the lead content in the final dried solids in fresh paint to less than 1 percent. Ingestion of 1 percent Pb was selected for these calculations as a conservative estimate. Lead-based paints normally contain 5–40 percent Pb.

[3] Based on lead content of approximately 2500 g Pb/g street sweepings found in New York City (72) and atmospheric levels reported adjacent to heavy traffic (58).

[4] Based on lead content of 242 μg/g in superficial soil samples obtained 8 meters from a rural section of interstate highway near Platte City, Missouri (71) and average atmospheric levels reported from three metropolitan areas in 1965 (58).

[5] Based on lead content slightly above that found in earth's crust (73) and atmospheric levels reported from urban areas in the National Air Surveillance Network, 1962–1964 (26).

[6] Based on lead content of earth's crust (73) and atmospheric levels in the upper range of nonurban samples reported from the National Air Surveillance Network, 1965 (26).

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Exhibit 10

AN INTERIM REPORT BY L. B. TEPPER, DEPARTMENT OF ENVIRONMENTAL HEALTH, COLLEGE OF MEDICINE, UNIVERSITY OF CINCINNATI

The work reported here was supported by Contract PH 22-68-28 with the Air Pollution Control Office, and by the American Petroleum Institute and the International Lead Zinc Research Organization, Inc.

In 1961-62, public health, industrial, and academic organizations participated in a study designed to evaluate the significance of atmospheric lead particulates derived primarily from the combustion of leaded motor fuels. The investigation consisted of air sampling over a 1-year period at a number of locations in Cincinnati, Los Angeles, and Philadelphia, and the gathering of blood and urine samples from selected population groups in these cities. The details of the study and the results were reported in collaborative report prepared by the United States Public Health Service: Publication No. 999-AP-12.

It was a primary purpose of the investigation to establish a baseline for the lead content of the atmosphere in urban areas and in the blood and urine of selected population groups. Those responsible for the work anticipated a subsequent study, which would reflect changes in these lead levels which might be attributed to various relevant factors: vehicle density lead content of fuels, mechanical condition of vehicles, local climatology, and population patterns.

Some two and a half years ago (1968), the Department of Environmental Health at the University of Cincinnati initiated a study which was designed to examine air lead levels at those locations which had been used in 1961-62. The work was supported by the National Air Pollution Control Office, the American Petroleum Institute, and the International Lead Zinc Research Organization. Instrument stations were re-established at the original sites; identical equipment and filter media were used. Several additional sites were established in the more recent study in order to provide information in certain residential areas. These additional sites were located in Okeana, Ohio ("rural Cincinnati"); Ardmore and Wynnewood, Pennsylvania ("suburban Philadelphia"); and Los Alamos, New Mexico, a relatively isolated community of 17,000 persons remote from major roadways.

Because of the relatively heterogeneous population groups examined in the 1961-62 study, those conducting the survey reported here felt that blood lead levels could be better examined by utilizing more specifically described populations. Accordingly, populations reported here were composed of volunteers from church or civic groups who had lived within a prescribed area for a period of

at least five years. The area approximated a circle of one-mile radius drawn about a sampling instrument. Volunteers were exclusively women so as to minimize the influence of industrial or occupational exposures to which men might be exposed and to increase the proportion of each day spent by the subject in a geographical relationship to the air sampling instrument. Urine samples were not obtained.

In association with the collection of the blood samples subjects were interviewed with respect to age, place of residence, food and water supply, local travel, occupation and place of work, tobacco consumption, and health history. The influence of these variables upon blood lead levels is under present study and is not incorporated in this interim report.

It is essential to indicate that the stations selected in 1961-62, although representing certain types of neighborhoods, elevations, and proximities to major roadways, were selected arbitrarily. Data from a specific site have meaning for that site only, and pooling or "averaging" for an entire city has no validity. Alternative sites could have been selected to yield other "averages" for each city. It would therefore not be judicious to make unqualified inference from the findings of a number of stations in a city or other area to that city or area; for example, the findings from eight selected locations in Los Angeles cannot be generalized to the "situation in Los Angeles". It is possible, however, to describe the pattern at each location and to make comparisons in time at a given location. In the latter case it is possible to pose the statistical hypothesis "the lead levels in 1962 and 1969 were the same" and reject this hypothesis if the evidence at hand so warrants.

At the conclusion of the atmospheric studies in Cincinnati, Philadelphia, Los Angeles, and Los Alamos in December, 1969, the sampling stations were removed. Stations were transferred to sites in New York City, Houston, Chicago, and Washington, D.C. Data from this second series of cities and from their associated population groups will be reported at a later date when analysis has been completed.

A. LOS ANGELES

Site No.	Classification	Height above ground, feet	Location
1	Commercial	80	Downtown Los Angeles—County Air Pollution Control District.
[1] 2	do	5	La Brea District-Telephone Co.
3	Rural	5	Arcadia—County Aboretum.
4	Residential	10	Pasadena—County Air Pollution Control District.
5	do	60	Pasadena—California Institute of Technology.
6	do	40	Westwood-University of California at Los Angeles.
7	Industrial	5	Vernon-Vernon City Health Department.
8	Commercial	95	Downtown Los Angeles—Los Angeles City Health Department.

[1] Moved approximately 1¼ mile north of the 1961-62 site because of changes there.

B. PHILADELPHIA

Site No.	Classification	Height above ground, feet	Location
11	Mixed	5	U.S. Naval Hospital.
12	Commercial	50	Philadelphia City Health Department.
[1] 13	Commercial	5	15th and Market.
14	Industrial	25	Air Pollution Control Laboratory.
15	Residential	12	Pennypack Home Owners Association.
16	Rural	10	Private Residence.
17	Rural	10	Eva and Dearnley Water Treatment Plant.
18	Residential	20	Rittenhouse Square—Apartment.
19	Residential	10	Ardmore—Playground.
20	Residential	5	Wynnewood—Private Home.

[1] Moved across street from 1961-62 site (construction).

Note: Original station #10, Philadelphia Airport, omitted because of insufficient biological relevance and major changes in aviation fuel.

C. CINCINNATI

Site No.	Classification	Height above ground, feet	Location
30	Commercial	70	Cincinnati Main Library.
31	Residential	40	Kettering Laboratory.
32	Industrial	45	Vine and Seymour Fire Station.
33	Rural	15	French Park.
34	Rural	5	Okeana Farm.
35	Rural	5	Okeana Farm.

D. LOS ALAMOS

Site No.	Classification	Height above ground, feet	Location
41	Residential	15	Grammar School, Diamond Drive.
42	Commercial	15	Store, Community Center Plaza.

Note: Although not included in the original study, two stations were established in Los Alamos, N. Mex. for the 1968-69 year. The purpose was to provide aerometric data from a well-ventilated non-industrial community with only moderate motor traffic.

SUMMARY OF MONTHLY AVERAGES OF LEAD AND TOTAL PARTICULATE MATTER [BASED ON DECEMBER 61-NOVEMBER 62 AND DECEMBER 68-NOVEMBER 69]

Station	Station	Geometric mean Pb (ug/m³) 61-62	Geometric mean Pb (ug/m³) 68-69	Percent Change (4)-(3)	Confidence limits for percent change		Geometric mean PM (ug/m³) 61-62	Geometric mean PM (ug/m³) 68-00
(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)
Los Angeles	1	2.49	4.03	[1] +61.42	37.45	89.56	121.68	79.35
Do	2	2.63	4.23	[1] +60.45	24.84	106.21	105.75	57.72
Do	3	2.61	3.46	[1] +32.71	12.26	55.90	112.67	85.77
Do	4	2.27	3.72	[1] +64.04	35.59	96.99	107.71	80.20
Do	5	2.04	3.06	[1] +49.78	24.52	80.17	104.16	79.91
Do	6	1.49	2.35	[1] +58.63	21.14	107.72	95.64	57.05
Do	7	2.17	3.39	[1] +56.29	38.59	76.25	138.11	83.42
Do	8	2.80	4.55	[1] +62.62	40.17	88.66	132.32	80.75
Philadelphia	11	1.39	1.89	[1] +35.66	17.95	56.03	121.54	97.14
Do	12	1.75	1.74	−0.078	−1.83	1.71	117.07	82.00
Do	13	3.27	3.75	+14.69	−1.61	33.70	145.07	123.81
Do	14	2.13	2.18	+2.02	−14.78	22.13	124.63	97.78
Do	15	1.10	1.33	[1] +25.68	22.14	29.32	83.62	60.29
Do	16	0.87	1.09	+26.22	8.63	46.66	68.27	55.11
Do	17	0.86	1.08	+25.35	6.03	48.19	78.92	55.97
Do	18		1.67					79.79
Do	19		1.28					64.03
Do	20		1.01					53.84
Cincinnati	30	1.70	1.92	+13.27	−5.29	35.46	98.14	68.80
Do	31	1.09	1.45	[1] +32.97	6.18	66.51	76.31	74.64
Do	32	1.70	2.13	[1] +25.50	6.97	47.22	94.12	75.87
Do	33	0.87	0.85	−2.69	−26.25	28.40	53.76	56.80
Do	34		0.31					46.07
Do	35		0.33					45.10
Los Alamos	41		0.14					Estimated
Do	42		0.20					Estimated

[1] Change significant at .05 level.

MONTHLY LEAD PARTICULATE (UG M.) FOR EACH STATION, 1968 69

Station	Dec.	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
Los Angeles:												
1	5.8	4.2	3.5	3.9	4.1	2.9	2.4	3.1	4.8	4.6	5.0	5.2
2	5.7	5.2	4.5	4.6	3.4	2.9	2.6	3.6	4.1	4.3	6.6	6.8
3	5.0	3.8	3.2	4.1	2.8	2.7	2.1	2.9	3.7	4.2	4.3	3.9
4	5.3	3.5	3.0	3.5	2.9	3.2	2.7	3.7	5.1	5.4	3.8	3.7
5	3.7	2.3	2.7	3.3	2.1	2.8	2.2	3.2	4.2	4.4	3.5	3.3
6	2.9	2.0	1.9	3.1	1.8	2.3	1.4	2.3	3.5	3.0	3.9	1.6
7	7.0	5.0	2.7	3.8	2.6	2.3	1.7	2.4	3.2	3.6	4.5	5.1
8	7.6	5.6	4.7	5.2	3.5	3.0	2.5	3.4	5.2	5.1	5.3	6.1
Philadelphia:												
11	2.1	1.8	1.6	1.7	1.3	1.4	1.6	1.9	2.2	2.7	2.6	2.4
12	1.9	1.9	1.4	1.6	1.2	1.5	1.4	1.8	1.8	2.6	2.2	2.1
13	3.9	3.4	2.6	3.5	3.2	3.0	3.7	4.4	3.8	5.1	5.1	4.1
14	2.3	2.1	1.5	1.8	1.6	1.9	2.3	2.3	2.4	2.9	3.0	2.6
15	1.6	1.4	0.9	1.3	1.0	1.1	1.1	1.3	1.6	2.0	1.9	2.0
16	1.6	1.1	0.6	0.8	0.9	0.9	1.0	1.0	1.2	1.5	1.7	1.4
17	1.3	1.0	0.6	0.9	0.9	0.9	1.1	1.2	1.2	1.5	1.3	1.4
18	1.9	1.9	1.2	1.4	1.1	1.5	1.3	1.8	1.8	2.6	2.3	1.9
19	1.5	1.3	0.8	1.0	0.9	1.0	1.1	1.4	1.7	1.7	2.1	1.5
20	1.2	1.0	0.8	0.7	0.7	0.9	0.9	1.1	1.0	1.3	1.6	1.3
Cincinnati.												
30	1.3	1.4	1.4	2.1	1.9	1.7	1.9	2.1	3.1	2.6	2.3	2.0
31	1.2	0.8	0.9	1.7	1.2	1.2	1.3	1.5	2.6	2.1	1.8	2.2
32	1.5	1.2	1.5	2.2	2.0	2.1	2.1	2.1	3.1	2.8	3.3	2.6
33	0.6	0.5	0.7	0.9	0.7	0.9	0.8	0.9	1.2	1.1	1.0	1.2
34	0.1	0.3	0.1	0.5	0.3	0.3	0.3	0.3	0.4	0.3	0.5	0.3
35	0.2	0.3	0.4	0.5	0.3	0.3	0.2	0.3	0.4	0.4	0.5	0.3
Los Alamos:												
41	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.3	0.1	0.1
42	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2

AIR AND BLOOD LEAD LEVELS

Name	Stations	Air Lead ug m	Number of subjects	Blood Lead ug 100g
Los Alamos	41 42	0.17	204	15.4
Okeana Farm	34, 35	0.32	166	15.8
Ardmore-Wynnewood	19 2[illegible]	1.15	156	18.0
Rittenhouse Square	18	1.67	137	20.6
Pasadena	1 5	3 39	209	17.6

Exhibit 11

Motor Gasoline Blending

Table 12 presents the lead concentration of each of the three grades for each year examined under Schedule L. The relatively low TEL levels in each grade (as early as 1972) emphasize the fact that TEL reduction becomes increasingly difficult and costly as concentrations approach zero. This is further emphasized where one observes the gradual decrease in TEL levels from 1972 to 1976 when all three grades finally are forced to be made without TEL.

TABLE 12.—TEL CONTENTS OF SCHEDULE L GASOLINES[1]

[g.m. gal.]

	1972	1973	1974	1975	1976
93 octane grade	0.4	0.4	0.	0.	0
94 octane grade	.9	.7	.5	.2	0
100 octane grade	.7	.3	.3	.3	0
Pool	.8	.6	.4	.1	0

[1] All grades unleaded after 1975.

The lower lead levels shown for the 100 grade gasoline compared to the 94 grade gasoline in 1972, 1973 and 1974 result from the fact that premium level octane is derived from components which show less response to lead additives than those which will satisfy the lower quality grades. In 1975, premium shows slightly more lead than the 94 grade because the emphasis is beginning to shift from Research Octane to Motor Octane limitation and the lead response octane level balance shifts slightly.

Table 13 presents the characteristics of Schedule L gasolines for selected years. As can be seen from the pool composition data, there is a strong (inverse) relationship between gasoline aromaticity and TEL content. It also shows the benefit of small amounts of TEL compared to unleaded fuels. It appears that TEL reduction at low concentration requires about 3 barrels of aromatics (replacing 3 Bbls of non-aromatics) per pound of TEL eliminated.

(Whereupon, at 1:55 p.m., the hearing was adjourned.)

THE INNER CITY ENVIRONMENT AND THE ROLE OF THE ENVIRONMENTAL PROTECTION AGENCY

FRIDAY, APRIL 7, [redacted], 1972

COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON THE ENVIRONMENT,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10 a.m., in room 5110, New Senate Office Building, Hon. Philip A. Hart (chairman of the subcommittee) presiding.

Present: Senator Hart and Stevens.

OPENING STATEMENT BY SENATOR HART

Senator HART. The committee will be in order.

This is a meeting of the subcommittee on the environment of the Cemittee on Commerce and it is actually the resumption of hearings on the role and the potential of the Environmental Protection Agency in the inner city.

Our first hearings in this area, which were last February, produced a sort of catalog in discouraging terms of the serious environmental problems which overwhelm ghetto communities.

Today we will turn to the response and suggestions and, I am sure, the hopes of the Environmental Protection Agency with regard to these problems.

One of the encouraging responses last year was the creation by EPA of a task force on the environmental problems of the inner city. As I understand it, the assignment of this group was to present the Administrator with a report recommending action in this area of concern.

We are fortunate—any committee is fortunate—to have Administrator Ruckelshaus, because he has in a short period of time demonstrated great ability and talents. So this committee is fortunate to have him with us today to present his reactions to the recommendations made him by that task force.

Let me do a little testifying before we hear from him on my reaction to at least one of the recommendations, this business about removing lead from gas.

The task force recommended that that goal be attained, or at least the objective be, to eliminate lead from gas by 1977.

This subcommittee has had some studies and some testimony which reflect the extent of the health danger associated with lead. In fact, Dr. Fritsch, who will be a witness today, has been one who has established this fact.

Because of that high level of danger, I would argue that no comparable interest or offsetting claim could justify continued production of leaded gasoline beyond 1977. Hence I am disappointed at the EPA's not having accepted this recommendation of its task force, as I understand it, and the counter proposal of a two-thirds reduction in lead content of gas by 1977.

Now clearly I acknowledge that that feeling on my part must be tentative. We have not heard from Mr. Ruckelshaus or others. But it is a strongly held tentative conclusion based on, first, review of the EPA proposal. I am not sure that it considered adequately the health effects of ingestion of lead-containing dirt by inner city children. It would appear that dustfall associated with EPA's proposed regulations will continue to pose significant dangers to children with pica and perhaps to other children as well.

Second, my own tentatively held conclusion—and this comes from staff economists in whom I have confidence—is that the case has not been made that it is not economically feasible to attain the more stringent standard, to get rid of it all by 1977.

So, for those reasons it is my hope that the Agency would consider tightening the regulations before they become final.

Now for a discussion of these and other issues relating to the inner city environment let me welcome Administrator Ruckelshaus on behalf of the committee.

I repeat: I think it is the judgment of this committee that you have done an outstanding job in a fast-moving field where competing claims are vigorously pursued. I am delighted you should take time out to come.

STATEMENT OF HON. WILLIAM D. RUCKELSHAUS, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY; ACCOMPANIED BY CAROL M. THOMAS, DIRECTOR, OFFICE OF CIVIL RIGHTS AND URBAN AFFAIRS; AND DR. JOHN FINKLEA, ACTING DIRECTOR, HEALTH EFFECTS RESEARCH DIVISION, TRIANGLE PARK, N.C.

Mr. RUCKELSHAUS. Thank you, Mr. Chairman, for those fine remarks.

If it please the chairman, I would like to read my statement and then address the question of lead. I address it in the statement and then I can address it in more detail afterwards.

Senator HART. Fine.

Mr. RUCKELSHAUS. I am pleased to have the opportunity of appearing before this committee to testify on the inner city environment. I have with me Mr. Carol Thomas, Director of our newly established Office of Civil Rights and Urban Affairs. The establishment of that Office with that designation was one of the recommendations of the task force to which you referred earlier. On my right, Dr. John Finklea, Director of our Health Effects Research Division in Triangle Park, N.C.

My statement this morning will briefly summarize EPA's mission and programs for the inner city. I am also submitting a more detailed statement for the record.

The environmental problems of the Nation's inner city residents are of critical concern to EPA because pollution levels in the inner city are often at their worst and because this pollution impacts on a population already bearing a number of other social, economic, and environmental burdens. In July, 1971, I established, as the chairman mentioned, a task force to assess inner city environmental problems, to review EPA programs related to those problems, and to make recommendations to me.

The task force was comprised of staff members of the various EPA offices, assisted by a number of summer interns. It operated under the general direction of EPA's Director of Equal Opportunity. The task force submitted a draft report in September 1971 which has been available to the committee.

The report gives a wide-ranging and unconstrained look at the problems of inner city pollution. It presents many facts and recommendations for action, some of which we have already initiated.

The report does not represent EPA's official position on this critical issue, but it has served as a good starting point for EPA review. It has provided invaluable input in arriving at EPA's current position and in determining what EPA can contribute to improvement of quality of life in the inner city.

We have reviewed and considered the task force findings as well as other information. We have approached the problem of defining EPA's mission and programs in the inner city as follows:

We have attempted to assess the relationship between the general problem of urban pollution and the special concerns of the inner city.

We have reviewed current EPA activities in terms of their attention to the inner city.

We have sought to outline, where practical, action by EPA can further address this problem.

Our findings are as follows:

Over three-fourths of the Nation's total population lives and works in urban areas, and pollution is largely, although by no means exclusively, an urban problem. In many cases it is difficult to separate the inner city pollution problem from that of the overall urban area concerned.

We are now laying the groundwork for an accelerated nationwide effort to control pollution. If we are successful in accomplishing our goals that effort should yield significant enviromental improvements in the Nation's urban areas in the years ahead. As a result, the residents of many of our inner city areas will enjoy cleaner air, improved access to water-based recreation, improved refuse disposal services, and other benefits.

We recognize, however, that we cannot rely entirely on our broadly based national programs to meet the more specific problems and needs of the inner city. Continuing efforts must be made to identify and address inner city needs in their own right.

Improvement of inner city environment involves far more than an attack on environmental pollution. It must involve a concern for other urban environmental ills such as neighborhood decay, impact of highway intrusions upon neighborhoods, need for adequate recre-

ation and open space, and upgrading of environmental health services. Further, urban environmental problems cannot be sharply differentiated from other inner city problems such as poverty, education, employment and crime. We recognize that in many cases these are of greater priority and more immediate social and economic impact than is pollution control. However, EPA's mandate in these areas is limited.

Therefore, to have maximum beneficial impact on the quality of life for inner city residents, EPA's inner city pollution controls programs must be linked to other programs to upgrade environmental and economic conditions and community services. In this regard we hope that EPA concern and involvement will serve as a useful catalyst through which we can do our share in stimulating and assisting comprehensive community improvement projects.

Community involvement and support will be an essential ingredient in developing meaningful programs The help, guidance, and views of inner city community organizations will be central to the formulation of more effective EPA programs. Towards this end on January 28, 1972, we established an Office of Civil Rights and Urban Affairs consistent with one of the major reommendations of our task force.

This Office incorporates functions of EPA's former Office of Equal Opportunity relating to minority hiring and contract compliance. In addition, an urban affairs function has been added to coordinate EPA's programs for dealing with problems of the inner city environment. The Office will develop communications with inner city groups and develop demonstration projects for the application of environmental programs to urban core areas.

I have introduced the Director of the Office, Mr. Carol Thomas, who is here with me today. We have already initiated discussions with local organizations around the nation, beginning to develop ideas on community needs and innovative pilot programs.

There are also significant opportunities for developing effective inner city projects through improved interagency cooperation. Towards this end, we have entered into discussions with a number of Federal agencies here in Washington with the objective of identifying and strengthening linkages between our programs. For example, the Bureau of Community Environmental Management in HEW with its rat control, health educator aide, and other programs, affords a major opportunity for cooperation. The Bureau's NEEDS—neighborhood environmental education and decision system—program conducts physical surveys and household interviews to determine the particular needs of individual communities. This may provide much of the basis information which is needed to guide and formulate future EPA programs.

Again HUD's model cities program, housing management, Operation Breakthrough, and other programs provide important interfaces with EPA activities.

At the field level the recently strengthened Federal regional councils, operative in the 10 major Federal centers, provide a mechanism for indentifying and implementng coordinated approaches tailored to the needs of specific localities. We are instructing our EPA re-

gional administrators to utilize the councils for this purpose in developing inner city programs. For example, EPA is currently working with several regional councils to initiate projects designed to assist Spanish-speaking minorities.

Environmental pollution presents a serious health threat to inner-city populations. Based on current knowledge, the most serious direct health effects of inner-city environmental pollution are those associated with air pollution. These effects stem from a combination of exposure to high levels of pollution and vulnerability of the population due to inadequate health care, malnutrition, hereditary traits, and other factors.

Other direct health threats include impacts of noise pollution, contamination of water supplies, pesticide poisonings, and diseases associated with rats and other pests. Added to these direct health threats are other costs of environmental pollution such as blight and esthetic nuisance and foregone recreational apportunities.

In a moment, I will describe EPA's programs for dealing with these problems. However, I also wish to stress the continuing need to monitor the health impact of pollution and to assure that our environmental standards and programs are adequate. Relatively little concrete information concerning the impact of pollution on inner-city residents as such is available to EPA. Many of our present conclusions are based upon presumptive evidence rather than hard facts. EPA plans to expand research on the effects of pollution on the more vulnerable sectors of our population, including inner-city residents.

Air pollution generally impacts the inner city more heavily than the urban area as a whole, and far more heavily than most suburban or rural areas.

EPA is attacking this problem through implementation of the nationwide program set forth under the Clean Air Act of 1970. Achievement of the primary ambient air quality standards promulgated by EPA for sulfur oxides, particulate matter, carbon monoxide, photochemical oxidants, nitrogen oxides, and hydrocarbons should protect the health of inner-city residents from these contaminants.

The basic vehicle for attaining the primary ambient standards by the 1975–77 period mandated by the Clean Air Act will be the State implementation plans. In these plans, the States must formulate control strategies which will result in attainment and maintenance of national ambient air quality standards, adopt rules and regulations with specific time schedules to carry out the control strategies, develop special plans to prevent air pollution emergencies, establish adequate enforcement authority and procedures, and institute an air quality monitoring network. In some areas of the country, the States will have to institute transportation controls.

EPA has given top priority to assisting the States in the development of these plans, and the State-submitted plans are currently under review. Under the Clean Air Act, if a State fails to adopt a control strategy adequate to meet air quality standards, EPA is directed to adopt an approvable strategy. We will first attempt to have the States revise plans that are deficient. If that fails, we will, as the law requires, promulgate rules and regulations designed to meet the standards.

Implementation of these plans will call for major commitments by all levels of government. Accomplishment of the program mandated by the Clean Air Act and achievement of the primary standards should assure increased health protection for inner-city residents.

EPA's recent accomplishment in connection with the Birmingham, Ala., air pollution episode also points to a means of relieving critical urban pollution problems when health is seriously threatened. In that case, after local authorities unsuccessfully attempted to achieve significant voluntary curtailment of emissions from major sources, a small, highly skilled staff of EPA and Justice Department officials requested and received from the Federal district court an order shutting down the pollution-producing operations at 23 plants until the city's air quality returned to its normal levels. We will not hesitate to invoke such action again in other areas should this prove necessary.

Lead poisoning is a particularly serious inner-city problem. The Department of Health, Education, and Welfare has reported that every year 200 children die from lead-paint poisoning. Many thousands more receive permanent central nervous system damage from exposure to lead. Unquestionably the prime contributing factor to lead poisoning in children is ingestion of lead-based paint found in deteriorating housing.

Primary Federal responsibility for addressing this problem rests with HEW and HUD. The Food and Drug Administration has recently taken action to reduce the maximum permissible lead content of paint. The problem of lead paint in existing dwellings is being approached under the provisions of the Lead-Based Paint-Poisoning Prevention Act.

We understand that the program planned by the HEW Bureau of Community Environmental Management anticipates screening and treatment of affected children, and support to communities to accomplish emergency deleading of their dwellings. Any successful attack on lead-based paint poisoning requires the shared responsibilities of the Federal Government, States, communities, and individuals, including voluntary action.

However, airborne lead principally from motor vehicle emissions is also a significant threat. EPA has moved to assure a substantial reduction of airborne lead levels through recently-proposed regulations limiting lead as a fuel additive. Our proposed regulations call for a 60–65 percent reduction in use of leaded fuel additives during the 1974–77 period.

In addition, we are seeking means of reducing all other unnecessary environmental lead exposures, such as those from stationary air pollution sources. These will be controlled in large part through the particulate control requirements of State implementation plans. Additionally, new source performance standards for some lead-emitting industries, such as secondary lead smelters, will be promulgated in the next year. These new source performance standards will oblige the States to take action with respect to lead emissions from existing plants.

Refuse disposal is a major inner city problem. There are some indications that inner city residents consider solid wastes and the asso-

ciated pest control problems their most distressing environmental problem.

Basically, we must approach this issue in two ways: Through overall improvements of our solid waste program and through projects specifically aimed at the inner city.

We are currently reorienting our solid waste program to place less emphasis on development of sophisticated new technology and more on assisting communities to upgrade their urban waste disposal services. We plan to concentrate our resources in those areas where potential for success is highest. We will select localities for planning, technical, and demonstration assistance which have broadly representative problems capable of being solved with available or nearly available techniques and where there is an indicated capacity to solve them now. We hope to be able to demonstrate improvements in those selected communities. Then we hope to show that successful experience can be transferred widely to other communities.

Let me give an example:

EPA has been providing technical assistance to help Cleveland improve its collection efficiency and service levels. Through improved routing and manpower utilization, service has been improved and citizen complaints reduced at the same time that substantial cost savings were realized.

In addition to improving overall urban service, however, we must also turn our attention to the particular problem of the inner city. In our view, the most critical need is for improved household storage and collection of wastes. This is a difficult problem for which we have no ready answers. We must develop better approaches through pilot projects and demonstrations, and then extend our successes through technical assistance. We will be exploring a number of routes These include efforts to demonstrate storage containers and methods best suited to inner city use, to stimulate community involvement and education, and to involve inner city businessmen in private waste handling enterprise.

Noise pollution is a significant environmental problem in inner city areas. Intrusion of freeways and traffic arteries has increased noise levels in many inner city areas. It is clear that there is a need for improved and comprehensive efforts at all levels of government for environmental noise control.

Local and State governments have the primary responsibilities for actions necessary to provide a quieter environment, such as land use planning, zoning, building codes and use regulations. However, a coordinated Federal effort is needed as well. The Administration's proposed noise pollution control legislation under consideration by the Senate would provide the basis for implementing an effective program within the inner city, as well as nationwide.

Special problems associated with improper household use of pesticides may exist in the inner city because of higher use rates and educational difficulties, although we have no data to verify this at this stage.

The most significant inner city pesticide problem is probably acute poisoning of children through ingestion of household pesticides. This is by no means confined to the inner city. We have been work-

ing with FDA and are advised that they will shortly publish proposed regulations under the Poison Prevention Packaging Act requiring childproof containers for pesticides.

There may also be opportunities for special programs directed towards inner city residents, such as educational activities to reduce risks associated with household pesticide use. Further study and a better fact base to guide program development is required.

The principal water supply issue characteristic of the inner city itself is deterioration of water quality in distribution systems and within the home. This results in increases in metals which can affect health. There is evidence of lead concentrations which exceed the Federal drinking water standards.

In our judgment, waterborne lead has been a far less serious problem than other sources, particularly paint. However, we believe that all unnecessary environmental exposures to lead should be reduced, particularly in situations where the cumulative exposure can be large.

In cases where we have detected lead or other parameters in excess of the drinking water standards, we have advised the communities concerned through their State health departments of the need for corrective action. In many cases, adjustments at the water treatment plant can reduce corrosion and lead pickup. In addition, there are situations where replacement of older water mains and home plumbing systems might prove necessary if lead reduction is to be achieved.

Mr. Chairman, we are launching a citywide investigation in Boston to identify any correlations between lead in water supplies, particularly in the inner city, and the amount of lead found foremost in children, but also in the adult population. We hope that this study will give us more and better data than we now have, enabling us to establish the correlation between levels of lead in water supplies and levels of lead that we might find in human beings living in the inner city.

On March 20, 1972, EPA Deputy Administrator Fri testified before this committee to the effect that strengthened Federal legislation is needed to assure provision of safe drinking water. He outlined the nature of the water supply problem. Today, I wish to reiterate support for legislation along the lines detailed by Mr. Fri.

Such legislation would strengthen our ability to deal with water supply problems generally. In addition, through the requirements to report on the quality of water systems we have recommended, we would have a better record of where lead exceeds the drinking water standards. We could then call upon State and local governments to take corrective action. Federal enforcement authority could come into play if the States and local governments failed to act.

Water pollution in our urban areas results in damages to water supply, fish and wildlife and recreation. The problem cannot be addressed specifically within the confines of the inner city as such. It impacts entire river basins and metropolitan areas and must be attacked on that basis. At the same time, closed bathing beaches in or near major metropolitan areas deny needed recreational opportunities to the inner city poor.

An accelerated regulatory and financial assistance program is already underway under the provisions of the Federal Water Pollution Control Act. Legislation now before the Congress would provide for further acceleration. Under that program, we can expect to see substantial improvements in or near our urban centers. We are already assigning priority attention to critically polluted areas, including many where pollution is denying recreational opportunities to large urban populations. We hope to be able to open some of the bathing beaches now closed.

The active and trained involvement of inner city residents is a central ingredient in long-term improvement in inner city environmental conditions. This will provide better communication and identification of problems and needs, and participation in their solution.

In addition, the accelerated nationwide pollution control effort offers significant opportunities for bringing jobs and income to the inner city poor. For example, acceleration of the municipal waste treatment works of construction program should generate major employment opportunities.

EPA already has a number of programs underway to increase minority employment. These range from training sewage treatment plant operators to supporting graduate professional training at black universities. They include a number of youth programs. Particularly important are our programs to prohibit discrimination in employment in EPA grants and contract supported activities.

We will be making a comprehensive review of these activities and aggressively pursuing opportunities for improving these programs across the board.

In summary, there can be little question that inner city pollution is a serious problem that calls for special attention and concern on a continuing basis. I have outlined some of the EPA programs as we now envision them.

What I have described is only a start. For many inner city environmental problems we have no clear-cut answers. In part those answers will come from better facts. There is a major need for research and rigorous evaluation to guide development of effective programs, particularly where those programs are dependent upon scientific fact as in the establishment of standards. For this reason we plan to increase our data gathering and evaluation on the inner city problem.

However, we recognize that further study is not a substitute for action. In the final analysis, I expect that many opportunities for new approaches will be generated by community organizations and other representatives of the inner city. Their participation is essential. That is why I am placing heavy emphasis on the communications channels to be established by our Office of Civil Rights and Urban Affairs.

Mr. Chairman, that summarizes our position.

At this point, if I could address myself somewhat to your earlier statements about lead, I would point out that what we have done in our efforts by regulation to remove lead from gasoline is:

Announced in January of 1971, about a month after the agency came into existence, our intention through an advance notice of rulemaking to propose standards to remove lead from gasoline.

We could have done this in two ways: We could have set an ambient air standard for lead, based on our authority in the Clean Air Act to protect the public health with a primary standard, and against all known or anticipated adverse effects of air pollution with a secondary standard.

The second way is the approach we have taken: elimination of lead as a fuel additive itself, under section 211(c)(1)(A) and (B), of the Clean Air Act.

Under the fuel additive authority we can regulate additives to fuel in order to make possible the achievement of any emission standard which also was set under the act: In this case the removal of nitrogen oxides, hydrocarbons, and carbon monoxide through use the catalytic muffler. So to achieve those standards by 1975 and 1976, we can regulate fuel in that way.

There is a second provision under section 211 which permits us to regulate fuel additives in order to protect the public health. We have chosen to go the Section 211 route because it's clear that in order to achieve the 1975-76 standards, if, in fact, the automotive companies can achieve that standard, they have to get the lead out of gasoline by 1975 for the catalytic mufflers to work.

Also, we believe this gives us a dual justification for the control of lead in gasoline, the other justification being the protection of public health. We studied this problem for over a year: there had been a considerable number of studies prior to be announcement of our proposed standards.

We commissioned a report by Bonner and Moore to give us an overview of the economics of the situation and suggest schedules we might adopt. They gave us several schedules for the removal of lead as a fuel additive and tried to assess the impact—this study primarily dealt with economics, rather than health effects.

From this study and based on many health-effects studies that we have, not only inhouse studies, but also many that have been done outside our agency, we concluded that the proposed standard was the best way to accomplish lead reduction.

Now, it's one of the most complicated problems that I have had to face since coming to this job as Administrator of the Agency, and I by no means claim this is the final answer.

We are hoping out of these hearings to be able to conclude if the standard we have proposed is the best way to go about it. As we expected when we proposed them, there were loud outcries on both sides of the question that we on the one hand were going too fast and on the other hand were not going fast enough.

As to the health-effects problem which I think your opening comments specifically addressed, the most convincing evidence to me was that as best we can determine, when lead in air gets above the two micrograms per cubic meter which our standard is aimed at reaching, we start to see a buildup of lead in human blood.

So, it seems to me to be, as best we can determine, that when it gets above this level we begin to see buildups in the human blood from the lead ingested from air. Now, the problem in the inner city, anywhere for that matter, is that there are many sources of lead—food, drinking water, and, of course, the most immediate concern as far as its toxicity is concerned, paint.

The problem of a more rapid removal from gasoline is a problem that has concerned me over and over again in this Agency. That is not only do we have to be concerned about the known devils that we are dealing with in the environment, whether it be a detergent or gasoline or in food or as a pesticide or however—but we also have to be concerned about the unknown devils.

The problem regarding lead is that if you suddenly remove lead, there has to be something substituted in order to meet the needs of existing cars. Most of the automobiles now coming on the market can use 91-octane gasoline and they don't need lead as an additive to get the octane levels up. But the so-called aromatics that are generally in use and are suggested as substitutes for lead to get the octane levels up are troublesome to us because we don't have enough information, nor is it likely we could get—I know we could not get—enough information on the impact of these substitutes between now and any sudden removal of lead from gasoline to give us the kinds of information on health effects of substitutes that we think we ought to have in order to know what their impact would be.

Implementing EPA's lead reduction schedule which begins in 1974 and culminates in 1977, will not result in increased emissions of substitute. Accordingly, we will have more time to collect data in order to be able to predict more carefully what the health effects of substitutes might be. Also, because the automobiles that are then online will not need additives for operation of their engines, there will not be aromatic substitutes used as the lead is phased out.

It was primarily because of these reasons that we adopted the schedule we did. I am by no means saying that this schedule is the final word in terms of wisdom or otherwise as to what we should do to get the lead out. We are going to get the lead out. The question is, How do you do it to protect the public health and at the same time do it in a way that causes as little dislocation to the society as possible.

Dr. Finklea, I am sure, could give you more information regarding our Agency's views on the health effects of lead.

Senator HART. I am going to make a public confession that I may regret in a moment, but one very quick question:

When do you think the agency will reach what you would describe as a final decision on lead in gasoline?

Mr. RUCKELSHAUS. Mr. Chairman, after we propose a standard, our target is 90 days for reaching final decision. We have scheduled hearings on a release we issued the middle of March for April 11 and April 27 in Dallas, and May 2 in Los Angeles. The reason we have chosen these cities is that they are the areas where we found the ambient levels of lead to be the most troublesome.

Senator HART. Here is my confession: The whole broad subject, particularly of lead, is of really significant concern and importance not just to poor people living in the city, but to everybody. While I had an opportunity late yesterday to review with the very able staff of this committee some of the concerns we were trying to deal with, and while they gave me some very fine questions, I am just not going to try to fake it.

You know about the competing claims around here. You were saying a moment ago that some people tell you you are going too

fast on this, and others are voicing the concern that you are not going fast enough. I know there are people in another hearing who are voicing outrage that I am not there.

That explains in part why I feel I am not as prepared as the seriousness of this subject would demand.

The problems of the Department of Justice and ITT, and the Judiciary Committee are serious and grave, and that story damages the faith of people in Government, but you have just got to halt around here and think about the problems of some other people who happen to live in the center of the cities. If we could just get the attention of the press, big business, Members of Congress, everybody—half as much as we have at that other hearing, to focus on what we do about lead that is destroying children, maybe there would be a resurgence of confidence in Government.

But given the claims on the time of those of us on the Judiciary Committee, including today, I simply would be a fraud if I tried not to develop with you the kind of questioning that would produce a record that would enable this committee to have an understanding of what to do about the environment where it is worst of all. The environment where people live whose problems are greatest of all and who are least likely to ever be heard around here.

It is for that reason that I ask Mr. Bickwit, without any restraint on time, to get the record we need.

Mr. RUCKELSHAUS. Fine, Mr. Chairman.

Mr. BICKWIT. Thank you, Mr. Chairman.

The chairman asserted that it was at staff instigation that on review of the proposed regulations it appears that——

Senator HART. Just to prove how wretched the scheduling functions are, we have to recess. There is a vote on the floor, but with luck I will not get caught at that other hearing.

(Recess.)

Senator HART. Come to order, please. I apologize for that delay. Mr. Bickwit, would you proceed?

Mr. BICKWIT. In your proposed regulation to limit the lead content of gas, it is stated, and you stated it again this morning, that airborne levels exceeding 2 micrograms per cubic meter averaged over 2 months or longer represent a hazard to public health.

In the backup information, it appears to the staff that the health hazards of an airborne lead at a level of 2 micrograms would occur from breathing the air without taking contaminated soil into account as well; soil which may be ingested by small children, especially inner city dwellers who might have pica.

Perhaps the best way to go about this is to ask you whether that is the case, whether our understanding is the case, and if so, why was this danger ignored?

Mr. RUCKELSHAUS. I think if you read the document to which you refer, where we talk about the health effects of lead itself, that we try to indicate in those paragraphs that we are trying to take into account the cumulative impact of lead from all sources, and that the fact that lead is in airborne dust that ends up in the gutters or may end up even in households, particularly those households near freeways where much lead is emitted, is a buttressing health effect of the

standard itself, an adverse health effect that buttresses the standard. We do try to take that into account in arriving at this figure of two micrograms per cubic meter.

Mr. BICKWIT. In Table 7, the assumption appears to be that total diet from sources other than airborne lead will remain constant as airborne lead increases. That suggests to us that adequate consideration was not taken of the amount of lead in dirt, since we would assume that that would not remain constant as airborne lead increased or decreased.

Mr. RUCKELSHAUS. I am not quite sure I understand how that shows we didn't take it into account.

Mr. BICKWIT. First of all, you talk about the daily lead absorption from the air, then you talk about the amount from the diet. Diet is defined as absorption from food and water. Moreover, it is assumed that the amount that is absorbed from the diet remains constant.

Mr. RUCKELSHAUS. Maybe Dr. Finklea can explain this to you better than I can.

Mr. FINKLEA. I think the standard that the administration is advocating will also greatly reduce lead in dustfall. That is one point to make here.

Mr. BICKWIT. We understand that.

Mr. FINKLEA. The second thing is that the lead in household dustfall or community dustfall as contrasted with lead in road-side dustfall are quite different matters. If a small child were playing in a gutter on an expressway, the increment in dietary lead could be considerable. Of course, there would be other health risks attached to playing along an arterial trafficway that would probably far exceed those of the lead itself. However, we have investigations underway of dustfall lead in households which indicate that there is no great increase in risk. We have seen some little increase in blood level, but no great increase in risk from ingesting household dustfall.

Mr. BICKWIT. This No. 30 in the table, let me put this directly, is that meant to include absorption from dirt?

Mr. FINKLEA. No, that is not.

Mr. BICKWIT. It is not?

Mr. FINKLEA. Correct. The amount of lead that would be absorbed from dustfall by a child would be quite variable depending on where the child lives and what the child's play habits are and whether or not that child has a habit of ingesting abnormal substances, the so-called pica.

Mr. BICKWIT. So that if someone were exposed to air at a level of 2 micrograms per cubic meter and in addition had a diet of 30 micrograms per day, he would be in trouble as a result of the additional lead he would consume from the dirt?

Mr. FINKLEA. Well, this would depend on how much lead one consumed through the dirt. I also might say that the amount of lead in the diet could, of course, be variable also. The figures here would be average figures.

Mr. BICKWIT. That's right, but you are assuming the average.

Mr. FINKLEA. Right.

Mr. BICKWIT. You would assume he would get some lead from dustfall?

Mr. FINKLEA. It is certainly true that some children would get some lead from dustfall.

Mr. RUCKELSHAUS. But not all of them.

Mr. BICKWIT. Let's do some calculations. In 1969 the lead content of dustfall was measured at four sites in Cincinnati. At 100 feet from the highway, the average of the four sites was 2,825 micrograms per gram of dust. Our staff calculations show that consuming one-tenth of a teaspoon of this dirt per day would result in worrisome levels of lead in the blood.

Now according to a pediatric consultant to whom we have talked, a child could easily consume this much dirt, especially if the child had pica. This is what worries us.

Mr. FINKLEA. We share your concern about the possible effect of dustfall and lead. As I say, the proposed standard will have the effect of decreasing dustfall lead by over two-thirds. We are looking at what the effect will be on household lead.

Mr. BICKWIT. What we are saying is that after you decrease it over two-thirds, it still constitutes a significant danger to the inner city child.

Mr. FINKLEA. I think the Cincinnati studies are based on lead near expressways in open areas.

Mr. BICKWIT. That's right.

Mr. FINKLEA. This work was done by our division. Certainly our agency recognizes the difficulties which may be placed in those areas. Our later data which we could make available for the record, but which I don't have with me, show that the dustfall lead in households is much lower than this.

Mr. BICKWIT. How about the lead in dustfall on the streets?

Mr. FINKLEA. The lead in dustfalls in busy arterial highways is of the order of magnitude you have described.

Mr. BICKWIT. What we are saying is that your regulations are going to preserve that danger.

Mr. FINKLEA. They would substantially decrease that danger.

Mr. BICKWIT. They wouldn't decrease it from the figures we have here if our calculations are correct.

Mr. FINKLEA. The child——

Mr. BICKWIT. We are basing our calculations on an airborne lead level which is lower than the airborne lead level that you are trying to achieve in your regulations by 1977.

Mr. FINKLEA. I don' think the levels referred to here of the impact on dust fall have been quantitative in the table that you are referring to. I think we can safely say that if a child with pica was in a gutter with road dust which had large amounts of lead in it, this child would have—would be an increased risk. I don't think there is any dispute on that.

Mr. BICKWIT. In another study that you have done reference is made to the amount of lead in the air in Cincinnati at about the same time as the dustfall samples were taken. The amount of airborne lead in Cincinnati is lower than the amount of airborne lead that you will achieve if your regulations go into effect as now proposed.

Mr. FINKLEA. The amount of airborne lead in Cincinnati—this was in the three-city study you are referring to?

Mr. BICKWIT. I don't know which study.

Mr. BROWNLEE. This is the 1969 National Air Sampling Network Quarterly Composit Lead Data which shows an average of 1.20 micrograms per cubic meter.

Mr. FINKLEA. I think there was other information taken in Cincinnati which showed levels somewhat higher than this and over a period of time would be—as I recall once again we can furnish the material—there was about three micrograms per cubic meter in that study.

Mr. BROWNLEE. When were those studies made?

Mr. FINKLEA. The field observations were completed about a year ago and the interim report was made available by our agency.

Mr. BROWNLEE. Could we also assume, then, that the dustfall levels might also be higher as a result of the higher levels?

Mr. FINKLEA. We don't have information on that at this time, sir.

Mr. BICKWIT. The only point that we would continue to make is that this airborne lead level was taken at about the same time as the dustfall lead level was taken and that a correlation can therefore be established to show that if you have 1.20 micrograms per cubic meter in the air, then probably you are going to have something like 2,825 micrograms of lead per gram of dust and that is dangerous. Now what particular portion of that statement do you find objectionable?

Mr. FINKLEA. I think there are two different studies involved in Cincinnati. The study that you are talking about was particularly designed to evaluate the dustfall effects around highways. The national air sampling site is in a different central city location with different air quality. We know that the dust fall levels would vary with where you are in a city.

Mr. BICKWIT. You are suggesting that there would be amounts of lead in the dustfall, but these would not be as significant as the amounts that we have here. Would they probably be something like one-third of the amount we have here?

Mr. FINKLEA. I think there would be substantial reductions in roadside dust even in the busy areas we are describing here in Cincinnati, and that we would also achieve reductions in household dust in areas that were less affected by arterial traffic.

Mr. BICKWIT. So we are now left with the conclusion that if you have an airborne lead level of something like three micrograms per cubic meter, only then would you have the situation we described.

Dr. FINKLEA. I don't think we have the data to justify that correlation at this time, sir. We do have the information, of course, to justify the relative hazards to the child in the inner city from lead from paint, and lead from automobile emission sources, and of course the lead from paint is a much greater hazard to the inner city child.

Mr. BICKWIT. Do you take the lead in paint into account when you decide how much lead there ought to be in the air? Do you assume that the child is getting some lead from paint?

Dr. FINKLEA. This has not been assumed in that statement.

Mr. BICKWIT. Again that bothers us. It appears that you are not assuming he is getting lead from paint, not from dirt, then if you don't——

Mr. RUCKELSHAUS. I don't really understand this. If somebody is actually ingesting lead from paint, this is a serious problem, and regardless of any other source of lead, is going to get them in trouble if they ingest very much of that.

Now what we are trying to do in setting this standard is take into account the cumulative impact of lead that might come from other sources, from waterborne sources, to a child with pica, from dust that blows in, that is, accumulate all that. But if somebody is ingesting lead from a massive source, then it is not going to make any difference if we go down to zero tomorrow with this lead. They are still in trouble.

If we get it out of the street, out of the water, and out of the air—if children eat lead-base paint, that causes the problem. The cumulative impact we're trying to get at is difficult to correlate with the child who ingests lead-based paint.

Mr. BICKWIT. If the child has ingested lead-base paint, and dirt perhaps, and this has taken him up to the allowable daily intake, but no further, wouldn't the presence of lead in the air put him over that level?

Mr. RUCKELSHAUS. Sure, you can postulate where it could.

Mr. BICKWIT. What if he ingested lead from paint, and that puts him up to the allowable daily intake, and the lead he gets from air and dust puts him over?

Mr. RUCKELSHAUS. We have studies where we have tried to relate the amount of lead found in children with the ambient levels of lead. That relation would take into account what they would get from the ground, from dust, from other sources that would be caused by that ambient level in the paint. These have not indicated—even where they are near a lead smelter, with the possible exception of this problem in El Paso—that the levels are above what we consider to be dangerous. We haven't found in the data we now have any direct correlation. That doesn't mean that the potential isn't there. But where we find the real problem to exist, where children have died or where they have been seriously and acutely injured, it is through the ingestion of lead-based paint. I don't know that we can set an ambient standard for lead and start relating that standard in its cumulative impact to a child that might actually be eating a massive source of lead as you find in paint.

It would be almost like saying we should set a level for DDT, given the fact that some people may ingest eating DDT from a sack in the barn. That happens, but I don't know that we can set a standard, based on that possibility.

Mr. BICKWIT. We're saying it is much more likely for them to ingest dirt that is the result of lead in the air than for him to ingest a sack of DDT.

Mr. RUCKELSHAUS. I think that's right, as far as the dirt is concerned. Ambient levels or emission levels in lead from gasoline take that into account. However, as Dr. Finklea said, when you start talking about lead-based paint, we are more into the area, although it does seem that a significant number of people ingest it this way.

Mr. BICKWIT. Do you have any correlative data on the amount of lead in the air and amount of lead in the dirt?

Dr. FINKLEA. We are getting this in the central city community study program. We don't have data which is published or even data which is available.

Mr. BICKWIT. Do you have any reason to believe that the relationship between lead in air and lead in dirt is other than linear? In other words, if you reduce the content of lead in air by one-third would the content of lead in dust be reduced by more or less than one-third?

Dr. FINKLEA. We don't have experimental information on that.

Mr. BICKWIT. Given that you don't, isn't it a natural assumption that it is linear and that we therefore could draw some correlations? And we could reduce the dust content by reducing the content of lead in air?

Dr. FINKLEA. We agree with you, and we certainly feel that a substantial reduction in fuel will reduce that.

Mr. BICKWIT. Assuming it is linear, you have questioned the staff calculations by saying that probably——

Dr. FINKLEA. I didn't question your claculations, I am just saying the sampling was taken at two different sites, and we couldn't justify drawing conclusions here.

Mr. BICKWIT. You are saying the air in Cincinnati probably had three times as much lead in it as in the areas where this amount of lead in dust was found?

Dr. FINKLEA. I said there were several different values taken about the same time in Cincinnati. You are speaking of the national air sampling network. I saw the station: it was in the downtown area in a parking lot area. The network described for roadside lead was on busy arterial expressways.

The third air sampling involved a community area for the seven-city lead study. These were three independent efforts. As I recall, the lead levels in that community standard were a little higher.

Mr. BICKWIT. And you guessed about 3 micrograms?

Dr. FINKLEA. It was between 2 and 3.

Mr. BICKWIT. Okay, let's assume 3.

Dr. FINKLEA. But once again, this is another measure of community lead in terms of suspended particulates. It was not taken right by the expressway itself.

Mr. BICKWIT. But if I understood you correctly, you would assume that 3 micrograms of lead per cubic meter would result in the kind of lead content in dust that we assumed came from something like one microgram per cubic meter.

Dr. FINKLEA. No, I don't have the information to justify that with me.

Mr. BICKWIT. If it is true, then what we're left with is that three-tenths of a teaspoon of dirt per day would result in worrisome levels, rather than one-tenth?

Dr. FINKLEA. The basic question you want to get to, I think, is what is the suspended lead content adjacent to arterial expressways, and I am sorry, I don't have that information with me. But it is not——

Mr. BICKWIT. You would admit it is highly relevant to these regulations?

Dr. FINKLEA. It is relevant to the consideration of ingestion of roadside dust, yes.

Mr. BICKWIT. If there is a close correlation between the amount of lead in air and the amount in dirt, the amount of lead in dirt that is caused by your regulations has got to be very prominent as a consideration in those regulations. Would you agree?

Dr. FINKLEA. It is my opinion. Also in this document on health hazards of lead the possibility of this factor or the probability of this factor having some impact was taken into consideration in keeping the blood levels as low as are projected on table 7. This is a worst case assumption based on a situation in which you don't have the pica, factors of lead in paint or ingested road dust.

Now if you have ingestion of paint or ingestion of large amounts of road dust containing high lead levels, you, of course, would expect higher blood leads. The degree of protection would depend on how much roadside dust the child ingested over what period of time.

Mr. BROWNLEE. Are the proposed regulations justified on the basis of inhalation of lead in air alone?

Dr. FINKLEA. The proposed regulations were presented on the basis of the effect of lead on the emissions control devices. The document on health hazards of lead is presented as a background document.

Mr. BROWNLEE. You are not saying that the sole justification is the effect on——

Mr. RUCKELSHAUS. No, there is, in addition to this, this health effects justification.

Mr. BROWNLEE. The health effects part of the justification takes into account and justifies the regulations on that score merely from the effects of breathing lead. If I am correct, the health effects paper says that when you breathe air in excess of 2 micrograms per cubic meter, you get accumulations in the blood which are deemed to be adverse.

Dr. FINKLEA. You get an increase in the blood level to a certain level which is deemed to be adverse——

Mr. BROWNLEE. The only point of this line of questioning is that if the regulations are justified on the health effects side by inhalation only, if you add the effects of dust to the equation, you increase that justification.

If justified on the basis of breatheable lead, they are further justified if you take dirt into account.

Dr. FINKLEA. We agree with you that the ingestion of roadside dust levels does further justify the regulation, yes.

Mr. BROWNLEE. They might also——

Mr. RUCKELSHAUS. Your point is why shouldn't it be lower if you take that into account?

Mr. BROWNLEE. That's right.

Mr. RUCKELSHAUS. One of the things I think is difficult here is that, in adopting this regulation. The question of health effects of lead is one of great controversy, and I have sat around and dis-

cussed it with the doctors on our staff who have studied it. There is a great deal of disagreement as to the impact of lead in the human body at these levels, because of the tremendous gaps in our knowledge as to what happens when the blood levels of lead start going up. What does this do to the blood? What happens when the metabolism is impacted by lead at higher levels? What does this do? It changes metabolism. Is that a health hazard? There is disagreement on that.

In setting this standard—and knowing that if we suddenly stop the use of lead and drive in a substitute about which we have no effects information—we know lead doesn't do any good in the body, and therefore we ought to get it out, even though there is some controversy over the actual health effects of lead at these levels. The problem we start to get into where there is no controversy at these higher levels, is that it is difficult to correlate those levels in the blood in terms of regulations.

Mr. BICKWIT. Are you trying to get down to a level where there is not an increase in body burden of lead?

Mr. RUCKELSHAUS. I think that is right, as long as I understand your definition of environmental contamination.

Mr. BICKWIT. Exclude lead paint for purposes of this.

Mr. RUCKELSHAUS. I would say in general, yes, although this is not going to get at the problem of the lead smelter or the fact that there may be some places in the inner city where lead has built up over a period of years and continues to disseminate into the environment.

Mr. BICKWIT. As we read this, the 2 microgram per cubic meter ambient level when combined with a figure that you have for dietary intake will bring you to the point where you will no longer get an increase in the body burden of lead. Do we read that correctly?

Mr. FINKLEA. In this particular model, if all these assumptions were met, that is correct.

Mr. BICKWIT. Diet is defined as intake from food and water.

Mr. FINKLEA. Right.

Mr. BICKWIT. So that if there were an intake of roadside dust as well, it would result in an increased body burden of lead.

Mr. FINKLEA. Correct, it would result in an increased burden.

Mr. BICKWIT. We are told there is often an increase in the lead content of roadside dust, quite often.

Mr. FINKLEA. Yes, I might say that we are assuming this and that we have more information on soil leads around the country, but little information on roadside dust.

I think the paper you are quoting is the only one.

Mr. BICKWIT. That is right. But if our objective is to achieve no increase in lead burden from environmental contamination other than lead paint and peculiar situations such as the smelter, these regulations have not achieved that objective.

Mr. FINKLEA. They have achieved that objective for that portion of our population which doesn't eat roadside dust. It is a small portion of small children who are the people we are concerned about in terms of the lead paint.

Mr. BICKWIT. So these regulations are all right except for the inner city kids with pica?

Mr. FINKLEA. I didn't say that at all. That is your conclusion.

Mr. BICKWIT. Excuse me, that was a liberal characterization.

Mr. FINKLEA. Very liberal, yes.

Mr. BICKWIT. What you did say was that these——

Mr. FINKLEA. I think the inner city child with pica is in infinitely greater risk from the hazards of lead paint than he would be from roadside dirt.

Mr. BICKWIT. If we somehow solved the lead paint problem, he would still be exposed to lead contamination as a result of these regulations.

Mr. FINKLEA. If he were playing directly on the gutter in a busy arterial trafficway, the concerns you have would be quite valid.

If he were playing in a house or in a yard that was not previously contaminated with lead, we would like information to quantify that particular risk.

Mr. BICKWIT. Are you intending to seek that information and make it a component of your regulation?

Mr. FINKLEA. Yes.

Mr. BICKWIT. And will your objective remain the objective of not allowing any buildup of environmental lead in the body?

Mr. FINKLEA. We are seeking additional information on community lead, on lead both suspended and in dustfall in the community; in households in which we are getting lead in the tapwater we are looking at lead burdens of the people who live in those households.

We are doing this in several areas of the United States, including inner city areas. We are seeking this information. As it becomes available, it will, of course, be used in the regulatory process. So, we are seeking this.

I think—the significance of any change in body burdens of any small change in tissue burdens of the people is not known. It is a very excellent scientific question.

Mr. RUCKELSHAUS. I think that it is very important to emphasize that point. That what we are dealing with here in terms of the increased body accumulation of lead through the children that are ingesting it through pica—even given all those assumptions—is that we still are operating in an area where we are not exactly sure what happens when that occurs.

Now, we do know what occurs when they ingest lead-based paint. But we are trying to devise a regulation which, given the potential for health impact of some of the substitutes, and given all the problems which your questions very validly bring out, is the wisest way to reduce the amount of paint ingested by any children.

But, if you start thinking which class of people are we trying to protect within the society in setting one of these standards, whether it is with an ambient standard or whatever, you are talking about classes that are susceptible.

You take carbon monoxide. People with heart disease are more susceptible to that pollutant. Someone who may otherwise die in 24 hours may perish in two hours with exposures to one or two parts per million. In other words, you have to eliminate carbon monoxide completely in order to protect that individual. Yet, the standard that we set does try to protect the class of people who have heart

trouble and who are most susceptible to carbon monoxide. We will not protect every single individual in the society.

Mr. BICKWIT. I agree. But does the class of people you are trying to protect include inner city children who have pica?

Mr. RUCKELSHAUS. Certainly, yes it does.

Mr. BICKWIT. And you acknowledge, if I understand you correctly, that the regulations in their proposed formula will increase the body burden of lead in those children?

Mr. RUCKELSHAUS. No, no, not just children with pica. Children who may sit by a roadside with pica—the studies that you are referring to show that roadside lead goes down very quickly as you get 25 to 100 feet away from the roadside.

Mr. FINKLEA. A very busy roadside, an expressway roadside.

Mr. BICKWIT. Are you saying if you are not by an arterial roadside, you won't get any?

Mr. FINKLEA. No, I didn't say any—I don't have——

Mr. BICKWIT. I don't know how much you are getting either. I am saying you will get some and it will increase the body burden. If your objective is to avoid that you haven't achieved it.

Mr. FINKLEA. I don't think the total objective of the Agency is to avoid all increases in body burden. I think this is an assumption which you are making.

Mr. BICKWIT. And are we going to accept an increase in body burden?

Mr. FINKLEA. No: we didn't say that.

Mr. RUCKELSHAUS. We are also using by that standard 30, and some people may be getting 70, and the body burden is going to go up with that person.

Mr. BICKWIT. We have a whole class of people that we know are constantly ingesting dirt. You don't want to ignore them, but won't your regulations, if they go into effect as proposed, hurt them?

Mr. FINKLEA. No, I think the regulations will help them.

Mr. BICKWIT. Not worse than they are now, but, if they continue to eat the dust that is going to result from those regulations, won't they be harmed?

Mr. FINKLEA. As we develop additional information on dustfall and household dust in these areas, if we find that household dust levels are, indeed, resulting in an adverse health effect in these people, this information will be available to the Administrator to adjust the regulations.

We don't have that information at the present time. One can't equate a group of children playing on the edge of the expressway with reality. You are asking us for information that we do not have at this time.

Mr. BICKWIT. I am further asking you, is it wise until we get the precise information to assume, as these regulations appear to, that there will be no exposure from that source?

Mr. RUCKELSHAUS. Obviously not.

But just as obviously, we don't have any information that there is a large degree of lead poisoning going on because of the factors other than paint in the inner city or elsewhere in the country, and because of the additional consideration that if you remove lead

tomorrow—even assuming you could do it from gas if it was physically possible we have no information on the substitute—absolutely no information on what that is going to do to the health.

Mr. BICKWIT. Between known and unknown hazards, which do you choose?

Mr. RUCKLESHAUS. You are talking about a known hazard in terms of its being an immediate hazard to children in the inner city that we can prove is causing levels of lead in their blood above what is acceptible or amounts to a health hazard, and we don't have that information. We don't have that kind of evidence.

The evidence——

Mr. BICKWIT. You don't have evidence as to the precise health threat. You do have evidence that there is a threat, don't you?

Mr. RUCKLESHAUS. That it will increase level, yes.

Mr. BICKWIT. Our only point is that we would like to see you promulgate final regulations which would not lead to that increase.

Mr. FINKLEA. I think the competing risk of the control technology is a very, very important one. If you substitute other metals, we have the problem of accumulations of these metals in the children. If we substitute things which cause a long term danger of cancer, we would have the problem of inflicting this burden on children at a young age when they are liable to be more susceptibe to the influence of this. If we consider the blood levels of inner city children as we see them now, I think the differences between the lead levels we are talking about here, say even between 2 and 3 micrograms, would be quite small considering what the levels are at present in the inner city.

So, we don't want to minimize the importance of your point. We want to emphasize that our available quantitative information base is quite small, but we also want to emphasize that base which we have is from the worse possible case. We do have additional information on household dust levels from other cities which is much, much less than we are talking about here.

One other point that Dr. Bridbord brought to my attention is that with the Lead-Based Paint Poisoning Prevention Act the levels, if they are reduced as you suggest, would be below those in the so-called lead-free paints that are being acted on by the FDA.

Mr. BICKWIT. Was the objective of the lead paint regulations just promulgated by FDA, to prevent all buildup?

Mr. FINKLEA. I am afraid you would have to ask Dr. Edwards and Dr. Mitchell of FDA about that. I think their primary concern was one of acute childhood lead poisoning and dangerously elevated blood levels.

Mr. BICKWIT. As we understand from an EPA paper bearing on that regulation, that was the objective.

Mr. FINKLEA. I think Dr. Bridbord, who wrote the EPA paper that you are referring to, is in the room.

Mr. RUCKELSHAUS. If you want to talk to him, fine. Doctor, do you want to come up?

Dr. BRIDBORD. I am Dr. Ken Bridbord. I work in the Health Effects Branch of the Office of Research and Monitoring of the Environmental Protection Agency. I really would like to step back

and explain a little bit of the rationale for the safe level in paint, and then apply this to the whole question of dustfall with a few simple calculations using some of the numbers we have been talking about today.

Basically, my own understanding of the rationale behind the level of lead in paint as advocated by FDA and the understandings of the people in the Agency who helped write this particular paper that you referred to, is that we would not want to have significant additional sources of lead beyond that which people normally get from food and water which would more than double their daily intake. This is a feeling that has been expressed by a number of people. It is in published literature in a number of places and supports the EPA position strongly.

The EPA position in that paper ("A Control Strategy for Lead in Paint") is consistent with the position taken by FDA and with the American Academy of Pediatrics. It says that if you reduce lead in paint to about .06 percent—this is an approximate figure, nothing magic about saying this is an absolute level—this level will certainly have with it a considerable degree of safety for preventing any problems of lead poisioning in future generations.

Now, what I would like to do is take that figure of .06 percent and relate it to concentrations of lead and dustfall which we know and/or suspect to exist in central city areas. There have been some figures quoted that relate lead concentrations to as high as about .3 percent. That would be 3,000 micrograms per gram.

Now, this doesn't mean that everywhere in the central city lead dustfall contains .3 percent lead. This is in the areas where you would expect the absolute highest levels.

So, I want to hypothesize now—and again as Dr. Finklea has stated we don't have the data to back this—but we can make reasonable estimates of what might be going on.

I am going to make the assumptions that the level of lead in city dustfall in the street a little bit away from a very, very busy highway is approximately one-half of that in the highest level, or about .15 percent. Now again, this is an assumption, but I am going to make it for the record. If one considers this .15 percent concentration and takes a look at the Agency's regulations which now call for a two-thirds reduction of lead in the air, and assumes the linear reslationship the committee assumed—we don't know if it is, but in the absence of any other data we will assume it to be linear—one would find that if you reduce that by two-thirds, you are down to .05 percent.

Now again, there have been a lot of assumptions made and we admit that we need to know more about what is going on. But the point I want to make is that we really are in the ball park of what is consistent with what is recommended by FDA, by the American Academy of Pediatrics, and by the people in the EPA who thought most about this problem.

So, one may argue whether a level of .05 percent or .1 percent is truly the safest level but the point is it is really in the ball park and it is consistent with the best available evidence that we have. I just would like to rest our case with that.

Mr. BICKWIT. As you say, that does assume not the worst possible case but one-half of the worst possible case.

Dr. BRIDBORD. Allow me to continue a little. Every child doesn't spend all of his time sitting on the roadside. Half of his time will be spent in the house where he is exposed to levels of lead in the dustfall considerably below even .15 percent without any controls or the .05 percent with controls. The important factor is what is the average concentration of lead to which he is exposed. If we introduce this factor, I think you might find that we have an even greater degree of safety introduced in here as shown by just looking at the average-concentration of lead in dustfall to which a child would be exposed.

Obviously, if the child spent 24 hours a day playing in an area that had .3 percent lead then we would be worried about that.

Mr. BROWNLEE. Again, on an average, that certainly is true. However, there is considerable data that says the dustfall in certain areas of the country, parrticularly large cities, probably runs much in excess of 3,000 micrograms per gram.

Dr. BRIDBORD. I am not really aware of any definite data that shows that. The point is I would like to say I think we need to know much more about that. But as far as an additional approach in terms of saying how much from the point of view of dustfall, I think the agency's position really is in the ball park. If additional evidence comes out, to show that it needs to be adjusted that the levels are higher—then this is going to be considered and will be taken care of as Mr. Ruckelshaus pointed out. This is not our final position. This is the most reasonable and consistent position for an initial decision that we made.

Mr. BROWNLEE. I would point out for the record that in this same paper, "Health Hazards of Environmental Lead," that the data from New York showed lead in dust to range from 2,413 to 5,160 micrograms per gram of dust.

Mr. BRIDBORD. Again those do not show that the lead content is in the house and it does not relate how much time the child spends actually exposed to that particular concentration. In the absence of knowing all of the factors that contribute you have to make a start somewhere. Our start is the two-thirds reduction.

Now, we are having public hearings and we will hear the opinion of many, many people who have worked and considered the issues quite extensively, and, if the hearings show additional disturbing information, revisions would be considered.

I cannot see at the moment, realizing all that we do not know, that we are really shooting at this as the primary objective. It is not far off. It really is very close.

Even if you said that the levels of dustfall were twice as much to even make it .1 percent there are many medical authorities who would tell you that that also is quite adequate to protect the public health.

So I——

Mr. BICKWIT. In your paper did you not say the .01 percent was what you had to shoot for in lead paint?

Dr. BRIDBORD. .01 percent would be in the extreme case of someone who eats a tremendous amount.

The other thing I want to point out about that paper, is that it is a first-draft paper that has not really been reviewed by many other people. We didn't control how that paper was published or how it got out. It just did.

I think that most scientists would tell you that——

Mr. BICKWIT. It is very convincing.

Dr. FINKLEA. I will say one other thing. You know we are stealing all of our positive arguments for the public hearing.

Mr. BICKWIT. Fell free to adopt them as your own.

We had other questions prepared on this particular issue but in light of time problems we would like to submit them to Mr. Ruckelshaus for response for the record. We would, however, like to address some questions to you on some other issues.

With respect to the lead paint issue we realize yours is not the primary agency in administering lead paint programs. However, we would like to know whether you believe the proposed Federal expenditures to deal with the problem of lead paint poisoning are adequate.

Mr. RUCKELSHAUS. It is my understanding that this year there is $7.5 million appropriated. For next year the request is $9.5 million. I really am not in a position to know enough about the specifics of how they intend to go about this to be able to answer your question.

I do know enough based on similar programs that we have to understand that an argument can be made advocating removal of all the lead-based paint from inner city homes in which case funding is obviously not sufficient. But I think there ought to be a decision that that is what you want to do before your judge the expenditure against that result.

It is my understanding they are trying to be much more careful in isolating where this problem might be severe, then treating children they find who are suffering from it in a large way. They also have a program to try to remove lead-based paint where that seems to be warranted.

This is the same sort of thing that is asked of our agency: Whether we have the money to solve the problem of separation of storm and sanitary sewers. The figure is somewhere around $75 billion to separate all of them. Although we don't have nearly that much, we have some that we are addressing to it. But to get at it in terms of the priorities of water pollution control, maybe even then we do not have enough.

Mr. BICKWIT. Granted, it is debatable whether you would want to delead every house that has lead paint on the walls, but would you take the position that at the very least the money ought to be adequate to screen those children who are at great risk?

Mr. RUCKELSHAUS. I would say yes without having really any idea of how much money we are talking about.

Mr. BICKWIT. Our estimate is that approximately $50 million would be required to do that.

Mr. RUCKELSHAUS. I do not know how much of that is being done at the local level now.

Mr. BICKWIT. We understand precious little is being done.

In light of that and in light of your responsibilities under section 309(a) of the Clean Air Act would you regard it as within your

duties to comment on the proposed expenditures for the screening of children for lead paint poisoning and would you feel if after further study you come to the conclusion these funds are insufficient, you ought to make that decision known?

Mr. RUCKELSHAUS. There are many expenditures that we have that from time to time I comment on within the Administration. Obviously in the effort to judge priorities of expenditure I do not always win.

To say I should be commenting on the level of expenditure being made as to this particular health problem as opposed to any others or as opposed to the expenditures our own agency is making in areas that I might feel need more, I am not sure that is precisely what 309 of the Clean Air Act was directed to.

I don't know how I could comment on this under that section and refuse to comment on expenditure levels within our own agency that might not——

Mr. BICKWIT. I do not have the precise language——

Mr. RUCKELSHAUS. Your question goes to how much influence does the Administrator of the EPA have in attempting to get expenditures of other agencies up to where I think it is necessary to protect the environment. That influence is either great or limited, depending on how I use it, to be absolutely honest with you, if what I do is every time I see an expenditure I think is too little issue a statement on it, that influence is going to diminish as far as being real in getting those expenditures up.

I am not sure that, number one, that was the purpose of section 309, to comment on expenditure levels as opposed to statutes or as opposed to projects that take environmental statements——

Mr. BICKWIT. We would not want you to comment on every health proposal. However, when the proposals are related to your own jurisdiction——

Mr. RUCKELSHAUS. And most of them are.

Mr. BICKWIT. Most of them are not as closely related as this one.

Mr. RUCKELSHAUS. We have a large health effects research effort and it is expanding and expanding because it is absolutely necessary for us to get more information. In almost every case we are trying to make sure our research does not become simply redundant with what is being done as HEW or any of the other health agencies.

The problem is that you have a number of health problems that exist in the country and there is bound to be some limitation of funds. Any agency doing health effects research has to set priorities in terms of where that research is going to go. Lead is one of those problems.

There are all kinds of problems that we have in our agency, including some 9,000 pesticides that have been registered, some 900 chemicals that come on the market every year, that we are trying to allocate our research dollar to get at the ones that seem the most difficult and the ones that need the most immediate research.

Mr. BICKWIT. Well, admittedly it is debatable as to exactly what Congress did intend in section 309(a).

Let us simply ask, if you do not regard section 309 as requiring public comment in this particular instance and you do regard the

level of expenditure as insufficient, as I get from the gist of your remarks, let us simply ask and perhaps prod you to make that position known in whichever way you feel is most appropriate.

Your prime emphasis on garbage collection, which is the next area of questioning we would like to pursue——

Mr. RUCKELSHAUS. Resource recovery, you mean?

Mr. BICKWIT. The prime emphasis seems to be on research demonstration projects, and technical assistance to cities. The task force report you received recommends a national Operation Clean Sweep with large amounts of Federal operational and financial assistance as well as a research and demonstration effort. Assuming from your testimony that your reaction to that proposal is negative, can you elaborate for us as to why?

Mr. RUCKELSHAUS. Well, the task force report calls for the expenditure of $50 million in some 20 cities including the District of Columbia for projects similar to Operation Clean Sweep that occurred here—not exactly the same, but similar.

We tried to break down in the paper we submitted to you—in the longer paper—the seven problem areas we have been able to isolate in this solid waste chain.

The essential problem in the inner city that I see—that we see—is the problem of storage and collection. We do not see that an Operation Clean Sweep in which you go in and clean up an area is getting at that problem.

What clean sweep gets at is the symptom, rather than the lack of storage areas or lack of desire on the part of the people living in the inner city to use whatever storage areas might be necessary, and it may also reflect a collection problem. Although, again, in cities where we have seen collections go up to as often as 6 days a week, if you have inadequate storage facilities you still do not get at this litter problem which is what Operation Clean Sweep is aimed at.

If Operation Clean Sweep—and we are trying some in region 1 in New England—is part of a kickoff toward a more comprehensive approach to the problem of storage and collection so that what you are doing is generating an awareness of the people that live in the inner city of what can happen to their environment if they take advantage of storage facilities or storage projects and increased collection systems, then we think maybe Operation Clean Sweep or something of that type has some viability and some use. But an Operation Clean Sweep, absent the direct zeroing-in on the problems of storage collection, is pretty much of a cosmetic approach. We are not sure that if you are not careful in going into a massive program like this, spending $50 million and running through and sweeping up, and then have nothing to come in behind it to really get at the problem, it isn't going to do anything lasting.

We have had the problem of raising expectations. Disillusionment follows and we are right back where we were before. We have to avoid that in this area.

We frankly just don't know exactly how to get at this problem of storage.

You go into Philadelphia. We have a proposal there that looks promising. But you go into a row of houses in Philadelphia and

there are four or five families living in a house constructed for one family and they do not have the room to put the stuff. To deal with only the symptom of what is happening, like Operation Clean Sweep, is not going to solve the problem in our estimation.

We are trying the "demster dumpsters" which provide for storage facilities in areas where people can get to them. The Philadelphia area proposal is aimed with the urban league at areas where there has been citizen participation before and where they can get the participation with trucks scheduled to come in several times a week so people can take their solid waste out and put it on the trucks on a regular basis. They don't know if it will work, but they are asking for our help.

Depending on the area you are dealing with, the density of the population, their willingness to participate in the project, where those things will work maybe we can transfer them to other sections of the country.

We do not know at this point what will work.

The Resource Recovery Act—with huge amounts of money authorized—is aimed at the construction of recycling systems and resource recovery systems that are very expensive. There simply are no markets for the material that comes out the front end of this technology. And that does not get at the problem of storage collection. That is why we have reoriented our program to emphasize two areas. One is management and systems analysis to get at the storage and collection problem. The other deals with what happens to this stuff that comes out of the front end of this technology.

Mr. BICKWIT. Do you know exactly what type of implementation plan will do the job under the Clean Air Act?

Mr. RUCKELSHAUS. We certainly do not, but I am convinced having reviewed the plans to the extent we have been able to so far that the exercise that is forced under the Clean Air Act to set national standards and have the States submit to us implementation plans, this across the board effort is going to result in appreciably cleaner air in the country by mid-1975.

It is not going to solve the problem. We will have sections of the country that violate the ambient standards. But it will result in a lot cleaner air.

I think that for the first time this process, this foundation, we are now laying, is going to have some real results.

Mr. BICKWIT. Why not the same kind of approach to garbage collection? Why not set standards of cleanliness and require implementation plans to be submitted?

Mr. RUCKELSHAUS. If I knew what those standards would be——

Mr. BICKWIT. Standards of cleanliness like those adopted in New York City. They are not anything special. They just show pictures of what kinds of levels of cleanliness you are trying to attain.

Mr. RUCKELSHAUS. If you want to know the one system in the world that really works as far as the litter problem of solid waste is concerned is in Singapore. If you throw anything on the street in Singapore they fine you and sometimes throw you in jail.

I am not recommending that as a nationwide solution to is problem. But we have people in our agency who have been to Singapore

and they say you can look all day and never find anything in the street.

Now, you have almost a dictatorship there, but they really enforce the antilitter law. We have all kinds of antilitter laws that are not enforced.

I do not know if that is the answer. We do not know that by setting standards of cleanliness other than an antilitter law which you see along the highways all the time—and people try to hit them with cans as they go by—I am not sure it will work.

Mr. BICKWIT. But if you set standards of cleanliness and provide the cities with financial assistance needed to meet those standards—

Mr. RUCKELSHAUS. As far as Federal assistance, we have experience with that in the sewage treatment plant area. If you look at the Council on Environmental Quality estimates of what it will cost to take care of the solid waste problems between 1970 and 1975, it's $105 billion. Most of that is now being spent in the local communities. Unless the Federal Government goes into some massive construction program, a grand-in-aid program, unless you put enough money in, what you will do is inhibit these communities to do something on their own.

Mr. Kretchmer will tell you in New York, the budget is up to its bursting point. He may well be right. But it seems to me the principle of the individual paying—whether corporate or personal taxpaying for whatever it costs—is a pretty good principle to apply. All you are doing by getting the Federal Government involved—unless you get them involved in a massive way—is spreading that tax burden across the entire society. Then the chances are that since we are in an area where we don't know what really to do, there won't be enough money appropriated to solve the whole problem.

What will happen is that the cities won't go ahead on their own until the Federal money is available, just as they did in the sewage treatment plan, Senator, in your home State of Michigan. They now have a tremendous problem of getting cities to go ahead and construct phosphorus removal systems around Lake Michigan where we have put them on order in the Lake Michigan enforcement conference because there isn't enough Federal money available to meet the matching amount of the cities.

There are 50 communities around Lake Michigan with phosphorus removal systems, and there isn't enough Federal money available. I am supposed to go in and enforce these systems, and if I do, the local communities say as soon as you give me the money, I will go ahead and do it. We have increased funding from $200 million to $2 billion in the last 3 years: there isn't enough money available.

I see the same thing happening if you get into a construction grant or grand-in-aid program for solid waste systems of a massive scale. The local communities, unless we are sure what we want to do and until we know there is enough money in there, will again be a problem.

Mr. BICKWIT. How about assistance for operations?

Mr. RUCKELSHAUS. How much are you talking about and how do you define operations?

Mr. BICKWIT. I am talking about actual garbage collection in the city.

Mr. RUCKELSHAUS. I have the same fear. We are talking about an awful lot of money and unless Congress will put the money in there to cover it, you inhibit the local communities from going ahead on their own. They will simply say we will wait for the Federal money.

We found in Cleveland that by adopting sound management systems—a systems approach—we can save a lot of money by reorienting the way they collect the garbage. We did it in the nineteenth century in many cities. We have union problems.

Mr. BICKWIT. Are you saying that if you had it to do over, you wouldn't go ahead with water quality standards and Federal funds for sewage treatment?

Mr. RUCKELSHAUS. What I am saying is I would decide how I would do it before I did it. I wouldn't call that $50 million "seed money."

That is inhibiting money.

I was in Indiana, and we had an application for that money, and we would take all the cities' applications and put them up on a blackboard. We had a rating system where we had 10 criteria to be eligible. If they got through eight, then they would be in the list of eight or nine communities eligible that year.

I would go to the tenth city and say, you start building sewage treatment plants or we sue you. "Fine, that gives us No. 9 up there on the board." If there is a suit by the State against them to build a sewage treatment plant they get Federal funds next year. "Please sue us." That is what was inhibiting those people from going along. Unless you put enough money in to meet the municipal need, it will inhibit municipal action.

Mr. BICKWIT. All right, why not massive Federal assistance?

Mr. RUCKELSHAUS. Because we don't know the need. Is it more garbage trucks, resource recovery systems——

Mr. BICKWIT. You don't know what the need is for air pollution?

Mr. RUCKELSHAUS. That is a different thing.

Mr. BRICKWIT. You call for implementation plans, yet you don't know what traffic——

Mr. RUCKELSHAUS. We set an ambient air quality standard which protects the environment and we tell the States how to figure that out, and we give them options that we could think of that they could adopt.

Mr. BICKWIT. You are saying you don't have the options——

Mr. RUCKELSHAUS. No. I am saying I don't know what the standard ought to be. I don't know what you mean by "standard of cleanliness in a city."

Mr. BICKWIT. All I can say is the Urban Institute has developed some and New York City developed some. I understand the District of Columbia is considering some or has adopted some.

I am not clear on what the situation is, but it doesn't defy solution to——

Mr. RUCKELSHAUS. I am not saying it does.

Mr. BICKWIT. (Continuing) to point to a level of cleanliness in a picture and tell your monitor that that is what has to be achieved.

Mr. RUCKELSHAUS. I am not saying it does, either. I don't know what they might be, but I am not saying it defies solution.

But to get back to your original question, it does seem to me that we have to try to avoid identifying a problem of solid waste in the city and saying, "Let's spend $50 million in 20 cities, and maybe this is going to solve it." I don't think that the history of this kind of approach to solving all kinds of inner city problems has proven very good. If the problem is there, throw money at it and it will go away!

Mr. BICKWIT. I am not saying that.

I am saying throw the money at it and evaluate the plans to see if they will achieve the cleanliness standards set.

Mr. RUCKELSHAUS. That is worth investigating. It's kind of a new theory to me.

Mr. BICKWIT. I think the greatest reason for its being worth investigating is just the filth that you do see nowadays and the reaction in this quarter at least that if we don't investigate solutions like that, it will remain.

Mr. RUCKELSHAUS. I couldn't agree with you more. I think we have to investigate every conceivable solution to these problems.

Mr. BICKWIT. Thank you very much.

Senator HART. Mr. Ruckelshaus, gentlemen, thank you very much.

Mr. RUCKELSHAUS. Thank you, Mr. Chairman.

Senator HART. I have never envied your assignment and I continue not to envy it.

Senator HART. We will recess to resume at 2 o'clock.

The hearing will be chaired at that time by Senator Stevens of Alaska.

(Recess.)

(The statement follows:)

STATEMENT OF HON. WILLIAM D. RUCKELSHAUS, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY

Mr. Chairman, I am pleased to have the opportunity of appearing before this Committee to testify on the inner city environment. The environmental problems of the nation's inner city residents are of critical concern to EPA because pollution levels in the central city are often at their worst, and because this pollution impacts on a population already bearing a number of other social, economic, and environmental burdens.

The following statement summarizes our position concerning EPA's mission and programs for the inner city.

EPA TASK FORCE

In July, 1971, EPA established a Task Force on Environmental Problems of the Inner City with the following functions:

1. Assessment of environmental burdens on the urban poor resulting from air, water, solid wastes, pesticides, and noise problems.
2. Review of current EPA activities to determine how they will alleviate the environmental burdens of the urban poor.
3. Formulation of recommendations for achievements in environmental improvements by June, 1972.

The Task Force was comprised of staff members of the various EPA offices, assisted by a number of summer interns, and operated under the general direction of the Director of EPA's Office of Equal Opportunity. The Task Force submitted its draft report in September, 1971, and that report has been made available to the Committee.

The Task Force report provides a wide ranging and unconstrained look at the problem of the inner city environment. The report presents many facts and recommendations for action and has served as a good starting point for EPA

review of the critical inner city problems. The report does not represent EPA's official position on this issue; but it has provided invaluable input in arriving at that position, and in determining what EPA can contribute to the improvement of the quality of life in the inner city.

GENERAL CONSIDERATIONS

Over three-fourths of the Nation's total population lives and works in urban areas, and pollution is largely, although by no means exclusively, an urban problem. In many cases, it is difficult to separate the inner city pollution problem from that of the overall urban area concerned.

The accelerated nationwide pollution control program now underway should result in significant environmental improvements in the Nation's urban areas. To that extent, it will also benefit inner city residents.

We recognize, however, that special efforts must be made to identify and address the more specific problems of inner city pollution. In doing this, we have reviewed and considered the Task Force findings, as well as other information. We have approached the problem defining EPA's mission and programs in the inner city as follows:

1. We have attempted to assess the relationship between the general problem of urban pollution and the special concerns of the inner city.
2. We have reviewed current EPA activities in terms of their attention to the inner city.
3. We have sought to outline where practical action by EPA can further address to this problem.

EPA'S ROLE WITH RESPECT TO INNER CITY PROBLEMS

Improvement of inner city environment involves far more than an attack on environmental pollution. It must involve a concern for other urban environmental ills such as neighborhood decay, impact of highway intrusions upon neighborhoods, need for adequate recreation and open space, and upgrading of environmental health services. Further, urban environmental problems cannot be sharply differentiated from other inner city problems, such as poverty education, employment, and crime. We recognize that in many cases, these are of greater priority and more immediate social and economic impact than is pollution control. However, EPA's mandate in these areas is limited.

Therefore, to have maximum beneficial impact on the quality of life for inner city residents, EPA's pollution control programs must be linked to other programs to upgrade environmental and economic conditions and community services in the inner city. In this regard, we hope that EPA concern and involvement may serve as a useful catalyst, through which we can stimulate and participate in comprehensive environmental improvement projects which extend beyond EPA's specific areas of responsibility.

EPA Office of Civil Rights and Urban Affairs

An essential ingredient in developing meaningful programs will be community involvement and support. The help, guidance, and views of inner city community organizations will be central to the formulation of more effective EPA programs. Towards this end, on January 24, 1972, EPA established an Office of Civil Rights and Urban Affairs.

The Office of Civil Rights and Urban Affairs incorporates functions of EPA's former Office of Equal Opportunity relating to compliance with Executive Orders calling for equal opportunity in employment in EPA and prohibiting discrimination in employment by EPA contractors. In addition, we have added an Urban Affairs function. An Urban Affairs Staff will develop demonstration projects for the application of environmental programs to urban core areas and coordinate activities which involve urban core areas, including volunteer activities sponsored by the Agency which deal with urban or community-related activities.

Establishment of this Office is a major step to provide an EPA focal point for coordinating communications and programs for dealing with problems of the inner city environment. We have already initiated discussions with local organizations around the Nation, beginning to develop ideas on community needs and innovative pilot programs.

Interagency Programs

Significant opportunities for developing effective inner city projects also exist through interagency cooperation. Towards this end, we are entering into discussions with a number of Federal agencies here in Washington, like the objective of identifying and strengthening linkages between our programs.

To cite a few examples: the Department of Health, Education, and Welfare (DHEW) Bureau of Community Environmental Management, with its rat control, Health Educator Aide, and other programs affords a major opportunity for cooperation. The Bureau's NEEDS (Neighborhood Environmental Education and Decision System) program conducts physical surveys and household interviews to determine the particular needs of individual communities. This may provide much of the basic information which is needed to guide and formulate future EPA programs.

Again, HUD's Model Cities Program, Housing Management, Operation Breakthrough, and other programs provide important interfaces with EPA activities. We will be exploring with HUD additional means of integrating pollution control measures into concepts of neighborhood rehabilitation.

At the field level, the recently strengthened Federal Regional Councils, operative in the 10 major Federal Centers provide a mechanism for identifying and implementing coordinated approaches tailored to the needs of specific localities. We are instructing our EPA Regional Administrators to utilize the Councils for this purpose in developing inner city programs. For example, EPA is currently working with Regional Councils in several of its Regions to develop environmental projects relating to Spanish speaking minority populations.

DESCRIPTION OF THE INNER CITY AREA

Although the term "inner city" and the set of conditions that term represents convey a widely and generally understood meaning, it would be well from the outset to discuss this definition further.

The "inner city" has no discrete geographic boundaries which set it apart from the rest of the urban area. It includes the decaying older areas generally found in the heart or center of the urban core. In some cases, however, isolated sections of a metropolitan area away from the central core may also contain inner city characteristics.

The "inner city" is not the entire central city, which is the area enclosed by municipal boundaries. Rather, it consists of sections of the central city which usually are proximate to the old central business district. The Bureau of the Census has no such term as "inner city." As we use it here, it means areas of the central city in which housing, business and infrastructure are in the process of deteriorating or decaying and areas contiguous to or enclosed within such deteriorating sections.

Deterioration of the central city has grown and spread in the last 30 years. As older neighborhoods drain of their more economically able households, the pace of community and economic decline accelerates. Additionally, the construction of highways and freeways through such neighborhoods hastens deterioration and, conversely, deterioration lowers land values and encourages further highway intrusions. At the same time as housing is being depleted, overcrowding in remaining units rises as the margin narrows between feasible rent levels and the expenses of amortization, taxes, utilities, and maintenance. Maintenance and modernization are the first expenses to be eliminated in this squeeze, and overcrowding hastens building wear and depreciation. Environmental hazards such as flaking lead paint and garbage accumulate and buffers to pollution, such as air conditioning, insulation, and maintenance are not provided.

Living in these areas in comparatively crowded conditions, both in their homes and in their neighborhoods, are densely concentrated populations including large numbers of ethnic and racial minority groups, of the young and the old, particularly those with debilitating conditions; and of the poor—the people believed to be the most susceptible to health problems contributed to by pollution.

Neither decay nor minorities predominate throughout all city areas or within the inner city itself. However, middle and upper income families living within the inner city are not spared the impact of air pollution, noise and other environmental ills. Yet to some extent they can insulate themselves from

some of these problems. Air conditioners can partially mitigate the effects of air pollution and shut out street noise, better living conditions within the home to some extent may offset external environmental surroundings, and higher income and mobility make it possible to escape periodically to better environments. These opportunities are not available to the inner city poor.

The 1970 Census reported that of the 63.82 million people living in central cities, 49.45 million were white, 13.15 million blacks, and 1.22 million other non-whites.[1]

Minority population is increasing, both in numbers and in percentage. Central city growth between 1960 and 1970 was 3.1 million people. Of this, there were increases of 3.2 million blacks, 0.5 million other nonwhites, and a decrease of 0.6 million whites. As a percentage of the central city population, blacks rose from 16% in 1960 to 21% in 1970. At the same time black population as a percentage of surburban population remained 4.8% and declined 1% to 9.3% as a percentage of rural population.

By age group, the percentage distribution of young children has declined over the last 10 years in the central cities and the percentage distribution of the elderly has increased slightly. However, studies of selected low income central city areas have revealed that a much higher proportion of the population is under 16 years old—over 40%—than in the central city as a whole—about 30%. And, similarly, these same studies indicate that approximately 14% of residents of low income areas—as opposed to 10% of central city population—are age 65 or older.

If we combine the particular conditions to which this report is addressed—a largely poor population living in the decaying urban core—we estimate that roughly 8 million persons are involved.

EFFECTS OF POLLUTION ON INNER CITY RESIDENTS

An inner city resident may be exposed to environmental pollutants from conception to death. An unborn child in the inner city may be subtly effected by pollutants to which its mother is exposed. Thus, her developing baby could be adversely effected by carbon monoxide, polynuclear hydrocarbons, lead, cadmium and possibly other pollutants. Our National Environmental Research Centers are quantifying the impact of such exposures. We have as yet detected no major, overt health disorders attributable to interuterine pollutant exposures, but there is little room for complacency. At birth the inner city infant, who is more often premature, may be subjected to an exposure of carbon monoxide which might aggravate any respiratory difficulties, complicating infections or hemolytic anemia and the accompanying jaundice. After discharge from the hospital the inner city baby is more likely to develop iron deficiency anemia the effects of which can be accentuated by exposure to high levels of carbon monoxide.

Based on current knowledge, the most serious direct health effects of inner city environmental pollution are those associated with air pollution. Air pollutants will increase the susceptibility of the inner city resident of all ages to common acute respiratory disorders including colds, sore throats and bronchitis. Inner city citizens will also be most affected by irritating, at times disabling, symptoms of the eyes and respiratory tract during acute air pollution episodes. Symptoms of chronic respiratory diseases such as bronchitis and emphysema are increased in young adults who are exposed to high levels of sulfur dioxide or mixed urban air pollution which are found in the inner city. Even before chronic respiratory disease symptoms appear, the ventilatory component of lung function may be shown to be decreased in inner city children exposed to high pollution levels. This decrease in lung function is also present in well adults. Acute air pollution also has been linked to fluctuations in daily mortality rates in metropolitan areas.

Inner city citizens suffering from specific chronic illnesses will undoubtedly be more adversely affected by air pollutants than suburban residents with the same disorders because of the higher pollution concentrations. Air pollutants

[1] As the "inner city" is ill-defined, detailed population data are not available for that area. Information exists however, for central city areas and for selected low-income areas of central cities from which we can extrapolate to some extent to describe inner city conditions. Central city population is that portion of the population living in Standard Metropolitan Statistical Areas which lies within the city boundaries.

might impair the limited physiologic reserves of the patient with sickle cell disease, iron deficiency anemia, or glucose 6 phosphate dehydrogenase deficiency. Air pollution aggravates asthma and exacerbates the symptoms of preexisting chronic heart and lung diseases. Air and other environmental pollutants may also contribute to the development of cancer and may also contribute to the development of cardiovascular disease.

As will be described in our discussion of air pollution below, EPA standards relating to air quality were established to protect the classes of population most vulnerable and likely to be affected by the pollutants concerned. There is a continuing need to monitor the health impact of air and other environmental pollution, and to determine whether additional standards or programs will be required.

EPA's health effects research activities are designed to provide this information.

Five of these health research programs known by the acronyms CHESS, CHAMP, CLEVER, CLEANS and ACTIONS warrant further discussion. The Community Health and Environmental Surveillance System (CHESS) together with the Community Health Air Monitoring Program (CHAMP) constitute a series of epidemiologic investigations involving the coordinated cooperative efforts of universities, local health departments, state agencies, private research orgnaizations, and a multidisciplinary EPA research team. CHESS investigations seek to quantify dose-response effects of existing air pollution upon asthma, acute respiratory disease, chronic respiratory disease, heart disease, cancer, lung function, irritation symptoms, death rates and other health indices. Both the acute and chronic effects of short-term and long-term air pollution exposure are evaluated. CHESS is now underway in 30 neighborhoods from seven metropolitan areas. CHESS will also quantify the benefits of pollution control in these areas.

Inner city residents are now participating in four of CHESS areas. Community health workers from our Agency found that inner city residents do not want any more "special studies" of themselves. What these citizens do want is to receive adequate consideration as part of overall health and environmental quality programs. Special research techniques have been designed to allow them to participate. In fact, inner city residents in St. Louis are helping to plan and will largely staff the health studies which our Agency will initiate in fiscal year 1973. For example, community health aides trained in neighborhood clinics will administer CHESS pulmonary function testing and collect CHESS health information which has previously required telephone contact. Community action groups, churches, and model cities programs are only a few of the other social institutions of the inner city which are involved in the St. Louis CHESS studies. These citizens allow our Agency to evaluate the health impact of air pollutants from such sources as fossil fueled power plants, municipal incinerators, petrochemical complexes, smelters, and airports. Inner city residents also scheduled to participate in CHESS studies of stationary sourceslocated in the Chicago Northwestern Indiana metropolitan complex. We hope to initiate these studies in the next fiscal year.

During fiscal year 1973 sophisticated air monitoring equipment will also be installed in our CHAMP stations which are located in each of the CHESS neighborhoods .These stations will allow our researchers to determine the effects of short-term peak level air pollution exposures and serve as instantaneous monitors of air quality for residential neighborhoods in some of our most polluted cities.

A mobile clinical research laboratory is the heart of the Clinical Environmental Epidemiological Research (CLEVER) program. CLEVER will allow our health researchers to verify the results of epidemiologic surveys and to detect the earliest signs of emerging chronic disease in volunteers from CHESS neighborhoods. Neighborhood health clinics in inner city areas plan to utilize CLEVER as an extension of their own preventive medicine programs. CLEVER will improve the accessability of preventive services for inner city populations. Much of the developmental work for CLEVER is in progress or nearing completion. We plan to acquire the remaining necessary equipment during fiscal year 1973.

Field studies in the inner city must be supported by a mosaic of scientific information, some of which emanates from the clinical and cellular biology research programs of our Agency. The Clinical Evaluation and Assessment of

Noxious Substances, or CLEANS program, of our Agency is providing critically important information on the effects of carbon monoxide upon heart disease and driving performance. Carbon monoxide is highest near central city expressways. The cellular biology program which is called ACTIONS or Assessment of Cellular Toxicity and Interactions of Noxious Substances, targets on risk factors for acute chronic disease, and on the effects of pollutant combinations. ACTIONS will also provide a toxicologic screen for environmental chemicals such as fuel additives. This screen will enable our scientists to select chemicals which must be definitively tested to protect our citizens from disorders such as cancer, mutations, susceptibility to infection, and impaired reproductive capacity.

Other EPA health research programs will benefit inner city residents by providing the scientific base for regulatory actions dealing with environmental problems involving radiation, pesticides, drinking water, recreational water, noise, and multimedia toxic substances. A number of their investigations involve problems which could significantly impact upon inner city residents. For example: Our scientists are monitoring tissue levels of trace substances and pesticides residues in inner city areas. They also are designing studies to quantify the health effects of urban noise pollution. Our radiation research teams are conducting health effects studies in the laboratory and modeling urban population exposures to non-ionizing radiation emitted by communications facilities. These scientists also monitor vital statistics to help substantiate the efficacy of Federal radiation standards.

INNER CITY POLLUTION PROBLEMS AND PROGRAM NEEDS

Air Pollution

Air pollution generally impacts the central city more heavily than the urban area as a whole, and far more heavily than most suburban or rural areas. Major sources of air pollution are automobiles, trucks, buses, and aircraft; commercial and residential heating; construction and demolition; incineration; and steam and electric generation. These sources release hydrocarbons, carbon monoxide, nitrogen oxides, sulfur oxides, particulate matter, oxidants, lead, other gaseous by-products and dust. Although the mix and levels of pollutants borne in air varies from city to city due to varying combinations of sources and dispersion patterns, characteristically greatest concentrations are found either in the areas surrounding central commercial districts or in adjacent industrial areas, for in these areas the density of sources is greatest. Generally speaking, therefore, air pollution concentration varies directly with the population density and inversely with the distance from the center of the city.

The components of air pollution also vary from neighborhood to neighborhood, although general levels coincide with population density and industrial location. Lead and carbon monoxide levels are highest near urban expressways and main thoroughfares, and mercury and sulfur oxides are highest in neighborhoods near coal-burning power generation facilities or where older home heating systems burn coal and oil. Similarly, dust levels are highest where sources are greatest, but street cleaning practices do not keep pace.

Thus, the central city resident in general and the inner city resident in particular suffer the greatest overall exposures to air pollution. A 1969 NAPCA study of Chicago-Gary, for example, indicated a positive geographic correlation between poverty areas and sulfur dioxide and particulate concentrations in the air. Poverty areas were located within the central city areas of higher pollutant concentrations. Other studies have demonstrated that people who live and work in the center city have significantly higher levels of lead in their blood than suburban residents who work outside the city or than suburban residents who work in the center city.

As already outlined, there is ample evidence to indicate that air pollution in the inner city is creating special health problems because of the vulnerability of the population, due to inadequate health care, malnutrition, hereditary traits and other factors.

Under the Clean Air Act, a major vehicle for preventing air pollution impacts on health nationally and in the inner city is establishment and implementation of national primary ambient air quality standards which, in the judgment of the Administrator, are requisite to protect the public health.

EPA has promulgated standards for six of the most pervasive common air pollutants—sulfur oxides, particulate matter, carbon monoxide, photochemical oxidants, nitrogen oxides, and hydrocarbons.

Primary standards for these pollutants were based upon available scientific evidence concerning effects on human health. The standards are stringent ones, and based upon evidence currently available to EPA we believe achievement of these standards will protect the health of inner city residents with respect to these pollutants.

The basic vehicle for attaining the primary ambient standards by the 1975–1977 period mandated by the Clean Air Act will be the State Implementation Plans. In these plans, the States must formulate control strategies which will result in attainment and maintenance of national ambient air quality standards, adopt rules and regulations with specific time schedules to carry out the control strategies, develop special plans to prevent air pollution emergencies, establish adequate enforcement authority and procedures, and institute an air quality monitoring network. In some areas of the country, the States will have to institute transportation controls. This will be necessary to achieve compliance primarily with the carbon monoxide and photochemical oxidant national ambient air quality standards. Such controls may include periodic inspection of motor vehicle emission control systems and limitations on motor vehicle usage.

EPA has given top priority to assisting the States in the development of these plans, and the State-submitted plans are currently under review. Under the Clean Air Act, if a State fails to adopt a control strategy adequate to meet air quality standards, EPA is directed to promulgate its own strategy. We will first attempt to have the States revise plans that are deficient. If that fails, we will, as the law requires, promulgate rules and regulations designed to meet the standards.

Implementation of these plans will call for major commitments by all levels of government. Accomplishment of the program mandated by the Clean Air Act and achievement of the primary standards should assure increased health protection for inner city residents.

A number of other measures, all of which will have major impact on air quality improvement in urban areas and within the inner city, will be mentioned briefly here. These include: development of regulations and implementation of a program to achieve major reductions in motor vehicle emissions, and development of new source performance standards for steam generators, sulfuric and nitric acid plants, cement plants, and municipal incinerators.

EPA's recent accomplishment in connection with the Birmingham, Alabama, air pollution episode, also points to a means of relieving critical urban pollution problems when health is seriously threatened. In that case, after local authorities unsuccessfully attempted to achieve significant voluntary curtailment of emissions from major sources, a small, highly-skilled staff of EPA and Justice Department officials requested and received from the Federal District Court an order shutting down the pollution producing operations at 23 plants until the city's air quality returned to its normal levels. We will not hesitate to invoke such action again in other areas should this prove necessary.

In summary, we believe these measures will go far to cleanse the air over the Nation's cities, and will provide substantial health benefits to inner city residents.

Lead

Lead is a particularly significant aspect of the inner city air pollution problem, and deserves special discussion here. The Department of Health, Education, and Welfare has reported that every year an estimated two hundred children die from lead poisoning. Many thousands more receive permanent central nervous system damage from exposure to lead. Unquestionably the prime factor contributing to lead poisoning in children is the ingestion of lead based paint peeling from the walls of deteriorating older housing. This problem is particularly serious in the central city where houses such as these are most abundant. Repeatedly surveys have shown that 80–90% of reported cases of clinical lead poisoning are associated with deteriorating housing containing lead based paint. Ingestion by children of even minute quantities of peeling lead based paint constitutes a significant health risk.

When evaluating lead poisoning in its true perspective one must consider all potential exposure risks. In a 1–3 year old child with no significant additional sources of lead exposure, approximately one quarter of absorbed lead comes from the air and the remaining three quarters from food and water (mostly food). Of critical importance is the recognition that additional childhood sources of lead exposure via either oral or respiratory routes will contribute significantly to blood lead and body burden.

Since no biologically useful function has ever been demonstrated for lead and since adverse metabolic effects of lead have been shown to occur at exceedingly low tissue concentrtions, every effort should be made to prevent avoidable lead exposures. The recent National Academy of Sciences special study of lead entitled "Airborn Lead in Perspective" calls special attention to the concept of "exponentially increasing risk" associated with arithmetic increments in blood lead content. Accordingly, every reduction in exposure to lead can significantly reduce the risk of lead poisoning or permanent neurologic deficit.

Recent studies have demonstrated substantial increases in atmospheric lead levels over the past several years. Available evidence suggests that these levels are highest in central city areas. Average blood lead levels also tend to be higher among urban residents than suburbanites. Potential contributions of airborn lead to these elevated blood levels cannot be ignored. Higher concentrations of lead are also found in dust, soil, and vegetation in close proximity to heavily traveled streets and highways. These elevations are attributed to lead emissions from motor vehicles. In the central city with its marked traffic density the possible contribution of dustfall lead to body burden among children prone to pica (ingestion of nonfood objects) must be carefully evaluated. Such ingestion is precisely the mechanism by which peeling lead paint causes lead poisoning. Concentrations of lead in city dustfall have ranged up to one half of one percent, a level capable of causing lead poisoning in children if continually ingested even in small quantities. According to the National Academy of Sciences report referred to previously, swallowing lead-containing dusts (derived primarily from leaded automobile emissions) may contribute significantly to the higher mean blood lead levels found in urban children.

In light of this evidence EPA has taken action to assure a substantial reduction of airborne lead levels in the central city. Proposed Agency regulations call for a 60–65% reduction in use of leaded fuel additives beginning in 1974 with that level to be reached by 1977. Since over 95% of airborne lead in urban environments is due to lead fuel additive emissions, this will substantially reduce respiratory lead exposures. By 1977 anticipated introduction of catalytic emission control systems in automobiles which require lead free gasoline will reduce lead emissions even further. Public hearings with regard to Agency proposed lead regulations are being held in Washington. Comments from industry and the public at large are welcome to insure that all relevant information is considered and that the public health and welfare are fully protected.

In addition, EPA air pollution control programs will limit lead emissions from stationary sources. Although these sources represent only a small percentage of airborne lead, they represent highly localized, and therefore potentially serious, situations. Lead emissions from stationary sources of air pollution will be controlled in large part through the particulate control requirements of State Implementation Plans. Additionally, new source performance standards for some lead emitting industries such as secondary lead smelters will be promulgated in the next year. These new source performance standards will oblige the States to take action with respect to lead emissions.

An additional source of environmental lead which is of concern to us is lead in drinking water. This problem will be discussed further in the section of this statement on Water Supply.

EPA scientists have conducted a theoretical analysis based upon the best currently available data to determine the maximum safe amount of lead in paint for interior residential surfaces. A first draft copy of this in-house technical report, entitled "A Control Strategy for Lead in Paint," appeared in the February 9, 1972, Congressional Record—Extension of Remarks, pp 1010–1011. This paper concluded that continual ingestion of only one-twentieth of a teaspoon of paint containing 0.05% lead would double average daily lead absorption from food and water in a 10Kg child.

Although primary responsibility at the Federal level for limiting the amount of lead in paint rests with HEW and HUD, EPA scientists met on several occasions with representatives from these agencies to discuss our position with regard to lead based paint as presented in this paper. On March 10, 1972, Dr. Merlin DuVal, Assistant Secretary for Health and Scientific Affairs, Department of Health, Education and Welfare (before the Subcommittee on Health, Committee on Labor and Public Welfare, United States Senate) announced a new FDA regulation reducing the maximum permissable lead content of paint to 0.06% as of January 1, 1974.

The problem of lead paint in existing dwellings is being approached under the provisions of the Lead Based Paint Poisoning Prevention Act. We understand that the program planned by the HEW Bureau of Community Environmental Management anticipates screening and treatment of affected children and support to communities to accomplish emergency deleading of their dwellings. HUD also has a number of activities addressed to this problem, including lead paint removal projects in several Model Cities programs. Any successful attack on lead based paint poisoning requires the shared responsibilities of the Federal government, States, communities, and individuals, including voluntary action.

SOLID WASTES

Solid waste disposal is a major problem confronting the nation's metropolitan areas today.

Urban waste in the United States amounts to more than 360 million tons annually. Adverse effects of improper waste disposal range from minor irritations to significant contributions to the degeneration of entire neighborhoods, and are usually almost directly related to the concentration of people. Inadequate disposal can cause air pollution, contamination of ground or surface waters, danger of concentration of methane gas, the present of vectors, and aesthetic blight.

For the inner city resident, however, the problem is even more pressing, and there are indications that inner city residents consider solid wastes and the associated pest control problems their most distressing environmental problem.

The 1971 report of the Council on Environmental Quality, in examining the issue of inner city environment, graphically described the solid waste problem:

Junk and litter accumulated in streets, on sidewalks, and in vacant lots and doorways are a familiar sight in poverty areas and cannot help having a psychological effect on those who live there. The resident often despairs of keeping his small living space clean when all around him are litter and garbage. He may conclude that since refuse collection is a public service, the abundance of uncollected litter indicates that his neighborhood is being discriminated against. Residents in 9 of 20 cities surveyed by the National Advisory Commission on Civil Disorders listed inadequate sanitation and garbage removal as significant grievances. Many cities able to set their own priorities with Federal funds have placed emphasis on sanitation services such as collecting garbage, buying trash and garbage containers for the city poor, removing abandoned automobiles, cleaning up littered vacant lots, and increasing the number of sanitation workers.

Solving the problem involves more than merely upgrading municpal services. Some New York City poverty areas have garbage pickups six times a week, compared to three times a week elsewhere in the city. In Chicago, inner city poor are served by three collections a week, compared to one collection in the rest of the city. Yet inner city littering and unsanitary conditions continue, and there is widespread disenchantment at the failure of cleanup campaigns to have any lasting effect.

The reasons for this failure to maintain sanitary conditions in the inner city are complex and interrelated. Frustration over limited opportunities for housing, employment, and education can lead residents of the inner city to withdraw from active efforts to improve conditions around them. This psychological impact is worsened by physical conditions which work against sanitation. Buildings designed in earlier days have been subdivided into numerous crowded living units, with little provision for storage areas, common spaces, or refuse collection systems. Receptacles are often nonexistent, makeshift, or in poor condition—all leading to a situation in which wind, animals, and vandals spread litter throughout houses and neighborhoods. The abundance of vacant

lots and abandoned structures, already strewn with refuse, encourage further junk, garbage, and other debris. Together these forces work to frustrate even the most willing city sanitation department in working with residents toward a cleaner neighborhood. Also, sanitation collection services have been criticized as perfunctory in some poverty areas. Often such services are confined to curbside collection of packaged refuse, ignoring litter in lots, sidewalks, and gutters.

Strewn garbage, besides being unattractive and odorous, also invites rodents. Rats feed on easily accessible garbage and present a health problem to inner city residents. Greater than the danger of the diseases they carry is the insecurity and fear they inspire, especially in parents with small children.

An estimated 60 to 90 percent of rat bites occurs in inner city neighborhoods. Eighty percent occurs after midnight when most victims are asleep. The problem is intensified by large-scale building demolition in old, inner city areas, where rats are dislodged and then flee to other parts of the city. The presence of rats in an apartment often has nothing to do with the particular building's cleanliness. Substandard housing often is replete with holes in basement walls or around windows and pipes, giving rats entry points from which they fan out through a building.

EPA plans action along several general lines to help improve management of inner city solid waste problems:

1. Upgrading urban waste disposal services generally.
2. Improving household handling and storage of wastes.
3. Developing improved waste handling and storage methods in new public housing.
4. Encouraging inner city businessmen to participate in refuse handling enterprise.
5. Supporting inner city cleanup campaigns.

Upgrading Urban Waste Disposal Services

EPA has recently completed a comprehensive review of its national solid waste disposal program. Among the principal findings of that review were the following:

1. Currently, the most acute problems are high waste collection costs and offensive disposal techniques, particularly in large urban areas.

2. In the near term, these problems could be solved to a large extent if localities would apply available technology and management methods.

Existing technology can provide economical, environmentally-sound disposal alternatives for a wide array of local conditions. For example, sanitary landfills are inexpensive (Even where long hauls to remote sites are required) and can protect the environment (if adequately designed and monitored).

Effective local management of waste collection, using existing or nearly available technology, can reduce total waste management costs due to the high proportion (80%) of the total related to collection and to inefficient equipment utilization and low labor productivity which prevail.

3. The primary constraint on wide scale application of available technology and methods appears to be institutional rigidities and public attitudes. Changing these to achieve the full benefits of known technology and methods is more immediately preferable to developing new technology to overcome them on a wide scale, due to long leadtimes, high research costs, technical risks and economic and physical obstacles potentially associated with wide-scale capital intensification of waste management.

These findings have led to a significant departure from the previous emphasis of the solid waste program, which was on the development and demonstration of new and improved technology. As a result of the findings of this study, EPA's solid waste management program will be planned and carried out to:

1. Demonstrate that existing solid waste problems can be solved on a wide scale by applying available, or nearly available, technology and management techniques.
2. Perfect sanitary landfilling as a disposal method.
3. Understand more thoroughly solid waste problems and alternative solutions.
4. Concentrate program and research resources where the potential for success in solving solid waste problems is highest.
5. Provide solid waste management techniques for disposing of hazardous materials.

Technology development, recycling, and reduction of changes in consumption patterns will also play a role in the program, particularly over the long run.

We plan to concentrate the resources of our solid wastes program in those areas where the potential for success is highest. We will select localities for planning, technical, and demonstr. ion assistance which have broadly representative problems capable of being solved with available or nearly available techniques and where there is an indicated capacity to solve them now. For example, EPA has been providing technical assistance to help Cleveland improve its collection efficiency and service levels.

We hope to be able to demonstrate improvements in those selected communities. Then we hope to show that successful experience can be transferred widely to other communities.

We believe this program reorientation will provide significant benefits in the form of overall upgrading of urban solid waste handling practices and should prove particularly helpful to the inner city areas where the problems are most acute.

Improving Household Handling and Storage of Wastes

Solid waste management is a system composed of at least six separate and distinct phases:

1. The manufacture and distribution throughout market networks of products.
2. Consumption of products at the end of distribution networks which takes on varying patterns.
3. Storage of product wastes after use is completed.
4. Collection and transportation of wastes from storage sites to processing locations.
5. Processing or treatment of wastes for either resource recovery or, by volume reduction methods, for ultimate disposal.
6. Disposal of uncovered resources or whole wastes.

In our view, the most critical step in improving the inner city solid waste problem appears to be storage and collection. A basic problem in inner city areas is inadequate storage containers and facilities or the failure of residents to adequately utilize those provided. This leads to littering, unsanitary conditions, and rat problems. In addition, inadequate storage compounds the problem of collection and transportation. Wastes which are littered and scattered and not stored in adequate containers are difficult to collect and haul. Or, they may be flushed into catch basins of sewers and cause flow stoppage and become a source of food for rats and other animals.

Collection and transportation of solid wastes represent a major cost to municipalities. In the inner city we estimate this cost is roughly 50% higher than the national average, which is $30–50 per household per year. Thus, improvements in storage patterns which can ease the collection problem and make the provision of adequate collection services in inner city areas more feasible can also substantially alleviate burdens of municpal government.

EPA's work, therefore, as oriented directly towards the inner city must focus heavily on the aspect of improved storage methods. As a first step, an evaluation of studies and research on storage has been completed. A demonstration project in Los Angeles demonstrated the viability of plastic bags for storage in some settings, but revealed the limits of the approach in more densely populated areas where exposure to vandalism and animals resulted in widespread tearing of bags and scattering of contents. The need for stronger containers to protect bags in some situations became clear. Projects run in the cities of New York and Chicago have been directed towards finding acceptable outside storage methods in densely populated areas, primarily through use of "dempster dumpster" type containers. Evaluation of the health and cost aspects of these projects have been favorable, but the lack of easy access to containers by residents significantly restricted use, particularly in inner city areas.

EPA is in the process of initiating a number of planning and demonstration projects to examine what types of storage and collection containers and configurations, inner city residents would best utilize in differing living situations. Various types of individual household and collective use containers and arrangements of these will be explored. Possible approaches which will be studied include the incorporation of dumpster containers serving several residents into multiuse areas, adding refuse chutes and storage containers to the

outside of apartment buildings, and providing onstreet refuse collection service at specified hours and locations.

We will also be following closely a test of street trash containers in the District of Columbia by Pride, Inc. Pride has offered a large number of the containers at no cost to the city in return for a contract to sell advertising space on side panels. Sould the project be successful in alleviating litter problems, EPA will promote application of the concept in other cities.

Even here, however, we must recognize that improvements in containers will not in themselves solve the problem without community based support to utilize such containers. We must recognize that overall community participation is required to overcome failures in refuse disposal, and must also consider additional programs needed to stimulate improved individual waste handling practices.

On the basis of this need to treat solid waste problems as part of an integrated approach to urban problems, EPA is exploring opportunities for relating its efforts to probrams of other agencies which seek overall community improvement. These include:

(a) Closer ties with HUD's Model Cities and Housing Management Programs. Within model city areas, improved refuse handling can be linked to overall environmental and neighborhood upgrading. The success of this has been demonstrated in the Los Angeles model city area, where the introduction of plastic bags promoted substantial improvements in solid waste as part of an overall community upgrading.

(b) Closer ties with HEW's Bureau of Community Environmental Management programs, designed to improve sanitation in the inner city. We could build upon the efforts currently underway in 30 cities funded by the Bureau of Community Environmental Management's urban rat control program. The majority of these projects lie in model city neighborhoods and contain strong elements of city participation, development and enforcement of municipal codes, and accelerated municipal collection services. In addition, the same agency's Health Educator Aide program can be utilized to disseminate information on home refuse handling. Health Educator Aides function on a person-to-person basis as communicators of information on such matters as sanitation techniques, insect and rodent control, and the availability of various health and welfare services. In this regard, EPA is also reviewing the possibility of sponsoring the development of films on home refuse handling for use as a training aid in inner city situations.

(c) EPA's SPARE program which is a part of the Labor Department's Neighborhood Youth Corps programs, is emphasizing problem assessment and community education as an approach to better waste handling.

Developing Improved Waste Handling Methods for New Housing

Looking to the longer range, EPA is working with HUD's Operation Breakthrough, which is demonstrating new methods of housing construction. We would like to insure that such new housing techniques incorporate provisions for refuse disposal. Specifically, we are cooperating in a large HUD project in New Jersey where we are evaluating a pneumatic collection system of solid wastes which would eliminate many of the problems of individual storage and household handling in future housing.

Promoting Business and Job Opportunities for Inner City Residents

Opportunities exist for involving inner city businessmen in private waste disposal programs, where such programs are institutionally feasible in the context of the municipal structure concerned. We believe these could have some direct and indirect benefits in securing the greater participation and involvement within the inner city community. Towards that end we are holding discussions with the Small Business Administration regarding their SBA 8(a) program which offers loans and operating support to minority-owned businesses, and with the Office of Minority Business Enterprise in Commerce. We hope to have strong programs encouraging minority business involvement in solid wastes handling and other areas underway by the end of this calendar year.

Additionally, since the private solid wastes contractor or the city sanitation department is a major inner city employer, we are exploring means of making this a stepping stone to upward employment mobility. A very successful proto-

type of this approach has been in operation in Inglewood, California, for the last three years. There young men are hired by the municipal solid wastes agency for a maximum period of five years after graduation from high school. They first receive on-the-job training as garbage collectors and then, while they work as collectors, are supported fully by the city and county to attend a trade school or the local community college. After two to five years they are placed in better paying or higher potential jobs, either with the city or outside. This program is supported entirely through user charges. The Office of Solid Waste Management Programs plans to offer technical assistance to cities to develop programs similar to the Inglewood model.

Supporting Inner City Cleanup Campaigns

There has been considerable interest in inner city cleanup campaigns, in which inner city residents are employed to eliminate accumulated wastes from streets and alleys. For example, a highly publicized project entitled Operation Clean Sweep took place in the District of Columbia during the summer of 1971. The project was funded and operated by the District Government; the majority of costs were for overtime pay to sanitation workers. EPA provided technical assistance and volunteers.

Our appraisal is that to be of lasting value, such efforts should be tied to more sustained programs for dealing with the basic causes of the problem. Subsequent surveys of the Operation Clean Sweep project area showed that litter conditions reverted in a short while in the absence of broader, sustained efforts.

Therefore, while such campaigns do provide a means of increasing citizen and community involvement over the short run, we believe that means must be sought at the local level to develop more sustained program efforts. Some approaches have been outlined above.

In summary, although we have initiated some promising approaches towards the problem of inner city solid waste disposal, we recognize a major need to continue to seek solutions to the problem. We are willing and anxious to receive ideas concerning additional approaches and projects which can be tested in the field. As successes are demonstrated we must also give added attention to transfering these to ther communities with similar problems.

PESTICIDES

The urban poor live in an environment where they are daily subjected to conditions of substandard housing, improper sanitation, refuse disposal problems, and pests and their associated diseases. Pesticides are used by many of these residents to combat rodents, roaches, and oher vermin which invade their homes and bring discomfort and illness. Similarly, pesticides are used in inner city restraurants and grocery stores with similar sanitation problems, thus leading to additional risk of food contamination.

Presumably, the levels of use and risk of pesticide exposure are less in the inner city than in agricultural districts, and higher than those for domestic uses generally, although exact information is lacking. For example, a pesticide use survey urban households in Charleston, South Carolina, contrasted the use of household pesticides by middle-class white families with that of non-white families (mainly Negro) of a lower socio-economic level. This survey indicated that 83% of the white families sampled used pesticides in their homes, whereas 97% of the non-white families used pesticides.

There is also evidence that blood and fat levels of DDT and its derivatives are higher in Negroes than in whites. However, it is not clear whether this results from greater use of pesticides or from other factors.

Accompanying the increased application of household pesticides is an increased danger of misuse, accidental poisoning, and increased contamination of the home environment. Homeowners are seldom acquainted with the scientific rationale of safe application and frequently fail to read and heed the instructions contained in the label. Thus, problems of overuse and misapplication of pesticides have reached the point where contamination by household pesticides may constitute a significant proportion of the total population exposure.

Misuse of household pesticides, leading to human health hazards, is widespread. For example, the South Carolina study previously referred to showed

that both white and non-white families commonly ignored safety precautions in the use of household chemicals. Locked storage was not employed by 88% of all families; 66% stored pesticides within easy reach of small children; 54% stored chemicals near food or medicine; and 66% never wore protective gloves during use or washed their hands after application.

Hazards associated with household chemical use can be categorized as those resulting from chronic increases in pesticide exposure and danger of acute poisoning.

For neither category of hazard are data available to EPA at this time which distinguish the level of hazard to the inner city poor from the urban population as a whole. For example, statistics are available from the Nationwide Clearinghouse for Poison Control Centers concerning pesticide poisonings. While these data show that the preponderance of cases (69% in 1969) occur in children under five years old, they do not provide nationwide information with respect to race, socio-economic status, and physical environment of the victims.

Presumably, however, the most serious inner city health problem associated with use of pesticides is acute poisoning through ingestion, particularly by infants and children, of pesticides stored or used to control rats, roaches, and other household pests.

In summary, while we recognize that there is a need to reduce hazards associated with improper household use of pesticides generally, we have not been able to verify that the problem is more serious in the inner city. At present, we can only assume that a special problem may exist as a result of higher use rates and also perhaps, as a result of linguistic or educational difficulties which may contribute to inadequate safety precautions.

In part, the problem may call for improvements in general programs for control of pesticides, such as registration and labelling activities under the Federal Insecticide, Fungicide and Rodenticide Act. Action is also under consideration by the Food and Drug Administration to issue regulations under the Poison Prevention Packaging Act governing childproof packaging of pesticides which should go far towards minimizing the acute poisoning problem.

In addition, we are continuing to explore possible programs tailored specifically to the inner city:

1. Ways of obtaining better information on patterns of inner city pesticide use and its consequences, to determine future program needs.

2. Development of specific educational programs on household use of pesticides for disadvantaged groups. Probably the most promising means of accomplishing this is through work in association with broader educational programs in the inner city, such as the Health Educator Aide Programs of the DHEW Bureau of Community Management, which is designed to employ and train inner city residents, to utilize a person-to-person approach for motivating residents and landlords on ways that help bring about improvement of environmental health conditions in the inner city.

3. Changes in labelling, both under the existing law (FIFRA) and under pending pesticide legislation. Increased precautionary measures for labelling would be authorized by the Federal Environmental Pesticide Control Act, passed by the House of Representatives and awaiting action in the Senate. Special attention in considering changes in labelling requirements could be focused on ensuring that the essential message of the labelling on consumer size and consumer type products comes through clearly to persons of limited reading ability and those dependent upon Spanish or other foreign languages.

NOISE

Noise pollution is a growing problem in the Nation's urban areas. The recent EPA "Report to the President and Congress on Noise," December 31, 1971, presented a comprehensive review of the noise pollution problem.

The report pointed out that a major factor in the growth of urban noise has been changes in land use patterns such as construction of freeways and airports. The growth of areas impacted by high noise levels has been dramatic. In 1955 less than 100 square miles was exposed to levels of intrusive highway and airport noise at levels deemed to be objectionable. By 1970 that figure had risen to 2,000 square miles.

In many cases such land use changes have taken place within the inner city, which is frequently cut by freeways or transected by traffic arteries. The prob-

lem may be exacerbated for the inner city poor by lack of ability to insulate themselves from such noises.

It has long been known that exposure to excessive noise levels can lead to temporary or permanent hearing loss ranging from slight impairment to almost total deafness. Whereas noise levels sufficient to induce some degree of hearing loss were once confined mainly to factories and occupational situations, noise levels approaching such intensity and duration are today being recorded on city streets.

In addition, noise can interfere with speech communication, disturb sleep and relaxation, be a source of annoyance, interfere with an individual's ability to perform complicated tasks, influence mood, and otherwise detract from the quality of life. Psychological impact has been related to a number of factors, among the most significant of which are magnitude and duration, time of day, and deviation from background levels.

However, studies have not yet established the quantitative relationships between noise and these problems. We cannot state, at this stage, the full extent and nature of noise pollution and attendant health problems affecting the inner city population. We can, however, conclude that noise is a significant inner city environmental problem, and one which detracts from the quality of inner city life.

Further, it is clear that there is a need for improved and comprehensive efforts at all levels of government for environmental noise control. Local and state governments have the primary responsibilities, in most respects, for the actions necessary to provide a quieter environment. This includes land-use planning and zoning, building codes, use regulations, and the necessary enforcement programs. However, with the rapid growth of environmental noise, it has become clear that there are some noise control functions that are best carried out by the Federal government.

This conclusion led the Administration to submit proposed noise control legislation to the Congress in 1971. This legislation is currently under consideration by the Senate.

In its December 31, 1971, "Report to the President and Congress on Noise," EPA set forth recommendations for a program to achieve the objective of a significant reduction of noise over the next 5 to 10 years. These were:

1. *Federal Leadership in Noise Abatement and Control*

Federal governmental programs relating directly to noice research and control are among the activities of several Federal departments and agencies. There is a need for improved coordination of this effort. To that end, it is recommended that:

a. The Environmental Protection Agency should provide the leadership and should promote coordination of efforts of the various agencies that would be responsible for their respective activities.

b. The Federal government should provide leadership in controlling noise associated with its activities.

c. Programs of technical assistance to states and their political subdivisions for regulations and enforcement should be developed.

2. *Standards and Regulations*

A regulatory scheme should be established, and accelerated noise abatement efforts should be made by local, state, and Federal governments as follows:

a. Federal noise emission standards should be established for the principal sources of environmental noise including:

1. Transportation equipment—including aircraft, for which EPA should have authority to approve FAA standards for regulation of aircraft noise.

2. Construction equipment.

3. Internal combustion powered devices.

b. Product labeling authority requested in legislative proposals presently being considered is a necessary element in an overall noise abatement and control program.

c. Uniform noise codes, regulations, and standards should be developed by EPA and other Federal agencies, in accordance with the above-mentioned plan, and should be enacted into law by states and localities. Technical assistance should be provided by EPA on enforcement and other related activities.

3. *Research and Analysis Needs*

Some investment of effort and funds in noise research has already been made at the Federal level (and to a lesser degree in the private sector as brought out in this report). There remain, however, numerous gaps in knowledge and extensive areas of technical and scientific disagreement that require a continuing research effort. To meet these needs, the following steps are recommended:

a. Present Federal research and development on specific noise source control should be continued and expanded, but with a more direct focus on environmental aspects. Such a program should directly involve the considerable expertise already existing in the professional and academic community and in industry.

b. Federally planned, directed, and supported research for improved methodologies of measurement and evaluation are needed. In particular, a critical assessment of a large number of the varying measuring systems and methodologies now in use is required. Simplification, standardization, and interchangeability of data should be the goal of this project.

c. Continuing efforts to determine the noise exposure of the American public should receive early attention.

d. Research on physiological and psychological effects of noise should be continued. Such research provides the basis for the necessary criteria documents to be used in setting standards and in formulating state and local regulations.

e. Analysis of the economic implications and economic impact of noise control is essential in the decision-making process and for the development of realistic standards and should be undertaken as part of the existing EPA investigation of the broader issue of environmental economics.

4. *Education and Public Awareness*

Although there is awareness of some aspects of the noise problem and control techniques, the typical citizen, while vexed by the intrusion of environmental noise into his life, is generally unaware that methods to alleviate the problem are already at hand. The efforts called for in the above recommendations will lead to the improved information needed to move ahead with effective measures to lessen the impact of noise.

Enactment of the pending noise pollution legislation will provide a basis for implementing these programs and should result in major improvements in inner city noise problems. In the interim, under our continuing authority in Title IV of the Clean Air Act, EPA is seeking to lay the groundwork for a successful program to understand and solve the problems caused by inner city noise pollution. One project follows individuals "bugged" with monitoring devices to chart noise exposures in daily life on a continuous, or 24-hour-a-day basis. This project will add invaluable information to that being gathered in the workplace by the Labor Department under its authorities in the Occupational Safety and Health Act. In the District of Columbia we are working with the Federal City College to develop locally-based skills in the design and interpretation of noise studies in the community.

Additionally, we are cooperating with the Department of Transportation, the Department of Housing and Urban Development, the National Bureau of Standards, NASA, and the Air Force in a long range project to develop descriptors of community noise. The effort will study how noise is perceived, what its impacts are, and develop alternative programs to alleviate problems which are made clearer through this joint research.

WATER POLLUTION

Rivers, lakes, and coastal areas in or near many of the nation's urban centers are seriously polluted. Such pollution manifests itself in a number of ways, including destruction of fish and wildlife, deterioration of water quality for water supply purposes, and reduction of elimination of recreational opportunities.

Water pollution cannot be addressed specifically within the confines of the inner city as such. It impacts entire river basins and metropolitan areas and must be attacked on that basis. An accelerated regulatory and financial assistance program is already underway under the provisions of the Federal Water Polution Control Act, and pending legislation currently under consideration by the Congress provides for further increases in this effort.

However, pollution in urban areas may impose a particular burden on inner city residents, who frequently do not have access to alternative water recreational sites. Closed bathering beaches in or near major metropolitan centers in a number of areas of the country deny recreational opportunities to the inner city poor.

Therefore, high priority in pollution clean up should be directed towards improvement of conditions at polluted beaches and other recreational areas. In carrying out its water pollution control program, EPA has directed its Regional Administrators to focus their resources and attention on areas of critical importance. Many of the areas selected for priority attention are those where pollution is denying recreational opportunities to large urban populations—for example, the New York-New Jersey Metropolitan area, Detroit, Cleveland and Chicago.

Improvement of urban recreation opportunities is a major goal of the Administration. The President's "Legacy of Parks" concept, announced in his Environmental Message to Congress in February, 1971, is a multifaceted approach to increase substantially the open space, parklands, and recreation facilities of the Nation and to redirect Federal programs in a way that will help assure that most of the new recreation areas are located in or near cities. The Legacy of Parks seeks to bring "parks to people," primarily through changes in existing programs of Federal recreation grants to State and local governments and through transfers of Federal surplus properties to State and local governments, at no cost, for use as parklands.

In two cases, the President has proposed direct Federal action to further the Legacy of Parks program. The President submitted to the Congress in May, 1971, a bill to establish a Gateway National Recreational Area in the States of New York and New Jersey. The proposal would open to the New York City metropolitan area's more than 14 million people ocean beaches, wildlife preserves, and natural areas. Mass transit arrangements will provide access to this area for New York City's inner city population. Water pollution control is a central element in this proposal, to assure that beaches and other areas can be maintained and protected. EPA is working with State and local agencies in an intensive clean up campaign for this area. Similarly, water pollution control programs will be important to the success of the Golden Gate National Recreational Area in the San Francisco Bay area, proposed by the President in his 1972 Environmental Message.

WATER SUPPLY

The Community Water Supply Study was a field inspection and evaluation of 969 community water supply systems conducted by HEW in 1970. Extrapolated results of this study indicate that approximately 5.4 percent of the national population, or 8 million people, are served water that is potentially dangerous in that it fails to meet the mandatory drinking water standards set by the Federal Government. The majority of these deficient systems are smaller systems serving smaller communities.

While the Community Water Supply Study shows that most Americans are receiving drinking water that meets health standards, it also indicates that many of our Nation's water supply systems are subject to potential problems because individual water supply systems contain structural or operational defects: because they are manned by improperly trained personnel: and because many State and local control programs are inadequate.

On March 20, 1972, EPA Deputy Administrator Robert W. Fri testified before the Subcommittee on the Environment, Senate Committee on Commerce to the effect that strengthened Federal legislation is needed to address certain aspects of the situation and to assure safe drinking water.

Several deficiencies have clearly emerged in the over-all national approach to providing safe public drinking water supplies. First, the application of federally enforceable standards is not broad enough to cover all community water supply systems. Second, State and local control programs, because of deficiencies in their planning, training, and enforcement activities are not providing adequate regulation of local water supply systems. Finally, from a reliability standpoint, many of the systems themselves are not adequate to assure delivery of drinking water of acceptable quality on a continuing basis because of their lack of adequate facilities and sufficient numbers of trained personnel.

Within individual urban areas, inner city residents are served by the same

water treatment facilities as are other residents, and the findings of the Community Water Supply Study are considered representative of problems there. However, a special problem faced by inner city residents is deterioration of water quality in the distribution systems and within the home itself. Within distribution systems deterioration through corrosion can take place, resulting in increases in metals such as copper, iron, manganese, and zinc, which affect the potability or aesthetic quality of water, and other metals which can affect public health—principally lead. Such problems are by no means confined to the inner city. However, older areas of the central city generally have older water mains where possibilities of deterioration are increased and where the impact of inadequate maintenance may be worse.

A second related problem rests within the home itself. Water pipes in older inner city housing often contain lead joint sealants or lead pipe, which can result in high and in some cases dangerous levels of lead in drinking water.

Lead is also being introduced into drinking water in the distribution system through corrosion. The community Water Supply Study found that 1.6% of the population studied is receiving lead in excess of the 50 micrograms per litre Drinking Water Standard. Although we have no statistical evidence indicating whether or not this problem is worse in the inner city because of the paucity of data on trace metals in distribution systems, this bears further investigation. Lead increases within the inner city could be particularly significant in relation to the overall problem of blood and body burden levels previously discribed.

In our judgment, waterborne lead has been a far less serious problem than other sources, particularly paint. However, we believe that all unnecessary environmental exposures to lead should be reduced, particularly in situations where the cumulative exposure can be large.

In cases where we have detected lead or other parameters in excess of the Drinking Water Standards, we have advised the communities concerned through their State Health Departments of the need for corrective action. In many cases, adjustments at the water treatment plant can reduce corrosion and lead pick up. In addition, there are situations where replacement of older water mains and home plumbing systems might prove necessary if lead reduction is to be achieved.

Strengthened legislation along the lines previously referred to would strengthen our ability to deal with water supply problems generally. In addition, through requirements to report on the quality of water systems we have recommended, we would have a better record of where lead exceeds the Drinking Water Standards. We could then call upon State and local governments to take corrective action. Federal enforcement authority could come into play if the States and local governments failed to act.

TRAINING AND EMPLOYMENT OF INNER CITY RESIDENTS

A central ingredient in the long-term improvement of inner city environmental conditions is the active and trained involvement of inner city residents. This will provide better communication and identification of problems and needs.

Further, the accelerated nationwide pollution control effort offers significant opportunities for bringing jobs and income to the inner city poor. For example, acceleration of the municipal waste treatment works construction program will generate major employment opportunities.

TRAINING

EPA directs a number of its training programs towards the objective of increased minority employment in environmental fields. In addition to those ongoing programs outlined below, we are currently undertaking a comprehensive review of our training programs and needs with the objective of reorienting our programs as necessary in relation to those needs. Opportunities for extending and expanding minority group involvement will be considered in this review.

Wastewater Treatment Plant Operators Training

Major expansion in construction of sewage treatment works is projected for the years immediately ahead. Trained operators will be needed to man these

plants; current EPA estimates suggest 64,300 more technicians and operators will be needed in 1976 than were needed in 1971.

A number of programs to meet these needs are already underway. These include:

1. *Water Quality Operator Training Programs Under MDTA.*

The future use of Department of Labor Manpower Development and Training Act programs in support of EPA responsibilities to respond to manpower needs and the extent to which these programs might be directly supported by EPA funding is currently under discussion. Under current organization, MDTA programs are:

a. *Coupled On-the-Job Training*

The Office of Water Programs manages a national contract with the Department of Labor and Health, Education and Welfare (MDTA and Economic Opportunity Act) which provide training in waste treatment plants for entry level operators drawn from the unemployed and from under-employed blue-collar workers. The program requires that 30% of the trainees be new entrants and that training be developed into one 44 week course or two 22 week courses. Training locations are selected on the basis of need for training. The current program has 1,130 trainees of which 237 or 21% are minorities.

b. *Transition Program*

The Transition Program is conducted at military installations and in cooperation with near-by academic institutions. The purpose of the Program is to provide armed services personnel, prior to discharge from service, with marketable skills which will make them employable. EPA is participating in this program with the objective of training entry-level operator positions in wastewater pollution-control plants in civilian life. We coordinate efforts to place successful trainees in water pollution-control plant jobs. Under this part of the Transition Program, 310 servicemen are now in training, of these 73 or 24% are minorities. The Transition Program is being expanded to provide training at bases located in Korea and Germany. This will provide training for an additional 100 enlisted servicemen prior to release from the service. It is anticipated that a high percentage of these will be minorities.

c. *Institutional Training Program*

The purpose of institutional training is to provide unemployed persons with a marketable skill through classroom training. Again, EPA is participating in activities aimed towards entry-level positions in wastewater treatment plants. Trainees are recruited from areas where employment needs are anticipated in existing plants and where plant construction and expansion will create new employment opportunities. Ninety-eight or 30% of the current trainees in the waste treatment field are minority group members.

d. *Public Service Careers*

This program is aimed toward training disadvantaged persons for employment in the public sector. Currently, EPA is participating in training programs in the waste treatment and water treatment field. The program emphasizes entry level training, but also provides for the upgrading of present employees. Of 1,474 people presently in training in these programs, 353 or 25% are minorities.

2. *Operator Training Under the Federal Water Pollution Control Act*

EPA is utilizing this authority to train persons for purposes not covered by MDTA. Funds were initially provided by a supplemental appropriation in fiscal year 1971 for the purposes of adding career-oriented trained technical manpower to the wastewater treatment field and upgrading the skills of those working in the field, again with emphasis on career development. Advanced wastewater treatment training programs are being developed under authority to train personnel in the latest advanced waste treatment technology. Two year community college programs are supported, and the target is to develop team leaders and first line supervisors.

Three grants are active; one of which has been awarded to a black college, Durham College, Durham, North Carolina. Two additional grants to black colleges are pending, both of which may be funded by June 30, 1972. These would provide an opportunity for an additional 55-60 black and Puerto Rican students.

Professional and Technician Training

EPA is supporting a number of programs in black colleges and universities designed to increase the flow of scientists, engineers, and technicians into the environmental field. These include such programs as graduate training in air pollution and environmental engineering at Howard University, Washington, D.C., environmental biology at Tuskeegee Institute, Alabama; sanitary chemistry at Delaware State College, and air pollution technician training at Shaw University, Raleigh, North Carolina.

YOUTH PROGRAMS

1. *Spare*

The Summer Program for Action to Renew the Environment (SPARE) is a cooperative program of EPA and DOL through the latter agency's Neighborhood Youth Corp (NYC). The DOL provides the wages for enrollees and EPA provides funds for supervision and equipment in the selected cities. In FY 71, over 9,000 participants were engaged in the program. The primary goal of the program is to involve disadvantaged young people, mainly minorities, in environmental action and education programs in urban areas. The work this coming summer will be directed toward relevant urban problems such as rodent control, lead poisoning, examination of housing projects, and potable water supply. Through this program, the NYC enrollees have an opportunity to improve some of the existing environmental problems in their communities and gain an understanding of the daily environment.

EPA plans to increase its direct funding and involvement in this program this coming summer. In addition, we have awarded a contract for evaluation of the program. We expect to assess a number of aspects of the program, including environmental improvement and learning achievement levels.

An example of the way the program operates may be seen in the case of St. Louis. Last summer in that city, the Mayor's office coordinated a survey of homes which might have lead-based paints. The Medical School of Washington University devised the survey forms so that inner city youth could gather data on a house to house basis.

In Omaha, the Mayor's office coordinated a program with three key aspects: (1) the youth working in SPARE established a recycling program for glass which generated a sizable stock of pellets, (2) the city paved a section of road with "Glassphalt" to illustrate the utilization of re-used materials, and (3) the owner of a private section of woodland volunteered his tract of land and his services to conduct a course in field ecology.

2. *Green Power Foundation*

Last summer a grant was made to the Green Power Foundation, a Los Angeles-based, minority run, nonprofit organization, to work in an inner city area of Los Angeles to explore methods of determining inner city attitudes and priorities of concern toward environmental problems. Inner city high school students received training in environmental topics and interview and survey techniques, and designed and administered a survey in South Central Los Angeles. The results indicated a general awareness of serious environmental problems, but a lack of faith that the problems would be solved. A widely publicized finding was that the number one ranking environmental concern of residents contacted was roving semi-domesticated cats and dogs; the serious air pollution problem in the area ranked a close second.

Phase II will be conducted in the same area this summer under a second grant to Green Power. The same and more youths will work to develop recommendations for solutions to environmental problems unearthed last year in Phase I, particularly to establish a greater environmental awareness in issues where local participation can have an impact. An interface has been established with the Los Angeles city government to ease implementation of solutions. Additionally, Green Power will provide technical assistance to all 20 cities participating in SPARE. Green Power will work with city personnel to assist in the design of activities and later to provide evaluation of projects.

3. *Urban Environmental Intern Program*

The Urban Environmental Intern Program is a new EPA effort beginning this year to develop generalists especially aware of the problems of and solutions to urban pollution. Top urban high school students will enter the pro-

gram in their senior year and work in four program areas of EPA—the Offices of Air, Water, Solid Waste, and Civil Rights and Urban Affairs—for successive college vacations. Through the program, urban youths will be provided experience, skills, and training in environmental protection which they can apply in jobs in Federal, State, or local government or community organizations after graduation.

EPA MINORITY HIRING

In addition, EPA can provide substantial opportunities through direct Federal employment. Current efforts include:

1. EPA's Cooperative Education Program for undergraduates, through which we are making special efforts to recruit from minority schools. Under the program, students alternate work and classroom periods during their junior and senior years in college, enabling mutual evaluation of work experiences. Each Regional Office has been instructed to work with schools in its Region Headquarters is working on formal agreements with Howard University and Federal City College.

2. Regular college recruiting for full-time personnel, which is also emphasizing minority universities—Spanish speaking in the southwestern regions and predominantly black schools elsewhere. Personnel representatives joined OEO officials in a few minority school recruitment conferences during the fall of 1971.

3. Under our youth programs category, two active efforts to locate positions for inner city high school students: (a) for students from the D.C. Postal Street Academy, and (b) through a new cooperative education program with the D.C. public schools primarily for students interested in industrial arts and the sciences. This latter program, expected to begin formally in the fall, will not only provide jobs, but also an evaluative opportunity for program developers in the D.C. public school system.

CONTRACT COMPLIANCE

In the area of minority employment on EPA-funded construction contracts, EPA takes a firm position requiring all contractors to demonstrate affirmative implementation of OFCC-imposed plans or "Hometown" plans, like the Philadelphia Plan. Where implementation is inadequate we have and will continue to step in. In the past year bids have been rejected in three cities due to unresponsiveness on the part of potential contractors to local minority hiring plans. We feel our actions have served to extend opportunities for minority hiring in the construction industry.

We intend to continue our requirement for strict adherence to the principles and intent of equal employment opportunity guidelines in federally assisted grants and contractors. A review is now underway in the Office of Civil Rights and Urban Affairs with the intent of strengthening our procedures to better ensure compliance.

SUMMARY

The accelerated nationwide pollution control program now under way should result in significant environmental improvements in the inner city. At the same time, it is clear that efforts must be made to identify and address the special problems of inner city pollution.

EPA's conclusions concerning the inner city environmental problem and its programs addressed to the problem are as follows:

1. Improvement of inner city environment involves far more than an attack on environmental pollution. It must involve a concern for other environmental needs, such as housing, land use, and recreation. In the final analysis, many of these problems are of greater priority and more immediate social and economic impact than is pollution control.

2. To have maximum beneficial impact on the quality of life for inner city residents, EPA's inner city pollution control efforts should be coordinated with other programs to upgrade environmental and other conditions in the inner city. Significant opportunities for accomplishing this exist through improved inter-agency cooperation and improved communications with inner city organizations.

EPA must strengthen its efforts to develop these linkages, both in Washington and the field. At field level, EPA Regional Administrators will utilize the

Federal Regional Councils as well as other means to identify and implement coordinated approaches tailored to the needs of specific localities.

3. The recently expanded EPA Office of Civil Rights and Urban Affairs will provide a mechanism for communicating with inner city organizations on inner city problems, for facilitating development of pilot approaches and other programs for encouraging employment and business opportunities, and for assuring that EPA continues to focus attention on inner city environmental problems.

4. Air pollution presents a significant health threat to inner city populations. Achievement of the primary ambient air quality standards promulgated by EPA for sulfur oxides, particulate matter, carbon monoxide, photochemical oxidants, nitrogen oxides, and hydrocarbons should protect the health of inner city residents from these contaminants. State Implementation Plans, currently under review by EPA, and other measues are designed to achieve those standards within the 1975–1977 time frame mandated by the Clean Air Act. This should go far towards cleansing the air over the Nation's cities, and will provide substantial health benefits to inner city residents.

5. Lead poisoning is a particularly significant inner city problem. Unquestionably the prime contributing factor to lead poisoning in children is ingestion of lead-based paint found in deteriorating housing. However, airborne lead, principally from motor vehicle emissions, also represents a significant threat. EPA has taken action to assure a substantial reduction of airborne lead levels through recently proposed regulations limiting lead as a fuel additive. In addition, we are seeking means of reducing all other unnecessary environmental lead exposures, such as those from stationary air pollution sources.

6. Refuse disposal is a major problem in the inner city, and there are some indications that inner city residents consider solid wastes and the associated vector control problems their most distressing environmental problem. EPA is currently reorienting its solid waste program, to assist communities in upgrading their urban waste disposal services generally. In addition, a number of activities directed specifically towards inner city problems are planned or underway.

In our view, the most critical step in improving the inner city solid waste problem appears to be storage and collection, and EPA work directed towards the inner city is focusing on this problem.

7. Noise pollution is a significant environmental problem in inner city areas. The intrusion of freeways and traffic arteries into many inner city areas has been a particular problem. It is clear that there is a need for improved and comprehensive efforts at levels of government for environmental noise control. Local and State governments have the primary responsibilities for actions necessary to provide a quieter environment, such as land-use planning, zoning, building codes, and use regulations. However, there is need for a coordinated Federal effort as well. The Administration's proposed noise pollution control legislation currently under consideration by the Senate would provide a basis for implementing an effective program within the inner city, as well as nationwide.

8. Special problems associated with improper household use of pesticides may exist in the inner city because of higher use rates and educational difficulties, but this is unverified. In part this problem may call for improvements in general programs for control of pesticides, and there also may be opportunities for special programs directed towards inner city residents, such as educational activities. Further study and a better fact base to guide program development is required.

9. The principal water supply issue characteristic of the inner city is deterioration of water quality in distribution systems and within the home plumbing system. The principal cause for concern is evidence of increases in lead levels. Such problems are by no means confined to the central city, but older areas of the city generally have older water mains where possibilities of such deterioration are increased. Water pipes in inner city housing often contain lead joint sealants or lead pipe, which can result in high levels of waterborne lead.

Waterborne lead appears to be a far less serious problem than lead contamination from other sources. However, EPA believes that all unnecessary lead exposures should be reduced, particulrly in situations where the cumulative exposure can be large.

In many cases, corrective action can be taken through adjustments at the water treatment plant to reduce corrosion and lead pick up. Strengthened Federal legislation, along lines already detailed to the Committee by EPA, would provide a better basis for obtaining corrective action in cases where lead increases exceed the Drinking Water Standard.

10. Water pollution cannot be addressed specifically within the confines of the inner city as such. It impacts entire river basins and metropolitan areas and must be attacked on that basis. At the same time, closed bathing beaches in or near major metropolitan areas deny urgently needed recreational opportunities to the inner city poor.

Substantial improvements are anticipated under proposed acceleration of the national water pollution control programs. In addition, we are assigning priority in EPA's water pollution control program to critical areas, including many where pollution is denying recreational opportunities to large urban populations.

11. A critical ingredient in long-term improvement in inner city environmental conditions is the active and trained involvement of inner city residents. This will provide better communications and identification of problems and needs as providing employment opportunities in the environmental field. EPA is currently directing a number of programs towards this objective, and will be reviewing opportunities for extending and expanding these programs.

12. Information on the impact of pollution on the health of inner city residents is very limited. Such information is needed to assure that pollution standards and remedial programs are adequate. Strengthened study on inner city populations is planned as an integral part of EPA's overall acceleration of health effects research.

13. Information is lacking on many other aspects of inner city pollution problems and needs as a basis for program formulation. Increased study and evaluation efforts will be directed towards this end.

Senator STEVENS (Presiding). Would you go ahead, sir?

Happy to have you here, Dr. Fritsch.

I am filling in for the chairman this afternoon, as you know, and we would be happy to have your statement.

I am sure you realize that the record in these matters is important especially since some of my colleagues are not able to be here today.

STATEMENT OF DR. ALBERT J. FRITSCH, CODIRECTOR, CENTER FOR SCIENCE IN THE PUBLIC INTEREST

Dr. FRITSCH. Thank you, Mr. Chairman, for inviting me to come and address this committee on the serious question of lead additives in our gasoline.

I am Dr. Albert J. Fritsch, codirector of the Center for Science in the Public Interest. I have worked for several years on heavy metal contamination of our environment and have written a report on gasoline which we are releasing to the public today. I would like to submit a copy of this report for the record.

Senator STEVENS. Do you have it with you?

Dr. Fritsch. Yes; I gave a copy to your assistant.[1]

Senator STEVENS. All right. Fine. We accept it and I will leave it up to the chairman as to how much of it is printed and how much to be retained in the files, Doctor.

Dr. FRITSCH. On February 23, 1972 the Environmental Protection Agency finally recognized lead as a health hazard. In the backup data for his proposed reduction of lead to 1.25 grams per gallon by 1977 the EPA introduced some very pertinent data to substantiate

[1] See p. 289.

their claims; these data showed lead concentrations of more five micrograms per cubic meter in the atmosphere of Los Angeles. The Agency reasoned that a 60 to 65 percent reduction by 1977 would allow these averages to be reduced to a more acceptable level of 2.0 micrograms per cubic meter.

The critical word here is "average."

The flaw in this reasoning is the people in our country are not a group of bland averages. When we speak of the poor we are not speaking of average people but people whose physical condition is below average And in the case of exposure to lead pollution the poor are above average, they have higher lead concentrations in their blood than average Americans.

The proposal to reduce airborne lead levels by 65 percent still leaves many inner city areas with lead levels of five micrograms per cubic meter or more. God help the poor that are forced to live next to the freeway six blocks south of here.

In the first annual report of the Council on Environmental Quality we find a quote by the Secretary of the Departement of Health, Education, and Welfare:

"The Secretary suggested a plan to reduce lead levels in regular grades to 0.5 grams by July 1, 1971 and to zero lead content by July 1, 1974."

The Secretary provided for premium leaded gasoline for older cars. If the Environmental Protection Agency had put such a plan into effect we would have saved our environment, by our calculations, 2 billion pounds of lead fallout.

In January 1971 the EPA presented an advanced notice of proposed rulemaking—a meaningless document except to say they were still thinking about the problem.

In August EPA said there would be a proposed rulemaking in December. Six months and 250 million pounds of lead later we have a rulemaking notice of February 23.

However, instead of going down to 0.5 grams of lead in all grades the rulemaking provided for one lead-free grade and the remaining grades to be down to 1.25 grams per gallon by 1977. This gives us the unwanted gift of an added one and a half billion pounds of lead by that date and even more later.

In November of last year our center and the Environmental Defense Fund petitioned the EPA to choose the strictest feasible phase-out by 1976, approximately the Bonner and Moore Schedule L.

We were disappointed that EPA did not follow this more responsible course but instead chose to compromise the public interest and allow economic considerations to outweigh health ones.

EPA chose a watered-down version, Bonner and Moore Schedule O. When I asked officials what considerations they used for this schedule they replied "health only."

I would like to treat in detail some of these health considerations at this moment.

The EPA report entitled "Effects of Reduced Use of Lead in Gasoline on Vehicle Emissions and Photochemical Reactivity" clearly refutes claims made by several lead additive manufacturers that increase in aromatic content (needed to raise octaine in lead-free fuel) will increase smog levels in our cities.

In fact, the major components of this smog—ozone and peroxyacyl nitrte (PAN)—will both decrease. Formaldehyde and other aldehydes will also decrease with increase in fuel aromatic content.

Plant damage will possibly decrease and eye irritation will show at most very small increases. The amount of aerosol formation will also probably rise, but the 10 percent increase will perhaps occur only below 25 percent fuel aromatics.

In summary, these predicted adverse effects of increased aromatic content are very small or nonexistent.

In the general discussion of tailpipe emissions the EPA report predicted a linear increase in aromatics through the 1975 model cars.

Olefins, which are harmful, would have a linear decrease with aromatic content, and phenols would increase up to 1970 model vehicles and the results are unknown on later models.

Only PNA, polynuclear aromatics, seems to be a matter of deep concern in that report and this would have a linear increase up to 1968 models and possibly up to 1975 model vehicles.

However, these summary estimates do not include a compensation in effects of fuel aromatic increases resulting from the decrease in overall emissions. In short, an auto engine that is fueled with unleaded gasoline will give off less PNA emissions.

What does all this mean? First, PNAs are not good things to have around. For example, these compounds include benzo (a) pyrene (BaP) which is carcinogenic.

I agree this is toxic material. About 95 percent of it in the atmosphere comes from nonautomotive sources. Some 80 percent comes from inefficient coal-stoked furnaces—mainly residential.

Of the automotive 5 percent, only 2 percent comes from cars.

A simple urban restriction on leaf and grassburning or against dirty incinerators would more than compensate for any anticipated increases in automotive caused PNA.

However, this is not the whole story. The PNA scare is further augmented by a statement in the summary of the EPA report of a drastic reduction of lead, schedule N, and that this would increase the PNA.

Within the text there is a corrective sentence which states:

"Even a 60 percent increase in 1980 in PNA emissions versus the reference schedule still results in a PNA emission which is only one-third of the emission level in 1971 (reference schedule)."

When I objected to the author about this summary—because many only read summaries—he said my objections were absolutely correct. The report is being revised by EPA. I hope the proposed schedule will also be altered accordingly.

When speaking of PNA increases in the report just mentioned, EPA means increases over the scheduled reductions of all hydrocarbons. Higher aromaticity in gasoline will reduce the reductions of PNA.

A schedule which represents the most rapid lead reduction program possible within the construction industry capacity and meeting any legal requirements should be installed.

The Commerce Department's Automotive Fuels and Air Pollution Report, March 1971, states:

It should be noted that a significant correlation exists between the PNA content of exhaust gases and the PNA content of the fuel used. This implies that controls on the PNA content of fuels could be used to reduce exhaust PNAs.

In veiw of the fact that automotive sources currently constitute only between 2 and 10 percent of the total PNA emissions nationally and that incorporation of advanced exhaust gas treatment systems, especially a catalytic system will result in selective decreases in polynuclear aromatics, the panel concluded that present evidence was not sufficient to warrant a recommendation on PNAs.

The panel gave a healthy suggestion to demand regulations to control PNA content of aromatics used in gasoline, within the authority of the EPA. Treatment of gasoline for PNA removal is known and used by some companies today.

An added point on this so-called hazard: Recent tests show that lead deposits in the carburetor increase PNA. In fact, cars with leaded deposits give off more PNA from current types of fuel than do engines with no leaded deposits but using high aromatic fuels.

And yet it is this scare about PNA which makes us consider a moderate lead phaseout schedule. Is this valid? Or were we duped into believing that health was the primary reason for this schedule and really it was economics—the same reason why we had lead additives in the first place: Lead is the cheapest means the industry has for increasing octane number. I mean cheapest for the industries. The increased maintenance costs to the consumer may have made the use of leaded fuels more costly.

The report done for the EPA by the Aerospace Corp. shows a conservative saving of 0.095 cents per mile because of spark plug and exhaust savings. If a strict schedule requires gasoline of 2 more cents per gallon the maintenance savings and reduced number of oil changes and filter changes will just about equal increased gasoline costs.

Some claim 11 percent mileage gain using lead-free fas and some claim 12 percent mileage loss due to lower compression engines. Here we probably call it a draw. We are not sure.

Some have attempted to scare lead-free users by saying that valve recession will occur if we adopt a strict lead schedule. Ameriacn Oil Co. which has marketed a no-lead gasoline for many years testifies that there has never been a complaint in this area.

Test results by one independent oil company on various make cars showed no recession under normal driving conditions.

The scare stems from some heavy duty testing done by Mobil a few years ago. The chances that pre-1971 cars will be used for heavy duty driving after 1980, e.g., pulling trailers across the country at relatively high speeds, are small; in cases where the car owner wishes to do so he should be advised to buy a nonlead and nonphosphorous anti-scuff agent.

As far as the cost to the industry for a rapid changeover, I am confident that the industry that wants to build an Alaskan pipeline in 2 years for between $1 billion and $2 billion can manage to find the capital to invest in new processing equipment—$1 billion a year at the most.

This is hardly an insurmountable problem and certainly not one which stands on equal footing with either clear-cut health dangers or possible ones.

Why should we argue for a very strict schedule?

Two reasons call for removing all of the lead The first is for health reasons and the second for technical reasons.

In July 1970, I came and testified before this committee. At that time I called for complete elimination of mercury from sources which allow the mercury to be dispersed to such a degree that it could not be recovered. This was a strict recommendation, and one which the EPA has eventually adopted.

In areas where there was little dispersal there was no need for converting to other methods or processes. Here we have another heavy metal, 98 percent of which is dispersed by one use alone, anti-knock additives. The principle still holds. No toxic metal should be released into the environment in such a way that it cannot be recovered. It is the sheer mass of lead, 525 million pounds of led used for antiknock additives last year, that we are confronted with.

Lead effects seem to accumulate and mere banning of lead in paint while allowing lead levels in road dust to increase to levels equal to the banned paint is suicidal. It is not quite suicide for the policy makers who live in the cleaner suburbs. Rather, the ones affected are the poor and those forced to reside near congested traffic.

The second reason for a complete phaseout of lead at the earliest possible date is the metal's effect on pollution control devices. The mere presence of nozzles of different design will not halt the major cause of contamination of current stocks of lead-free gasoline: Sloppy handling, contaminated transport, and indiscriminate use of storage facilities.

If even percent of a company's grade is contaminated the catalytic emission control devices will be fouled over a mere 4-year period—the chances of getting some leaded gasoline is very high in the lifetime of the exhaust device.

The end result is that car owners will pay for the device and yet not know that it is not being effective in reducing hydrocarbons and carbon monoxide.

This cannot be fully resolved without some stiff government regulations. The most practical way of doing this is to stop all lead and perhaps sulfur and phosphorous contamination and use.

For a country that put men on the moon this is a minor problem. The major problem is the will of a people to place health and safety above economic considerations. That can be done when our people say "Never again" take away my freedom to breathe fresh air. This freedom is a right of man, his right to health. That right takes precedence over economics of industrial interests.

Senator STEVENS. Thank you very much, Doctor.

I wish you were correct in saying that they were trying to build that pipeline in 2 years. It has been 4 years already.

A requirement of the Clean Air Act with respect to limiting fuel additives is that other components of gasoline that might arise from reductions of lead must present no greater hazard. A strict reduction schedule, which would remove all lead by 1977, I am informed,

would result in increases in PNA over current levels. If I understand your statement, you disagree with that.

If we followed a strict schedule, do you think the hazards of increased PNA are greater than the lead if we left it under a more modest schedule?

Mr. FRITSCH. Well, there are two questions. The first is the strict schedule, the way I presented it. The "N" schedule called strict in the report of the EPA is not the strictest. The strictest is the L schedule that you have just brought up (to phase out all lead by 1977).

In the N schedule, there is decrease of lead across the board.

The N schedule reduces lead to 0.5 grams per gallon.

We are trying to work out this weekend a schedule which we will present to the EPA. This schedule must also keep the PNA's below the present levels. According to the Clear Air Act PNA's can't raise above the point of initiation of the phase out. The "L" schedule will rise above the reference schedule but this a a temporary effect due to older cars, with lead deposits. The PNA's will drop sharply by 1980, even on the L schedule.

Senator STEVENS. When you prepare that revision, would you provide the committee with a copy of it?

Mr. FRITSCH. Yes.

Senator STEVENS. Even though it has just been conjectured that the PNA emissions might increase, are there any other components of gasoline which, in your opinion, might also increase under a strict schedule?

Mr. FRITSCH. The aromatics will increase, but as these increase, the olefins decrease. Both are bad materials. So one increases, the other decreases. It is hard to say which is better. Effective antipollution devices will lead to *ultimate* reductions.

Senator STEVENS. Which has the most drastic effect on the air we breathe?

Mr. FRITSCH. The EPA paper shows that these higher aromatics will not necessarily increase the smog. Most likely they will decrease photoreactive effects. All the effects that had been predicted by some of the additive manufacturers and the Bureau of Mines that aromatics would increase smog troubles in our atmosphre have been disproved by later reports.

Senator STEVENS. As a layman in this field, I would like to know whether what you have just stated is a known and proven concept.

Mr. FRITSCH. It is now becoming more scientifically evident, because there is a lot more data now.

Senator STEVENS. At present, it is a prediction. Would that be correct?

Mr. FRITSCH. Presently it is a prediction that the aromatics will not——

Senator STEVENS. The other components that might increase under a strict schedule would not be more harmful than those that are decreasing?

Mr FRITSCH. Except for the one PNA (Ba P), I think that it is fairly solid scientific evidence that they will not. But with accompanying processes, one can lower all PNA's

Senator STEVENS. That leads me to my next question, maybe you can cover this at the same time: Assuming that PNA would be a problem, are there known ways of removing the excess PNA from gasoline, and what would be the cost to the consumer for that process in terms of gasoline prices?

Mr. FRITSCH. They tell us some of the companies eliminate some PNA, which is a high boiling end of the reformate fraction of gasoline. They are eliminating it right now to some degree, at no increased cost in gasoline. PNA can be removed by physical processes, whether by distillation processes or by filtration. And there aren't apparently major increases in cost because I haven't heard any of the gasoline companies say that they have increased gasoline prices due to removing PNA's. It can be done within the price of current processing. I would guess costs amount to a tenth of a cent a gallon.

Senator STEVENS. What companies are taking it out now, do you know?

Dr. FRITSCH. I am not sure which ones are. Texaco admits to the practice.

Not all the PNA coming out of the emission devices coming from the naturally found PNA. But the CTAB report by the Commerce Department, composed by a group of expert scientists says that one can remove the naturally found PNA, (about one half comes from the refinery). Emitted PNA comes from two sources: PNA comes from the original gasoline containing aromatics; it comes from the hot engine itself.

PNA can be cleaned from higher aromatic gasoline. But since gasoline accounts for 5 percent of the total PNA in the environment, I think EPA, should be concerned about other sources. I can't get data on PNA because EPA tells me it has never been concerned about PNA. If EPA is really concerned with the PNA problem now, the agency should also be monitoring PNA in the environment and taking steps to reduce it.

Senator STEVENS. It doesn't come from pipes, does it, Dr. Fritsch?

Mr. FRITSCH. Pipes?

Well, sure, there is PNA in all of our smoking. I think it is worse for cigarettes, probably.

Senator STEVENS. I am glad to hear that.

Mr. FRITSCH. Combustion causes PNA to form. We are making a major issue out of PNA in gasoline, just to show the correct size of the problem. I think the PNA scare is an unwarranted scare. Engine-derived PNA comes from lead deposits in the engine. If tomorrow, we were to clean all car engines and then use lead-free gasoline we wouldn't have all car engines and then use lead-free gasoline we wouldn't have this problem. It is the lead which causes us to have to speak about PNA emissions. A car with leaded deposit in it will have far more emitted PNA than a car without it. This has been shown by scientific testing done by a CRC group. And so we are burdened by lead in several ways.

We are burdened by the metal we are trying to remove, because lead is around and is causing the PNA problem.

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Senator STEVENS. The committee appreciates your appearing, and we would appreciate your cooperation if you would give us a copy of your revision.

Thank you very much, Doctor.

Mr. FRITSCH. Thank you.

(The following information was subsequently received for the record:)

REVISED PROPOSAL

Use the Lead reduction schedule "L" plus requiring the refiners to remove PNA in the higher aromatic gasoline.

From the Bonner & Moore Table I (p. 2-3) we see the percentages of aromatics needed for each major schedule.

Schedule	Percent of aromatics for each year						
	1971	1972	1973	1974	1975	1976	1980
A	22					24	29
O		22	23	24	26	27	30
N		26	26	28	31	32	31
L		27	28	32	36	38	36
Reference	23	22	21	21	21	22	22
Revised		(15)	(15)	(18)	(20)	(21)	(20)

If half the PNA is removed before sales, the effective aromatic content will be considerably lower than the Reference schedule shown above. Assuming that PNA emissions are proportional to aromatic content, one should expect considerable reductions in PNA due to removal prior to delivery.

Senator STEVENS. Is Mr. Kretchmer here?

Mr. KRETCHMER. Yes.

Senator STEVENS. We are pleased to welcome you from New York to appear before the committee, and again I am sorry that the schedules are such right now that there are not more of my colleagues to hear your testimony. I assure you it will be considered by the committee as we review this matter.

STATEMENT OF JEROME KRETCHMER, ADMINISTRATOR, NEW YORK CITY ENVIRONMENTAL PROTECTION ADMINISTRATION

Mr. KRETCHMER. That is okay. I once was a legislator myself, and I understand the problems. The Senate does better than we did, so I appreciate it. I have waited and am anxious to give this testimony, because I think that there are very large cities with New York's experiences, and I think an opportunity to discuss the inner-city ghetto problem, the environmental problem, is really a good opportunity to put out before the Senate and before the country, as a matter of fact, the kind of thing we are involved in in New York.

The environmental problems of the ghetto are the same ones that afflict the city at large, just worse.

Air pollution affects us all. But ghetto residents are more likely to live near polluting facilities, less likely to have landlords who control emissions from boilers, more likely to have low resistance to respiratory illnesses, less likely to get good medical attention for those illnesses.

Garbage, litter and abandoned cars are problems for the whole city. But the inner-city vacant lots become targets for gypsy dum-

pers; ghetto landlords consistently fail to provide garbage cans and storage facilities; janitorial and superintendent services, routine for the rest of the city, are either subpar or nonexistent; cars are abandoned more frequently because residents often cannot afford to buy good cars or repair their older ones.

While many middle-class critics prefer to believe that the poor, or the blacks or the Puerto Ricans, are simply dirtier than other citizens, the simple fact is that the extra sanitation problems of the ghetto are functions of the breakdown in basic services. One woman who was spotted "airmailing" a bag of garbage—tossing it from a tenement window into a vacant lot—said she used to carry her garbage down the four flights, but she grew afraid of running the gauntlet of addicts roaming the hallways of her building, and afraid of a rat attacking her child while she was doing so. In other words, as offensive as "airmailing" is, it had a sound internal logic according to the conditions under which she was forced to live.

Noise pollution, a particularly urban environmental problem and one whose effects are just beginning to be understood, would seem to affect all city-dwellers equally. But once again, the ghetto resident bears an extra burden. Urban flight patterns, with the constant roar of a stream of low-flying jets, show a peculiar tendency to crisscross the ghetto. Harlem and Newark ghettos seem to bear the brunt of an enormous number of over-flights. And, of course, the poor have much less influence in getting flight patterns corrected, as some airports do in response to complaints from middle-class areas.

In general, the ghetto proves to be a relatively safe place to build a polluting, noisy or simply congesting facility. The land will be cheaper, the complaints fewer.

One example of this type of quiet aggression against the ghetto is the North River water pollution control plant, now under construction along the Hudson River. A decade ago, when plans were drawn, it was obvious that the facility was necessary to clean up New York City's share of the wastes pouring into the river. The site chosen—in Harlem—was a perfect one according to the engineering needs. But, in fact, it could have been built further south, near middle-class, largely white residential areas. To its credit, the Harlem community complained loudly enough to force an excellent compromise. The plant is being built, but the roof will be at the pier line and covered with a 30-acre park jutting into the Hudson, so that Harlem will get some recreational facilities out of the project, and not just sewage from downtown.

In general the poor clearly have less political self-determination to zone out an offensive and polluting takeover of land, especially parkland. In some cases, the ghetto grows up around the polluting facilities that more affluent residents refuse to live near. In other cases, polluting structures can tip a marginal neighborhood into a ghetto by lowering property values. And since more and more middle-class neighborhoods have developed the ability to organize against undesired construction, the pressure to build in ghettos and marginal neighborhoods is growing.

A good deal of hard data on ghetto environmental problems remains to be gathered. And, we do not yet have realistic cost esti-

mates on most of the proposals we would like to see implemented. We are here to share with you what we have learned about the problems, and in general, to make clear that new sources of funding will be necessary, and where those funds could make a difference in a relatively short time.

The aerometric network data report by the New York City Department of Air Resources for 1971 does not appear to establish that ghetto air quality is significantly worse than in the rest of the city. However, largely due to electric-power generating facilities along the East River, the South Bronx and Harlem are in areas with the worst air in the city. For 1971, levels of sulfur dioxide averaged 0.040 parts per million whereas in Harlem and the South Bronx the average was approximately 0.060; levels of suspended particulates citywide were approximately 105 micrograms per cubic meter, while the averages for Harlem and the South Bronx were 131 and 141 micrograms per cubic meter respectively, 30 to 40 percent higher.

The Department of Air Resources is cooperating with the Federal Government in a study of the relationship between people living in areas with the worst air pollution and respiratory problems. Preliminary findings, of course, show such correlation. The effect of such air pollution is likely to fall most heavily on urban ghetto areas. Ghetto residents spend more time breathing bad air, because they cannot retreat behind air conditioning or escape the city for vacations.

It is doubtful that the air quality in ghetto areas will improve at the same rate as air quality citywide. The prime contributor to adverse air quality in the urban ghetto is boilers which release pollutants from low stacks. The boiler upgrading program in the ghetto is far behind the citywide average for upgrading. The citywide average is 30 percent, while the ghetto average is 5 or 6 percent. Upgrading has not worked in the ghetto because costs are prohibitive for many marginal deteriorated residences and tough enforcement would probably increase the rate of abandonment.

Thus bad air quality in the ghetto is part of a more fundamental problem: Totally inadequate housing which cannot be significantly improved unless and until we are prepared, as a nation, to make the necessary commitment to provide adequate housing for the urban poor.

Even if such a housing commitment is made and boilers are upgraded, it is unlikely that air quality in urban ghetto areas would be sufficiently improved because of inadequate maintenace. This problem is not limited to urban ghetto areas. A potential solution to this problem would involve the furnishing of steam for space heating from central plants with high stacks; sophisticated pollution control devices and experienced personnel for maintenace. In this connection, the recovery of waste heat from in-city electric generation and the conversion of such waste heat into steam for distribution would meet a substantial part of New York City's steam needs under a proposal for substituting central steam for individual boilers. The economics of centralized steam may prove prohibitive, but

we feel the proposal must be explored in view of the current maintenance problems.

In a ghetto, buildings are destroyed and abandoned. The lots become filled with refuse from individual as well as illegal large scale dumpers. The abandoned buildings that remain are receptacles for refuse and no services are provided. The lack of superintendents means that sidewalks are not swept, garbage cans are not cared for in storage areas, and residents cannot afford the constant expense of plastic and paper trash bags.

Merchants in the community may ignore sidewalk sweeping, generally do not properly containerize garbage for private cartmen who pick it up, or simply don't contract for cartmen services at all. Refuse is put out at night, and since there is no control over the pick-up schedules of private cartmen, the garbage often remains overnight, improperly containerized, and spills or blows over sidewalks and streets.

Mechanical brooms, which sweep the streets, are regularly impeded by illegally parked cars and by abandoned cars, which themselves fill up with rubbish.

To alleviate these problems, New York City's Environmental Protection Administration has taken a number of steps.

We have increased collections—now six times per week regularly and nine times weekly in summer, compared to five times per week on the higher income east side of Manhattan.

We have instituted 10 two-man self-help offices which process complaints and help organize special cleanup drives. Under the Federal emergency employment program we have hired block superintendents to sweep sidewalks and containerize refuse, and with model cities, we have undertaken a multimillion dollar program to hire neighborhood residents to clean lots and sweep sidewalks with mechanical sweepers.

Experiments have been made with plastic bags and mechanically loaded containers. A free distribution of plastic bags in a poor area showed that sidewalks are cleaner and collection savings of up to 20 percent can be realized (because trucks can move faster, and sanitationmen needn't stop to return cans to the curb). However, the bags are expensive to give away and the program difficult to expand.

Of the two mechanically loaded containers, one is rolled behind a truck and mechanically dumped. The other remains on the street and is lifted by a hoist compactor truck up over the truck's cab and into the storage area. The results of these tests show faster loading times and greater container capacity for high-density areas than the current can system. We have also worked with General Electric to use Federal funds to design a truck with mechanical side-arms that could reach over parked cars and pick up four to six cubic yard containers. In January of this year, however, we were informed that no Federal funds would be made available for this project.

Furthermore, we have a good many new proposals that would deal with ghetto sanitation problems.

Using Federal model cities and Environmental Protection Agency funds, we could greatly expand the block superintendent program to cover the areas in greatest need of extra services. Since the city col-

lects only containerized refuse from the curb and sweeps the streets, the building owners and supers have major sanitation responsibilities. When the owners are absent or financially unstable and when supers are nonexistent or offer very poor service, the Government financed block super provides a vital community function. Lack of funds has held us back.

We could distribute free plastic bags. The problems of cost of a sufficiently strong bag, of distribution and the need to use bags correctly are being evaluated by EPA. The possibility exists that productivity gains through widespread use of the bags would justify the cost.

While I was sitting here before reading some of my mail, it became clear to me that they probably would not justify the cost, and we would want to change that part of the testimony when we are through analyzing the problem.

We could vastly expand use of mechanically loaded containers. We have not increased this program mainly because of the problem of street access for collection trucks. We await the development of collection trucks that can reach over parked cars and regularly service a given route.

We are working with model cities on a proposed newspaper recycling project and have encouraged volunteer recycling efforts in the poor areas of the city.

With sufficient funds for research and development, we could explore some promising technological suggestions, such as chutes on buildings, mini-incinerators, and the vacuum-tube systems in housing. While diversion of funds to collection may be advisable, some capital-intensive labor savings devices should be pursued.

We are exploring the possibilities of community-run sanitation services on an experimental basis in Bedford-Stuyvesant, a low-income Brooklyn neighborhood. The Bedford-Stuyvesant Restoration Corp., a nonprofit community development corporation, has proposed to us that they form a subsidiary company which would contract with the city to perform a broad array of sanitation services, including 6-day-per-week collection, bulk collection, lot-cleaning, street and sidewalk sweeping, and catch-basin cleaning. Such an experiment could test whether a low-income area can perform its own sanitation services better and cheaper than the city. The first year's budget which would include initial investment in sanitation equipment is estimated at $700,000 to $1 million, but it is expected that subsequent years' costs could be lower.

Obviously the sticking point on these proposals is funding. New York City has an enormous solid waste flow—nearly 30,000 tons per day and climbing by 4 to 6 percent each year. Much of our attention and energy is understandably focussed on disposal systems, and the new technologies and new sources of funding that will be required to meet our obligations through the 1980's. Merely to extend the life of our land-fill areas for another decade will require $100 million in capital expenditures.

While our first priority is disposal systems, and while demonstration grants are important, it must be said that current Federal solid waste legislation is so inflexible that it would not provide funds for

on-going operation for disposal or collection after they have passed the demonstration stage.

This is a crucial point for us. In the air and water pollution fields, standards are set, and Federal funds routinely make possible the continuous operations to help reach those standards. Similar provision should be made in the solid waste field.

In water pollution control, Federal funding is not restricted to demonstration projects, as it is in solid waste. Instead, Federal funds make operations possible in a field that happens to be capital intensive. We think it should do so in solid waste, though this field is labor intensive. Standards for disposal sites and street cleanliness should be set and operational assistance offered to meet those standards. Without this kind of help, it is doubtful that we will be able to keep ahead of our mounting sanitation responsibilities and deal with the problems of the ghetto.

That was read very fast. The testimony obviously speaks for itself. I am more interested in whatever questions the committee might happen to have.

Senator STEVENS. I am delighted that you came, Mr. Kretchmer. How do you pronounce your name?

Mr. KRETCHMER. Kretchmer, like the wheat germ.

Senator STEVENS. Regarding your last comment, how much do you need in this solid waste area to have an operating program as opposed to a demonstration project?

Mr. KRETCHMER. It depends on whether we are talking about collection or disposal. We spend about $200 million a year to collect the garbage in the city of New York, and we are collecting it better now than ever before but not well enough. When I say collection, I mean collection and street cleaning. We have this enormous problem of the ghetto sidewalks, and sidewalks are areas we have not been able to get through to the landlords and building owners on. I understand that other cities are suddenly beginning to suffer the same affiliction of dirty sidewalks.

It seems that we have some systems for cleaning the streets. We are gaining on mechanical brooms, we have got more men in the streets, we are taking some off collection. We have purchased small Cushman scooters with dump backs and that increases the productivity of our street sweepers.

The problem is on the sidewalks, and we just don't have enough sanitation men. We have this superintendents program going, this "super supers," as we like to call it. We pay them about $5,650 apiece under the Emergency Employment Act. We have about 18 of them now, and we get about nine square blocks done for every hundred thousand dollars. We really don't yet know how many square blocks there are in ghetto areas. We are in the process of examining that and we will be certainly glad to give the committee a figure when we have it.

I think that where we really need the help—I mean I don't suspect we are going to get terribly much money from the Congress to run our day-to-day collection efforts. I mean I just don't see that is the way Federal efforts are structured.

We are going to make a $500 million capital outlay over the next 4 to 8 years in terms of building disposal systems, disposal systems now nobody even imagine exists because we don't build those, and if we don't find them and decide what those disposal systems ought to be and then make the investment in them we are really going to choke in that huge mound of garbage everybody always laughs about.

I say some nights I wake up and I have these 30,000 tons balanced on my outstretched palms and everybody wants to let us pick it up and nobody wants us to put it down and it is really not an exaggeration.

I teach a class at the New School and I try to give them a taste for that. I took them out to the landfill and there was nothing so overwhelming as standing there a couple hours and watching 650 ton barges loaded with New York City's refuse be barged around the city and come to get unloaded at the rate of 14,000 tons a day and watch it get carried out a mile, 2½ miles out to the landfill site and watch it get dumped and watch these wagons come back.

You have the feeling it is never ending, you have the sense you are never going to get rid of it and that no systems are being designed to create less of it. We are up against it on both sides.

I testified here just 2 weeks ago about how much waste was being created and I felt when I left that we had made very little impact on the people that make the waste, the manufacturers, bottlers, packagers, all the useless products that get sold in our society.

Okay, so you say that and deal with that problem, and then you cross to the other side and say, now those guys who are making it can at least design systems to dispose of it, and get them involved, the mess makers, to design systems to dispose of it. We have been dealing with Monsanto, the chemical company in New York, a subsidiary called Envirnochem, for 5½ years to try to get a pyrolysis plant built which would be a major breakthrough in garbage disposal, a thousand ton-a-day plant.

I have to tell you, we meet with them once every 10 days and every 10 days the signals get changed. That large American company which has had its own problems is unwilling to take the step which a thousand-ton-a-day plant would mean.

Now we don't see any sense in that. The programs the Federal Government EPA has going, are kind of "spit in the ocean" stuff, all too small to be of any practical application to New York.

All the Federal EPA says is that if it is not brand new, if it is not innovative, if it has never been done before, they won't give us money. They do it on a small scale, 30 tons, 50 tons, 100 tons. We need it at a thousand tons or bigger in New York City.

When we ask them for the money, they tell us, "We are not giving you money, we are already doing it." We say, "You are doing it for 30, 50, 60 tons. What happens when you do it for a thousand tons?" And if you don't do it for a thousand tons it doesn't make any sense in our city to invest in those programs. And we can afford a thousand ton experiment if somebody will pay for it. Because if it doesn't work, the other 29,000 tons of capacity—we can absorb the thousand tons. And it sounds funny, but it is true.

Detroit, Cincinnati, if they build a thousand-ton-a-day plant and it doesn't work, they are stuck. If we build it and it doesn't work we can absorb that thousand-ton burden at another facility.

For the first time in the history of the cities' problems, our bigness is an advantage, and we can't get anybody to help us out. We can't get the State committed to the program, we can't get the Federal Government committed to the program. We can't find the kind of capital dollars essential to dispose of the garbage. It is going to happen some day in New York State. Right now there is still plenty of places to put it. That is one of the problems. I testified in a congressional committee the other day and I had the feeling that—the chairman listening to me very respectfully, and I was thinking he probably doesn't even know where the landfill is in his community. They have it tucked behind a hill somewhere, and as long as you have it tucked behind a hill, there is no urgency to solving the problem.

We have landfills at a place called Pelham Bay. We have 30,000 people looking out the windows at a garbage dump, and somehow we have to come to grips with the problem, and so far we haven't been very successful.

Senator STEVENS. Would revenue-sharing plans help you at all?

Mr. KRETCHMER. Anything that would get us funds would help. We think revenue sharing is a substantial part of the answer. We think we will get about $200 million if there is really a good revenue-sharing proposal that comes down the line, but we think that direct subsidies in many of these areas is an equal answer. We think that particularly in the area of capital construction, and more importantly, in the area of important innovation. Can we take two or three or four sanitation districts and can we collect the garbage differently in those districts? Maybe we can.

We ought to have funding for that to find out. One of the problems is that when you try new things in collections in the city of New York, it takes 2 or 3 years to assume the savings. The sanitation budget remains the same and you can't use the money you save to conduct the experiments. So you have to have the experiments paid for some place else, and the places either the Federal or State Government, and the State government hasn't done anything for us like that since we have been relating to them, and clearly the Federal Government hasn't done anything like that either. So we need Federal money for substantial collection experiments, for new ways of collecting. We were supposed to build a pneumatic system in one of our large housing developments in the city of New York that the Federal EPA were going to finance, and suddenly they withdrew the financing.

I never understand why this happens. I have to confess, on the record, that in some instances our results with small Federal programs have not been as spectacular as we would like them to be, but that was with an old administration. This is with a new administration. I think that the Federal Government has to somehow get into the business of being involved on a day-to-day basis with the sanitation problems of the large cities. It is getting dirtier in Chicago, dirtier in Los Angeles, dirtier in San Francisco, it is dirty in De-

troit, it is dirty in Cincinnati, it is dirtier in New York, and somehow unless you people get involved with us and unless we do this thing together, as I have told this to Mr. Ruckelshaus before, we haven't got a chance. It is just going to pass the cities by. And you know, maybe I overstate the case. Maybe it is not dirty, maybe it is just not as clean as it ought to be. But clearly it is not going to get very much cleaner unless we see some new influx of funds.

The city of New York has a billion dollar budget deficit that we are talking about this week and trying to resolve. And in that budget deficit, sanitation is suddenly going to become an even lower priority than we would like to think it is now.

Senator STEVENS. What programs are presently in effect in New York which deal with lead poisoning?

Mr. KRETCHMER. We are involved now—incidentally, I heard last night on the telephone, and I was curious about it, that a $55 million appropriation just sneaked in the Senate program on lead poisoning. Is that accurate? No?

Senator STEVENS. The bill hasn't come out yet. I think there is some consideration of additional money.

Mr. KRETCHMER. We heard last night via one of the Senators that there was some substantial money in there. We have a city program for testing the children for lead poisoning, children who suffer from lead poisoning obviously as a result of eating lead-based paints, and we have a program in the Housing Administration for going in in areas where we find lead-based paints and covering the walls. It is barely a sufficient program. It has not gotten off the ground. It is not as well administered as we would like it to be. That is, the covering of the walls isn't off the ground. We are conducting a substantial number of tests of children.

Our Health Services Administration has run that program, it has been a priority program, and while I am not as familiar with that as I would like to because it is another administration, I know we have done well, and I know the number of children we have. It is on a city basis and on a voluntary basis.

We have people set up who do that as part of a community service program, and we are getting a large number of children tested.

On the other side, in the lead and gasoline problem, we have just passed, as you probably know, back in October or September, a very strong air code which has very substantial lead limitations.

The industry then came in and opposed our lead limitations and asked for a variance because the Federal EPA had not acted, and they said we should not act before the Federal EPA acts. We are in the process of considering that variance, and as a matter of fact, we have made a decision which we are waiting for approval of by the corporation counsel. I am not permitted to reveal what that is, other than to say that our position remains consistent, and so we have taken a very hard line on lead and gasoline.

I was sitting in the back during the lead discussion before, and it seems to me in an area which is so clouded and there is so much substantial evidence that lead is a problem and it is causing serious health problems, we just ought to do away with the lead and make sure none comes in and doesn't cause the problems as well.

I have listened to some technical arguments about lead, and as a layman and attorney and public official, I have no capacity to really understand so many of those arguments. But it seems to me that if there is that great gray area, that the simplest solution is to get the lead out of the gasoline and reduce the quantity of lead in the ambient air.

Senator STEVENS. You may be right. I would like to think I am not very old, but I remember the days when lead was first introduced in gasoline. Everyone told us this was going to increase performance and mileage. I want to make sure we are not going to remove the lead while adding some other problem at the same time. That is the reason we are trying to make absolutely certain what the effects would be first.

Mr. KRETCHMER. I agree with the concern. One of the things we don't get a chance to do—and I say this very quickly—we never seem to have the capacity to consider the total environmental impact. Is it important the people get good mileage? Is that a greater economy than children whose brains get addled? I always have to do that, because it sounds overly dramatic——

Senator STEVENS. I am not saying it is worth it. I am saying at the time it was introduced in the thirties, it was supposed to bring about an economic effect, but now I don't think it does.

Mr. KRETCHMER. I have sat in this room and heard the automobile testimony about how important the mileage is. I wasn't referring to you. One of the things the gasoline industry says that is important about lead, is for mileage. I have reams and reams of testimony, we have 5 days worth of documents of concentrated hearings, and over and over again the industry told us that lead was important because the engine performed better and the mileage was better. I didn't mean to say that you said that. They are still saying that, making that claim, and I think that might be a valid claim, but it has to be measured against all the other impacts, both health, environmental, social, and all that.

I mean, Senator, I say this to you, and I have said it to many of your colleagues, it seems to me that the single greatest problem that exists with all of this is that we haven't yet constructed a system in which we can reasonably make all of these exchanges and come out with good answers. Five years into this environmental problem, 2 years, dependong on when you measure it, we still have insufficient information and don't ever get a chance to make the appropriate trade-off. We act because pressure is created, we act because the best available information at the time is thus, and then we find absolutely different information.

Just to tell it to you quickly, because I think it makes the point so dramatically. Con Ed was building incity generators in New York, large ones. We stopped them, and as a result they started to bring in small jet engines, turbine generators, about 22 megawatts in size, and they now have about 2,000 megawatts worth of capacity. And it turns out that those, what we call peak load generators, which are supposed to be the answer to our problems, are now working as base load facilities, generating 50 hours a week apiece, 2,000 megawatts, and they are the cause of a substantial increase, in particulates in the air.

So I mean my problem is, and my point is, that we move through these things so quickly, we seize upon what is before us, and we try to do something about the problem in the best of faith, and I think we do it rather than not do anything.

One of the things that we have had to consider in our agency is an action that may ultimately prove to be wrong, a better action than no action at all. And I know the counsel sitting next to you faces that decision every day of the week in recommending to you which direction he thinks the committee ought to take, and that is such a difficult thing to do, and so hard to understand, and we still can't seem to get anybody to tell us the straight score.

The variance of judgements on atomic power, as an example, whether that is a legitimate way to generate electricity. All of them are very bright and intelligent, and we hope honest, out of the 180 degree end of the spectrum.

As a person in the city who knows well enough its problems, trying to get information necessary to solve that problem is often very difficult, and I got into that whole long discourse by way of pointing out that I understand your dilemma in trying to deal with the lead problem. It is a complicated problem. But I say that the decision that we often make is to deal with the immediate problem and work our way through the problems that are caused as a result thereof.

Senator STEVENS. I appreciate your comments. Why don't you ban cars from parking along those places where dumpsters pull up, rather than go to the expense——

Mr. KRETCHMER. We do, but we can't enforce the law. I tell a story about it. We finally figured it out. We were going to put two concrete poles in front of the dumptsters, and put the dumpster alongside a pump so that the pump—fire hydrant—would be the closest thing to park in front of, because people are fairly respectful of fire hydrants, and then we would get the concrete poles in there wide enough so the guy could get his truck in and get the hooks over the pump and pick the can up. And, damn, the guys figured out ways to get their cars in an an angle.

In New York, a parking space is more important, sir, than life itself, and people are so resilient and so clever and so anxious to beat the system. I have visions of the guy picking the container up and some guy parking his car while the container is in the air.

Senator STEVENS. In my State, we spend considerable amounts of public money to build parking spaces, including horizontal ones. Even in Alaska, we have vertical parking, provided at public expense. And my visits to New York have led me to believe that if there are such, you don't tell visitors where they are.

Mr. KRETCHMER. We have some of those.

Senator STEVENS. Are they public?

Mr. KRETCHMER. Yes, public, a couple.

Senator STEVENS. Why don't people use them instead of the streets?

Mr. KRETCHMER. Because the streets are free, and we have never been able to get through to the city council a system of charging for using the streets, although we are hard at that now, as both a revenue-raising and environmental measure.

I give you three examples. We only seem to be able to get some laws to be self-enforcing. People do not generally smoke in our subways. For some reason, the prohibition against smoking in the subways seems to carry a certain social structure of its own, and people don't very much smoke in the subways, and when they do, it is the one offense their neighbors or their neighbor in the subway might talk to them about. Conversely, we have a law in New York against dogs on sidewalks, and the amount of dog excrement on our sidewalks defies the imagination.

We have a law against parking illegally as well, and people park—I mean I can't describe to you—I have to take you for a walk some day in my neighborhood—I live on 86th Street in Central Park—to show you the imaginative ways people have dreamt up to defy the parking laws. And we go out and give them a summons and we have a computerized system now that follows the summonses up and by and large they pay the fines, violations—they are $25 and $50 apiece, and notwithstanding that, people go on parking illegally, they go on paying the summonses. It is just—we have just been unable to get people to get their cars away from the curbs so that we can clean them.

Senator STEVENS. Although I might sound facetious, I'd like to know why you need a car in New York?

Mr. Kretchmer. Beats me. I don't think you need a car in New York at all.

One of the things our agency is doing, we are running a series of television commercials all of which are designed for people to give up their automobiles.

Senator STEVENS. I don't want to suggest that, but don't you have a periphery parking area?

Mr. KRETCHMER. Right. Probably the best way to go is the rental system. When you want to go away for the weekend, you go to some peripheral place and rent a car. When you want to visit out of town, you rent a car, all of which is at much more reasonable rates.

We do seem to have a decline in automobile use but othing like what we need. We have talked about different toll rates, and on a large number of problems. For example in the ghetto the automobile becomes a symbol of accomplishment. They want a car because it indicates a certain economic achievement they haven't made otherwise. When we talk about cars and limiting the use of cars and people not having cars, people who work in the ghetto, people who work with people who live in the ghetto tell us that this is a mistake because the car is a clear example of striving for success, and to deprive people of that example would be a mistake.

You get into this huge cycle of which comes first, the chicken or the egg. It's clear we will not do anything about the car in New York City until we do something about the subway system. It's only adequate to the place where it gets you to almost everyplace, but it's dirty, and it's messy, and we need a large infusion of Federal funds for particularly relief in terms of getting money from the highway trust fund.

If we could improve the subway, Senator, we could go a long, long way to making the car a less attractive form of transportation in the central cities.

Senator STEVENS. Very good.

Do you have any cost figures for these suggestions you have presented?

Mr. KRETCHMER. We have some and when I get them I'll put them in the record.

Senator STEVENS. In your statement you have a series of asterisks concerning lack of Federal funds for example. I think the committee would be interested in having some dollar cost figure projections. I wish we had more time—perhaps we could have lunch some time and I'll continue my education.

Mr. KRETCHMER. I will take that as an invitation and I'll have my office call you.

Senator STEVENS. Thank you very much.

Mr. Alexander?

STATEMENT OF JAMES P. ALEXANDER, DIRECTOR OF ENVIRONMENTAL SERVICES FOR THE DISTRICT OF COLUMBIA; ACCOMPANIED BY BILL McKINNEY, DIRECTOR OF SOLID WASTE MANAGEMENT; AND MALCOLM HOPE, DIRECTOR OF ENVIRONMENTAL PLANNING

Senator STEVENS. I appreciate your coming, Mr. Alexander, and you may proceed in any way you desire. You could put your full statement in the record and highlight it or proceed however you wish.

Mr. ALEXANDER. Thank you, Mr. Chairman. First on my right, Bill McKinney, Director of Solid Waste Management in the city, and Mr. Malcolm Hope, Director of Environmental Planning.

Senator STEVENS. If you do it that way, we'll print the entire statement and we'll have exchange on it later, if you wish.

Mr. ALEXANDER. Yes, sir. In thinking about my testimony before this committee and being concerned about it, I didn't simply address my problems to the District of Columbia. Based on some level of experience in Federal and State services I looked at the problems as I thought they were nationwide in the cities.

I would like to speak in that vein:

Nearly every major city in America has a "Shaw district"—not by the same name, but by congestion of its population, its poverty and its unsightly neighborhoods; trash-littered strees, alleys, empty lots and buildings; its traffic-caused concentrations of filthy air; its nerve-shocking noise levels; its lead-paint coated houses; its rat infestations; its unsightly and depressing street scenes; its frustrating environment.

Now many of these basic problems affect other city areas as well but nowhere are they so overwhelming, so persistent, so hopeless and so degrading of mind, spirit and body as they are in our inner cities. Many Americans are born, trapped, fight to survive and to progress in an environment that erodes their will and their strength, an environment they are so accustomed to that many do not even realize that they strike out, turn violent, erupt under the pressure of surroundings they cannot stand.

The reality is that ugly streets, ugly neighborhoods, scarred and filthy surroundings bring out the frustration and the ugliness in people.

I am a veteran of infantry combat in two wars, an ex-newsman, a one-time correctional program executive, experienced in State, Federal and city-level government—supposedly hard-boiled, hardened and pragmatic—but a walk, a slow walk, a feeling walk through one of the "Shaws" of the District of Columbia and other cities moves me to a sense of shock, of anger, nearly to sickness. Yet I do not have my home there. I merely walk through those areas and try to do something to reduce the problem. And, at times, I suffer the further horror of hearing some citizen say "Thank you." Thank you for what?

In the middle of a recent neighborhood cleanup effort, an elderly woman told me that she was grateful that, for the first time in years, her grandchildren were "able to play ball in the alley." She was tearful in her thanks, in her gratitude.

The incredible part of it is that she should have been angry. The city's basic job was not being done. Unfortunately we have let most of those problems creep up to alarming levels in our inner cities, air pollution, noise pollution, visual blight, trash and garbage, rats—without exception.

Mr. Chairman, let there be no doubt of what I am saying: I believe our national priorities are wrong. It is not a case of this political party or that one. It is not the case of this administration or the last one. It is simply a fact that the Congress, this Federal system, our States, our counties and our cities have let filth creep into our neighborhoods, our air, our total lives—have let blight descent over our inner cities.

We have shifted priorities away from the basic task of cities to maintain a safe, healthy and clean environment. I do not mean it has been deliberate. The fact is that the pressure groups, the persuaders, the seekers-after-action have been otherwise involved in wars on crime, on poverty, for quality education, for an expanded economic base, and for the salvation of our forests and trout streams. People have really only reacted politically in the last decade to the realization that industrial chimneys belching dirt into the air in poor areas contaminate entire cities and regions; that untreated water flowing into rivers upstream means depleted recreational resources and poorer drinking water downstream.

And our Nation's power structures still have not recognized that concentrated filth in inner cities inevitably will spread a similar blight over an entire city and region, that rat infestations inevitably spread, for example.

I think it is high time that we recognize filth in our streets must be fought as hard as crime in our streets. Filth, spreading filth, threatens the public health—and should be stamped out.

I would recommend, therefore, that Congress call for establishment—where solid waste, trash, garbage, filth are concerned—of a filth control standard, somewhat as we have approached the problems of air and water pollution.

The Federal Government, as with air and water, should monitor maintenance of filth control standards, should provide subsidies and program priorities so that cities will be helped to meet the critical financial demands of filth control, and should provide the same kind of technical assistance and sharing of manpower and equipment resources as in social and crime control programs.

And where cities fail to meet standards, the Federal Government should have the same power to move in, take over and enforce those standards that it does in the area of air and water.

On the subject of money, it is unfortunate that some think that long overdue revenue sharing programs will mean that cities—armed with new, unconstrained dollars—will invest those dollars in filth control. Revenue sharing probably will make a considerable difference where priorities are clearly recognized. The lesson of our cities, however, is that the priority of ending filth has not been appreciated. Cities, States and the Federal Government, through its community improvement programs, have failed to spend adequate portios of the dollars they already have in any kind of generally effective campaign against filth. There is no indication they would do so with revenue sharing. What is clearly needed is categorical funding directly available for no other purpose than wiping filth from our inner city neighborhoods.

Let me give you an impression of the size of the accumulative problem. Last fall in the District of Columbia, shortly after my department was formed, we conducted a 3 month special effort to clean out the piled up debris of years. This was an effort in addition to normal waste collection and street cleaning. Crews working overtime in partnership with community residents collected and disposed of 26,500 tons of garbage, trash, and debris. For a brief period of time, alleys, empty lots, backyards, were cleaner than ever; rat haborages were reduced. For a longer period of time, the inner city fire rate was down, simply because we had wiped out the nests in which fires are born.

Shortly thereafter, Congress wiped more than $1 million from our budget; overtime money dried up, and we fell behind—not as far as before, but it was a setback. Collection and disposal agencies in city after city go through the same cycle. Money goes to other priorities as money becomes scarce. A concentrated Federal grant program on a regular basis is vital to clearly reestablish cleanliness as an American standard.

At that point I must say I totally disagree with the comments directed to this committee by Mr. Ruckelshaus when the question was posed as to whether there should be a national cleansweep program; the answer was no, that we don't know all the methods we must know in order to conduct the perfectly, mechanically-structured method of doing that.

The fact is we can't wait, the filth is there; it must be disposed of. The fact is, Mr. Chairman, that we know enough now to take out the massive amounts of filth that have been laying around our cities for years. We know it takes crews, we know it takes trucks, we know it takes containers, we know we have to have a place to put it.

We know that, working with communities, we can get it out.

Senator STEVENS. I appreciate your saying that, but I also am on the District of Columbia Appropriations Committee, and I have been spending some time going over their documents. The city sets priorities. If this is your highest priority, why don't you go to the city and set it? It is one thing to take on Mr. Ruckelshaus; it is another thing to go to your own people and say the priorities you set here in the District are wrong. We see this daily that you set priorities just like the Federal Government. I don't see any reason to take on Mr. Ruckelshaus because the Federal Government hasn't found out yet how to help the cities; the cities haven't been able to help themselves.

I want to make sure that you understand. It isn't my intent to stick up for the Administration. That is not my point. The point is that Mr. Ruckelshaus says that the Federal Government doesn't know yet whether they would be complicating New York's problems—you have just heard those and I think they are fantastic, and there are others we have heard about. But if you have this problem building up in the District as you say, then part of the problem is the District of Columbia itself.

I just went over the budget this morning again concerning the priorities, et cetera, and the District hasn't put any priority in terms of increased expenditure of funds for filths control. Yet you are saying the Congress should. The Congress should spend national money to assist the cities in doing it before the cities themselves have placed a high priority on such programs.

Mr. ALEXANDER. Mr. Chairman, I am glad you broke in on my statement. The fact of the matter is that as I indicated before, that the State of this city's condition is no worse than most throughout the country.

Senator STEVENS. I think that's right.

Mr. ALEXANDER. I think the cities throughout the country are plagued with a number of problems, social welfare, crime, health problems. In nearly every area of major advances in city thrust, that I know of, against problems they have been initiated and started with some Federal assistance. The fact is over the years the priorities have gone to quality education, increasingly to crime control, have gone to water pollution, are now going to air pollution and all I am saying, Mr. Chairman, on a national basis, I would appreciate the Federal Government recognizing that filth in the streets and alleys is a significant pollution as air pollution and water pollution and noise pollution.

I think this should be recognized. I think the Federal thrust to help the cities to start moving is vital. Cities have not met this problem I agree with you that cities have a responsibility, but in this area the Federal Government has moved in on air, water, noise, has moved in food standards. I think they should move in on filth.

That is all I say, Mr. Chairman. The city has a responsibility and in the city it is my job to fight for budget. It is my job also to recognize that there is some crime on the streets, to recognize that some people can't get medical treatment and to try as best I can to accommodate to the needs of other departments.

Senator STEVENS. I don't think there would be any disagreement. I think you are singling out Mr. Ruckelshaus' testimony, which I

didn't hear this morning, because I was at the District of Columbia appropriations hearings. It seems to me what you are saying is that the Federal Administrator ought to be taken to task because he has not accomplished what the cities themselves haven't done. He hasn't made this the number one priority for his agency. I think it is undoubtedly one of the priorities for our country, but I don't think that EPA, which has only been in existence for 2 years, ought to be taken to task for not coming up with a solution to something the District, New York City and my home of Anchorage haven't been able to solve for years.

Mr. ALEXANDER. Mr. Chairman. I certainly understand and appreciate what you are saying.

Senator STEVENS. Thank you.

Mr. ALEXANDER. Frankly, I react simply because I am still convinced that what you want is to hear differing views as they exist.

Senator STEVENS. I am sure the committee will be happy to hear that. Certainly.

Mr. ALEXANDER. I think that quite obviously there are things that can be done locally and some of those things we are endeavoring to do, as you know from your experience on the committee. We are a new department, as you know, and from the clean sweep experience itself, we have learned much that despite 2 years of reductions in one case by Congress and in one case our own internally in the city, we expect within 2 or 3 months we will have the city leaner than it has been in 10 years.

But that is because there has been slack and lag and we have learned how to operate better. But we could use help in terms of Federal emphasis on filth, not just air, water, and noise.

Senator STEVENS. I agree. I was involved to some extent with the Boy Scouts for the past 2 years. This organization is a prime example of what can be accomplished beyond the Federal Government in terms of making our environment more livable.

Mr. ALEXANDER. Yes, sir; and as a matter of fact, we are working with them here and with other groups. One of the amazing things about out local clean sweep was the amount of energy it generated among community groups. We have groups activating their own campaigns to try to help us and it is a good sign as you indicated.

Senator STEVENS. We used to sentence people to pickup trash along the highways for traffic violations. To your knowledge, did the District ever do that?

Mr. ALEXANDER. Not to my knowledge.

Senator STEVENS. It was very successful. Our traffic violations declined dramatically; so did some of the litter.

Mr. ALEXANDER. That technique can provide incentive.

The second part of the solid waste problem is disposal. I will stand on my written testimony. The present-day incinerators are almost doomed across the country to closure as the air pollution regulations are tightened.

Land fill is becoming increasingly scarce and distant and we do have to find other ways to handle the problem. One certainly may be some effort to either specially tax or require new products be used by the manufacturers of drinking cans and the people who have de-

veloped super containers. The increased burden on cities caused by paper towels, new containers and packaging, and disposable cans, is rather fantastic. A special tax may be in order. But I think really salvage is the vital answer to the problem. Much of the recycling technology has been developed. We know how to separate ferrous and nonferrous metals and glass from solid waste. We know that the market for metal is fair; for the glass, poor. We think the Federal Government, working with us and with industry, could hopefully develop a better market so that cities can invest more freely in the kind of equipment that will allow separation of these items, and their return for re-use.

I think this is something that is very important and recycling demonstration programs should be expanded, as I see it.

Commenting on the subject of air pollution, Mr. Chairman, and departing from the text again, I should point out in this city we have 10 areas in the inner city where we have identified the carbon monoxide counts are above 35 p.p.m. This is, by every standard I know, too much. It begins to affect the health; it is particularly acute to children with sickle-cell anemia. We are moving to reroute traffic in this city; we expect to have difficulty in doing so, but we have to do this.

The fact of the matter is, we have a state implementation plan in the EPA now; we are awaiting approval of it. We call for more mass transit, reduced downtown parking, fleet use of natural gas; I have to admit that everything I know leads me to doubt that all these steps will keep up with the mounting use of the private car. I believe that sooner or later the probability is we will save to go to the total closure of parts of downtown, massive fringe parking, and shuttle bussing.

I agree with Mr. Kretchmer on that. I would hope that EPA would try to develop some systems with some of these systems.

Senator STEVENS. What happened to that proposal? When I left here in 1960, after having been here a few years, there was a fringe area parking proposal to allow people to leave their cars in the fringe area and use the buses. This was designed to decrease the utiliztion of downtown streets. It was very widely hailed as one of the signals of a new era, when I returned in 1968, there are more cars, less parking.

Mr. ALEXANDER. Every panacea that comes down the pike goes the same way, I guess. The fact is that parking downtown has grown to a large degree as it has in District installations, as you know, and the increasing expressway and freeway system has brought in more cars and the general growth of the area has brought in more cars, so we are much further behind than we were. The only way you get to it is not by fringe parking alone, but a combination of reduced parking downtown, fringe parking outside, and some shuttle busing to get people into town. It is more complex than everybody thought it was.

Senator STEVENS. Are you now formulating a plan for fringe parking in connection with Metro utilization?

Mr. ALEXANDER. There is a plan for parking areas in connection with Metro. The tragedy is that every experience in every city that

I know of, with established transit systems such as Metro, the experience is not that traffic over time is reduced. The Philadelphia situation in the early days of its Metro, has shown a drop in traffic, but it is expected it will turn around and continue to climb.

Rapid transit doesn't solve the problem; you have to go further with stoppage of cars.

Senator STEVENS. We are doing that in national parks now. Vehicles have become so numerous in our parks, that we had to close some parts of our parks. In Mt. McKinley, for example a permit system for going beyond a specific point has been established. If we can do this in the national parks with public approval why can't we do it in the national capital?

Mr. ALEXANDER. I think what you are saying is probably where we are headed. It is a tough row to get there, though, because people are so used to having their car three steps away, it will be difficult to break. The first step may involve commuter control and then some steps to actually prevent the use of private cars in certain areas of the city.

Senator STEVENS. I will agree with you on that; we have a special responsibility for the District of Columbia. We must see to it that a plan works in the District of Columbia and, if the plan is feasible, try to lead the rest of the Nation into adopting a similar plan in-terms of dealing not only with traffic and filth, but with the entire concept of environmental control.

Mr. ALEXANDER. If you like, sir, I will send you a copy of the plan that we have developed that talks in the vein we are talking now.

Senator STEVENS. I would like to see it.

Mr. ALEXANDER. If I could make a comment or two on noise and lead poisoning, sir. I realize the pressure of time.

On the subject of noise, however, one of the strange experiences I have had in terms of contrast was in 1964 in California I was involved in an agency's effort to establish a prison hospital. We looked at the proposal and discovered it was close to an airport. We sent teams down to measure the noise and discovered that indeed the range of decibels was between 80 and 90.

Based on advice from public health authorities we said no to the prison site. The fact of the matter is, is that in the cities people are exposed to noise levels throughout the day of 80, 90 and above.

We said no to the prison plan because of the physiological and psychological affect on inmates. Yet, we expose people in the inner city to more than that.

All I say is that I sincerely hope EPA will be able to go ahead with noise standards and that the Senate will act on the noise control bill which I believe is before you now.

Senator STEVENS. Yes; it is.

Mr. ALEXANDER. Noise is a problem that is recognized. Lately recognized.

In 1968 we visited universities and tried to encourage them to go into research into noise. At that time there wasn't much interest because there was money available for other areas. It's a critical problem that has crept up on us.

The latest example is the impact of rock and roll bands. People have begun to realize the harm they can cause, physical harm. In general, noise leads to frustration, despair, family breakup and juvenile delinquency, because of psychological effects according to some theoreticians.

If you like, we have additional material we can submit to you on this subject.

Senator STEVENS. Yes; I would like to see it.

Mr. ALEXANDER. The implications of lead poisoning have been discussed here today. So I won't go back over parts per million and so on.

Senator STEVENS. I do have one question concerning your statement. You say you think there is considerable reason to believe that lead may cause poor educational achievement in inner city children, especially blacks. Have you conducted any studies in District Columbia indicating that this is the case?

Mr. ALEXANDER. My statement doesn't say especially blacks. I think that is a staff note. If it does—the fact is what we have is this: We have the evidence accepted by people in the field that lead above a certain point does cause an irreversible brain damage. There is all kinds of testimony and research in this area. We do have the knowledge that the cases where you find the greatest number of low quality, high lead paints are more often the inner city, houses that have been there for years and have been painted and repainted.

We know also that earlier this afternoon there was discussion of the question of a along arterials the high degree of lead concentrated in the air and in dust. We do know that the inner city streets where cars idle, are heavily laden with lead in the air—probably more so than they are on the freeways outside of cities.

What we are saying is that every bit of evidence that would tend to indicate lead conditions leading to brain damage is there in the inner city. We know that educational achievement level can be affected by brain damage, and therefore, we must consider steps to protect inner city youngsters against that.

The fact is that educational achievement levels have been lower in the city. There have been millions of dollars invested in trying to solve the problems of poor facilities and what-have-you, and we think the lead appears to be to us a serious problem in that connection.

Mal, would you have anything?

Mr. HOPE. I think I might point out, Mr. Chairman, that as a result of the recent screening of the population within the inner city area of the youngsters between 1 and 6 years of age, we had a rather comprehensive program underway, providing that over 25 percent of those youngsters who have elevated blood levels——

Senator STEVENS. Do you relate that to paint more than to the leaded gas?

Mr. HOPE. I think we have to recognize all the sources of lead to which the individual is being exposed, and I would have to agree that probably the primary problem is the question of the lead paint in those old dwellings that are beginning to flake off and peal and the youngster has a tendency to eat that.

Senator STEVENS. Does the District have a problem similar to the one in N.Y. which the Commissioner described?

Mr. HOPE. Yes; except ours is a little more comprehensive and more forward-looking than the one they have in New York, if I may be permitted, Mr. Chairman.

Senator STEVENS. What are we doing here?

Mr. HOPE. We are screening the total population group between one and six in the model cities area in all instances where we find youngsters with elevated blood levels—that means more than 40 micrograms per mililiters of blood—we check out the residence to identify the source of the lead to which he is being exposed.

We find it and take the necessary measures which we can under the regulations of the District to see that that hazard is removed.

There is that concurrent problem that once you take a youngster into the hospital you clean the system of lead through the procedures and you put him into that same environment and let him once again build up a high lead level, you seem to have a massive reaction on that second exposure.

So that at the moment the owners of the properties in which those children reside are being compelled to institute the necessary cleanup measures to remove the lead from that environment.

We are running into some situations as of the moment where we are finding high leads in some of the children and at the same time as we check the residential environment we are not finding lead. We are beginning to look other places. We are beginning to take a look at the day-care center in which many of these children are housed 8 hours a day, 5 days a week, while the mothers are working.

We are concerned with the fact that the dust in these homes which we have not been looking at previously according to a national academy of science report, indicates a lead level of about 1,600 micrograms per gram of dust. The daily permissible intake is only 300. So if you eat one-third of a gram of dust which you could easily pick up—the youngster as he is in contact with the dust within his residential environment—you may be getting those toxic exposures.

Senator STEVENS. Do you have a control program for that, too?

Mr. HOPE. For the dust?

Senator STEVENS. Yes.

Mr. HOPE. No, sir. I don't know of any control program that anyone has.

Senator STEVENS. I mean for the day-care centers?

Mr. HOPE. We have started a program to try to identify the sources of lead in those places, yes.

Mr. ALEXANDER. We are going first to 30 randomly selected day-care centers. This started 2 weeks ago. My guess is that we will find the problem and we will have to go to the rest of them.

Senator STEVENS. Has the National Science Foundation indicated how lead is combining with dust?

Mr. HOPE. Yes, from the ambient air. The major contribution to the air is from the burned leaded gasolines used by the vehicles in the District. That is the only place that the lead can come from.

There may be a little weathering of some of the lead paints within the residential area, but I am sure it would not contribute that content of lead to the dust itself.

Senator STEVENS. Not that significantly.

Mr. HOPE. No.

Senator STEVENS. That is very interesting; I appreciate that information.

Mr. ALEXANDER. If I could close with just a few more comments, unless there is more on lead, sir?

Senator STEVENS. No, I was interested in what the C-level was. We just had the New York levels, now for the record——

Mr. HOPE. For an ambient air content it is in the neighborhood of 1.5 to 2 micrograms per cubic meter.

Senator STEVENS. As compared to New York's 3?

Mr. HOPE. Yes, I guess Mr. Kretchmer said it was 3. As far as the actual intake from the ambient air, this would contribute according to the figures that I have seen, on about six micrograms per day to the average youngster's blood level. We are worrying about substantially more than that so that I think what we're worrying about is the constant flaking of the lead as it is disposed of in the environment, and it accumulates in the household, and the youngsters get it, or those going through the teething process, and crawling around on the floor—in that situation it is not difficult to pick up a third of a gram in connection with his normal activities during the day's period of time.

Senator STEVENS. Have you checked the playgrounds and the housing project areas to determine what the ground dust content might be?

Mr. HOPE. No, sir, we have not done that. We have been accepting the national average figures put out by the Academy. I think it would be a good idea if we did, and we can.

Senator STEVENS. Are most of our playgrounds in D.C. paved?

Mr. HOPE. No, many of them are dirt playgrounds. The idea is that you have fewer accidents if the youngsters fall on dirt as opposed to concrete.

As you know, many of our playground areas are completely surrounded by heavily traveled streets in the District, so there is a chance of buildup of lead in that soil.

Mr. ALEXANDER. I should point out that everything turns back to solid waste and solid waste control. The better job we can do of keeping our streets clean and flushed, the less dust we are going to have flying and the more we are going to be able to remove some of this lead-concentration that spreads.

In that same connection I might point out that we had a dramatic lesson in rat control recently. We were on the edge of the model neighborhood where we have a rat control project. It was a day when we didn't have enough people so Bill and I and some others were manning a truck.

Senator STEVENS. I want to commend you on that. I have heard several comments on the radio about your good work and what your crews have done in terms of your voluntary effort. I certainly think that the committee should see to it you receive the credit you deserve for the hours you have been putting in and the work you have been doing.

Mr. ALEXANDER. Thank you very much, but I was making the point for this reason: we stopped for one stack that looked fairly

dry: the neighborhood was fairly clean and outside a rat control project.

The first shovel hit it and one rat came out. And by the time they all came out there were seven rats. It was just outside the rat control project.

The reason I mention this is that there is some rat control money in the Federal budget administered by HEW and (I know how controversial the subject was just a few years ago) the fact of the matter is that HEW money is now having to be spread thin across the cities.

Cities who undertook and received grants under that program, their funds are being reduced and funds are going to other areas in hopes of generating and starting new projects there and spreading the concept of an organized attack on rats. The problem is that old problem of the Federal grant system, partly our own fault as you told me, is that very often we start programs because the money is available, and as soon as the money is gone we have not the capacity to replace it with our own, so while we are talking the rhetoric of trying to go citywide with what we learned in model cities, we are now facing a reduction in funds which means a constraining of the rat control program in this city.

Senator STEVENS. That is the HEW budget?

Mr. ALEXANDER. Yes, sir. There is merit in what they are trying to do. They are trying to say okay, we have started this city and this one and this one, now let's take some of that money and give other cities a start. But the fact is if cities didn't in the first place budget their own money and they had other priorities and now they have tested something and it works and the money goes away, you have a problem.

Senator STEVENS. I am going to ask the staff to give us a report on that from HEW so we'll know how much money was there, how much they have used and how much they requested this year. The HEW program happens to be an extracurricular activity of mine. Maybe we can do something there.

Mr. HOPE. May I make one more point, Mr. Chairman, the $15 million in the HEW budget for so-called rodent control activities really is dedicated to an environmental improvement program. This is along the lines not only of controlling rats, but you do this through the mechanism of denying them a source of food. You deny them the nests which means cleaning up the areas, and here in the District we have taken those health environmental aides who have been working with us and we have trained them in the problems that relate to lead poisoning control, they have related to the community and neighborhood groups in setting up environmental improvement programs.

So those dollars have had a much broader impact than just rodent control per se. Basically it is an environmental improvement program, it is elimination of that filth.

When we first started out with that program in the District we had a 50 percent incidence of rats in the model cities. This means every other property had live rats on it. As a result of the clean up operations we have been able to reduce the incidence of rats in the

model city area by 75 percent with concurrent improvement in environmental quality.

Senator STEVENS. As I drive through Rock Creek in the spring, I can see rats crossing the creek. They are not confined to the inner city area. There are a lot of them in those dead logs along Rock Creek.

Mr. HOPE. That is right, we have some problems in the neighborhood of the zoo, for example.

Senator STEVENS. Yes.

Mr. ALEXANDER. Sir, I think I better let the remainder of my statement go to the record except for one point which isn't concerned with the inner city environment possibly but it is a—since we are discussing the effort to protect the environment in general also I will state that I think the whole question of water resource, pollution, supply, that is something that requires a great deal more examination than it is currently getting.

Let me look at it from the point of view of this region for one moment. This city and several other cities in the area are jointly using what is called the Blue Plains Water Pollution Control Plant for processing of sewage. The plant is being expanded. We are waiting on funding that is being debated now between two houses of Congress. The fact is total investment in expanded investment there would total about $374 million. That would increase the capacity and increase the quality of water. Even as that plant is completed within 3 years, due to growth in this region, we will need another regional plant. If growth continues unchecked, another and another.

What we are looking toward is a $500 million plant, a $700 million plant and probably a billion dollar plant by the time we are finished in order to meet the growth needs of this region. At the same time, we are facing considerable problems in water supply. We are dependent upon the Potomac, so are the jurisdictions around us. One dam is being built. In 1963 the Corps of Engineers recommended 16 dams. Some people say we should take water from the estuaries. There is concern, however, about virus in that water.

This year the House Public Works considered the Corps of Engineers' request for two dams. It was rejected. The Senate is now going to consider this in the near future. The fact is unless our domestic water supply is met by action of those dams, there is a strong possibility and the engineers will say it, too, that, before the end of this decade, we will be faced with a rationing problem in the city of Washington and some adjacent cities. Just as right now Montgomery County is placing moratorium on construction pending sewerage system construction, so we may have to face that problem with the water supply. Other cities are having the same problem in this fight to attain Federal standards which are of course vital to meet water quality and water supply needs.

The whole area of reuse needs to be given attention. Unless there is a definite advance in terms of finding new water sources, or reuse of water we are going to face throughout this entire country before too many years a really challenging problem of how do we stop growth because the water isn't there, and, Mr. Chairman, I submit to you that is a very serious question.

Senator STEVENS. You are talking about quality or quantity?

Mr. HOPE. In the District of Columbia metropolitan area we have only 2 days storage on the municipal water supply which is supplied to us at the treatment plant operated by the Corps of Engineers, very well operated, I might say, incidentally. There have been times when the low flow in the Potomac has been less than the day of high pumping. Fortunately those two periods of time have not occurred simultaneously. But in the event of some long draught and these are cyclic things as you know that come on a periodic basis, we could well run into a situation where we are going to have to resort to rationing in order to stretch the available water supply as far as we possibly can or we may have to resort to the unhappy eventuality of pumping the water out of the estuary which is that body of water that surrounds Haines Point in front of the Watergate Terrace, some 5 billion gallons but I would remind you that that estuary also receives the storm water drainage from the surrounding area, and we have the sewage treatment plant there, and we have the reservation of the efficacy of the sewage treatment process, and the removal of bacteria as it is processed.

So I would reason as far as the statement made by Mr. Alexander, the situation is desperate. If we had the dollars in hand it would take us 10 years to get the dams in place and build up reserves of water than can take care of us during periods of low flow in the Potomac.

Senator STEVENS. It would probably take 10 years to get environmental clearance to build the dam.

Mr. HOPE. I would hope not. Hopefully, we can accelerate that part of the operation one of these days.

Mr. ALEXANDER. The Corps of Engineers did tell us that by superhuman effort, they could finish them in 7 or 8 years. I think that probably we have gotten so far away from the prepared text that if you have any other questions we would prefer to answer them.

Senator STEVENS. I have enjoyed your testimony. I am sure the committee will pay great attention to it. The staff will give you a copy of the testimony so that you can make any additions or corrections because of the way we skipped around.

Mr. McKinney, did you have any statements to make in this regard,

Mr. MCKINNEY. I think that my primary responsibility is solid waste management. I think it has been pretty well covered not only with Jim's testimony but with the other testimony.

It seems that New York and the District face similar problems with regard to street cleaning. New York has a problem with enforcement of no parking ban regulations in order to maximize utilization of manpower and equipment. We have just concluded the planning for a night street cleaning program involving some 60 streets in the city of Washington and I think that there is a need for better cooperation on the part of District agencies in recognizing the critical needs of solid waste management with regard to utilizing to the maximum resources. To date we are facing some opposition on the part of the police department as well as highways and traffic department with regard to that night street cleaning program

which in our estimation will serve to benefit of the city as well as the department in terms of being able to utilize its equipment and manpower to the fullest extent.

I think the question of the minor or minimum inconvenience on the part of citizens and businessmen in terms of the night street cleaning program raises a few eyebrows in terms of taking traffic off the streets at the time when there is minimal use of those streets and using that time to clean.

I think the critical problem is that what is more important is finding a way to utilize the resources available to the fullest extent.

Mr. ALEXANDER. Mr. Kretchmer's problem of no parking where they want to is not unique to New York.

Senator STEVENS. As a northwesterner when we post the streets and say we will clean them on particular hours of the snow, if there is a car in the way that guy has got himself a real problem. It is going to cost him a great deal of money to get it out of the impoundment yard and he will find if he left his brake on he has a ruined car.

We are not apparently as considerate of law violators as the eastern cities are.

You mentioned the difficulty of clearing the streets to use this night crew concept. We do it. I wonder sometimes, for example, if you have lived in the area where they have very deep snows if you see what they do. You literally clean those streets. I don't know the reason why you can't do the same with dust and dirt. Maybe there is more of a resistance to that type of real authoritarian application of the street cleaning process in the east but certainly in the north country you have to do it.

Have you studied, Mr. McKinney, the New York City plan for this new street cleaning operation that they have up there?

Mr. MCKINNEY. I have talked to some extent with people concerning it and I understand Mr. Ketchmer's position and I have been there. I was stationed in New York and I know a parking place is as valuable as life in New York. People are willing to pay the impoundment charges in order to park for that period of time. I think it is a habit that has formed over the years and I think it will take a stiff fine on the part of city administrators to break that habit.

Mr. ALEXANDER. I don't mean to be critical of departments but the fact is that the priority on doing something about filth has evaporated from many of the older cities of the country. It isn't there as much as it was years ago. What we are talking about is, after years of sanitation, being of low import, we are talking about turning it around, in New York, here and many other cities. Turning it around means when you start enforcing parking laws, it means something the police have to do, the highway department has to do something else, it takes them away from priorities they have.

So in the years of trying to reverse the tide of filth, you will have conflict, within city, State and Federal Government, and with people.

Senator STEVENS. You are probably right. I certainly thank you, gentlemen.

(The statement follows:)

STATEMENT OF JAMES P. ALEXANDER, DIRECTOR, D.C. DEPARTMENT OF ENVIRONMENTAL SERVICES, INNER CITY ENVIRONMENTAL PROBLEMS

Nearly every major city in America has a "Shaw" district—not by the same name—but by congestion of its population, its poverty and its unsightly neighborhoods; trash littered streets, alleys, empty lots and buildings; its traffic-caused concentrations of filthy air; its nerve shocking noise levels; its lead-paint coated houses; its rat infestations; its unsightly and depressing street scenes; its frustrating environment.

Many of these basic problems affect other city areas as well but no where are they so overwhelming, so persistent, so hopeless and so degrading of mind, spirit and body as they are in our inner cities. Many Americans are born, trapped, fight to survive and to progress in an environment that erodes their will and their strength, an environment they are so accustomed to that many do not even realize that they strike out, turn violent, erupt under the pressure of surroundings they cannot stand. The reality is that ugly streets, ugly neighborhoods, scarred and filthy surroundings bring out the frustration and the ugliness in people.

I am a veteran of infantry combat in two wars, an ex-newsman, a one-time correctional program executive, experienced in state, federal and city-level government—supposedly hard boiled, hardened and pragmatic—but a walk, a slow walk, a feeling walk through one of the "Shaws" of the District of Columbia and other cities moves me to a sense of shock, of anger, nearly to sickness. Yet, I do not have my home there. I merely walk through those areas and try to do something to reduce the problem. And, at times, I suffer the further horror of hearing some citizen say "Thank you." Thank you for what?

In the middle of a recent neighborhood cleanup effort, an elderly woman told me that she was grateful that, for the first time in years, her grandchildren were "able to play ball in the alley." She was tearful in her thanks, in her gratitude. The incredible part of it is she should have been angry. The city's basic job was not being done. Unfortunately, we have let most of those problems creep up to alarming levels in our inner cities, air pollution, noise pollution, visual blight, trash and garbage, rats . . . without exception.

Mr. Chairman, let there be no doubt of what I am saying:

I believe our national priorities are wrong. It is not a case of this political party or that one. It is not the case of this administration or the last one. It is simply a fact that the Congress, this federal system, our states, our counties and our cities have let filth creep into our neighborhoods, our air, our total lives—have let blight descend over our inner cities. We have shifted priorities away from the basic task of cities to maintain a safe, healthy and clean environment. I do not mean it has been deliberate. The fact is that the pressure groups, the persuaders, the seekers after action have been otherwise involved, in wars on crime, on poverty, for quality education, for an expanded economic base, and for the salvation of our forests and trout streams. People have really only reacted politically in the last decade to the realization that industrial chimneys bleching dirt into the air in poor areas contaminate entire cities and regions; that untreated water flowing into rivers upstream means depleted recreational resources and poorer drinking water downstream. And our nation's power structures still have not recognized that concentrated filth in inner cities inevitably will spread a similar blight over an entire city and region, that rat infestations inevitably spread, for example.

I think it is high time that we recognize filth in our streets must be fought as hard as crime in our streets. Filth, spreading filth, threatens the public health—and should be stamped out.

I would recommend, therefore, that Congress call for establishment—where solid waste, trash, garbage, filth are concerned—of a filth control standard, somewhat as we have approached the problems of air and water pollution.

The federal government, as with air and water, should monitor maintenance of filth control standards, should provide subsidies and program priorities so that cities will be helped to meet the critical financial demands of filth control, and should provide the same kind of technical assistance and sharing of manpower and equipment resources as in social and crime control programs.

And where cities fail to meet standards, the federal government should have the same power to move in, take over and enforce thost standards that it does in the area of air and water.

On the subject of money, it is unfortunate that some think that long overdue revenue sharing programs will mean that cities—armed with new, unconstrained dollars—will invest those dollars in filth control. Revenue sharing probably will make a considerable difference where priorities are clearly recognized. The lesson of our cities, however, is that the priority of ending filth has not been appreciated. Cities, states and the federal government (through its community improvement programs) have failed to spend adequate portions of the dollars they already have in any kind of generally effective campaign against filth. There is no indication they would do so with revenue sharing. What is clearly needed is categorical funding directly available for no other purpose than wiping filth from our inner city neighborhoods.

Let me give you an impression of the size of the accumulative problem. Last fall in the District of Columbia, shortly after my department was formed, we conducted a three months special effort to clean out the piled up debris of years. This was an effort in addition to normal waste collection and street cleaning. Crews working overtime in partnership with community residents collected and disposed of 26,500 tons of garbage, trash, and debris. For a brief period of time, alleys, empty lots, backyards were cleaner than ever; rat harborages were reduced; for a longer period of time, the inner city fire rate was down, simply because we had wiped out the nests in which fires are born. Shortly thereafter, Congress wiped more than $1,000,000 from our budget; overtime money dried up; and we fell behind—not as far as before but it was a setback. Collection and disposal agencies in city after city go through the same cycle. Money goes to other priorities. A concentrated federal grant program on a regular basis is vital to clearly reestablish cleanliness as an American standard.

The fact is the Federal Government can help to some degree without new laws. The Government could move now to give priority in existing programs for massive "clean sweep" and "stay clean" programs. Such funding programs as urban renewal Model Cities and others could give priority to filth control and the Public Health Service, the military and other agencies could be tapped to provide technical assistance and manpower and equipment for tasks ranging from comparative inspections, to identifying priority problem areas and to direct efforts to wipe cities clean.

Cities are in no position to go it completely alone. Their priorities are established. Present day industry is generating increasingly vast amounts of refuse which urban, state and federal government cannot ignore. The problem must be recognized; the filth must be seen; the decision must be made to clean our cities.

It is possible that Congressional action should go still further. The tremendous uptrend in disposable products, ranging from paper towels to no-return drink bottles to super-containerization has increased the mountains of trash which must be disposed of. Additional street sweeping, additional collection and increased disposal needs all cost cities money, scarce money. I would strongly urge either a special tax on such products or that the industries creating this additional waste be required to develop and implement recycling programs so that cities may at least get costs out of return of such raw materials.

Solid waste is more than a collection problem. Once you have it, you have to dispose of it. It is obvious that a strong market for the metals, the glass, the other salvageable resources in solid waste would help cities. The market appears to be growing slowly and erratically. Meanwhile, most cities are either incinerating or landfilling. Landfill is becoming increasingly sanitary and planned landfill now is giving us some classic examples of once waste land being turned into parks, golf courses and even industrial development areas. Present-day incinerators will become increasingly unpopular as the war against air pollution intensifies. In our city we have vowed to get out of the incineration business as soon as possible. And landfill space will certainly vanish as cities sprawl increasingly across new rural landscapes.

Salvage—as close to total salvage as possible—must come and come quickly. Separation of some products from bulk solid waste is possible now. As I indicated the salvage market is erratic and weak. I believe that the Federal Envi-

ronmental Protection Agency should step up its efforts to get new technology tested and established so that we can find the most practical ways to convert bulk solid waste into heat, steam, electricity or some other marketable form of energy; so that we can extract from municipal solid wastes every reusable component.

This problem area must be attacked on a massive basis. Cities must be encouraged in partnership with industry to develop resource recovery and marketing programs. This means money to buy tested and proven equipment and operate it; money to invest in experimental equipment; and money to subsidize markets until the industrial techniques for use of recovered material are totally effective and economically sound.

While the disposal problem is not only that of the inner city, it is clear that finding ways to make solid waste a valuable resource may make it easier financially for cities to invest in adequate levels of inner city maintenance.

While cleaning inner cities of filth is a first priority, this will not assure us of healthy neighborhoods and healthy citizens. In city after city across the country, traffic moving through and clogging inner city streets builds up pockets of air pollution that pose an invisible threat to health.

In Washington alone, for example, there are now identified 10 intersection areas where carbon monoxide counts exceed 35 parts per million throughout much of the day.

That does not sound like much. But look at it from the point of view of an inner city resident. No air conditioner. No humidifier. Windows open. Children with sickel cell anemia and needing all the oxygen they can breathe 24 hours a day. This affects health, particularly if one has pulmonary problems, to which city residents for a variety of reasons are susceptible.

What must a city do. In this department, as managers and professionals, we are shortly going to be seeking some rerouting of traffic, possibly some closing of areas to motor vehicles. We know that this will excite resistance from a number of community sectors. But the step must be taken, not only in Washington but also in other cities, if we are to move meaningfully forward against the effects of air pollution.

Let's talk about that automobile problem—the pollution it causes in Washington, as it does in other cities. This city has 4,000 registered automobiles per square mile—the highest density of any city in the United States. On top of that, tens of thousands of motor vehicles carry commuters into the city daily from Maryland and Virginia. Automobiles, therefore, account for 98 percent of the carbon monoxide emitted into Washington's air.

While other pollutants cause serious problems, the adverse physiological effects of carbon monoxide warrant special attention. Excessive concentrations in the air we breathe reduce the bloodstream's ability to carry oxygen and, as a result, may cause difficulties such as headaches, insomnia, lassitude, fatigue, irritability, confusion, memory impairment, digestive disturbance and reduced mental agility. These symptoms have been observed in healthy adults. Adverse effects are even stronger on the very young, the elderly, and individuals suffering from emphysema, bronchitis, asthma, congestive heart trouble, and anemia.

Many people concerned about air pollution become reassured by discussion about control of auto emissions when manufacturers succeed in meeting federal requirements, if and when they do. But there will still be the problem of pre-1975 vehicles, a continuing growth in the number of cars and trucks and the serious question of maintenance of efficiency in pollution control systems. The fact is that next week EPA will begin hearings on the request of auto manufacturers for an extension. I obviously would oppose this.

As with many states and cities planning air pollution control campaigns, this city plans to expand mass transit, encourage or force car pooling, tax all day parkers, promote vehicle fleets using low-pollutant fuel and other steps.

From my perspective, however, I see a cycle of increasing cars, increasing traffic, increasing traffic jams and minimal reduction in carbon monoxide unless this city and others are able to take bold, expensive steps forward. If we really are to protect our people, we soon must consider establishment of massive fringe parking areas, inexpensive shuttle bus service downtown and banning of privately operated cars in large central city areas. Small scale developments of this kind exist in Europe. I believe the Federal Environmental Protection Agency should identify the most threatened of our cities and with funding provided by Congress attempt on a pilot basis such a major jump for-

ward. Otherwise, I fear, we are simply attacking the air pollution problem with a "too little and too late remedy." And 10, 20 or 30 years from now some other subcommittee will be discussing the failure of the latest clean air act to bring about adequate progress.

If one factory was emitting one-tenth of the air pollution we suffer from cars, we would demand its closure in a minute. I do not believe we need more time for research. Yesterday was too late to begin. Let us not talk of more delays. Let us consider radical surgery now, in our auto use patterns. If this means, for example, diversion of highway tax funds to mass transit and to mass fringe parking lots, and I believe it does, I ask you to enact legislation making this possible now.

I am not here as a prophet of doom, Mr. Chairman, but there is another problem I want to share with you. Several years ago we were considering a correctional institution site in California. We turned it down because the noise level reached about 80 to 90 decibels throughout the day, noise from airplane take off. We did not want an adverse affect on the physiological or psychological health of our inmates; nor do we want such an affect on our citizens at large.

Today in congested, traffic clogged inner cities, millions of men, women and children are exposed to such levels day in and day out. The noise level has climbed gradually. People do not realize how much more noise batters their ears and mind, wears their emotions and erodes their spirit.

What this contributes to breakup of families, to unrest in inner cities, to crime and delinquency researchers are only beginning to understand.

This much it is safe to say:

Very loud noise can cause temporary or permanent loss of hearing. Sudden loud noises cause a fear reaction; noise interrupts or disturbs our thinking and our conversing. It it irritates; it tires; it wears down psychological strength. Noise is suspected of causing increased blood pressure, constriction of small blood vessels, dilation of blood vessels in the brain, altered heart rhythm, changes in kidney function, secretion rates of hormones and gastric fluids and even increased levels of blood cholesterol. It intrudes almost every place one goes. But it can be controlled, through noise reduction design for cars, construction equipment and such seemingly harmless devices as garbage disposals and even through noise limits on contemporary bands.

Yet we have no established national standards limiting noise. The issue has not become politically vital yet. A few years ago, working for the Department of Health, Education and Welfare, I tried to interest some university leaders in priority concern with noise research. Their interest, however, lay where the easy research money was, in other priority areas.

The fact is, once again, inner city residents bear the brunt of the noise onslaught, with their apartments lined up along side streets, with their windows wide open as they seek moving air on hot summer days.

I urge that this Subcommittee press for early setting of adequate noise standards so that throughout our cities we may gradually turn back the upsurge of auto and truck noise, motorcycle noise, jet and piston aircraft noise, household machine noise, construction noise, intruders we cannot evade in the inner city. The House of Representatives already has acted on H.B. 11021 on noise control. I urge prompt Senate action on a comparable bill.

Filth, air pollution and noise extremes make the inner city a jungle of environmental threats, Mr. Chairman, but there are other problems.

How many times have you read of the poor educational achievement of many youngsters in inner city schools? And how many times you have heard the traditional reasons, poor facilities, poor teachers, unwillingness to learn, among others. I submit to you there is considerable reason to believe that that low average may be caused, in part, by lead.

Lead serves no really useful physiological purpose yet it is present in the food we eat, air we breathe and water we drink. The primary source of exposure to lead in quantity, however,—particularly for children—is the lead-based paint on the walls of much of the substandard housing in our inner cities.

Current studies show, for example, in the Washington Model Neighborhood that 25.6 percent of the children tested under six years of age show elevated blood lead levels (over 40 micrograms per 100 ml).

It is not just a matter of paint. One recent study showed that household dust in 77 cities averaged 1,636 micrograms per gram, in lead content. The

daily permissible lead intake for children has been set as 300 micrograms per day. He can breathe or eat this much from an infinitestimal amount of dust. And that lead in the dust comes from airborn lead in motor vehicle emissions.

The agonizing point is that too much lead can mean irreversible brain damage, the result of lead's toxic effect on the central nervous system.

I am convinced, Mr. Chairman, that there is enough evidence at hand to warrant, without delay:

1. Strict limits on lead use in paint.
2. Identification of residences, day care centers, etc., where there is high lead content in paint—and mandatory and permanent replacement or covering of the surfaces. This will be expensive.
3. Revision of plumbing codes to ban lead from water distribution piping.
4. The elimination of lead from gasoline.

I urge the Subcommittee to consider legislative proposals and funding for such programs.

Recently, Mr. Chairman, when manpower was short, some of my staff and I cleaned some alleys in the city. When we tackled one stack of debris with our shovels, a rat raced out, then another . . . and finally, seven. One pile of debris in a relatively clean neighborhood.

Those are alleys used as play areas by children and walkways for families. The rat problem in our city and most cities is far from beaten. Yet I have received reports of diminished federal funding for rat control programs. I would urge your support, Sir, for not reduced but rather increased funding so that recent demonstration projects may be expanded and not curtailed as cities, losing special funding levels find their own financing committed to other priority areas.

The problems of the inner city environment warrant a book. I regret there has emerged no Rachel Carson to trumpet and win attention to the pollution of our inner cities. If there were, I am sure he or she would also write about visual blight, the depressing, ugly effect of decaying store fronts, deteriorating homes and apartments, and drab neighborhoods . . . when, instead, one would hope that Americans would find their neighborhoods scenes of beauty; if not beauty, at least attractive and human.

The entire field of the impact of visual blight on man needs research, demonstration programs and effort on the part of federal, state and city environmental workers. I believe it is a neglected area of concern.

And, last but not least, there is water. Increasing growth, increasing congestion in urban areas are skyrocketing the demand for water in metropolitan regions across the country. At the same time, sewage treatment lags, our rivers are dirty—and those rivers are the source of our drinking water.

The aging inner cities need more than bright new buildings, homes and transport systems above ground. They need renewed water distribution systems; they need to replace old, small and inadequate sewage collection systems.

And they need the cleaner supply sources and the improved water treatment processes that today's science and technology should be giving us.

In the area of water resources, I would strongly urge that Congress move to compromise the current water pollution control bills being debated between the House and Senate . . . and I would further urge that the Federal Environmental Protection Agency be asked to intensify its research, its search for alternatives to our current, expensive, rapidly outmoded ways of processing waste water. Unless technology is improved and the cost factors lessened, I fear we will never catch up.

As an aside, Mr. Chairman, if you can help this city get two dams—Sixes Bridge and Verona—into the omnibus public works bill this year, you would greatly reduce this city's fear of water rationing before the end of this decade, possibly before the Bicentennial celebration.

It is difficult to talk about the trash around us, the air we breathe, the noise levels of the inner city, lead in our homes and air, rats and water without expressing some concern with the food we eat, whether it be from a small inner city cafe or a corner grocer.

Last September we strengthened and intensified our inspection system on food sanitation, have subsequently suspended briefly numbers of establishments and compelled the closing of others. The effect has been a drastic improvement in sanitary practices in food centers.

It is unfortunate that this action was the result of a probe by another Congressional committee . . . unfortunate in the sense that the inquiry caused action that should have been taken long before.

The point I am making is that the food we eat, by our interpretation, is part of the environment that affects our well being and growth. I would hope that this Subcommittee or some other would look long and hard at the level of sanitation in food establishments throughout our inner cities to make certain federal guidance, standards and direction are adequate.

We have received numbers of requests from other cities for briefings on how we have moved and with what success from cities considering final action plans to upgrade food sanitation in inner cities.

I have appreciated the opportunity to appear before your Committee to discuss environmental control problems and programs. Your interest in the urban environment is one of the most encouraging developments I have observed in the past several years. If I were to be critical, there has been a notable lack of leadership at the Federal level in pressing for a coordinated total approach in dealing with the problems of environmental degradation in the cities of our nation. The present approach is fragmented, inadequate, and lacking in direction. We are dealing with problems on a crisis basis, attempting to meet the emergencies of today with a total disregard for the needs of tomorrow.

We were encouraged by the establishment of the Federal Environmental Protection Agency—an attempt to weld together into a cohesive whole, a Federal agency with the broad charter to deal with all environmental problems. Within the limits of its responsibilities and with the support of the Congress, major steps have been taken in designing and carrying out national programs of water and air pollution control. These activities have stimulated the imagination and interest of politically oriented and emotionally aroused citizens. And yet, I detect a notable lack of interest on the part of large masses of our citizens—particularly in the lower socio-economic levels—of the needs, objectives, and goals of these programs. I am concerned at their lack of participation in public hearings on water quality and ambient air quality standards. I am dismayed at the lack of support from our central city groups in pressing for adequate funds and staffing of these programs. I am disturbed by the preoccupation of the Environmental Protection Agency with the problem of solid waste disposal with almost a total disregard of the problem of collection. In the urban environment, the generation of interest in the subjects of pesticide and radiation control is practically impossible. The need for these programs is obvious and the leadership role of the Federal establishment—both the legislative and executive branches—is commendable.

Nevertheless, the time has come to provide the same type of leadership in dealing with those problems of primary concern to our population groups least able to help themselves.

What is the environment? It has been defined as "the aggregate of all external conditions and influences affecting life and the development of an organism, including man." Your concept and mine as to what is encompassed by this definition is completely foreign to our less favored citizens. As I attend neighborhood and community meetings, what are the primary subjects of discussion? What questions are we asked as we participate in public forums on environmental problems? They are simple—they are direct—they are unsettling. In a nation that prides itself on having attained the highest standard of living in the history of the world, who would ask about control of rats, plumbism in our children, deteriorated substandard housing, the safety and cleanliness of food sold in the community, garbage and refuse disposal, insect and vermin control, noise which invades our privacy and disturbs our rest,—the cycle of filth which is the badge of our inner city environments.

We are the product, in large measure, of the environment in which we have been raised and in which we live. Hopefully, we progress to increasingly desirable levels as a result of technological progress, the increasing affluence of our nation, and the inherent desire of everyone to better their position. A review of the situation in our inner city areas indicates that a reverse trend has been established with a continuing downward degradation of environment. The changes are subtle, insidious, and demeaning to those who through no fault of their own are compelled to endure the trauma of having to live in such areas.

Those of us in government concerned with the environment have failed in our responsibility to the public we serve:

The Federal Government for lack of leadership and failure to establish a bill of rights for the citizens of the nation defining their entitlement to a decent living environment in which to live, work, and play.

The States for their failure to support the urban areas in the development of coordinated urban environmental health programs.

The local jurisdictions for lack of support of environmental control programs and the insistence to continue to do business as usual. This criticism, however, must be tempered by the fact that budgetary limitations have frequently been the critical factor in lack of such support.

The failure to provide the necessary institutional arrangement, lack of funding, and inability to define goals, and objectives constitutes a sad commentary on the ability of the "establishment" to deal with the "gut" issues of the environment. The most pressing need is to establish focal points for environmental control at the several levels of government.

In the District, we deal with the several entities of the Environmental Protection Agency as separate autonomous entities, each with their own criteria and bureaucratic structure for the dispensing of Federal grants. We look to the Public Health Service, HEW, for support on rodent control and prevention of lead poisoning. HUD is our resource for the many related programs designed to improve the residential environment. The Department of Agriculture has been a vital source of funds for the improvement of our food sanitation program, particularly in the control of meat products in the District. The Department of Transportation relates to air pollution and noise control programs. How much better it would be to be able to deal with one single Federal agency in negotiating the return of taxpayer's dollars as grants for the support of environmental control programs. We are not naive enough to believe that a block grant to the District for environmental control program support would be used to supplement D.C. funds on a priority of need basis.

I do not apologize for the tone of these comments; they reflect a heartfelt feeling that this is the time for change. Environmental problems in our inner cities have developed in the point where change is indicated and necessary—now.

Senator STEVENS. We are going to adjourn this hearing. Thank you very much.

(Whereupon, at 3:59 p.m., the hearing was adjourned, subject to the call of the Chair.)

THE INNER CITY ENVIRONMENT AND THE ROLE OF THE ENVIRONMENTAL PROTECTION AGENCY

MONDAY, MAY 8, 1972

COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON THE ENVIRONMENT,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 12:20 p.m., in room 5110, New Senate Office Building, Hon. Philip A. Hart (chairman of the subcommittee) presiding.

Present: Senator Hart.

OPENING STATEMENT BY SENATOR HART

Senator HART. The committee will be in order.

Clearly I owe an apology to the witnesses and to other interested persons and to the staff, but beginning at 10 o'clock this morning and continuing until a few minutes ago this afternoon, the Democratic Membership in the Senate was attempting to develop a position on the response, if any, we should make to the possibility of reescalation in Indochina. I am sure it would be agreed that this is where we should be, but it is certainly inconvenient to everybody else and I am sorry. We didn't do a thing about Indochina either.

Our hearings this morning renew our interest in the environment of the inner city. On April 7, Administrator Ruckelshaus of the Environmental Protection Agency testified before this subcommittee on the role of his Agency in the inner city. At that time we discussed the adequacy of EPA's proposed regualtions to reduce lead in gasoline. That hearing raised some very substantial questions as to whether EPA's regulations will remove lead at a fast enough rate to adequately protect inner city youngsters. This morning we hope to develop additional information and knowledge on the problems of lead in the inner city as it relates to lead in gasoline.

As our first witness, let me welcome an acknowledged expert on childhood lead poisoning, Dr. Jane Lin-Fu. I understand Dr. Lin-Fu will be accompanied by Dr. Robert Laur of the Health Services and Mental health Administration of HEW.

STATEMENT OF DR. JANE LIN-FU, PEDIATRIC CONSULTANT, MATERNAL AND CHILD HEALTH SERVICE, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE; ACCOMPANIED BY DR. ROBERT LAUR, DEPUTY ADMINISTRATOR, HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION

Senator HART. You may proceed.

We will order printed in the record the full prepared statement of

Dr. LIN-FU and other witnesses and as you go on, if there is any adding or shorthanding you want to do, feel free to do so.

Dr. LIN-FU. Mr. Chairman, I want to thank you for inviting me to testify on the sources and health implications of lead in inner city children.

Accompanying me today is Dr. Robert J. Laur, Deputy Administrator for Prevention and Consumer Services, Health Services and Mental Health Administration of the Department of HEW.

With your permission, I would like to submit for the record an article published recently in *The New England Journal of Medicine* entitled, "Undue Absorption of Lead Among Children—A New Look at an Old Problem," in which data on the prevalence of undue lead absorption among urban children and its health implications are presented and discussed in some detail.

Undue lead absorption—absorption beyond that which normally occurs from intake of uncontaminated food, drink and air—is an important public health problem which is largely neglected today. According to the U.S. Surgeon General's policy statement on the Medical Aspects of Childhood Lead Poisoning, a blood lead concentration of 40 or more μg. 100 ml of whole blood, confirmed on two separate occasions, is to be considered evidence suggestive of undue lead absorption. Undue lead absorption unassociated with any overt evidence of toxicity must be recognized as an entity that is separate from but closely related to lead poisoning, which it almost invariably precedes by some time in children. Unless further undue exposure is terminated, as recommended by the Surgeon General's statement, progress to actual poisoning is the rule. Recognition of this phenomenon in children is therefore a crucial step in prevention of childhood lead poisoning.

The effects on health of this relatively "low" level of exposure is uncertain at the present. However, as presented in some detail in the enclosed paper, there is in vitro evidence of metabolic disturbances at low levels of exposure, and some followup studies suggest that permanent neurological damage can occur in young children with undue absorption of lead without overt clinical manifestation of poisoning. The possibility remains that what is termed today as undue lead absorption may have to be reclassified as lead poisoning tomorrow, if new findings so dictate.

The paper also presents data on the prevalence of this problem which were collected recently by screening programs in several cities. Briefly, from 20-40 percent of the children screened in high risk areas, mainly in the inner cities, were found to have blood lead levels of 40 μg. 100 ml or more. What are the sources of undue exposure in these children? Can lead paint in dwellings account for all or most of these cases? What are the health implications of such a widespread phenomenon? These and many more questions come to mind when one is confronted with the screening results from high risk areas, but at this time only partial answers are available, at best.

In searching for the sources of excessive lead exposure, it is important to bear in mind that lead is an ubiquitous trace element which occurs so widely in our environment that exposure to it is

almost inevitable, even for fetuses and infants. Studies of umbilical cord blood obtained at birth revealed lead concentrations not significantly different from that found in the mother's blood, indicating in utero exposure. After birth, lead enters the human body mainly via respiration and ingestion. Without undue lead pollution of the air, the respiratory intake contributes to a relatively small fraction of one's total daily intake. However, absorption through the respiratory tract is much more efficient than that via the gastrointestinal tract, and in a heavily polluted atmosphere, respiratory exposure can result in absorption of a significant amount of lead.

The "normal" diet of children as well as adults contains a certain amount of lead. The average daily diet of the 1-3 year old is estimated to contain 130-170 μg. of lead. Respiratory intake in atmosphere without undue lead pollution is estimated to be less than 10 μg. per day. In addition to such "normal" exposure, many children, particularly those in urban areas, are also exposed to other sources of lead, the most important of which are lead paint in dwellings, lead fallout particles in dust and soil, and excessive lead in ambient air. Miscellaneous sources to which children might be exposed include improperly glazed earthenware, lead paint on toys, furniture, pencils and other items with which children might come in contact, lead fumes produced by burning lead-impregnated materials such as battery casings, et cetera.

The significance of lead paint or dwellings as a common source of lead poisoning in children was recognized in the early 1930's, but little attention was given to childhood lead poisoning until recent years—after significant mortality and morbidity among children had been attributed to it for several decades. Lead poisoning in children was considered to be inextricably linked to two factors: Old deteriorating houses where peeling lead paint and broken lead paint plaster are readily accessible to children, and pica—a perverted appetite for nonfood items found in many young children. High-risk areas were considered synonymous with the inner city slums, where old deteriorating housing prevails. Data collected recently by screening programs in several localities compels us to reexamine these previously established "facts."

On the basis of currently available data and information, it appears that repeated ingestion of lead paint from the interiors and exteriors of houses is still the principal cause of lead poisoning in children. But careful examination of the literature reveals that a history of pica and paint or lead paint plaster ingestion is not invariably elicited in children suffering from lead poisoning or who show evidence of undue lead exposure. Among 1,155 children treated in Chicago for lead poisoning between 1967–1968, only 901, or 78 percent, gave a positive history of pica in relation to paint or lead paint plaster. Although deliberate denial by some parents and failure of others to observe such ingestion probably account for the negative history in some cases, other sources of undue exposure cannot be ruled out in many. Furthermore, the negative history of paint ingestion in some children correlates with findings reported in the investigations of dwellings of children found to have elevated blood lead levels or lead poisoning. In New York City, 2,600 apartments

of children found to have blood lead levels of 60 μg./100 ml. or more were inspected in 1969 and 1970. Of these, only 56 percent were found to have lead paint in excess of 1 percent. It should be noted that such a low yield of positive results probably reflect, at least in part, a sampling problem, and that paint containing 1 percent lead is no longer considered safe. Nevertheless, other sources of exposure must still be considered a possibility.

Data collected recently also indicate that undue lead exposure and lead poisoning are not necessarily problems confined to the "inner city" or the slums. In 1969 and 1970, 48 per cent of Baltimore children found to have blood lead levels of 60 μg./100 ml or more were reported from areas outside of the so-called inner city. Philadelphia similarly reported that, in 1970, several children with blood lead levels of 40 μg./100 ml. or more came from census tracts where the average property values were equal to or higher than the average for the city of Philadelphia. In Connecticut, all socioeconomic groups were represented among children found in several well-child clinics to have blood lead levels of 40 μg./100 ml or more. The data presented above suggest that it is time to take a new look at the sources of undue lead exposure in children and to scrutinize especially the less well-known sources, such as airborne lead and lead in soil.

Studies in adults as well as children indicate that the urban population has a higher mean blood lead concentration than the rural population. Persons living close to freeways have higher blood lead values than those living far from the freeways. Certain occupational groups who are incidentally exposed to higher atmospheric lead concentrations have higher mean blood lead levels than the general population. These findings suggest that the differences in respiratory intake account for the differences in the blood lead levels of these groups examined. This is supported by epidemiological data reported by Goldsmith and Hexter which related blood lead concentrations of various groups of subjects to different levels of atmospheric lead exposure.

In children, perhaps the potential danger presented by lead particles in dust and soil is even greater than that of respiratory exposure. Recent studies revealed an extremely high lead content in street dust and surface soil in some city parks. For example, New York City street sweepings yielded 2,650 μg. of lead/g. while surface soil in MacArthur Park in Los Angeles was found to contain 3,357 μg. of lead/g. The maximum daily permissible lead intake from all sources in children 1–3 years old is 300 μg. The average diet of children of this age contains 130–170 μag. of lead per day. If respiratory intake accounts for 10 μg., only another 120–160 μg. of lead may be taken from other sources. Ingestion of $\frac{1}{20}$ g. of dirt with lead content levels such as those cited above would raise the lead intake over the permissible limit. Such a minute amount of dirt could be picked up by children on their hands and ingested. In Airborne Lead in Perspective, recently published by the National Academy of Sciences, it is suggested that swallowing of lead-contaminated dust may well account for the rather large number of children whose blood lead levels fall in the range of 40–60 μg./100 g. For children with

pica who are dirt eaters, the danger of exposure is obviously even greater. The exact prevalence of dirt ingestion among young children is not known. But among 95 children with pica seen at the Children's Hospital of District of Columbia, 41, or 43 percent, are known to be dirt eaters.

In a paper entitled, "Soil Lead and Pediatric Lead Poisoning in Charleston, South Carolina," Fairey and Gray stated that "the yards of houses where pediatric lead poisoning has occurred contain large amounts of lead, and most cases of pediatric lead poisonings occurred in areas of high soil lead values." This finding strongly suggests, although it does not prove, that the cases of lead poisoning reported by these authors may have been caused by ingestion of soil with high lead content.

Dr. M. L. Lepow, associate professor, Department of Pediatrics, University of Connecticut, has informed me that soil with high lead content is believed to be the major source of undue exposure in three children treated for lead poisoning whose parents stated they were dirt eaters. Investigation of the soil contiguous to the tenement building where the children resided revealed a very high lead content. Although the lead was largely attributd to paint chips mixed in the soil, the important fact is that lead poisoning is now known to re-ult from ingestion of soil with high lead content. The three cases do not constitute a series, much less statistics, but those who contend that lead poisoning caused by ingestion of soil or dirt with high lead content is merely a theoretical possibility or speculation, must recognize the fact that the possibility is real.

In conclusion, the sources of undue exposure to lead in children, particularly those in inner cities, include lead paint on dwellings—both interior and exterior—lead particles in dust, dirt and soil, lead in ambient air, and some miscellaneous sources. Lead paint on dwellings appears to be the major source of undue exposure in children, but the role of airborne lead—including lead fallout—in contributing to undue lead absorption and actual poisoning has not been adequately explored. Recent data indicate that 20–40 percent of children screened in high-risk areas have blood lead levels of 40 μg./100 ml or more—levels which are suggestive of undue lead absorption. One to three percent of the children screened had blood lead levels of 80 μg./100 ml or more—levels which the Surgeon General considereres to be unequivocal evidence of lead poisoning. Investigations of the houses of these children have not invariably revealed the presence of lead paint, and other possible sources of undue lead exposure must be explored.

Lead poisoning in children is known to result in death. In survivors, mental retardation, cerebral palsy, convulsive disorders, blindness, learning disabilities, behavior problems, renal damage and other sequelae may occur. At present, it remains uncertain whether or not lead causes permanent damage at a low level of exposure and in the absence of overt clinical evidence of toxicity. But there is in vitro evidence of metabolic disturbance at such low levels, and some reports suggest that subtle yet significant permanent damage can occur in the absence of overt clincial manifestation of posoning. The high prevalence rate of undue lead absorption among children

demands an explanation and warrants further investigation into the sources of undue lead exposure and the health implication of such exposure, of which little is understood today.

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MEDICAL PROGRESS

UNDUE ABSORPTION OF LEAD AMONG CHILDREN—A NEW LOOK AT AN OLD PROBLEM

JANE S. LIN-FU, M.D.

THE Surgeon General's Policy Statement on Medical Aspects of Childhood Lead Poisoning released in November, 1970,[1] called attention to an important but neglected subject—the phase of undue absorption of lead (i.e. absorption beyond that which normally occurs from intake of uncontaminated food, water and air) that generally precedes lead-paint poisoning in children. According to the Statement, all children with excessive absorption of lead, as indicated by a blood lead concentration of 40 or more μg per 100 ml of whole blood, confirmed on two separate occasions, should be investigated. Children found to be currently exposed, whether or not diagnosed as having lead poisoning, should be followed, and hazardous sources of lead removed from their environment. By shifting focus from treatment to prevention through early detection and termination of undue exposure, the Statement puts the disease in its proper perspective.

The hazard of lead-paint ingestion among children living in poorly maintained old houses was recognized by the Baltimore Health Department in the early 1930's.[2] In the ensuing years, many reports appeared clearly defining the etiology, pathogenesis, epidemiology, symptomatology, sequelae, methods of screening, diagnosis and treatment.[3-14] Yet until recently symptomatic lead poisoning was recognized only with difficulty even by physicians caring for children in high-risk areas. Many seldom entertained the diagnosis. Others who recognized it considered it a disease inevitable to slum children about which little could be done. Some regarded it as an all-or-none phenomenon: children found to have elevated blood lead levels were either treated for lead poisoning or diagnosed as not having the illness and discharged with no follow-up observation. Among the latter group, many could have been prevented from becoming poisoned if exposure was terminated at this stage. But this logical step of preventive medicine was seldom practiced, despite knowledge that at least three months of fairly steady lead ingestion usually precedes clinical evidence of toxicity in children[8,10] and that the salvage rate is high if action is taken during this period. Thus, for decades this man-made disease was permitted to exist in epidemic proportions in many old cities.

Only a few cities made limited attempts to attack the problem. Interestingly enough, every city that made such an effort demonstrated that increased awareness of lead poisoning among health workers was invariably associated with a rise in the number of cases reported and a decrease in severe cases and fatalities.[9,15,20,21] In spite of these findings, systematic efforts to eradicate childhood lead poisoning were not made until recent years.

Although symptomatic lead poisoning is a common problem among children one to six years old living in old dilapidated houses, undue absorption of lead unassociated with overt evidence of toxicity

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is far more frequent among these children.[22] The problem of childhood lead poisoning has often been reviewed.[2,9,11,23-26] The purpose of this paper is to review briefly lead intake in children, studies of "normal" blood lead levels, the prevalence of undue lead absorption among children living in old urban neighborhoods, and the importance of detecting children in the early stage of undue absorption.

Lead Intake among Children

Lead is a trace element that has no known essential role in the human body.[27] It occurs widely in man's environment, so that exposure to it is almost inevitable, even for fetuses, infants and children.[28,29] Kehoe's classic studies in adults provide the basic information on the normal metabolism of lead in man.[30-32] Studies in children comparable to those of Kehoe are not available. Chisolm has reported a mean fecal lead excretion of 0.132 mg per day in children 12 to 35 months old with no known undue exposure.[8] Barltrop's studies of children 24 to 35 months of age similarly yielded a mean fecal lead excretion of 0.13 mg and an upper limit of normal of 0.18 mg.[33] On the basis of these data, the average daily intake of lead of children one to three years old may be roughly estimated to be 130 to 170 μg.

According to Kehoe, without undue intake, an equilibrium is established between the amount of lead absorbed and excreted, and no net retention results. In adults, as the mean daily intake exceeds 0.5 to 0.6 mg, accumulation of an excessive body burden begins, increasing progressively as long as abnormal intake continues.[30-32] In children one to three years old, 0.3 mg (300 μg) is considered to be the maximum daily permissible lead intake from all sources.[34] Barltrop's studies indicate that a daily intake of 1 to 2 mg for five to six months is sufficient to cause symptomatic poisoning in two-year-old children.[33]

Indexes of Lead Absorption and Toxicity

Many biologic indexes have been used to measure lead absorption and toxicity. These include measurement of lead concentration in blood, urine, feces and hair, and determination of urinary coproporphyrin and delta aminolevulinic acid (ALA), erythrocyte protoporphyrin, hemoglobin, hematocrit and basophilic stippling of red blood cells. In general, blood lead determination, even with its limitations, is accepted as the most valid and reliable indicator of recent excessive lead absorption. Although indexes such as urinary ALA and coproporphyrin are nonspecific, they reflect the response of the organism and are in fact signs of lead toxicity.[35-37] Urinary lead determination requires a 24-hour specimen, and excretion is influenced by renal function, fluid intake, administration of chelates and other factors. Only blood lead will therefore be discussed here as an index of undue lead absorption.

Blood Lead Values

Problems in Interpretation

Blood lead concentration is the result of several equilibria and should thus be interpreted with caution. A single measurement of elevated blood lead value may not indicate current excessive absorption, and a low value does not necessarily exclude a high bone burden of lead. Serial determinations are needed to determine trends. To assess a given blood lead value, the following factors should be considered: hematocrit; intercurrent infection; coincidental bone disease; current or recent excessive absorption of lead; the interval since excessive absorption ceased; and current or recent administration of chelating agents.[14,38] There is also evidence that blood lead values may fluctuate with the season.[22] Finally, different laboratories may use different methods of blood lead determination, and some vary considerably in accuracy.[39]

In the review that follows, blood lead values are given as reported by the investigators, so that some appear in micrograms per 100 ml and others in micrograms per 100 g or micrograms per cent. Values reported in milligrams are converted to micrograms. Blood lead values expressed as micrograms per 100 g will be numerically somewhat smaller than those expressed as micrograms per 100 ml. However, the difference is so small as to have little consequence in relation to natural and analytical variations.

An Erroneous Concept regarding "Normal" Levels

The upper limit of "normal" blood lead has been variously set at 80, 60, 40, 36 and 20 μg per 100 ml of whole blood.[19,22,40-43] Many papers that attempt to define a normal level seem to imply that values not diagnostic of lead poisoning are normal. In fact, most papers equate the lowest blood lead level diagnostic of lead poisoning with the upper limit of normal. A level not associated with overt clinical evidence of toxicity is not necessarily normal; however, most children with increased and therefore "abnormal" blood lead levels are reported as "asymptomatic."[22,41,43] But symptoms from low-level lead intake may have been overlooked because no one knows what to look for, and children are considered asymptomatic when classic symptoms and signs of lead poisoning are absent.

In industrial medicine, it has been widely accepted that the blood lead level below which lead poisoning does not occur is 80 μg per 100 g of blood.[39,44] In 1968, however, an international conference in Amsterdam did conclude that a blood lead level of 70 μg per 100 ml is the upper limit for acceptable lead absorption.[45] Among children, the blood lead level below which overt symptoms of poisoning are seldom encountered is 60 μg per 100 g.[14,24] In the pediatric literature, this level was therefore arbitrarily equated with the upper limit of normal for many years.

Studies in Children

In the past 15 years a number of reports have indicated that 60 μg as the upper limit of normal is too high, although this level is still used by some screening programs as the cut-off point.[15,43]

In 1956 Bradley et al. reported the blood lead levels of 333 children seven to 60 months old living in a congested low-income area in Baltimore.[46] Forty-four per cent of the children had values in excess of 50 μg per cent, a level at which a definite increase in other findings compatible with lead poisoning was observed. Bradley thus suggested that 50 μg per cent be considered the upper limit of normal. He also pointed out that although a number of children with values greater than 50 μg per cent were asymptomatic, while the study was in progress, eight children previously asymptomatic, with blood lead levels of 50 to 80 μg per cent, were admitted to the hospital with lead encephalopathy.

Two years later, Robinson et al. presented a study of blood lead levels of infants and children from the Jefferson Medical College Hospital in Philadelphia.[47] The median blood lead values of infants five hours to six months of age was 15 μg per 100 ml (range of 5 to 31 μg per 100 ml), and that of children six months to 13 years was 27 μg per 100 ml (range of 3 to 54 μg per 100 ml). Since the Jefferson Hospital serves a high-risk neighborhood, it is possible that the higher values were from children who had excessive lead intake even though they gave a negative history.

Despite these two reports, the Statement on Diagnosis and Treatment of Lead Poisoning in Childhood of the American Academy of Pediatrics, issued in 1961, recommended that "two successive determinations of 0.06 mg. per 100 ml. (60 μg.) of whole blood or higher should be obtained for definitely positive findings" in the laboratory diagnosis of lead poisoning.[10]

In 1964 Moncrieff et al. reported that among 80 children who were not mentally retarded and gave no history of pica, all except two had blood lead levels of 36 μg per 100 ml or less. Among 122 children who either were mentally retarded or had severe behavior disorders, 45 per cent had blood lead values greater than 36 μg. Of 40 children with a presumptive but unconfirmed diagnosis of "encephalitis," 30 per cent had values greater than 36 μg. Moncrieff suggested that 36 μg per 100 ml be considered the upper limit of normal. He also discussed the possibility that undue absorption of lead is responsible for mental retardation of "unknown" etiology in some children.[48]

Moncrieff's study prompted Woods et al. to investigate the blood lead level of 30 children who either were said to "put everything in their mouths" or had a history of early normal development followed by mental deterioration. Twelve of these children had blood lead levels of over 40 μg per 100 ml. Five children with cerebral palsy who were never able to put anything in their mouths and had been hospitalized for some years had an average blood lead level of 13 μg per 100 ml, with a range of 5 to 21 μg per 100 ml.[49]

In 1965 Chisolm reviewed the literature and suggested that the limit of "normal" blood lead concentration that had been widely accepted until then should be revised downward to 40 μg per 100 g.[14]

But new standards are seldom readily accepted, and in 1966, Jacobziner stated that 60 μg was used as the upper limit of normal in New York City but admitted that there were "a number of patients with lower concentrations, 0.05 mg. per 100 ml. (50 μg.) or lower, who have severe clinical plumbism."[11]

Further data on lead levels were supplied in 1967 by Gibson et al., who reported their study of 20 mentally retarded children with organic brain damage from known causes. Some were severely immobilized and under close supervision. The mean blood lead concentration of these children was 16.4 μg per 100 g; none had values greater than 40 μg per 100 g, in contrast to a mean blood lead value of 29.6 μg per 100 g among 20 children of normal intelligence, three of whom had values greater than 40 μg and a history of pica. Among 20 children who had mental retardation of unknown causes, the mean blood lead concentration was 32.4 μg per 100 g. Six had values greater than 40 μg and were found to have pica. The authors noted that eight of the nine children with pica and blood lead values higher than 40 μg per 100 g lived in old houses.[50]

In 1969 Blanksma et al. reported the mean blood lead level of 746 Chicago children 10 to 14 years of age—children theoretically past the age at risk for childhood lead poisoning — to be 23.5 μg per 100 ml.[51] Recently, Millar and his co-workers reported that the mean blood lead concentration of 30 children with IQ's of over 70 was 12.3 μg per 100 ml and that of 27 children with IQ's of less than 70 was 14.6 μg per 100 ml.[52]

The studies cited above are largely based on investigation of urban children. An unpublished report by Blodgett et al. entitled "An Inquiry into Certain Aspects of Lead Absorption in Children as a Community Problem," indicates that urban children have higher blood lead levels than rural children. In this study, the mean blood lead values of 19 rural children was 12.5 μg per cent (range of 6 to 24 μg per cent) whereas that of 30 urban children was 25.1 μg per cent (range of 6 to 52 μg per cent). Only two of the rural children but 19 of the urban children had values over 20 μg per cent. This difference in the blood lead levels of urban and rural children is in agreement with findings in adults.[51,52] Scanlon recently reported the lead concentration in the cord blood of urban infants to be 22.1 and that of surburban infants to be 18.3 μg per 100 ml, a difference considered not statistically significant.[53]

Since studies of "normal" blood lead values in children generally use urban children from low-income areas among whom the possibility of undue lead absorption cannot be excluded with certainty, it may be pertinent to review briefly some studies in adults of different occupations and from different geographic areas.

Studies in Adults

In 1947, Kehoe reported that the mean blood lead level was 23 μg per 100 g in a group of Mexican Indians and 27 μg per 100 g in a group of American students.[31]

Blood lead values of adults with and without undue occupational exposure reported by the United States Public Health Service are shown in Table 1.[32]

Table 1. Blood Lead Levels of Selected Populations.*

Type of Population	Mean Blood Lead (μG/100 G)	
	Males	Females
Population without known occupational exposures:		
Remote California mountain residents	12	9
Composite rural U.S.	16	10
Suburban Philadelphia	13	13
Composite urban U.S.	21	16
Los Angeles aircraft workers	19	17
Pasadena city employees	19	12
Downtown Philadelphia	24	18
Population with known occupational exposures:		
Cincinnati policemen (all)	25	
Cincinnati traffic policemen	30	
Cincinnati automobile test-lane inspectors	31	
Los Angeles traffic policemen	21	
Cincinnati garage workers	31	
Boston Sumner-Tunnel employees	30	

*U.S. Department of Health, Education, and Welfare, Public Health Service, Survey of Lead in the Atmosphere of Three Urban Communities, Publication No. 999-AP-12, Jan. 1965.

Kubota et al. recently reported that the mean blood lead concentration of 243 persons from 19 locations in 16 states in the United States was 13.17 μg per 100 ml. The mean values ranged from 7.25 μg to 20.34 μg per 100 ml.[34]

Goldwater and Hoover analyzed 801 blood specimens from residents of 15 foreign countries, and California, New York and Ohio, and found the mean lead concentration to be 17 μg per 100 ml, with a standard deviation of 11.[35] In the United States the mean blood lead values were 17 μg per 100 ml for residents of California, 21 μg for residents of New York City, and 16 μg for residents of Ohio. Blood lead levels of urban subjects were slightly higher than those of the rural subjects.

Thomas et al. reported that the mean blood lead levels of 15 men and 35 women living near the freeway in Los Angeles County were 22.7 μg and 16.7 μg per 100 ml respectively. That of 20 men and 30 women not living near the freeway were 16 μg and 9.9 μg per 100 ml respectively.[36]

"Normal" Levels

In the review above, blood lead levels reported in children are somewhat higher than those reported in adults, with few exceptions. This apparent difference is not surprising since most studies of children use residents of old urban neighborhoods as subjects. Pica is reported in 30 to 50 per cent of young children.[36,37] Today, lead-based paint is still found in 40 to 80 per cent of old houses in many areas,[38] and a single paint chip the size of a thumbnail could easily contain over 50 mg of lead. Investigation of these children to determine "normal" blood lead levels is therefore likely to yield values higher than those reported in adults. The studies of Woods and Gibson,[40,41] though done on a small scale, suggest that children who are physically restricted have essentially the same blood lead levels as adults.

In general, it may be stated that the mean blood lead level of the urban population without undue intake, expressed in micrograms per 100 ml, is between the teens and lower twenties, the upper limit of normal should be no higher than 40 μg per 100 ml and may actually be lower.[40,42]

Prevalence of Undue Absorption of Lead among High-Risk Children

With the arbitrary use of a single finding of a blood lead level of 40 μg or more per 100 ml as evidence of undue absorption, a brief review of the prevalence of this problem among children in old neighborhoods follows. This review is based on data from screening programs in various cities provided to me.

In Baltimore, blood lead levels of 40 or more μg per 100 g were found in 25.3 per cent of the children tested in 1968, in 27.9 per cent of the children in 1969 and in 31.5 per cent in 1970 (Table 2). Greater selectivity in screening during 1969-1970 largely accounts for the increase in this period.

Table 2. Blood Lead Determinations Performed by the Bureau of Laboratories, Baltimore City Branch, State of Maryland, Department of Health, 1968-1970*

Blood Lead Concentration (μG/100G)	1968		1969		1970	
	No. of Children	% of Total	No. of Children	% of Total	No. of Children	% of Total
0-39	497	74.7	538	72.1	643	68.5
40-49	131	19.7	154	20.7	159	16.9
50-59					68	7.3
60-79	23	3.5	33	4.4	56	6.0
80 & above	14	2.1	21	2.8	13	1.4
Totals	665	100.0	746	100.0	939	100.0

*Data of Dr. Emanuel Kaplan, Bureau of Laboratories, Baltimore City Branch, Maryland State Department of Health.

In Chicago, of 120,000 children under six years of age who were screened between 1967 and 1970, about 4 per cent had values of 50 μg or more per

100 ml, and 16 per cent had values between 40 and 49 μg per 100 ml.*

In New Haven, Connecticut, among 1897 children screened with blood lead determination in 1969 and 1970, 565, or 29.8 per cent, had values of 40 or more μg per 100 ml. Of these, 180, or 9.5 per cent, had levels of 60 μg per 100 ml.†

In Newark, New Jersey, blood lead determinations were done on 594 children in the summer of 1070 by the Department of Public Health and Preventive Medicine, New Jersey College of Medicine and Dentistry. Blood lead values of 40 to 59 μg per cent were found in 31.5 per cent, and values of 60 or more μg per cent in 7.4 per cent.‡

In New York City, of 2648 children from high-risk areas tested in 1969, 45.5 per cent had blood lead values of 40 μg or more per 100 ml, and 12.5 per cent had values of 60 μg or more. These children constitute about 40 per cent of all children tested in that year and are considered to be a fair representation of the entire population screened. In 1970, of 84,493 blood lead specimens analyzed (which represent 97 per cent of the total number of specimens tested for the year), 28.7 per cent showed values of 40 μg or more per 100 ml, 5.9 per cent 60 μg or more, and 2.7 per cent 70 μg or more. The apparent drop in the percentage of children with elevated blood lead levels is probably a reflection of the change from selective screening in 1969 to mass screening in 1970.§

In Philadelphia, 3496 blood lead determinations in children were done in 1970. Some children had multiple blood lead determinations, and the number of children tested is estimated to have been less than 3000. Blood lead values of 40 to 59 μg per 100 ml were found in 666 children and values of 60 μg or more in 524 children.¶

In Washington, D.C., 808 children were tested in a one-week pilot screening program in June, 1970. Of these, 476 were five years of age or younger. Forty-seven children were found to have blood lead levels of 40 or more μg per 100 ml; 44 of them were in the group from one to five years of age. Between October 5, 1970, and March 26, 1971, 1158 two-year-old children were screened at well-child clinics of the city; 255, or 22.0 per cent, had blood lead values of 40 or more μg per 100 ml, 139, or 12.0 per cent, values of 50 or more μg, and 25, or 2.2 per cent, values of 80 or more μg. Separately, of 193 children one to six years old who were found to have pica on screening in neighborhood health centers, 14.0 per cent had blood lead values of 40 or more μg per 100 ml, 7.3 per cent levels of 50 or more μg, and 1.6 per cent levels of 80 or more μg.‖ The wider age range of the children with pica probably accounts for the lower rate of elevated blood lead values as compared to the two-year-olds, among whom the peak prevalence of lead poisoning occurs.

The above figures clearly indicate that the problem of undue absorption of lead is enormous among young children living in old neighborhoods. It should be noted, however, that these figures are probably not accurate representations of the actual prevalence of this problem in high-risk areas. These data represent findings of the initial screening tests; repeat blood lead levels of these children are not available. A slightly elevated blood lead level in a six-year-old child who no longer lives in a home with lead paint and who is not exposed otherwise may merely indicate that he had undue absorption of lead in the past. A repeat test some time later will probably show a gradual decrease. The meaning of an elevated blood lead level in such a child is therefore quite different from that of a two-year-old with pica who lives in an old house with peeling lead paint. Furthermore, in cities that do not have large-scale screening programs, testing is more likely to be done on a preselected population — i.e., children with a history or clinical evidence of lead poisoning or undue lead absorption. But even in Chicago and New York City, with their mass screening, 20 per cent or more of the children one to six years old had blood lead values of 40 or more μg per 100 ml. Thus, one must still conclude that in magnitude the problem of undue absorption of lead among children living in old neighborhoods is matched by few, if any, other pediatric public health problems.

Importance of Undue Absorption of Lead

Undue absorption of lead unassociated with overt evidence of toxicity should be viewed as an entity that is separate from but closely related to lead poisoning, which it almost invariably precedes by some time in children. An exception is acute intoxication resulting from inhalation of lead fumes produced by burning lead-impregnated materials such as battery casings.[7,8] Lead poisoning resulting from culinary use of lead-glazed earthenware also tends to have a shorter course than that due to lead paint when exposure is heavy and on a regular basis.[10]

The importance of recognizing the early stage of undue lead absorption among children has at least three aspects: it is vital for the prevention of lead poisoning; there is the possibility of deleterious effects even in the absence of overt clinical evidence of toxicity; and young children may be especially vulnerable to the toxic effects of lead.

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A Crucial Step in Prevention

Three to six months of fairly steady ingestion of lead generally precedes the development of clinical manifestation of lead poisoning in children.[5,36] Detection at this early stage and prompt termination of such ingestion will therefore prevent almost all cases of lead-paint poisoning. The concept that blood lead levels not high enough to be diagnostic of lead poisoning or considered toxic are normal and therefore harmless is grossly erroneous and has been immensely costly, for it has been an important deterrent to the successful prevention of lead poisoning in children. Waiting for children's blood lead levels to reach a toxic level before steps are taken to terminate exposure has unnecessarily perpetuated this disease.

Data collected by Sachs in the Chicago Lead Poisoning Clinic in the past four years indicate that, of children found to have blood lead levels of 40 to 49 μg per 100 ml, approximately 75 per cent were known to be exposed to peeling paint and broken plaster in their homes, and 25 per cent gave a definite history of ingestion of such materials. Among children treated for lead poisoning at the clinic in 1969-1970, approximately one out of six had a screening blood lead level of only 40 to 49 μg per 100 ml, with follow-up values ranging from 50 to over 200 μg.* Over 40 per cent of these treated children showed a rise in blood lead levels from the initial values of 40 to 49 μg per 100 ml to 60 or more μg at the first subsequent evaluation. These data indicate that, if left alone, a substantial number of children with initial screening blood lead levels of 40 to 49 μg per 100 ml will eventually have lead poisoning — some within one to two months.

Metabolic Disturbance at Low Level of Absorption

Heavy absorption of lead is known to be toxic and even lethal. But is absorption at a low level harmless? In a review of toxic effects of lead, Hardy stated, "Because all recognized effects of lead in the body are harmful and the individual responses varied, it is a considerable leap to conclude that there is a threshold below which lead damage does not occur. The threshold may be useful in predicting a point below which certain clinical symptoms do not appear, but there is no guarantee that damage does not occur below this level."[60] Beyond such logical reasoning, there is also in vitro evidence that lead interferes with the enzyme system in man at blood levels generally considered normal and safe.

Lead inhibits enzymes that are dependent on the presence of free sulfhydryl groups for their activity, and is particularly noted for its inhibitory action on enzymes involved in heme synthesis.[61] The delta amino-levulinic acid dehydrase (ALA-D), which is responsible for the formation of porphobilinogen from ALA and is widely distributed in tissues, has been the subject of some recent investigations.

Various authors have reported in the past on the inhibitory effect of lead and other heavy metals on erythrocyte ALA-D.[62,63] More recently, a close negative correlation between blood lead concentration and activity of erythrocyte ALA-D was reported by several investigators.[35,50,66,67] A decrease in erythrocyte ALA-D was demonstrable even at blood lead levels considered to be in the range of "normal" (5 to 40 μg per 100 ml), and there appears to be no threshold for the inhibitory effect of lead on ALA-D. These in vitro findings contrast with reports by others that the first measurable increase in urinary ALA is observed only after blood lead rises above approximately 30 to 40 μg per 100 ml, and that the relation between blood lead and urinary ALA values is best described by a curvilinear regression line.[63,68] This apparent inconsistency between the effect of lead on ALA-D activity demonstrated in vitro and the accumulation of the enzyme substrate in the body might be explained by the presence of an enzyme reserve.[68]

So far, in man, studies of the inhibitory effect of lead on ALA-D have been confined to erythrocytes of peripheral blood. In lead-poisoned laboratory animals, this effect has been demonstrated in the brain, liver, kidneys and bone marrow. A correlation between the reduction of ALA-D activity in the blood and in the brain tissues of lead-poisoned animals was also reported by Millar et al., who suggested that children with slightly elevated blood lead levels may have some decrease in brain enzyme activity.[50] This rekindled an unanswered question previously raised by others: Does slight but sustained elevation of blood lead level cause subtle though appreciable impairment of brain functions such as mild retardation and learning defects in young children?

Whether the metabolic disturbances demonstrated in vitro at a low blood lead level are harmful to man remains uncertain. But preliminary analysis of data collected in a study of trace-element pollution of air in 77 midwestern cities indicated a positive relation between the lead dustfall in residential areas and cardiovascular mortality.[69] In laboratory animals given subclinical doses of lead, increased susceptibility to infection has been reported.[39,70]

Possible Damage without Clinical Manifestations

The diagnostic criteria for lead poisoning differ from institution to institution. Some consider clinical manifestations of toxicity a sine qua non in diagnosis; others regard an elevated blood lead level or other biochemical evidence of toxicity (or both) as sufficient. The Surgeon General's Statement recommends that a blood lead level of 80 μg per 100 ml be considered unequivocal evidence of lead poisoning, regardless of the presence or absence of other laboratory findings or clinical manifestation,

*Henrietta K. Sachs, M.D., personal communication, 1970.

and that levels of 50 to 79 μg per 100 ml be considered suggestive of possible poisoning.[1] A crucial question that cannot be answered with certainty and has been responsible for the confusion in diagnosis of lead poisoning is whether lead causes any permanent damage in man in the absence of clinical evidence of toxicity. A closely related question, also unanswered, is whether lead can damage the central nervous system of young children in the absence of overt signs and symptoms referable to that system.

In considering these problems, one must first realize that clinical manifestations of lead poisoning in children, such as anorexia, irritability, drowsiness, apathy, abdominal pains and developmental regressions or delay, are nonspecific and difficult to interpret. Perceptiveness and sound judgment of the parents and physician therefore have a vital role in determining whether a child is labeled "symptomatic" or "asymptomatic." Another consideration is that damage caused by lead may not be immediately apparent. Reports from Australia of a high incidence of chronic nephritis, gouty arthritis, mental impairment and hypertension among patients who had lead poisoning in childhood 10 to 40 years previously indicate that some insults caused by lead do not become evident until many years later.[71,72] Work done by Tepper in the United States has failed to duplicate the Australian reports, however, and there is evidence that nephropathy may be a sequela limited to very protracted lead poisoning in childhood.[14,73]

Several follow-up studies have indicated that, among children who had had either asymptomatic lead poisoning or mild poisoning without evidence of central-nervous-system involvement, many later showed deficits in visuomotor functions and behavior typical of children with "minimal brain dysfunction." Restlessness, short attention span, easy distractibility, impulsiveness and other behavior problems were common. Thus, despite adequate intelligence, most of these children did not do well in school. In these relatively small series of patients, no relation was found between the presence or absence of central-nervous-system involvement initially and eventual intellectual development or psychologic defects.[4,8,9,14]

In a larger series, Perlstein et al. reported that, among 425 children who had had lead poisoning, 39 per cent gave some evidence of neurologic sequelae at follow-up examination.[14] Among 59 children in this group who had had encephalopathic symptoms, 82 per cent were left with handicaps. Pertinent to the question of the toxic effect of lead in the absence of clinical symptoms is the finding that of 58 children treated for asymptomatic lead poisoning, five, or 9 per cent, were observed at follow-up study to be mentally retarded. Admittedly, this is a retrospective study, and one cannot be certain that mental retardation did not antedate lead poisoning in some of these children. In the same study, among 232 children with lead poisoning who initially had gastrointestinal symptoms and who had no evidence of encephalopathy, 19 per cent were later found to be mentally retarded, and 13 per cent to have convulsive disorders. Again, it should be noted that vomiting, often considered a gastrointestinal symptom, may be a sign of increased intracranial pressure.[18]

The above findings, though far from conclusive, suggest that lead may seriously damage the nervous system in children who are "asymptomatic" or have no apparent symptoms or signs referable to that system.

That slow deterioration may occur in a chronic disease such as lead poisoning is suggested by the recent experience of Sachs et al. with "asymptomatic" patients whose parents reported improvement in their behavior and language ability after chelation therapy.[23] This interesting observation, made in an uncontrolled group of patients, is difficult to interpret, but one wonders how many children labeled as "asymptomatic" today are in fact so.

Many others have reported on the bizarre manifestation of central-nervous-system involvement in lead poisoning among young children. Early signs such as withdrawal, frequent crying for no apparent reason, temper tantrums, fearfulness, loss of affection, listlessness, refusal to play, inattention and developmental regression generally precede the onset of the more classic manifestations of encephalopathy. Unfortunately, these early clues are usually recognized only in retrospect. Many children are considered to have behavior problems before the diagnosis of lead poisoning is entertained.[23,46,75-77] It is altogether possible that many who do not progress to the stage of frank encephalopathy are never diagnosed and never treated, and eventually appear in schools with learning disabilities, hyperkinetic syndrome and other behavior problems.

What can happen when children who have had lead poisoning are re-exposed is indicated by data collected by Chisolm and Harris. They found a highly significant correlation between the occurrence of severe neurologic sequelae and re-exposure to lead after recovery from mild encephalopathy. Among survivors of acute lead encephalopathy who continue to be exposed and ingest lead, severe permanent neurologic damage occurred in virtually 100 per cent.[8]

Vulnerability of Young Children to Lead

There appears to be some variation in individual reactions to the toxic effects of lead.[69] Some children with blood lead levels well beyond 100 μg per 100 ml appear "well" and "asymptomatic," whereas others present evidence of neurologic involvement at a considerably lower blood lead level.[61] Other than the seasonal factor, much remains unknown concerning the circumstances that determine

the onset of lead encephalopathy and the toxicity of lead in general in young children.

There has been considerable speculation that young children may be unusually vulnerable to the toxic effects of lead.[60,75,79] In fetal rats, lead is reported to act as a teratogen leading to developmental anomalies of the tail and sacrum.[80] Speculation and animal experimentation aside, lead poisoning in children is clinically somewhat different from that in adults. Evidence of toxicity becomes clinically apparent at a lower blood lead level. Among adults, lead poisoning is stated to occur only when the blood lead level exceeds 80 μg per 100 ml.[20,44] But in children, poisoning has been reported repeatedly at blood lead levels below 60 and even 50 μg per 100 ml.[15,41] Sudden onset of encephalopathy without previous symptoms is not infrequent in children 15 to 30 months old, less frequent in older children, and unusual in adults. On the other hand, the Burtonian blue line and peripheral nerve palsies that are characteristic of adult plumbism are rarely encountered in children. Severe colic, with board-like rigidity of the abdomen, typical of lead poisoning in adults, is seldom seen in children, who tend to have vague and less acute abdominal pains.[9,20,81] These findings are reminiscent of the statement made by Bell in 1924 that "Lead is not only much more toxic to the young and pre-adolescent than to the adults and old throughout the vertebrate kingdom, but also the effects produced by the metal are general in the young and local in the adult."[82] In the 4½ decades since that statement, little progress has been made in the understanding of the toxic effects of lead in humans, particularly in young children.

Research is urgently needed to clarify the many questions that have been raised. What is a "safe" level of lead exposure and absorption? Does a slight but sustained increased body burden of lead permanently damage human beings even in the absence of overt clinical evidence of toxicity? Are young children more vulnerable than adults to the toxic effects of lead? Do genetic disorders such as sickle-cell anemia and glucose-6-phosphate dehydrogenase deficiency, both of which are common in the population at risk, affect lead metabolism and toxicity? There are many others.

In summary, undue absorption of lead is a health problem of alarming proportions among young children living in old dilapidated neighborhoods. Its magnitude is many times that of lead poisoning, an illness already labeled as "epidemic" in many areas.[83] At present, it remains uncertain whether or not lead causes permanent damage in humans at a low level of absorption and in the absence of clinical symptoms. But there is in vitro evidence of metabolic disturbance at such low levels, and some reports suggest that permanent neurologic damage can occur in the absence of overt clinical symptoms. One certainty is that if exposure is not terminated in children with early evidence of undue absorption of lead, many will become poisoned. Detection and termination of the exposure at this stage is therefore an essential step in the prevention of childhood lead poisoning.

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Senator HART. Dr. Laur, do you have a prepared statement?

Dr. LAUR. No; I do not, Mr. Chairman.

Senator HART. I want to say that I have very little understanding of the health implications of such exposure as you have discussed today, so I will defer the questioning to the staff who has a little better understanding of it.

Mr. Bickwit.

Mr. BICKWIT. Thank you, Mr. Chairman.

In your statement, you say one-twentieth of a gram of dirt could be picked up by children on their hands and ingested, and if that one-twentieth of a gram contained as much lead as we are now finding in city dirt, the child would reach the maximum daily permissible intake. Is it possible for a child with pica to ingest more than one-twentieth of a gram, say one-fourth of a gram, which I understand is about one-eighth of a teaspoon?

Dr. LIN-FU. It is very possible. Children with pica have been stated to eat dirt by the handfuls.

Mr. BICKWIT. How about a normal child not eating dirt by the handfuls. Might he consume the eighth of a teaspoon we are talking about, one-fourth of a gram?

Dr. LIN-FU. This would depend on the hygienic habit of the child. Children who are careful in observing sanitary practice may not, but children who are careless, who do not wash their hands before meals, could ingest that amount.

Mr. BICKWIT. Would it be unusual to consume that much?

Dr. LIN-FU. I should think not.

Senator HART. Did you say "No, you think not"?

Dr. LIN-FU. No. That is, I refer to the kids who are careless about washing hands, sucking thumbs, all of that.

Mr. BICKWIT. As you say, sucking thumbs is not an unusual situation.

Dr. LIN-FU. Within a certain age group.

Mr. BICKWIT. That one-fourth of a gram, one-eighth of a teaspoon, appears to the staff to be quite important. EPA has gathered a good deal of data recently on how much lead is currently found in urban dust. For example, the New York City samples run from 2,400 micrograms to 5,400 micrograms of lead per gram of dirt. Seventy-seven midwestern cities averaged 1,636 parts per million in residential areas. Four southeastern cities ranged from 600 up to 2,000 parts per million. As you say, in MacArthur Park in Los Angeles, 3,357 parts per million was found. Under the proposed EPA regulations to reduce lead in gasoline, a two-third reduction of lead in fuel is to take place by 1977. If the two-third reduction of lead in fuel results in a two-third reduction in soil levels, the staff has calculated in those 77 midwestern cities, one-fourth of a gram of dirt would still give the child more than the maximum permissible daily dose.

In New York City, Salt Lake City, MacArthur Park in Los Angeles and in some areas of the southeast, considerably less dirt would give him that dose. In light of this, would you think that the EPA regulations as now drafted would still leave children with a substantial risk of lead poisoning from dirt?

Dr. LIN-FU. I wonder if Dr. Laur would care to comment on that.

Dr. LAUR. With the chairman's permission. I think the fundamental point we would make from the health agencies is that so far as we know, there is no useful human purpose of lead in the body. And therefore any amount in a sense is undue.

Now the critical question is whether the presence of lead in the soil and the ingestion of that soil in normally expected amounts by children constitutes a sufficiently severe hazard for the promulgation of the proposed regulations.

I don't believe we are in a position to determine that. It would seem to me that the setting of the level for lead in gasoline must take into consideration not only this potential health hazard (and I repeat, any lead seems to us to be something to be avoided). But also whether the proposed level can be accomplished practically. And the determination of that I believe is beyond the competence of HEW to comment on.

That has to do with the economics of the industry, the practicality of removing the lead. It also has to do with the frequency with which children do ingest dirt. One or two times is not going to represent a hazard. Daily ingestion of that amount of contaminated soil clearly does bring a child beyond what we believe is a safe limit.

Mr. BICKWIT. Recognizing that the evaluation of the practicality of removing lead from gasoline is in the Environmental Protection Agency under existing law, would you evaluate the amount of lead which we would assume would remain in dirt, assuming a two-third reduction, as posing a significant hazard?

Dr. LAUR. If you are addressing the question to me, I would prefer you address it to Dr. Lin-Fu.

Mr. BICKWIT. We address it to either of you.

Dr. LAUR. I am not scientifically competent to comment on that. To revert to our earlier position, however, if there is still lead remaining in the soil, which children can ingest, it still falls in that realm of a material we wish they would not ingest, we see no useful purpose in it.

Therefore, a two-third reduction is better than no reduction. But it may still not be a practical reduction.

Mr. BICKWIT. Our concern is in evaluating whether a two-third reduction is sufficient. And to help us evaluate that, we would like to ask either of you whether if we did reduce the lead content of dirt by two-thirds, we would be left with an amount that constitutes a substantial hazard. Maybe substantial hazard makes that question difficult to answer. Let me rephrase it by saying if we achieved the two-third reduction in soil, would we be running the risk of going over the maximum permissible daily intake which you have calculated is allowable?

Dr. LIN-FU. Based on your calculation, it appears that it does exceed the daily permissable intake in children of 300 microgram, taking into consideration the daily diet. But of course we cannot equate the availability of a substance with ingestion of that substance.

As I mentioned earlier, the habits of children are different, and differ from one to the other. Making dirt with high lead content available doesn't mean all children will eat it, but the risk is there that some might eat it.

Mr. BICKWIT. You did say it would not be unusual for even a normal child, one without pica, to ingest as much as one-eighth of a teaspoon per day.

Dr. LIN-FU. This would not be unusual if he is careless about washing hands before eating, or eating food dropped on the floor. This is especially true in children who suck their thumbs.

Mr. BICKWIT. We calculate that if he does ingest that much daily, over a lengthy period of time, he will exceed the maximum permissible daily dose. So it seems what we have arrived at is it would not be unusual for a child consuming the amount of dirt that we have talked about to exceed the maximum permissible daily dose. Some other data have recently come to our attention which appear to bear on this. EPA just recently measured dust fall in Cincinnati, where the ambient level for lead was about 1.5 micrograms of lead per cubic meter of the air. This is below the level which is the 1977 goal of the EPA regulations. Yet dust fall levels were nearly 3,000 micrograms of lead per gram of soil, a level at which you say one-twentieth of a gram of dirt would be worrisome if ingested.

What is your reaction to this data?

Dr. LIN-FU. First, I would want to qualify my statement by saying that my area of expertise is in childhood lead poisoning, not in air pollution problems. I am aware of this study and I note that there is considerable variation in the lead content of the dustfall from period to period. So I think in evaluating such data we have to take into consideration factors such as windpatterns, and other meteorological factors that come into play in determining the amount of fallout.

But I think the finding you cited is significant, and warrants further study to confirm or validate the findings that at an ambient air level of less than 2 micrograms of lead per cubic meter of air one can get such a high lead content in dirt or dust.

Mr. BICKWIT. Do we, in your opinion, have enough data to conclude that dangerous levels of lead might still be present in dirt with an ambient level near that which is the goal of the regulations?

Dr. LAUR. This is one I don't believe I can comment on. I would say that from the point of view of our agency, if scientist such as Dr. Lin-Fu felt that an additional data were yet needed, that would cause us to say we can't conclude that that level is too high.

Mr. BICKWIT. Well, certainly we would like additional data to see what ambient levels would be associated with what levels of lead in dirt. However, have we any reason to believe that if we reduce the content of the atmosphere by two-thirds that we would not have a similar reduction in the lead content of the dirt associated with that ambient level?

Dr. LAUR. It may be that neither of us is qualified to comment on that, which is essentially an air pollution question.

Mr. BICKWIT. In the absence of any data showing precisely what the correlation is between the ambient level of lead in air and dirt, would it be logical to assume that there is a linear relationship? In other words, as you reduce the lead content of air, you would reduce the lead content of dirt accordingly?

Dr. LIN-FU. I hate to answer this, because I am not an expert on air pollution. One would assume that with a decrease in lead concentration in the ambient air, there would be a concomitant decrease in the lead fallout in dust.

Mr. BICKWIT. In testimony before the subcommittee, Dr. Bridbord of the EPA did assume that for the record. Granted, we may not know that to be a fact, but in the absence of any data to the contrary it seems the only safe conclusion would be what Dr. Lin-Fu says, there would be a reduction of lead in dirt approximately, resembling the reduction in air.

If that is true, then if we reduce the lead content of air by two-thirds, we will be reducing the lead content of dirt by two-thirds, and we will have the kinds of levels of lead in dirt which you say would not be unusual to find exceeding the maximum daily permissible dose with regard to children of normal habits.

In light of that, do you feel comfortable with these regulations from a health standpoint, given that we are not asking you to evaluate the benefit side of the equation and are not asking you how practical it would be to get the lead out so we would not run that risk? Do you feel comfortable with the risk that you say we are running with the regulations as now proposed, given the assumptions we are making?

Dr. LAUR. I don't believe "comfortableness" is the appropriate criteria to be applied here.

Mr. BICKWIT. Can you give us another?

Dr. LAUR. Well, I attempted to, but I understand that my reply is vague. From a health point of view, any lead, so far as we know, does not represent a useful ingredient and, therefore, since we know in excessive amounts it is harmful, the safe conservative position would be as little lead to be absorbed as possible. But one's comfortableness with the regulations I think has to do with all of the other burdens we will have to bear as citizens in one way or another if we attempt to achieve zero lead fallout in the air or some minute lead fallout.

I don't know what those extra requirements would be on society to achieve that level. And that is why I find it impossible to comment on the comfortableness.

From the point of view of a health hazard, I believe Dr. Lin-Fu's testimony makes it clear that our concern is with the total accumulation which may become available for children and any addition to that does raise the possible level.

I believe further we have to say the available evidence does not cause us to be exclusively concerned about the hazard presented by airborne or ambient lead. It is a contributing source, and we simply don't know the extent to which it is a serious source and the extent to which that source is one that is either respirated by children or ingested through dirt as a significant source.

I do appreciate that that is a long winded waffle, but I think we lack data to come to any other conclusion than that.

Mr. BICKWIT. Obviously, all are hazards we would like to avoid. Just as obviously, significant hazards bother us a whole lot more than insignificant ones. What we are asking you is whether this would be regarded as a significant hazard.

Dr. LAUR. I think given our existing data, it is not a significant hazard. The question is do we know enough to be sure we can treat it as insignificant.

Mr. BICKWIT. Why is it not a significant hazard? Assuming the validity of our calculations, when a child ingests the amount of lead from dirt that we foresee will be there after these regulations go into effect, he is going to exceed the maximum allowable permissible dose. In other words, he is going to exceed the amount of lead ingestion which has been associated with a 40 microgram per 100 milliliter level in the blood, which we regard, and which the Surgeon General regards, as intolerable. Why doesn't that constitute a substantial risk?

Dr. LAUR. The distinction is again what could theoretically result, given the occurrence of the conditions you specified, and what actually occurs in children. It does require that the lead fallout occur in the concentrations that you described, that it falls out in soil which is available for the child to get hold of, and that the child in fact ingests that soil on a frequent enough basis to raise the maximum daily intake to the levels described.

Mr. BICKWIT. All of which Dr. Lin-Fu said we could expect to happen.

Dr. LAUR. I should let her comment on that factor.

Dr. LIN-FU. My speculation is that children who do not observe washing hands, before handling food, who frequently eat things dropped on the floor or ground could be exposed to such an amount as you cited. Whether they do ingest this amount or not needs to be documented. I think it is a theoretical possibility, and it is difficult for me to say they in fact do so. An exception would be children with pica, some of whom are known to ingest dirt in considerable amount. But the amount of dirt eaten or swallowed by children without pica would be a matter of speculation rather than a known fact.

From my knowledge of children, I think it is all together possible many children would ingest this amount.

Mr. BICKWIT. So your answer is that it is all together possible we would have a substantial risk in the event of normal children. If I understand you correctly, you are also saying with regard to a child with pica, it is a great deal more than all together possible.

In your statement you state that 20 to 40 percent of the children screened in high risk areas have blood lead levels which suggest undue lead absorption, that is, levels which would lead to lead poisoning. Obviously that figure is alarming.

Are you aware of any other disease which is as prevalent as this one?

Dr. LIN-FU. Nutritional anemia is very prevalent among certain age groups. But I am not aware of other conditions as prevalent as this which carries as serious an implication. We know that in children with undue lead absorption, if the process is not terminated in time, many do get lead poisoning, and we know this is a lethal condition, which leaves the survivors with many serious problems.

Mr. BICKWIT. It has come to our attention that some work recently done at University of Nebraska, College of Medicine, revealed

that Negro children with a deficiency in enzyme G 6 PD are more susceptible to lead poisoning. Are you aware of this study and, if so, would you interpret it for us?

Dr. LIN-FU. Yes; I am aware of this study done by Dr. M. McIntyre and Dr. C. Engel of the University of Nebraska, I believe, of children in Omaha. They found that Negro children with G 6 PD deficiency given the same exposure have a higher lead content in the red blood cells and in the whole blood than those without this deficiency. This is the only study I am aware of which seemed to link this hereditary or genetic defect to possible, susceptibility to lead.

I think this problem warrants further research to determine in fact what is the relationship, if any, of this genetic defect which affects a significant percentage of the Negro population as well as certain white population, to the toxicity of lead.

Mr. BICKWIT. In our last hearing we discussed the problem of lead in dirt and lead in paint with Dr. Bridbord of the Environmental Protection Agency. He stated that ingestion of lead in dirt where the two-thirds reduction has taken place will approximate the lead a child might get from ingesting paint containing .06 percent lead, a level which would about double the average daily intake for a child.

Could you tell us whether the .06 percent lead paint standard now required by HEW takes into account the lead a child might be ingesting from lead in dirt?

Dr. LAUR. I don't know the answer to that specifically.

As to the deliberations that produced that standard, and perhaps that is one we should furnish for the record, if we might, as to whether it took into account other sources.

Mr. BICKWIT. We would welcome that. We would ask Dr. LIN-FU, however, whether she has any personal knowledge as to whether the lead ingestion from dirt was considered.

Dr. LIN-FU. I am not aware it was. This is an FDA regulation and I don't think I can answer the question.

(The following information was subsequently received for the record:)

FDA STATEMENT

The limit of 0.06 percent lead in paint and similar coatings intended for use in or about the household effective with shipments in interstate commerce on and after January 1, 1974, was promulgated by the Commissioner of Food and Drugs Pursuant to the Federal Hazardous Substances Act on March 11, 1972.

This limit is in accord with recommendations by the American Academy of Pediatrics that considered the contribution of other environmental sources of lead including that from air, water, and foods. We are informed that to the extent the lead in the soil contributes to the other sources, it was considered by the Academy.

The limit on lead in paints applies to exterior paints for household use in order to prevent exposing the child to lead-base paint flakes which might fall to the ground in the area immediately surrounding the home. The prevalence of pica among very yound children was clearly recognized, as was the possibility that children playing near the home may ingest soil.

Mr. BICKWIT. Would you say that it should be? Again asking either of you, would you say that the amount of lead that a child would ingest from dirt should be taken into account when you promulgate a standard for lead in paint?

Dr. LAUR. I feel much the same way about the food and drugs determination of a standard as I do about EPA, which is many factors must be taken into consideration. It certainly is sensible when assessing a safe level of hazard to children, that all sources of the hazard to which children might be exposed be taken into account. To follow your line of reasoning, on the basis of logic, at least, that seems like a good idea.

Mr. BICKWIT. Well, it is our understanding that it was not and that what in effect was decided was that given the amount that a child would ingest from air, food and water, if we double that daily intake through the consumption of lead in paint, that was what we would tolerate without exceeding the maximum permissible daily dose, and that was the health effects justification for the standards.

Now, if that is right, if our understanding is correct, that lead in dirt was not taken into account when the lead in paint standards was set, and if the inner-city child ingests the amount of lead that we assume would not be unusual, given the various assumptions we have made with regard to the EPA proposed regulations, wouldn't the amount of lead that he consumes put him way over what he is allowed to ingest under the maximum permissible daily dose theory?

Dr. LAUR. If all sources were ingested, without going back through the arithmetic, my first reaction is yes, it would. It should perhaps be pointed out, if only to illustrate the difficulty of setting a standard, that the same effect could occur when many coats of paint, which conformed to this standard, are put on a wall, the accumulation of lead will gradually reach a point which may also be hazardous, even though no other sources were ingested.

Mr. BICKWIT. That is true. But it seems to us that even if we got all of the paint off the walls that is now there—I know how unlikely that is—but even if we did it, the amount of lead that a child would ingest from paint containing .06 percent lead plus the amount of lead he would ingest from dirt containing the kinds of levels we have been talking about, would put him miles over what he is allowed to ingest under the maximum permissible daily dose theory. If that is so, could you react to it?

Dr. LAUR. As to whether it would be "miles over" or not,—my reticence to respond is because, in fact, all of these conditions may not occur in such a way to produce that effect. If they all did occur, your conclusion is absolutely right. That is if the child ingests that lead paint, and all of the other sources are there in that amount.

Mr. BICKWIT. If the child has pica, he is probably going to ingest some paint unless I misunderstand what pica is. If he does, we are not only in the game, in the ballpark where we are saying it would not be unusual for him to get over 300 micrograms per day, which is the maximum amount of what is acceptable, it would be very probable for him to get that amount.

Dr. LAUR. I don't know whether Dr. Lin-Fu cares to comment on the observation I am going to make, but if she would, I would be grateful, which has to do with the fact that frequently in biological phenomena, the logical thing doesn't seem to occur. For example, we have many children living in dilapidated housing, exposed to high concentrations of lead paint chips, which we know is a contributing

cause of lead poisoning in children, and yet those children do not develop lead poisoning.

Mr. BICKWIT. But 20 to 40 percent of the children in the high risk area are developing undue lead absorption.

Dr. LAUR. Look at it the other way, which is 60 to 80 percent are not. And how does one account for that?

Mr. BICKWIT. You are not saying that that is great consolation.

Dr. LAUR. No; not at all. I am saying it becomes very hard to conclude that the effects you are postulating will, in fact, occur in a significant number of children.

Mr. BICKWIT. For that reason, my understanding is that the scientific community concludes that it will occur, then takes a rather significant safety factor to insure that under no circumstances will it occur. And that is the basis of most scientifically justified regulations. Is that not correct?

Dr. LAUR. Yes; I would agree with that in terms of the scientific justification for a regulation or standards.

Mr. BICKWIT. That is all we are asking you about. With regard to existing lead paint, paint on the walls now, do you consider the funds spent and proposed to be spent under the Lead Paint Poison Prevention Act adequate to meet the problem of lead paint now on the walls?

Dr. LAUR. No; the answer to that is they are not. But nor are they intended to do that job. The estimates we have of what would be required to remove hazardous paint from dwelling units range upward into the billions of dollars. The current expenditure of $6½ million by our agency in lead poisoning control and our 1973 proposal of $9½ million obviously falls way short of that. We do feel those amounts represent what we can spend well, that is, learning how to intervene in this problem in a practical, sensible way, to find the children who are at risk and to protect them by doing something, at least, within the constraints of HEW—by that I mean the resources available in our authorities—about housing units where children who have been diagnosed as having lead poisoning dwell. We wish to clean up those environments at the bare minimum. But if your question is will the $9½ million delead a significant number of homes in which children are exposed; no, it will not.

Mr. BICKWIT. Granted it is debatable whether you would want to spend the amount of money it would take to delead all homes. Would you take the position, however, that we ought to be spending enough to insure that those children who are at risk are spotted?

Dr. LAUR. Yes; I would. The one qualification to be added to that is that the screening and detection of children at risk is an imperfect science at the moment. In part it requires refinements and developments So until such time as we know how best to detect which children have been subjected to lead, these represent, I think, reasonable amounts of money for that purpose.

Mr BICKWIT. Have you an estimate on how much it would take to screen those children who are at risk to see whether or not they actually have lead poisoning.

Dr. LAUR. We have some estimates. The estimates keep changing as we acquire new information about the cost of screening, about

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alternative screening techniques, as we examine alternative ways of accomplishing the screening, that is can it be piggybacked on some other health activity, such as immunization campaigns or maternal and child health service. It also depends upon the strategy one uses to find the children. Do you begin by looking at housing units which are suspect that is they exist in areas that might well be contaminated and the trace the children who live in the units or does one begin with children, screening the children, and try to find the source of the lead such as their housing that is subjecting them to risk. I can supply either now or for the record our estimates of those different costs, depending upon which stategy is picked.

(The following information was subsequently received for the record:)

ESTIMATED COSTS TO SCREEN CHILDREN FOR LEAD-BASED PAINT POISONING

Elements included	$10.00 per child	$16.00 per child [1]
Initial blood sample and analysis physician and techincian	X	X
Laboratory analysis	X	X
Second (confirmatory) blood sample physician and technician		X
Laboratory analysis		X
Epidemiological follow-up to determine environmental source(s)		X
Outreach education and motivation of parent of Child	X	X
Administrative overhead		

[1] This estimate assumes a significant amount of community participation in addition to the 25% dollar matching requirement for a Federal grant. Such participation includes unpaid citizen volunteers to carry out much of the person-to-person education program to motivate parents to present their children for the initial and where appropriate the second blood test, the follow-up of the child to assure those requiring the second blood test receive it, the education of the parents on methods of reducing lead-based paint intake and limited epidemiological follow-up to identify lead paint sources in the home environments. The estimate also assumes a high degree of integration of lead poisoning screening operations with existing community health services.

Mr. BICKWIT. If you screen the children directly, can you give us the figure on that?

Dr. LAUR. Can I express this in rates? Let's talk about screening 100,000 children and we can multiply that by however many thousand or hundreds of thousands one wished to screen. We estimate the cost for initial screening to be about $10 per child, or a million dollars to screen 100,000 children. That would not include confirmation tests of those who on the first screening appear to require follow up. It would also not involve treatment of the symptomatic children and asymptomatic children where indicated or the screening of dwelling units where children reside or any hazard reduction in the dwelling units found to contain the hazard.

Mr. BICKWIT. How many children do you estimate to be at risk?

Dr. LAUR. Dr. Lin-Fu can help me here, but I believe it is two and one-half million at risk of lead-based paint poisoning. Just a moment and I will check that—that is correct.

Mr. BICKWIT. So that would require the expenditure of $25 million to screen everyone?

Dr. LAUR. I get lost with that many zeros.

Mr. BICKWIT. Maybe I got lost. Say 100,000 children——

Dr. LAUR. That is correct: $25 million.

Mr. BICKWIT. How do you reconcile the proposed expenditures under the Lead Paint Poisoning Prevention Act and the amount that would be needed just to screen the children?

Dr. LAUR. The amount we have available to us permits us to concentrate on the highest at risk population. It also, I think, permits us to develop screening methods which may enable us to bring the cost down. In other words, it would be unwise, I think, to try and screen all two and one-half million, using current technology, if in fact we believe improved, more efficient techniques can be found.

Mr. BICKWIT. Thank you very much; thank you, Mr. Chairman.

Senator HART. You mean you could, with $25 million, given existing technology, screen all of these two and one-half million children?

Dr. LAUR. Unless I made a mistake in arithmetic.

Senator HART. I just wanted to understand what you are saying.

Dr. LAUR. The only difficulty with that estimate is it is not a linear projection, as you well know achieving effective screening of population groups we can identify, where we know there is a chance of finding the children readily, is much less costly than screening the last 20 to 25 percent of the children at risk. So the cost is not linear. But if one adopted a linear projection, that is what it would require.

Senator HART. You said you had trouble with the zeros, and I do in a personal financial sense. The Congress doesn't have much trouble with a lot more zeros than that for seemingly less significant things in terms of human health objectives. Maybe I have been desensitized to zeros. If I am going to err, I would much rather spend $25 million for that and forget some of the longer strings of zeros for other things. On that inconclusive note, we have to recess. I apologize to our guests from Connecticut. We will resume at 2:15.

AFTERNOON SESSION

Senator HART. The committee will be in order.

We resume this afternoon to get the testimony of Dr. Martha L. Lepow, Professor of Pediatrics, University of Connecticut, and I believe Dr. Lepow will be accompanied by Miss Barbara Davis, who is a pediatric social worker, University of Connecticut.

We will order both statements printed in the record in full as though given, and as you go along, if there is any adding or footnoting you want to do, feel free to do it.

STATEMENT OF DR. MARTHA L. LEPOW, ASSOCIATE PROFESSOR OF PEDIATRICS, UNIVERSITY OF CONNECTICUT; ACCOMPANIED BY MISS BARBARA DAVIS, PEDIATRIC SOCIAL WORKER, UNIVERSITY OF CONNECTICUT, McCOOK HOSPITAL

Dr LEPOW. Thank you, sir.

Mr. Chairman, I appreciate the opportunity of being able to come here today and to present our data and our views before you.

The data which I will present to you today were obtained through the cooperative efforts to Messrs. Thomas Murphy and Mahlon Hale and Miss Carol Cohen, students at the University of Connecticut School of Medicine; Mrs. Elizabeth Medearis, nurse, University of Connecticut Health Center; Miss Chari Massion and Miss Nicole

Lurie, college students; Dr. George Bowers, clinical chemist at Hartford Hospital; Dr. John Charde, pediatrician, Sharon Clinic, Sharon, Conn.; the Hartford Health Department; the Connecticut State Department of Health; the Dutchess County, New York, Department of Health.

Since 1967, pediatric faculty, staff, and students at the UCONN health center have been deeply involved in determining the prevalence and etiology of lead poisoning and means of prevention of this scourge in children under 5 years of age living in the north end of Hartford—a poverty area inhabited mainly by black and Puerto Rican families. The stimulus for these investigations was the appearance of several young children with lead encephalopathy—brian swelling—the most severe form of pediatric lead poisoning. We know that such cases represent only the top of the iceberg of children with increased lead exposure and that there are many more children with an elevated body burden of lead who may be suffering from chronic damage due to this poison. Lead accumulates in living systems and is only slowly eliminated. Effects are cumulative. During the years 1969–1971, we investigated lead levels in Hartford children and studied their environment. In 1971, we looked at lead levels and the environment of children in Dutchess County, N.Y., and Litchfield County, Conn.—rural counties—as defied by the U.S. census.

A blood level of 40 ug/100 ml of whole blood—40 ug percent—has been defined by the Surgeon General of the United States as the upper limit of normal for the pediatric age group. Normality is relative because any level of lead is abnormal. There is no known living system in which lead is a necessary component. What is being defined as normal is actually what is being observed in many urban children who are heavily exposed to lead in the atmosphere which they are breathing and in lead-containing paint which they are ingesting.

Data of Patterson, the noted geophysicist, indicate that natural blood lead levels for man before the industrial age were less than 10 ug percent.

Two studies of lead levels in newborns and/or their pregnant mothers have been recently published. Among 24 women delivering at the Yale-New Haven Hospital, the blood lead levels were 20 ug percent plus or minus 5 ug percent. In New York City, a group of 100 newborn infants delivered at the Harlem Hospital was tested for lead content in blood at birth. Six had blood lead levels of 30 ug percent; 34 of 20 plus or minus 10 ug percent. The average blood lead level of the urban adult is at least 20 ug percent today. This is at least double what was probably present 100 years ago.

The omnipresent source of lead is atmospheric. In Manhattan, concentration of lead in the atmosphere is the highest in the United States. What is of grave concern is the fact that 6 percent of the infants in the New York group were born with lead levels (reflecting body burden of lead) approaching the upper limit of acceptable normal for children. They were above 30 micrograms. Since lead traverses the placenta freely, the infant's blood lead will be close to the mother's.

In adults exposed chronically to excessive amounts of lead, symptoms of lead poisoning seldom occur until blood lead levels exceed 40 micrograms percent or higher. Adverse effects on enzymes in the blood, however, are found at much lower levels. Nonetheless, this arbitrary limit of 40 micrograms percent has been transposed to the pediatric population, although there is no firm evidence that the conclusion is valid.

I would now like to refer you to chart 1 appended to our statement. This is a rather complicated chart, but what it reflects is the distribution of blood lead levels in a group of 272 urban children living in the north end of Hartford, as compared with the distribution of blood lead levels of 230 children living in Dutchess County, N. Y., or Litchfield County, Conn.

I think there are several important features here. They almost look like two different groups if one connects the tops of the bars and makes a curve out of both of these. If we take an average or a mean blood lead level of these two groups, the rural group has a mean blood level of 22.8 micrograms percent, whereas the urban group has 32.9 micrograms percent, an average that is 10 micrograms percent greater.

Also as you look at this chart, it can be seen that the range of blood lead levels in the urban children is much greater—from 6 micrograms percent to 136. Whereas in the rural children, the range is between 3 and 70.

One can look at this distribution in two other ways. One can look at the level which was the middle for the group. For the urban group it was 30, whereas the rural was 20. The level found most frequently for the urban children was 30 micrograms percent, whereas for the rural it was 18.

Now 6 percent of the Hartford children shown in that graph have levels of lead that were high enough or had symptoms of lead poisoning, which necessiated painful treatment with chemicals which in themselves may be toxic. None of the rural children had symptoms.

Most of the urban children were black or Puerto Rican; single parent families were common, a number were welfare receipients Almost all are renters of houses over 30 years of age. Less than 20 percent are living in public housing. Mobility is great. Newer housing is almost nonexistent.

The rural children had different socioeconomic characteristics. Only 2 percent were from welfare families; 91 percent were Caucasian. The father was the head of the household for 89 percent Eighty percent of the heads of household were either self-employee in work connected with agriculture or were tenant farmers. The remainder were in the professional or managerial group. Sixty percent of the housing was over 30 years old.

What are the sources of lead for these children? The two major sources are lead in the paint on accessible surfaces, as well as in the soil, and in the air from gasoline emission. The major mechanism of intake from paint is by ingestion—a habit known as pica. We are continually investigating other potential sources of lead, such as milk, painted toys, indadequately glazed pottery, and in water which may flow through leaded pipes. We have not found that these are

important, except for toys, and exterior playground equipment for the children we have been testing.

We have been able to show an excess of 1 percent lead in paint on indoor and exterior surfaces accessible to children in the dwelling units of about 60 percent of the urban children with excessive body burdens of lead and nearly all of the rural children studied. Although much of this paint was applied 20 to 30 years ago, some is of recent origin. Frequently, leaded paint is flaking so that it becomes accessible from ceilings and walls when it drops to the floor and ground. In some instances, we have found that both the indoor and outdoor environment are so heavily contaminated that it is difficult to determine which source is most important.

We cannot state for certain what proportion of the excessive body burden of lead in urban children is due to lead in the atmosphere, but we are convinced that this source must contribute significantly. It has been consistently shown, not only by us but by Blanksma and coworkers in Chicago, that many cases of symptomatic lead poisoning in children become manifest in the summer months and that lead levels are lower in the winter months. We believe these findings indicate increase exposure during the summer months to lead on exterior surfaces and in the soil. To support these statements, data are included in table 1 on five Hartford toddlers who required treatment for lead poisoning during the summer of 1971 and for whom no indoor source of leaded paint was found. All had accessible to them exterior surfaces with flaking paint, the lead content of which varied from 3 to 35 percent.

I might add there that some of the old paint that was placed on houses over 30 years ago had as high as 20 to 30 percent lead concentration. Lead was frequently added to it.

The other factor that occurs is that as lead paint stays on the structures for a long period of time, much of the other matrix dries out, so one has comparatively more lead per gram of paint that is left. It seems that other substances in paint are biodegradable and lead is not, and lead only remains. It is an element and stays where it is.

Now most of the samples that we obtained from exterior surfaces in the dwelling units for these five children had more than 20 percent lead content in them. There were two additional children, who were brother and sister, whose mother reported they frequently ate soil.

I ask you to turn to table 1 to look at what we learned about those particular children. These children had lead levels that were elevated enough so we had to treat them. In fact every child on this table required treatment with chemicals for deleading. The sole sources of lead for these two children that we could find in their immediate environment was a porch that had paint containing 28 percent lead, exterior bedroom window sills which these children tended to gnaw on from the inside when the windows were open of 24.3 percent lead. These children were observed at play by one of the group and soil samples were obtained, which are reported in table 2.

Samples of the soil were taken from the area where the children were playing and those samples contained chips of paint. There were

additional soil samples obtained further away from the house, from a local gas station parking lot, from a west Hartford suburban housing development, and from a city park, which has never had any building. The city park area was just two blocks away from the apartment where the two children played and ate the soil.

If we look at the lead content of the soil samples in table 2 and focus on No. 6, the city park, the city park had four times as much lead per gram of soil as was found in the West Hartford development.

The acceptable level of lead in the soil overall for the United States I have been told by the director of the Department of Laboratories, Connecticut State Health Department, is 25 to 50 parts per million of soil. And the West Hartford area, which has not been contiguous to a highway, has a lead content fairly comparable to what would be considered the national acceptable normal.

The city park already has four times as much lead in the soil. The lead in the soil near a driveway next to the street where our apartment building is located was 16 times as concentrated. This represents fall-out from the atmosphere. In the area where there were paint chips, and where the children were playing, we had as high as 2,300 parts per million lead in the soil. I think in this last sample we have a combination of atmospheric lead and paint. This finding was rather striking to us, and the quantity of paint chips that were present in that soil were so extensive I think it would be impossible to remove them.

So any children playing in that area, even if they were not actually ingesting the soil, would certainly become exposed if they played out there regularly. These children were observed to take some dirt in their hands and put it into their mouths, so we know they were probably ingesting it over some period in time.

I will add that we were disturbed enough about these children that we were able to get them into quite a different type of environment fairly quickly, along with the rest of their family.

I think the facts speak for themselves, that there certainly is excessive exposure of young children in urban areas, not only to the paint, but to atmospheric lead. This is reflected in the mean lead levels of urban, as compared with rural children.

Twenty children of 242 tested from Dutchess County, N. Y., and Litchfield County, Conn., were found to have blood lead levels of over 40 μg. percent. The environment of 19 of them was evaluated by one of us (CC), including obtaining samples of water and paint from interior and exterior surfaces of the house, toys, children's furniture and pottery—all of which were tested for lead content. Only the paint sample results were significant and the distribution of lead content in indoor paint compared with outdoor paint is shown in table 3.

What we have done here is just given a line listing of the sources of lead containing paint for these 19 children who had blood lead levels of above 40 micrograms percent. If you look at the last column on the right, the percentage of led in the samples, some of these are really quite astounding. Some paint chips have close to 40 percent lead. There was one paint chip that had 50 percent lead,

half of the chip was lead. The range here is really quite great. If we want to look at where this paint was; lead was found in the interior paint only in three of the 18 for whom we found the source, and exterior paints for nine, and both interior and exterior paint in five.

There was only one child, a 20-month old youngster, who lived in a paneled brick house, with no accessible paint surfaces, and for whom the source of his excess lead level was not determined.

There was one child in the group (M.A.) known to eat soil near the house and the chips were found there flaking from the porch railing. A sample of soil was not taken there but paint chips had 50 percent lead. A total of 78 paint samples was obtained from the 18 dwellings, and 48 had greater than 1 percent lead in the paint. Only seven samples had less than 0.06 percent lead which is the recently legislated acceptable lead content.

Most of these houses are over 30 years old, not 80 years old, that is an error in the report which you have in front of you and several of them were colonial. There were several houses that were quite new and had recently applied lead containing paint on both indoor and outdoor surfaces.

Air samples for a number of pollutants is done routinely in Connecticut. In Hartford, the sampler is placed on top of a two story building on the main street in town. In Norwalk—near New York City—the sampler is on top of the health department building. The quarterly composite of lead content in the urban air in Connecticut in grams per cubic meter is 1–7.5, with Norwalk having nearly the highest levels in the State. A comparable sample in a rural area in Litchfield County was 0–1. Hartford has had value close to four and each year it has been increasing.

We will be getting sampling nearer the ground in an area where many of our pediatric patients live which will be more representative of the true concentration to which they are being exposed. No data of air lead concentration at the 2 by 3 feet level is available to us. And that is where the children are.

Lead poisoning in certain zoo animals, particularly tigers, in New York City has been shown to be associated with a lead content in soil where these animals roam of 3,900 parts per million. Their cages were painted with paint that was supposed to be free of lead, although there was some found. These animals inhale lead; it also gets on their paws and fur where it is probably licked off and probably a certain amount of the poisoning is due to lead fallout from the air and from subsequent ingestion from the soil.

We feel strongly enough about the role of atmospheric lead in pediatric lead poisoning that we hope to begin a prospective study of lead accumulation over the first few years of life in two groups of newborn infants. One group will reside in the poverty area of Hartford and the other will be from houses in the suburbs. It will be a time-consuming study, but we believe that the role of atmospheric lead in the production of excessive body burden of lead can only be fully defined in this way.

Another series of observations has stimulated us to undertake the prospective study in infants. A group of 6–12 year old children from families in the poverty area was tested several years ago for

the presence of delta aminolevulinic acid (ALA) in their urine. ALA is a substance which appears in the urine when there has been excessive exposure to lead. It is used in industry and in some localities as a screening test for the presence of lead poisoning in children. All of these children were born in Hartford and had lived there most of their lives. Some had only lived in public housing projects where the paint was presumably lead free. About 10 percent had positive urine tests. When given a test dose of a chemical which is known to bring lead from tissues and allow it to be excreted in the urine, very large quantities of lead were excreted in the urine. We have not studied a comparable group of suburban children. However, we must conclude that the major source of the lead for the older children is a continuous exposure to atmospheric lead. If exposure ceases, lead is slowly excreted and it would be expected that even if these children had ingested large quantities of leaded paint as toddlers, they would not have such large amounts still present in their bodies 6–8 years later. The mean circulating blood levels of this group was 26 ug.

As a pediatrician who is trying to evaluate all aspects of this problem as well as to institute practical preventive measures, I can only conclude that we do not know whether any lead is safe for man. We do not know the effect of chronic exposure to atmospheric lead on the quality of life of millions of toddlers aside from the excessive exposure to paint. Our patients can't complain. They cannot express the qualitative aspects of "feeling poorly."

The life-long effects of chronic low-level exposure to lead has never been fully elucidated; yet the concept of adverse effect is challenged so aggressively by many vested intersts that we have reached a point where little biologic research is funded to answer these important questions. In addition, we are now seeing suggested correlation of lead exposure with cardiovascular disease, cancer, and chronic kidney disease. All of these are major killers today.

It may be well and good to guess and conjecture, but sound policy suggests that it is better to know by doing the studies that are needed.

In conclusion we urge the Congress of the United States to protect the public from further exposure to this serious environmental pollutant. Enormous strides toward this objective could be made by legislating against the addition of lead to gasoline and to paint.

Control of the burgenoning problem of lead poisoning is, in this sense, in the hands of the Congress.

Senator HART. Thank you.

Before we ask any questions, I suggest that we hear from Miss Davis.

Miss DAVIS. Thank you.

Mr. Chairman and members of the committee, I am here today due to my concern regarding children who have suffered from lead poisoning.

The University of Connecticut McCook Hospital medical and social service staffs and I personally in the past two and a half years have worked closely with families and children who have been victims of lead poisoning.

These children primarily have lived in the high density population areas and in housing which was built over 30 years ago.

Surveys conducted 1969–1971 by our health centers pediatric faculty and students have identified sources of lead poisoning exposure for these children in lead painted interior and exterior housing surfaces and in dirt and in air from gasoline emission.

Some of the children known to social service in the past were admitted to the hospital convulsing in the advanced stages of the disease. Deaths have occurred.

Other children have incurred major irreversible physical and mental impairments. Others have required long hospitalizations.

Some of the children who suffered major disability required institutional placements where they will probably remain for the rest of their lives separated from the love and nurturing of their natural families.

Other children have needed extended general hospital care which has involved painful treatment.

Because our patients are predominantly black and Puerto Rican, separation from family and home also has meant the trauma and anxieties of adjusting to different and strange cultural orientations. For Puerto Rican youngsters there has been the added burden of language barriers.

Our hospital has felt that no child who has suffered from lead poisoning should be returned to an environment until all sources of possible reexposure have been removed.

Therefore, family separation also has been lengthened by delayed hospital discharge while a home is being rehabilitated.

Or during this period a child may have been placed temporarily in a foster home or with a relative or in an institution. Frequently because of the subtle insidious nature of lead poisoning at times, it has been first, difficult to help families accept early treatment away from their homes and second, to accept an extended separation to prevent a repeated involvement of disease. We too have shared their concern because our goal is to keep families together.

In some instances, relocation to a new residence has been the only sound solution for a family.

Needless to say, it has been very difficult for some urban families of low income or who are on welfare to find nonhazardous housing.

Also, moving has meant uprooting from familiar neighborhoods, friends, schools, and religious affiliations. Some families, too, have been pushed into purchasing property at a time when they are least able to assume this cost.

Programs are needed to help the poor in purchasing housing.

Since we are aware of the possible emotional implications of pica, i.e., children eating substances such as lead paint chips, it has been important to include as part of treatment counseling and use of specialized facilities such are preschool and day care programs for parents and children.

The identification of one child with lead poisoning in a family also has necessitated our concern and follow-up of other toddlers in the home.

In many instances, too, through family contact regarding lead poisoning there has developed the need to help families with other problems.

Our local public health department medical, nursing, and housing code personnel have contributed major input in helping in education and rehabilitation with families and landlords.

Prolonged hospitalization, institutional care, relocation, rehabilitation, and on-going medical and social services have required the mobilization of many agency programs and services and resulted in economic burdens for both communities and individual families, some of whom have had to seek welfare financial assistance for the first time.

The more devastating effect of this preventable disease, however, is that so many children will never have the opportunity to attain their full potential for happy productive lives.

Lead poisoning strikes significantly in our overcrowded and slum areas. Thus the families and children who are most vulnerable are the already disadvantaged poor and minority groups who have lesser resources for coping with this disease.

We have identified sources of lead poisoning in paint which can be prevented. But, also further investigation is crucial to determine the other potentials of this kind of poisoning.

In summary, we know that the effects of lead poisoning in children include tremendous economic burdens, major physical and mental impairments and death.

I would like to urge the committee's support of Federal financial programs to eliminate this disease from our environment and thereby help to save our most valuable resource, our children.

I would also like to thank the committee for allowing me to present my views.

Senator HART. The committee is grateful to both of you for coming and giving us the benefit of your knowledge and experience. In your statement, Dr. Lepow, you speak of the five children who required treatment for poisoning not attributable to indoor paint. You suggest that the children were poisoned from lead ingested outside the house, probably through dirt.

As I read this testimony, the contamination of the dirt was from paint chips flaking from the exterior of the house. In that second table, Table No. 2, it shows that the soil around the house had some 1,200 to 2,200 parts per million lead. Now this suggests, does it not, that children could be getting poisoned if their only source of lead, aside from food, water, and air, was soil containing those or higher levels of lead?

Dr. LEPOW. Yes.

Senator HART. I assume, then, that from the data from Cincinnati, and I suppose elsewhere, on lead levels in dirt that are higher than those you found give you very real concern.

Dr. LEPOW. Yes. sir.

Senator HART. Is there a level of lead in the blood at which the effects on enzymes cease?

Dr. LEPOW. I think I have to answer that probably not, because the effects on enzymes have been recognized when the lead level is as

low as five micrograms in man. This is only one enzyme system which we can measure, and there are many other ones that perhaps we can't measure that might be equally affected.

Senator HART. One thing on which we will find complete agreement from this committee, at least from the committee that is present, is the need for a great deal more research on the hazards of lead. But have we reached a point in our knowledge where, even though the knowledge we realize is imperfect, we conclude that the hazard should cease? Do we know enough now to say, for example, to the Environmental Protection Agency when it is evaluating the regulations to reduce the lead in gasoline, given the strong suspicion we have, based on our imperfect knowledge that airborne lead can result in dangerous levels in dirt as well as the air, that we should simply resolve to make every effort to eliminate lead in gasoline just as rapidly as possible.

Dr. LEPOW. Yes, I firmly believe this, sir, on the basis of what we already know and what we can project. And perhaps the one additional comment that I can make to this is that the lead effect is cumulative, lead is stored in tissues. It is only very slowly excreted. So I think any arbitrary level that is set is going to be excessive, if one considers it over the lifetime of an individual. And particularly in a growing individual because if the lead stays there it doesn't stay inert. If it stayed inert, it would be fine, but it is gradually turned over as bone is turned over particularly, this is a major storage area for lead.

So any continuing intake over the lifetime of the child is going to be 70 or 75 years; we start out with a very low level; it will become a lot over a long time, because lead gets onto everything, it is on surfaces, in our milk, in our food; nearly everything that has been tested has small amounts of lead. So I think we have to stop putting it into the environment. And I don't know if we can ever get rid of it. There was no lead on the surface of the earth until we started to mine lead and use it. So we have tremendous amounts of lead; the polar ice cap is contaminated with it, which means the supply of rainfall is contaminated with it.

Even if we stop putting it into the atmosphere today, we still have many centuries before the hazard will be completely eliminated. It will be many generations from now.

Mr. BICKWIT. This morning the staff presented Drs. Lin Fu and Laur with some calculations we made which illustrate how much lead could be present in dirt after the EPA regulations reducing lead in gasoline have run their course. In the case of 77 midwestern cities, we calculated one-fourth of a gram of dirt daily could give a child enough lead to reach the maximum daily permissible intake. In other cities, it would be much less than that. If our assumptions are correct, do you think we may be subjecting inner city children to significant hazards, which was the term used this morning, even after the lead reduction scheduled is implemented.

Dr. LEPOW. Yes.

Mr. BICKWIT. What action would you counsel as a result of that hazard?

Dr. LEPOW. I think my counsel would be to make every effort to eliminate lead from gasoline and from paint. I know your question

is directed particularly to the gasoline, but I will put in the paint along with it, as quickly as it is feasible to do so. I am not a chemist, I don't have enough knowledge to know all of the factors that make tetraethyl lead very important to the performance of engines as they are now constructed, but I have great faith in the technologic ability of this country, that appropriate substitutes can be found or ways around this can be found.

I think as far as the paint is concerned, that there are adequate substitutes now. And the one major remaining use for lead-base paint, as I have been told by people who are knowledgeable on this subject, is as undercoating for bridges, that apparently its antitrust properties have yet to be surpassed by any other compound.

So I think that could be allowable. But I would certainly get it off the shelves for any use in residential structure—any place where people live or children play.

Mr. BICKWIT. Are you saying you would strive to take absolutely all lead out of gasoline and paints?

Dr. LEPOW. Yes.

Mr. BICKWIT. You mention the emotional implications of pica. Could you give us an idea of what role the emotional stressses of living in poor housing play on a child's tendency to eat paint or dirt?

Miss DAVIS. We are not fully aware of why a youngster may have this need; that is, pica, but it is some type of compulsiveness. Pica is found not only in children in slum areas, but children in many socio-economic groups have a need to eat things which are not food. But in terms of the youngsters who have been exposed to lead, this seems to be more of a danger because they have the sources of paint chips for example from broken ceilings, and holes on the walls, readily available to them which is dangerous.

In terms of their family constellations, we find here many families where either both parents are working, pressured by the needs of a large family, and/or low incomes; or you may have mothers alone trying to cope with a large family and children being lost somewhat within the family constellation, that is, many children demanding a great deal from one or both parents.

Or in some situations you may find youngsters who actually don't have enough to do, and we believe this need that is, is pica reinforced by lack of other outlets. Therefore we have tried to help in terms of the youngster, for example, to place him in a day care program or preschool, where his activities will be better directed. In working directly with parents we have attempted to relieve some of their socio-economic pressures if possible, and to counsel them in terms of their relationship with the child.

Those are the kinds of things we try to work with parents and children relative to the emotional aspects.

Mr. BICKWIT. I have one final question. You mention that in Hartford and Norwalk the air samplers are located on top of buildings. Do other cities measure lead in the air in the same manner?

Dr. LEPOW. Yes, When I talked to the director of the laboratories in the Connecticut State Health Department, I asked him why do we do this. I said why don't you put the samplers down closer to the ground. In fact, I wanted a sampler out last year in the area where some of our children lived. And he said the reason they put them up

high is to prevent vandalism, because they have these pieces of equipment smothering air over long periods of time. They sample for 6 hours of every 36 hours, or something about like that, so they have to leave some rather expensive equipment out in the open.

I asked whether there was any way to put them on the ground safely, and they said no. I know in several cities, it is on top of the health department building. The one in Litchfield County is on the dam, where there is no access of anybody to it without permission.

So that I would say most of the air sampling data we get from the country as a whole is probably from above ground, and one really doesn't know how this relates to what is on the ground, two feet from the ground or even down in the soil. I think one would assume the way air currents go, you would have more down below. Lead is attached to dust and water too. But that is an assumption.

Mr. BICKWIT. Why would you assume that?

Dr. LEPOW. In talking to people about the way the air currents go, this is an assumption that is made, but I don't have proof for it.

Mr. BICKWIT. Thank you very much. You have been very helpful.

Senator HART. Thank you very much. I think today suggests that we are left with the uncomfortable conclusion that the proposed lead in gas and the existing lead in paint regulations will leave us with a very substantial public health risk, particularly to the mother living in the ghetto. We seem to be saying if you bring up your family in that environment, you haven't very much option; if the children have pica, the odds are very strong that they will have lead poisoning also.

And I think—this is the dilemma—that we are telling her this even after these remedial regulations become operative. We have heard today testimony only on the danger side of the problem. We have little on today's record as to the cost of doing more than is proposed to be done. And yet as I indicated at the recess, it is hard to imagine that whatever that cost would be, more expensive gas, more expensive paint, paint with less of a particular quality, it would not be justified if it would eliminate the risks we are talking about here. At least with respect to the gasoline lead regulations, testimony at our earlier hearing and the advice of staff economists suggest a stiffer schedule of lead reduction than that proposed by EPA would be feasible.

Of course, I will express that feeling to the EPA. For those who testified today, as well as those who helped us in our earlier hearings, the committee wants to thank you very much. We are adjourned, to resume at the call of the chair.

(The attachments follow:)

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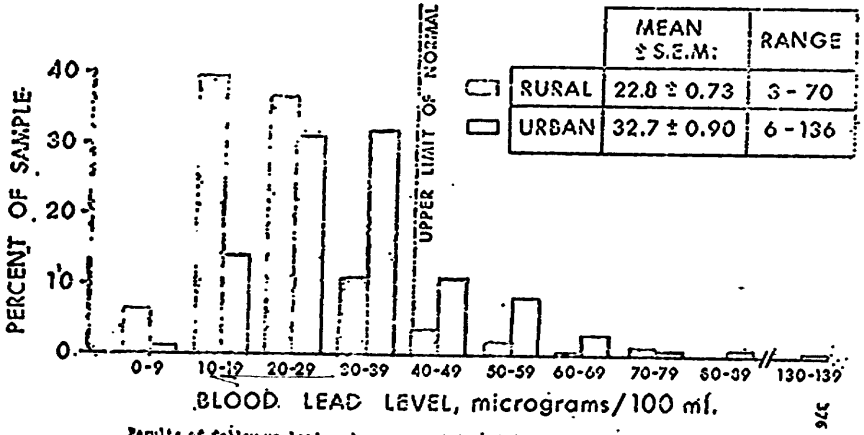
CHART 1

DISTRIBUTION OF BLOOD LEAD LEVELS OF 230 RURAL AND 272 URBAN CHILDREN BY PERCENT OF SAMPLE



Results of follow-up lead analyses are not included. All blood samples were drawn between May and Sept., 1971. Rural children are residents of Litchfield County, Ct. and Dutchess County, New York; urban children live in Hartford, Ct.

TABLE 1.—SOURCE OF LEAD IN EXTERIOR PAINT FOR 7 HARTFORD CHILDREN FOR WHOM NO INTERIOR PAINT SOURCE WAS FOUND[1]

Identity age	Highest blood lead level	History	Site and lead content of exterior paint (%)
V. G. 5 years	64	Ate soil for 2 years Anemic	Porches—14 and 13. Paint was present in soil but not tested.
C. M. 2 years	136	Ate soil "down south" Anemic and "quiet"	Back door peeling—26. Exterior windowsills—24. Porch rail—9.
J. N. 3 years	80	Ate paint chips from outside porch. Anemic	Porch rail—3.
E. H.	60	Ate paint chips from porch	3 samples from porch—24.7, 12.7, 32.
A. C.	64	Pica for paint on porch railings	Bathroom sill (ext.) 2. Porch railing—15. Ext. windowsill—32.
H. O.—3 yr.[2] } Brothers E. D.—2 yr. } Brothers	75 60	Anemic Mother did not know site of leaded paint.	Porch—28%. Bedroom windowsill (ext.) 24.3.

[1] Paint samples from interior and exterior surfaces of the houses are obtained by housing code enforcement inspectors employed by Hartford Health Department.
[2] These children were observed at play by one of us (CM) and soil samples were obtained which are reported in table 2. The lead content of soil where children played was 2,300 parts/million.

TABLE 2.—LEAD CONTENT OF DIRT SAMPLES TAKEN FROM URBAN AND SUBURBAN SITES [1]

Location of the dirt	µg/gm (percent lead)	Lead content (parts per million of soil)
1. Next to house on Garden Street, Hartford, Conn. (paint chips seen)	0.23	[1] 2300
2. 1 foot away from building (paint chips seen)	0.22	[1] 2200
3. 5 feet from building	0.12	[2] 1200
4. 10 feet from building	0.15	[3] 1500
5. Next to driveway near street between this building and adjacent apartment	0.094	[3] 940
6. From field in the city park near these apartment buildings	0.022	[4] 220
7. Gas station parking lot (no prior building on it) one block from apartment building	0.024	[4] 240
8. Next to new house in West Hartford (on a suburban street not close to highway; house of CM)	0.0053	53
9. 10 feet from same house in West Hartford	0.0068	68
Acceptable level of lead in soil (U.S.)	.0025–.0050	25–50

Note.—Analysis done by Connecticut State Department of Health, Laboratory Division, 10 Clinton Street, Hartford, Conn.

[1] 42 times as concentrated.
[2] 25–30 times as concentrated as West Hartford.
[3] 16 times as concentrated as West Hartford.
[4] 4 times as concentrated as West Hartford.
[5] 4 times as concentrated as in West Hartford.

TABLE 3.—SOURCE OF PAINTS CONTAINING LEAD IN 18 RURAL CHILDREN FOUND TO HAVE BLOOD LEAD LEVELS OF OVER 40 µg.

Identity and age	Samples	Percent lead in samples
INTERIOR PAINT ONLY		
1. N. N.—18 mo	Window frames	2.73
2. A. W. 3 yr	Living Room Ceiling	11
	Front Door Frame	9.32
	Bedroom window frame	17
	Stairs	2.8
3. C. N.—3½ yr	Bedroom windowsill	7.98
EXTERIOR PAINT ONLY		
1. E. W.—5 yr	Front Porch	14.25
2. W. W.—15 mo	Outside front door	16
	Porch window putty	3
3. L. L. 17 mo	Front windowsill	25
	Front doorstep	3.9
4. D. M.—2½ yr	Rear porch	20
5. C.W. 14 mo	Back porch floor	6.67
	Cellar door	23.2
	Back porch gutter	16
	Front porch gutter	14
6. P. B. 2 yr	Playroom windowframe	2.6
	Playroom door	7.8
7. M. A. 18 mo	Outside rear porch	34
	Paint chips from soil	50
8. A. S. 3 yr	Front porch step	3.82
9. M. C. 2 yr	Child's slide	1.72
BOTH INTERIOR AND EXTERIOR PAINT WITH EXCESSIVE LEAD		
1. S. H.—3 yr	Hall plaster	21.5
2. H. B.—18 mo	Bedroom windowsill	[1] 8.84
3. R. B.—18 mo	Kitchen door	[1] 5.25
	Rear windowsill	[2] 39.0
	Rear of house	[3] 31
4. J. V.—16 mo	Playroom door frame	[1] 6
	Back porch	[2] 26.8
5. E. T.—1 yr	Kitchen ceiling (flaking)	[1] 19.6
C. T.—3 yr	Hall ceiling (flaking)	[1] 1.35
	Windowframe	[1] 1.38
	Outside porch ceiling	[2] 21.0
	Outside porch railing	[2] 23.0

NO PAINT SOURCE FOUND

1. G. R.—20 mo	Paneled brick house with no accessible paint surfaces.

[1] Interior.
[2] Exterior.

TABLE 4.—CONNECTICUT STATE DEPARTMENT OF HEALTH LABORATORY DIVISION

[Lead in Ambient Air—Samples collected every 6 days at 53 stations throughout Connecticut are composited quarterly for analysis. The following results are in micrograms per cubic meter]

Quarter	Date	All stations		Hartford (mean)	Rural station (mean)
		Mean	Range		
	1970				
1	January to March	1.27	0.34–3.51	1.64	0.35
2	April to June	0.64	0.16–1.65	1.47	0.29
3	July to September	0.65	0.08–2.78	0.43	1.03
4	October to December	3.06	0.41–7.63	2.70	0.61
	1971				
1		1.24	0.16–3.07	1.50	0.49
2		0.61	0.18–1.48	0.55	0.25
3		0.76	0.11–1.63	1.49	0.20
4		2.38	0.12–4.65	3.85	0.58

Appendix A

The University of Connecticut Health Center Report

Not just a city problem

STUDENT FINDS LEAD IN RURAL CHILDREN

Lead poisoning in children, found mostly in blacks and other minorities living in old city slum housing, has now been uncovered in 9% of a largely white group of rural children.

Carol J. Cohen of New Haven, a second-year student in the School of Medicine, carried out a study in several towns in Dutchess County, N.Y., and in bordering Litchfield County in Connecticut which documents the rural problem for the first time.

As in the cities, lead paint on the inside and outside of old housing appears to be mainly responsible. A few of the rural homes where lead poisoning was found in children could broadly be classified as "colonial."

Miss Cohen's findings show that 20 out of 230 children between one and five years old who were tested in the two counties had unsafe amounts of lead in their blood—more than 40 micrograms of lead per 100 milliliters of blood equivalent to 4 parts per million.

Still, none of the children showed any outward symptoms of lead poisoning before testing and about 75% were checked while on routine visits to well-child clinics. Several children had blood lead levels high enough, according to usual medical standards, to warrant treatment.

Miss Cohen worked under the guidance of Dr. Martha L. Lepow, an associate professor of pediatrics at the school.

The student said she received excellent cooperation from the New York State Department of Health and its Dutchess County district unit, the Connecticut State Department of Health and its laboratory, and Dr. George Bowers and his laboratory staff at Hartford Hospital.

Also working with Miss Cohen on the study was Dr. John Charde a pediatrician in private practice in Sharon and the Millbrook area in New York.

Blood samples were taken from the rural children during last summer. Laboratory and statistical checking and analysis have been carried out since then by Miss Cohen and those working with her.

Some of the results are:

The mean—similar to average—amount of lead found in the blood of the 230 children stood at 22.8 micrograms of lead per 100 milliliters of blood, or .228 parts per million.

(The U.S. Surgeon General has established 40 micrograms of lead per 100 milliliters of blood (.4 parts per million) as the maximum safe concentration. Some authorities say this level is somewhat arbitrary and that any lead in the blood may be hazardous.)

The 20 children with abnormal blood lead levels in the rural study, some from middle or upper-middle class homes, had concentrations ranging from .4 to .7 parts per million of lead in the blood.

Dr. Lepow, who has had extensive experience with finding and treating lead poisoning in urban ghetto children, said treatment to "de-lead" a child is usually begun when the blood lead level exceeds .6 parts per million.

(By comparison, a 272-child group, nearly all black or Puerto Rican, tested last summer in Hartford in a clinic run by the medical school, was found to have a mean blood lead level of .327 parts per million.

(About 22 per cent of this group had blood lead levels above .4 parts per million; this, however, is an old story in urban testing in high-risk areas of old housing. In some cities, more than 50 per cent of the children tested had abnormal levels of blood lead. Lead in the air in cities from automobile exhausts, usually contribute to this problem and add to the hazard facing the child in housing with lead paint.)

Socioeconomic characteristics of the 230 rural children and their families as described by Miss Cohen were:

Only two per cent came from welfare families.

More than nine out of 10 were white—91 per cent.

The father was head of the household for 89 per cent of the families.

About 70 per cent of the children were from families in the two lowest socioeconomic classes, as ranked by education and occupation.

More than 70 per cent had lived in the same house for more than a year.

(This contrasts sharply with the Hartford group, and city experience generally where the large majority of children with abnormal levels of blood lead are from "welfare" families and many come from homes where the mother is head of the household.)

Two striking features shared by the rural and city children with abnormal blood lead leavels were:

Most of them lived in housing more than 25 years old where flaking paint, or lead-based plaster, was common.

Many of them found to have "pica" for paint and plaster, the medical term for a child's habit of putting any kind of non-food item in his mouth.

(Whereupon, at 3:15 p.m., the hearing was adjourned, subject to the call of the Chair.)

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

STATEMENT OF BERTRAN W. CARNOW, M.D., AND VIRGINIA CARNOW, R.N., REGARDING HEALTH CONSEQUENCES OF AIRBORNE LEAD AND THE RATIONAL BASIS FOR STANDARDS

To the members of the Committee, I am honored at your request that I present a statement regarding the problem of lead in gasoline. I have been concerned with this problem as a scientist and worker in the field, a physician and a citizen. At the present time, I am Professor and Head of Occupational and Environmental Medicine in the University of Illinois School of Public Health and Professor of Preventive Medicine and Community Health and Chief of the Section on Environmental Health at the University of Illinois Lincoln School of Medicine. I am also Director of the Environmental Health Resource Center of the State of Illinois Institute for Environmental Quality, which has been seeking to determine those environmental hazards facing the people of this state.

I have worked in the field of environmental pollution, particularly in air pollution, for the past ten years, and have been involved in studies of lead in the environment for the last five years.

In regard to the development of standards for lead in the ambient air and consequently the regulation of lead from gasoline which represents the overwhelming source of ambient air lead, a number of fundamental questions regarding lead itself and the populations subjected to its effects must be answered. These include the toxic effects of the metal, whether the body can or has the ability to use or handle this material, and its biodegradability and durability, that is its persistence in the atmosphere once it has been placed there.

Lead is a toxic material which effects multiple body organs and except for very minor traces, is of no use to the body. Since it is not a physiologic material, the body has no way to handle excess doses of it. In addition, once lead is put into the air it either remains there or falls down on the earth where it may then remain in the soil or in dust which blows from the soil or move into the water systems. It does not disappear as many other toxic materials do. It remains virtually forever. That is it is not a gas which, when the quantity produced is reduced, the amount present is less. It might blow about and be covered by soil, vegetation, or enter bodies of water, but it remains. Thus, any lead put into the air adds to all of the past total environmental burden and is cumulative, so that even if the amount used is decreased, one must recognize that the soil, dust, water and air content, hence the body burden of humans, will increase as time progresses.

Regarding the effects on humans, fundamental concepts must be considered and understood in order to assess the effect of lead on the population and to promulgate legislation which will create ambient air quality for lead which will protect the total population.

The first concept relates to total body burden. This means that the body reacts to the total lead taken in and this is cumulative as time passes if the amount taken in exceeds the amount that the body can excrete. Therefore, the increase in the body burden of airborne lead from gasoline produces a high baseline so that exposure to all other lead sources superimposed on that baseline then becomes a matter of much greater concern. It should also be noted that there are limits to the adaptive capacity of the body so that the closer one gets to the toxic level, the greater the possibility that small changes in intake may be reflected in serious health effect. Further in considering the standards, and particularly in view of the continuous gasoline source of lead, the exposure of special groups in the population, that is, those with lower adaptive capacity or those exposed to other point sources of lead, presents the strong possibility of an increased hazard for this very significant number of people.

In addition, the amount of lead absorbed from each source relates to the mode of entry into the body. Of the lead entering the body through the intestinal tract, approximately 90% is removed through the feces, although in individuals who are constipated this may be reduced. Ten percent, however is absorbed and enters the blood through that part of the circulation called the portal circulation which goes to the liver. There an additional amount may be filtered out and either stored in the liver or reprocessed for removal from the body before entering the major arterial system. On the other hand, lead which is inhaled is *potentially a much more dangerous source* of the material since 30 to 50% of what is inhaled is absorbed by the body. Of equal importance is the fact that *inhaled lead goes directly into the major blood circulation*, the systemic circulation, and is immediately available to the body in terms of its toxicity. Comparing lead with other particles in the air, particle size of lead is very small (the average is less that 1,000,000th of an inch in diameter) and it gets down into the smallest air passages and is rapidly absorbed into the blood. *Host resistance* is another critical factor, that is the susceptibility of the individual exposed. This is directly related to the amount of environmental insult in the sense that the lower the individual's resistance, the less environmental insult is required to overwhelm him. Thus, in considering standards for the total population, one must be concerned about the possibility that the lead levels which might be safe for some groups of individuals may place many others in the population at very high risk.

A further serious problem in regard to assessing the impact of lead onhhumans is that there is no such thing as specific lead disease. It mimics in its symptoms many other disease conditions. While at very high levels it may easily be implicated as the cause of acute encephalitis, it affects many major organ systems, including the brain, optic nerve, peripheral nervous system, the motor nerves to the hands and legs, the red blood cell and the smaller blood vessels, the kidneys, and the liver. Thus, particularly at low levels, it is insidious, in its development, which makes it even more dangerous. In addition, the population which is most sensitive to lead are in the age group from one to three. They are most often affected by acute lead poisoning, and because of their very young age, they cannot communicate their symptoms. Also, tests for the effects of lead intoxication, particularly as its effects the brain, are very poorly defined. I should like to present a case in point to demonstrate the insidious nature of this substance. Some months ago Virginia Carnow, R.N., and I were called in consultation by the city of El Paso, Texas, because of their concern regarding the large amounts of sulfur dioxide emitted by a local point source, a large smelter in the city. On examining the emission data given to the city by the company, it was noted that stack emissions included approximately 600 or more tons of lead each year. We noted this and stated that, based on this data, one could expect to find a significant number of people affected by it. When questioned, however, physicians in the city stated that they had not seen any cases of lead poisoning in the community. When blood samples were taken on children, however, particularly those living in an area called "smelter town" adjacent to this point source, a large number of them were found to have undue lead absorption, and more than 50% of those under the age of five included in the first samples taken were found to have lead poisoning. This included high lead levels and basophilic stippling of the red cells which are marks of lead intoxication. Examination of these children revealed one with a foot drop as a result of partial paralysis of the motor nerve of the leg, and one who appeared to be somewhat mentally retarded, although this was difficult to evaluate. In histories obtained from the parents lethargy was reported in some children and irritability was noted in others. Further, a number were found to have significant anemias and one had a dangerously low red blood count. Many of these children required hospitalization and treatment at the time. Thus, this condition can be *present for many years* and go unnoticed because the symptoms mimic other diseases and the condition can frequently present itself in a very nonspecific form. Let me present a number of other cases in point. Preliminary studies carried out by Virginia Carnow, R.N., in the North Shore of Chicago, an upper middle class area between twenty and thirty miles from the city, revealed significantly high levels, 30 micrograms and over, in more than 50% of the children tested, with no known exposure to lead in paint; and one is hard pressed to find another source other than the lead from gasoline. While documentation is not adequate, there would appear to be some increase in levels in those living closer to the expressways.

Studies carried out by the State of Illinois in the cities throughout the state on a random sample of children revealed that of the 2,675 tested, 620, or 25.8%, had 40 micrograms or greater per 100 ml of blood. In Peoria, Illinois, 31% of the children had these levels, in East St. Louis and Springfield, 24%, and in Aurora, 22%. Other studies carried out in Chicago revealed thousands of children, particularly in the low socioeconomic and black communities, with high levels of lead which required treatment with chelating agents. Again, there was no evidence that the children in Peoria, 1/3 of those tested, who exhibited such high levels were obtaining the lead from leaded paint or any other source in their homes. Again this implicates the general source, the major one which is airborne lead from gasoline.

We, therefore, feel that the extent of the problem is far greater than has previously been thought. The insidious nature of the disease, as documented by the El Paso and Illinois experiences for cases that had never been detected, suggest that the estimated 400,000 children in this country as having excessive lead levels may be a much to conservative number. While the eating of paint from walls of some buildings certainly appears to be the cause, or at least a part of the cause in severe intoxication, we feel that millions of children in this country may have abnormally high levels of lead and may be suffering from low grade chronic effects of this toxic material. Again, since the major group of victims are from the ages of one to three, who have difficulting in communicating symptoms, these cases are difficult to find unless there is consciousness about them and blood specimens are obtained.

We are not suggesting that these large numbers of children with high lead levels represent only lead being inhaled through the lungs. Certainly large amounts may be obtained from lead which has fallen from the air into the soil, particularly from street dirt in the cities getting on the hands of small children who play in the dirt. The lead then being absorbed from the intestinal tract. Leaded gasoline, however, is the source. In addition, some of the lead in the air from auto exhausts may get into the homes, either as an aerosol or as dust and settle on food that is consumed there. In El Paso we felt that all of these factors were operating. The air levels of lead were excessive and the high levels of lead in the soil reflected the accumulation of lead from the air from the smelter over the years. Measurements were taken and revealed levels in the soil as high as 20,000 and 30,000 parts per million. Inside the home dust levels were as high as 12,000 to 14,000 parts per million. Over a short period of time these can cause low levels of lead intoxication. All of these factors combined in these children to produce the total body burden but the source was the airborne lead, in this case, the smelter as the automobile is the source in urban areas.

What then constitutes an abnormal body burden? Given an average amount of lead in the food and water, an average air level of 0.7 micrograms per cubic meter of air will result in a level in the body where intake exceeds the ability of the body to excrete the lead so that this material begins to accumulate in the bones and other organs. Hence, studies of animals and humans show higher blood levels in all of the major organs in inhabitants of urban areas when compared with those in rural areas. This includes the large blood vessels, the kidneys, the brain,, bone, thyroid, blood, liver, and other organs. Even at this level, therefore, there is an abnormal body burden. Above 2.0 micrograms of lead per cubic meter one might expect a level from 25 to 30 micrograms of lead in the blood. At this level there may be interference with the synthesis of heme, an essential component of hemoglobin, which in turn is critical in the formation of red blood cells and is that portion of the red blood cell which carries oxygen. When heme synthesis is interfered with, there is a spilling into the urine of delta-aminolevuline acid (ALA) because of an overflow in the blood. This represents a metabolic abnormality in the sense that it represents interference with the production of necessary components of the red blood cell which are essential for life. While no serious effects on the body may be noticed at this level, none may be noted in an individual with diabetes who is spilling sugar into the urine; however, we do not say that this diabetic individual has no disease until he goes into a diabetic coma. We state that there is a metabolic abnormality, that the body is not handling sugar properly, and that a disease process is present and must be treated. In my view, this is also true when the synthesis of hemoglobin is interfered with, since this causes an undue body burden and represents a visible metabolic abnormality.

In my opinion, this may be stated to be a disease process. Even below the levels of 2 micrograms, however, when one considers the effects of lead, there is some increase in the body burden, because lead interfers with the normal oxidative activity of all cells and the body must have oxygen to carry out its function. This enables cells to grow, reproduce, and remain healthy.

Lead depresses the oxidative reaction of the cell by interfering with the material called mitochondria within the cell, so that the cell requires more oxygen to carry out the same function. If the interference is great enough, the cell then dies for lack of oxygen. This may be the manner in which it operates on the more sensitive organs of the body that require the most oxygen. These include the brain, the central nervous system, and some of the other hard working organs such as the liver and the kidneys. (At very high levels, other factors operate, including increased permeability of tiny blood vessels with leaking of blood into organ tissues.) There are other components of the cell called microsomes which are critical in the formation of protein and, therefore, in the production of new tissue. So even at levels below those visibly manifested, that is an excess of delta-aminolevulinic acid in the urine, there is interference with essential cell function, and an increased body burden. Those individuals in the population who have low resistance may have a serious problem as a result of this additional body burden.

Let us take a best case example. An individual may take in 300 to 500 micrograms of lead in food and absorb from 30 to 50 micrograms in the blood, and while a child may need somewhat less, the amount of lead per unit of body weight may be even more. Consider then, that there is no lead from any other source, that the child is not playing in the street picking up lead from the dirt, inhaling lead from automobiles by direct exposure, or consuming lead from dust which may be present in the home. Only that he is inhaling lead generally from the air. Given a 30 to 50% absorption rate, the child may take an amount equivalent to that received in the food into his body. This does not consider the increase in respiratory rates in children nor the increased intake when the child breathes at a faster rate while he is playing.

Now let us take as an example study of what one might call a "worst case problem, very common in many areas in this country.

In the City of Chicago much of the urban renewal is in the form of high rise buildings, many of them located along expressways or at least in areas of very high automobile use density. The socioeconomic status is low and the nutritional status of many of the children living here is inadequate. Recreation in these areas usually takes place in the streets where the children play and where the density of traffic is frequently very high. Assume that such a child takes in 300 micrograms of lead through food. What assumption can be made regarding the excessive amounts of lead this child may be taking in through street lead contained in street dirt which may get onto his hands or through the inhalation of street dust containing high concentrations of lead, as well as the direct inhalation of exhaust fumes. Consider also the possibility that large amounts of dust and aerosols from this airborne lead may be entering the home and settling on food and dishes. Also, such a child possibly might be eating from cheap pottery plates and it has been shown that much of this pottery (in one study more than 50%) contains excessive amounts of lead because it is frequently fired at under 2200° F. Thus, an incalculable amount of additional lead is imposed on this child by the lead taken in from these sources. Also, in some of the older slum tenement areas in the inner city lead from paint chips and dust from the lead painted walls and ceilings of old buildings may shake down on the floor and create an additional burden. The amounts consumed may be enormous.

The burden imposed by poor nutrition

The nutritional problem represents another factor rarely considered which may enhance the lead burden when nutrition is inadequate, as is the case in most of these children. While little is known about these factors in humans, experiments with animals reveal that those with low chromium body level are much more sensitive to the effects of lead and show much greater organ damage at equivalent levels of lead when the level of chromium in the body was low.

Low calcium represents further problems. The blood level of calcium is critical for life and small changes may lead to abnormal cardiac rhythms, convul-

sions, etc. Therefore, the body maintains a constant level in the blood, using deposition and absorption from the bone as the source for this calcium. When calcium is released by the bone into the blood, lead may follow. For example, animals on low calcium diets may develop undue levels of lead in the blood, possibly as the result of this great immobilization of lead from the bone compensating for the deficiency of calcium in the diet.

Experiments carried out revealed also that animals deficient in magnesium had much greater damage to their kidneys at equivalent lead levels than was found in animals with normal magnesium levels. This can occur in humans with nutritionally deficient diets low in leafy and other vegetables or those with basic nutritional deficiencies.

Acute and chronic disease as high risk factors

In many individuals acute infectious disease can apparently enhance the effect of lead. In children and adults living in communities where there is a much higher rate of infectious disease and where inadequate attention is given to illness because of inability to pay for medical care or the inaccessibility of good medical care facilities, the effect of lead could be increased. There is good experimental evidence that when pneumonia is produced in animals an increased activity occurs in their bodies which produces an increased negative effect from a level of lead that otherwise might not reach a toxic level. This was also true with salmonella, an infection that is relatively common among the poor. This disease affects the intestinal tracts of humans, particularly in the warmer areas of this country. Experiments with animals showed that a lead level which, normally, would not show visible manifestations of disease, caused a very high mortality in rats when combined with salmonella infection. When exposed to the infection alone there were not nearly as many deaths.

Chronic disease

The problem of chronic disease is also one which deserves serious consideration when thinking about standards to protect the population. There are many individuals in this country who have high blood pressure as a result of, or resulting in, decreased kidney function. This is also true of children with chronic kidney infection and quite common in those who have gromerular nephritis, also a disease of children. Since one of the methods of removal of lead from the body is via the kidneys, this would interfer with such removal, increasing the body lead and hence the risk of lead intoxication. Further, as a result of chronic infection, there may be abnormal activity of the bone, since the body works less efficiently and also requires greater metabolic activity to carry out normal function with an attendant release of lead into the blood. Other chronic disease which also must be considered is liver disease. Alcoholism is very prevalent in the United States and many millions of people suffer from this disease. In low socioeconomic groups the high cost of protein such as meat, results in the consumption of a high fat and carbohydrate diet. This, together with heavy alcoholic intake tends to promote an inadequate, if not diseased liver. In these individuals, also, lead may have a considerably enhanced effect.

The genetic factor

A very important area, again frequently overlooked, which deserves major consideration and which may be an important factor in lead poisoning in the poor, particulary in black communities is the genetic factor. Again, one must recognize that these individuals are the ones exposed to the highest levels of airborne lead from gasoline. It is estimated that one to two million people in this country, most of them black, have a deficiency in an enzyme called glucose-6 phosphate dehydrogenase (G6PD). When this deficiency is present there is interference with activity and longevity of the red blood cell. Lead may also cause a reduction in G6PD so that in the presence of this deficiency the effect of lead on the red blood cell is enhanced and may well cause harm to these individuals at levels where it might not be harmful to others. Further 10% of the black population suffers from sickle cell anemia either as a disease or as a sickle cell trait. Individuals with sickle cell trait have difficulty when they are subjected to reduced oxygen tension, such as occurs when going up in a non-pressurized plane.

At reduced levels of oxygen the red blood cells tend to be destroyed and the debris plugging up tiny blood vessels can cause damage to the brain, spleen,

and other organs. The increased oxygen demand may by lead because it depresses oxidative activity in the tissues may also be a very important factor. Further many children with sickling, because of abnormalities of these red blood cells have increased destruction of the red blood cell and the interference of lead with red blood cell production may enhance further the difficulties these children have.

An additional very serious potential problem which also has not been considered very often relates to pregnant women. It has been shown from studying women in industry that a very high rate of abnormal births and spontaneous abortions occurs when pregnant women are exposed to lead so that pregnant women generally are not permitted to work where they ay be so exposed. Given the situation of a woman who smokes cigarettes with its attendant increase in lead intake, who lives in a heavily urbanized area, and who may spend a fair amount of time driving in expressway traffic, there is a possibility of an effect on the newborne. The lead does move across the placental barrier and usually the levels in the fetus are considerably higher than they are in the mother. Considering that fetal tissues in the unborn child are very rapidly growing and require all the oxygen they can get, anything that depresses oxidation, particularly in the brain and other vital organs, may reflect itself in a serious effect on the fetus. Finally, it must be recognized that even with a decrease in the amount of airborne lead produced, in the future there will be continued increase generally in the world air, water, and soil, hence, the body burden. While the transient amounts in the air may decrease, lead is immutable and when it falls out in the soil and into the water it remains virtually forever. We must reiterate that lead is not biodegradable and any decrease in the airborne levels of lead should be seen in this light. This accumulation will continue, particularly in urban centers, for many reasons. Expansion of the size of urban centers, the increase in the number of automobiles, and the greater gasoline consumption, due to the use of more powerful engines, may well compensate for the decrease in the amount of lead which is projected.

For all of the reasons that I have noted, and because there are many millions of people in the population at excessively high risk, those at high risk are the ones who are most exposed to lead, the levels of airborne lead from automobile exhausts should be such that these populations are protected and that there is minimal exposure at any point in time. In my opinion, a level of 2.0 micrograms per cubic meter in the air does not provide such an adequate margin of safety for this very large and significant portion of the population. Removal, therefore, of only 60% of the lead by 1977 will do very little to ameliorate the problem and will do nothing in my view to protect the people of this country.

In summary then, the following points have been made.

1. No matter how much the airborne lead is decreased, the amount already produced will be added to, unless all lead is removed from the air in the future.

2. A large percentage of children in urban areas and those even in suburban areas are already showing excess lead burdens.

3. The levels of lead already present are sufficient in many cases to cause metabolic disease with the production of abnormal amounts of ALA in the urine.

4. Millions of people in urban areas are exposed to multiple sources of lead, most of it airborne from gasoline, and are therefore, at excessive risk.

5. The genetic problems faced by millions of individuals who receive high exposure of lead are such that they enhance the lead effect in causing disease, and undue body burden.

6. The combination of lead with acute and chronic disease and alcoholism represents another serious potential hazard, also to a large number of people.

7. Individuals such as pregnant women and their unborn children are subjected to an amount of lead in urban areas which may represent a threat to the unborn child and the mother.

8. The reduction in the amount of lead in gasoline is inadequate to protect a very large segment of this population, since this reduction will not result in decreased body burden.

One further point I have not considered in any of the above discussion is the effects of lead and other pollutants, but it must be noted that mercury and cadmium, particularly, and other materials which are present in the air of

urban centers also affect many of the same organs, particularly the kidneys, liver, and brain, so that any consideration of lead must also consider the presence and added effects of these other materials. I have not dealt with this because there has virtually been no research in this critical area, but I must note that it must be considered in deliberations of this body.

Thank you for permitting me to introduce this material. As a physician, and a teacher of preventive medicine concerned with prevention of disease and the health of the American people, I feel that it is essential for me to express my views in this manner.

Virginia Carnow, R.N., who has worked diligently in all of these areas joins with me in presenting this staement and joined in the preparation of this document.

STATEMENT OF FRANKLIN A. THOMAS, PRESIDENT, BEDFORD-STUYVESANT RESTORATION CORP. AND JOHN DOAR, PRESIDENT, BEDFORD-STUYVESANT D AND S CORP.

This statement is being submitted at the suggestion of the New York City Environmental Protection Administration.

Bedford-Stuyvesant Restoration Corporation (Restoration) and Bedford-Stuyvesant Development and Services Corporation (D & S) are jointly funded by a Special Impact Program grant from the Office of Economic Opportunity and also receive foundation grants and other contributions. The late Senator Robert Kennedy, with the help of New York City Mayor John Lindsay and Senator Jacob Javits, established these two non-profit membership Corporations which are committed to improving the quality of life for the residents of Bedford-Stuyvesant. The Corporations are funded at about $10 million annually and concentrate on enhancing the economic, housing and public services for the more than 400,000 inhabitants of the city of Bedford-Stuyvesant.

Our purpose in this statement is not to cite the inadequacies of the sanitation services delivered to Bedford-Stuyvesant. An inspection of the area would say more than words could.

We do want to discuss what we are proposing as a possible solution. We do recognize and applaud the efforts of the New York City Environmental Protection Administration and its Department of Sanitation, whose performance has improved measureably in the past eighteen months. Nonetheless, the area remains dirty, and residents have little incentive to cooperate with the existing structure. Relatively few members of the public sanitation force (which is responsible for residential and institutional refuse collection) come from Bedford-Stuyvesant. None of the private cartmen who serve commercial and industrial firms has offices in the area.

The Corporations' interest in sanitation is derived from several objectives:

1. To provide a healthier and more attractive environment for the residents;
2. To support and enhance the real estate redevelopment of the area;
3. To aid in recruiting businesses to locate in Bedford-Stuyvesant;
4. To provide sanitation employment opportunities for local residents;
5. To further the concept of community control;
6. To start and develop locally-owned businesses.

Specifically, Restoration proposes to organize and capitalize a wholly-owned for-profit subsidiary with whom New York City would contract for specific sanitation services within a defined area of Bedford-Stuyvesant, which services are now being performed by the Department of Sanitation. This "experiment" would seek to prove that a locally owned and operated sanitation company can perform at a lower cost than is presently being incurred by the Department, earn a profit, and marshal the community support and compliance without which the quality (as distinguished from the quantity) of sanitation services cannot truly be improved.

By way of background, in November, 1970 a study, initiated by New York City's Environmental Protection Administration but conducted by the New York City Office of Administration, suggested that the Department of Sanitation's refuse collection cost was almost three times that of private carters. This study recommended experimentation with private contracting for residential refuse collection. In early January of this year, New York City's Environmental Protection Administration released a reply which noted that there are significant differences in the operations of private cartmen who handle only commercial refuse and the Department of Sanitation. Further, it cited what it

believed to be some important deficiences in methodology in the Office of Administration's report but admitted that some cost differential may well exist. Implied was the need for a controlled experiment. We should note that New York City's Environmental Protection Administration concluded, however, "that the cost differential between the Department and private cartmen is not large enough to allow any reasonable expectation of significantly lower cost to taxpayers through load-shedding to private cartmen." It added that "only when entire routes were eliminated would cost reductions appear." It is exactly the elimination of an entire route that we are proposing.

In a letter dated January 19, 1972, the Corporations submitted the outline of their proposal, some terms of which were amended in a letter dated March 16, 1972.

On February 7, 1972, the *New York Times* reported Environmental Protection Administrator Jerome Kretchmer's intention of "conducting an experiment to determine whether private pick up of refuse might be cheaper in some areas than city collection." The story added that EPA was considering a proposal. The following day the press identified the proposal as ours.

In mid-February and early March we met with Mr. Kretchmer and his associates to answer their objections to our January 19th letter. We believe the most serious of these were answered by our March 16th letter, but to date we have received no written reply from EPA.

We are ready to proceed. We are proposing to perform the following services in that portion of Bedford-Stuyvesant designated by the Department of Sanitation as Section 401 (an area of about 75 square blocks):

1. Six day a week collection of regular household refuse, including bulk items that can be accommodated by the compactor trucks;
2. Weekly scheduled bulk collection of loose and sundry items that cannot be accommodated by the compactor trucks;
3. Regular sweeping of all catch basins;
4. The provision, maintenance, replacement, and emptying of 280 litter baskets throughout the area and 25 small containers;
5. Twice a week sidewalk sweeping by sidewalk mechanical brooms and, as needed, manual sweeping of sidewalk areas that cannot be reached by the brooms;
6. Regular street sweeping, subject to a satisfactory plan for enforcement of alternate side parking regulations;
7. Periodic cleaning of vacant lots.

The target area comprises somewhat more than 10% of Bedford-Stuyvesant and includes a number of blocks with 1-4 family homes, some high-rise apartments, a smattering of light industry, several commercial centers and other institutions.

Our price for these services is $732,000 for the first year and is premised upon refuse continuing to be disposed of at city dumps at no cost to Restoration Sanitation Company (RSC). This price is well below the annual cost incurred by the Department of Sanitation in Section 401. We estimate this cost to be slightly in excess of $900,000 for somewhat less service than we are offering to perform.

RSC would be capitalized at $600,000, including $200,000 of equity and $400,000 of debt. Capital expenditures are expected to be about $350,000 for 6 compactors, 2 street sweepers, 4 sidewalk sweepers, 1 open truck and other equipment. We project that our staff needs will be 12 drivers, 18 helpers, 1 top-flight mechanic, a foreman and a general manager. It is expected that most if not all of these people will be residents of Bedford-Stuyvesant, a point which will facilitate the garnering of community support.

The position of general manager will be the most important since this is a very labor intensive business (operating staff expenses will be about 55% of revenues) and motivation and supervision will be the keys to success. We have chosen a long-time employee of Restoration for this job. He has been spending and will continue to spend a good deal of his time in learning all aspects of the refuse collection business. Several other members of the Restoration/D & S staffs will aid in the start-up and monitoring aspects. One answer to motivation of employees is a compensation arrangement based partially on bonuses contingent on individual performance and the profits of the company. We intend to offer such a plan, the details of which have yet to be drawn.

Supervisory assistance and community involvement will be effected partially through block associations. Because of the efforts of Restoration's Neighborhood Center personnel we are in touch with at least 30 block associations in the target area. The goals and projected *modus operandi* of RSC will be fully explained to these groups. We would hope to use a delegation from these associations as part of the evaluation process that this experiment will require.

We shou.d point out that RSC is not yet a *fait accompli*. New York City's Environmental Protection Administration has yet to approve in principle our proposal though clearly they have a good deal of interest in it. The Sanitation Union is not likely to embrace our efforts and this hurdle must be cleared. A sizeable portion of the funds are expected to come from OEO which must approve grants of individual projects even though an over-all pool of funds has been authorized. We have submitted a preliminary proposal to OEO and received comments. We expect that final approval will be granted assuming agreement on a contract with New York City can be reached. The balance of the funds is to come from foundations and commercial banking sources, and would again be contingent on the successful negotiation of a contract.

It is true that RSC, should it come into being, will be a company with no experience in refuse collection. Without trying to denigrate the skill or art inherent in this business, we do feel that given the expertise of the Restoration/D & S staffs, as well as our commitment to hard work and the very vested interest we would have in the success of this project and the very direct risk should RSC fail to perform, we are confident that we can provide the services listed above.

To recapitulate, we are beyond the stage of arguing about the adequacy of sanitation services. For several reasons the Corporations want the opportunity to perform these services themselves. Such an experiment would demonstrate the ability of a community-based corporation to improve the quality of services at a lower cost than is currently being incurred and earn a profit with which it can motivate employees and provide retained earnings for additional environmental improvement projects.

CALIFORNIA INSTITUTE OF TECHNOLOGY,
PASADENA, CALIF., *April 5, 1972.*

M. B. BROWNLEE,
Senate Commerce Committee, Old Senate Office Building,
Washington, D.C.

DEAR SIR: The EPA proposal regarding the regulation of fuels and fuel additives has embodied within it some serious defects. In the absence of future projections of the amounts of leaded and non-leaded gasolines that will be burned, it is difficult to predict what the affect of this regulation will be on the quantities of lead emitted by motor vehicles. It is possible for lead emissions to actually increase under these regulations. This regulation might, therefore, mislead the public into believing that something concrete was being done about automotive lead emissions when, in fact, nothing was being done at all. It is misleading to associate either a lead concentration of 2 micrograms per cubic meter in air or a 60% reduction in lead emissions from motor vehicles with nonadverse physiological effects regarding lead poisoning. The 2 microgram lead concentration figure is the result of emitting very large amounts of lead into the air near freeways and streets and accumulating increasing amounts of easily ingested forms of industrial lead in cities. These reservoirs of lead have become so large that they now constitute a serious threat to the health of people. The essential point is that the yearly manufacture of many hundreds of thousands of tons of lead alkyls is an operation which serves to massively pollute our whole environment with poisonous lead, and in the best public interest it is the rate of manufacture of these lead alkyls which should be regulated. A freeze should immediately be placed upon any further expansion in the manufacturing facilities that produce leaded alkyls and a regulatory program for the orderly reduction in the production of the poisons should be instituted.

Sincerely,

CLAIR C. PATTERSON.

DARTMOUTH MEDICAL SCHOOL,
Department of Physiology,
Brattleboro, Vt., June 30, 1972

Hon. PHILIP A. HART
Senate Office Building,
Washington, D.C.

DEAR SENATOR HART: Thank you for sending me your letter signed by 49 members of Congress to Mr. Ruckelshaus, Administrator of the Environmental Protection Agency. Those few of us who have recognized the hazards of environmental lead to human health for the past eight years or so and who have been discouraged by the vigorous opposition of the lead and oil interests cannot help but be heartened by the action of you and your colleagues.

I am not surprised at the high concentrations of lead in city dirt. With two pounds of lead per capita annually entering the environment from motor vehicle exhausts, the lead must collect somewhere. The amount of air-borne lead is a direct function of gasoline consumption, by city; concentration of lead in herbage decreases as to distance from highways; contamination of vegetables grown near highways has long been documented. I suspect that lead from leaded gasoline contributes as much to lead poisoning in children as does interior house paint, for cases of lead poisoning in young slum children in New York City are much higher in the summer months, when presumably they play in the city streets, than in the winter, when presumably they are indoors eating paint chips.

Evidence has appeared from Finland that all adult urban dwellers tested, with blood lead levels believed to be "normal," have a defect in an enzyme in their red blood cells. This enzyme is extremely sensitive to lead, and is presumed normal only in rural populations relatively unexposed to motor vehicle exhausts using leaded gasoline. There is also evidence that persons dying of a variety of diseases unrelated to lead have much higher tissue levels of lead than persons dying of accidents.

When used crank-case oil is burned for fuel, that part of the gasoline lead retained in the motor undoubtedly enters the atmosphere to contribute to air-borne lead, which soon is precipitated to the earth or water. When rain washes lead in city dirt into the sewers, it contaminates our lakes and rivers, especially their bottoms.

I consider lead in gasoline to be a real and present hazard to the health of children and a potential hazard to the health of the urban population. The sooner it is removed from gasoline, the earlier will these hazards be lessened.

Sincerely yours,

HENRY A. SCHROEDER,
M.D., Professor of Physiology, Emeritus.

(The following information was referred to on p. 199:)

GASOLINE

by

Albert J. Fritsch, Ph.D.

Center for Science in the Public Interest

1346 Connecticut Ave. NW
Washington, DC 20036

April, 1972

Preface

This report is meant to be a citizen's guide to current problems dealing with gasoline safety, regulation, environmental effects and purchase. The content of the report is based on the following testimonies and petitions: before the Senate Judiciary Committee (July 21, 1971); before the Senate Commerce Committee (Feb. 4, 1972); before the Environmental Protection Agency (November 2, 1971) and before the Environmental Protection Agency (April 11, 1972).

Price $3.00

(Low-Income $1.00)

Acknowledgements

The author wishes to thank the following for assisting in gathering information for this report: Dr. Farley Fisher, CSPI, Mr. Mark Sebern, Marquette University, and Mr. Peter Braveman, Princeton University. Likewise, he is grateful to the directors and staff at the Center for Science in the Public Interest for their encouragement and critical comments.

GASOLINE

Introduction:

No consumer item so confuses the American Public as does gasoline. The average motorist spends $300 a year to fuel his car and yet he knows very little about this smelly chemical mixture. He has been told that gasoline is the number one air pollutant (see Table I); he knows that gasoline is the basic ingredient in a Molotov cocktail; he may even understand some of the current controversies on posting octane numbers, reduction of lead contents and advertising claims. But for every citizen there is a hidden curtain of secrecy about gasoline which frustrates him.

How safe are the additives used in gasoline? Will lead-free gasoline hurt my engine? Will new environmental controls cost me more at the pump? Which brand should I use for my car? Should I trust the multitude of advertisements I hear each night on television? How can I judge a better grade or blend of this fuel? Who should I listen to for information?

Answers to these and many similar questions are not easily found. However, better citizen and consumer choices can be made when information from economic, chemical, toxicological and technical sources are gathered together in one place. This report attempts to place valuable data in the hands of the citizen who must help decide the policy needed for controlling gasoline use and consumption. In many cases where critical data is lacking, the citizen has the right to demand that our government initiate proper monitoring.

Part I The Gasoline We Use

(a) Similarity of Gasoline

Most consumers know that the curtain of credit cards, crockery giveaways, cash prizes, razor blades and glossy advertisements do not make the gasoline different; these enticements could be indicative of a lack of difference. However, the claims to special gasoline additives (TCP-2, F-310, HTA) by the large oil companies are confusing. Are there differences among the brands?

Mr. R.J. Peterson, president of the Society of Independent Gasoline Marketers (SIGMA), testifying before the Senate Judiciary Committee in 1970 said, "for the most part, gasoline available at independents and gasoline available at majors is substantially the same." Perhaps the biggest difference is the price. However, when one goes to purchase gasoline he will quite often search through the forest of multicolored signs for one which looks quite familiar. It may be that he likes a particular colored sign, the speed of the attendent, the reputation of a clean toilet or the size of the gas station. It may be reinforcing his conviction that the time spent watching two million TV ads in his lifetime is not in vain.

The gasoline mixture (not gasolines) may contain varying amounts of 3,839 possible olefins, 661 possible paraffins, 10 to 15 aromatics and about 800 naphthenic compounds. Though these classes of hydrocarbons may confuse the non-chemical mind, the principal point should be easily grasped. No two gallons of gasoline is exactly the same--chemically. Gasoline is not to be compared with aspirin which is a single chemical compound. However, gasoline is treated commercially as a fungible commodity (any unit or part can replace another unit, as in discharging a debt); gasoline is interchanged within the petroleum refining and transport network. Then

by a grand hocus pocus, gasoline emerges as a non-fungible product when it reaches the confused consumer. It is necessary to make some basic distinctions to help clarify one of the most muddled and unpredictable marketing areas in the United States today.

One must begin with certain working premises:
(1) Gasoline is a mixture of hydrocarbon components designed for use as fuel in the internal combustion engine (our cars). The liquid refers to that part of crude oil which boils and distills in the 50 to 350° F boiling range, but is supplemented by cracked products from heavier petroleum fractions which are less commercially useful in their natural state. Gasoline is defined both chemically and by use and function.
(2) Materials called additives (see Appendix 1) are inserted to improve the performance of the gasoline or to add certain distinctive qualities to the commercial product. These may include antiknock agents, dyes, surface modifiers, detergents and several other functional classes. The compounds used in these classes are not obtained directly from fossil fuels but have been chemically synthesized in the laboratory. The additives do not modify the chemical structure of the refined gasoline as such, but are physically present for certain economic or functional reasons. However, some of these may chemically change the impurities present in refined gasoline.
(3) Gasoline is treated by the petroleum industry as a fungible product, just as other fuels such as natural gas, coal, electricity, fuel oil. This intermingling and exchange of gasoline by different companies is documented by experts in the field (see Appendix 2). Even officials of the American Petroleum Institute (API) admit the practice exists in"remote places." It is common knowledge that a single pipeline will serve a certain region (such as Utah) and that a variety of brands will come from a single refinery (Puerto Rico and Hawaii).
(4) Some additives are present before the refined

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gasoline enters the pipeline, but this practice varies with pipeline practice. Some additives are added manually after loading at the terminal and some are often ignored and not added at all. The cavalier manner in which additives are used is verified by the unexpected high lead analysis of American's certified no-lead variety, which was found in Maryland, New York and Wisconsin. This practice is not limited to a single company.

(b) Confusion of the Consumer

When the four premises are considered together, they form a picture of an inherently complex chemical mixture, treated as an interchangeable commodity, but not being substantially changed by mere addition of gasoline additives. The situation becomes quite confusing. It has been found that 64% of television viewers (CSPI survey) do not believe gasoline advertisements. This credibility gap may be a compliment to the common sense of the American people. However, what the viewer expresses to the surveyor is not always his actual practice, for he is often influenced by the ads he openly disdains. A CSPI survey found that 51% of the consumers prefer a special brand of gasoline and that the same percentage believes there is a real difference between the various brands of gasoline.

The consumer is unable to make an intelligent judgment about the quality of his gasoline. When he buys a shirt the consumer is able to test it, wear it, and wash it; he has a more firsthand touch and sight of the product. But gasoline stands at a technological distance from the consumer. Oil companies freely admit that the automobile is the major determinant of gasoline efficiency and not the additives. The consumer who is neither an oil expert nor a mechanic finds it most difficult to make a quality judgment; he is dependent upon the

word of the maker and seller. Why should he not be able to know what he is buying, how much and what kind of additive is present, and what the proof of the efficacy and safety of the product is? As consumers begin to understand their own rights, they will demand more substantiation of claims.

Since 90,000,000 buyers of gasoline do not have the expertise to judge gasoline, they are prey to secretive practices of which they are unaware. They are often victims of gasoline wars and find gas prices more volatile than the fumes. A 10% drop in prices would be a saving of 3 and 3/4 billion dollars per year. Yet consumers cannot find out the octane number of the gasoline he purchases. Granted the standard measurement of research octane number (RON) has some limitation (see Appendix 3), still it is the measurement for gasoline quality used by most companies. Major companies have successfully blocked proposed octane posting by the Federal Trade Commission without giving a meaningful substitute. If no measure for gasoline grading actually exists, then all gasoline should be considered the same; if such a measure exists and is used by industry, then the public should know it.

Though the absence of standards lends to public confusion, the number of refinery processes are even more baffling. These processes (see Appendix 4) produce different amounts of aliphatic and aromatic hydrocarbons. One popular misconception is that the various refinery processes take the same crude oil and make the fuel different; actually, the refinery takes different oil fractions and make them the same. This misconception has not been dispelled by advertising; instead, it has been augmented.

Different crude oil components are rearranged chemically to make gasoline components; this is what the oil industry actually does, not what it

advertises to do. Gasoline manufacturers intermingle their refinery product to such an extent that the source of the gasoline is unimportant, provided the proper bookkeeping is performed. If one puts 10,000 gallons into a common pipeline, then he withdraws that amount to his account at the terminal end.

Manufacturers who concede a limited amount of interchange of refined gasoline, stress that their particular additive or additive packages can change a common gasoline into "gasolines." When the consumer tries to find out what these additives are, he encounters a wall of secrecy and mystery. What exactly are all of the codes and lettered materials which companies such as Esso, Chevron and Shell boast about (see Appendix 5 for Registered list of additives; only about a third of these are held to be non-confidential).

(c) Types of Additives

To treat the gasoline additives properly one must classify them according to use and function (see Appendix 1). These additives may be classified according to when inserted into the fuel; whether essential, incidental or even harmful to fuel or automotive parts; or whether they change the basic quality of the gasoline.

A gasoline is meant to fuel an internal combustion engine and only properties which affect the function of the gasoline should be considered contributive to its quality. We can list four criteria of gasoline performance on which this quality should be based: stability in transport and storage; ability to burn smoothly and efficently in the engine; ability to form proper fuel-air mixtures for introduction into the engine; and ability to burn completely without leaving environmental contaminants.

Antirust agents, antioxidants. and metal

deactivators are essential additives inserted in small quantities at the refinery. All modern gasoline has these additives for stabilizing purposes (see Appendix 1).

A fourth class of additives is the antiknock agent (see Appendix 6 for popular antiknock packages and their chemical compositions). This class is well known to the consumer and is frequently discussed both from environmental and economic standpoints (Parts II and III). This class is the source of most of the lead in our atmosphere and urban dust; it poisons the most practical antipollution device now being developed; it reduces the lifetime of sparkplugs and exhaust systems. The addition of tetraethyl lead (TEL) is the cheapest way oil companies have to raise octane numbers, though other methods are known and currently used.

Antiknock additives were known from their first introduction in the early 1920's to cause detrimental effects to the engine; these effects must be remedied by other additives called scavengers, which prevent formation of ash deposits resulting from the lead oxides. The remarkable uniformity of scavenger composition is seen in Appendix 6. It must be noted that ethylene dichloride, one of the two scavengers most commonly used, is far more corrosive to the engine and yet is present due to its low cost.

Antiknock packages likewise contain dyes which were first added in the 1920's to warn of the presence of the highly toxic TEL. That was the time when the consumer still saw his gasoline in the old glass pump bulb. Today 85% of the consumers (CSPI survey) do not know the color of their gasoline. Consumer appeal must not be given as a reason for the presence of dyes.

Another additive class which is closely re-

lated (functionally) to the lead scavenger is the deposit modifier; some examples of this class include tricresyl phosphate, methyldiphenyl phosphate and trimethyl phosphate. Some of these compounds have proven to be quite toxic; however, these compounds also damage catalytic antipollution devices.

There are several classes of additives which are optional and can be added at the terminal or even at the station. These include the seasonal and regional deicing and antistall agents, detergents and upper-cylinder lubricants (usually light oils). Some scientists contend that detergents do not really clean dirty carburetors, though they may preserve a clean one. Since many companies stress gasoline difference through their brand of detergents, it is imperative that the consumer be shown their substantiated claims.

What do HTA, F-310, TCP-2 and Amotone really do? It is impossible to find the solid data to back detergent claims. One should question whether the intrinsic quality of gasoline can be judged by extrinsic cleaners, no matter how valid the claim.

The Federal Specifications VV-G-76B (March 20, 1970) can assist in distinguishing classes of additives. Section 3.2 state that gasoline may contain antiknock compounds, antioxidants, metal deactivators and antirust agents. Next there appears an interesting distinction: "additives other than those specified above, such as detergents, deicers, upper-cylinder lubricants, etc., will be accepted if prior approval has been obtained from U.S. Army Aberdeen Research and Development Center, Coating and Chemical Laboratory. Such additives must be compatable with any of the materials included in this specification and must not appreciably affect the specified chemical or physical properties." Thus a distinction is made

for additives permitted for enhancement of properties (stability, engine performance), while others have a somewhat more optional or secondary function; they are permitted only if they do not affect the other gasoline additives adversely.

(d) Properties of Gasoline

The common properties of gasoline are not affected so much by additives as by refinery processes. The first of these properties is the volatility (ability to change to a vapor) of the gasoline; this is measured by Reid vapor pressure and American Society for Testing Materials (ASTM) distillation curves. Desirable volatility characteristics vary with atmospheric temperature and humidity and with altitude (thus varying in the different parts of the country).

The variation is not so much among brands but according to regions; differences within a brand according to region is greater than differences in brands within a region. Furthermore, even though many companies fail to acknowledge seasonal variations in gasoline, there are winter and summer blends, which are marketed at the appropriate season under the same label. The Bureau of Mines' semiannual reports show the uniformity of gasoline within a season together with seasonal differences (Bureau of Mines, 1971).

Likewise, the Bureau of Mines'reports show the sulfur content, gum content and residue in gasoline samples from different regions. Sulfur content in most modern gasoline is low among all brands (but high enough to cause deterioration of the catalytic antipollution devices). The gum content is also low among all brands. In fact modern gasoline is of better quality than that of fifty years ago but this is not due to additives.

Octane number is the measure of the efficiency

of gasoline in a high-compression engine. However, after the point where the knocking disappears, the engine itself is the limiting factor in determining such efficiency. Octane number is the defining mark of so-called grades of gasoline (premium, regular, special). Again, as with other properties, octane number of the same brand may vary from region to region.

One might be surprised how much is known about the quality of gasoline, how standardized the methods and refining processes and how uniform the quality is among brands. Additives are not the primary determinants of quality. If one were to put all of today's additives into a gasoline of 50 years ago, that gasoline would still not be as good as today's gasoline without any additives. Variations among different brands within a region or season are smaller than variations between samples of the same brand from different seasons or regions. To speak of grades of gasoline makes sense only when one compares extremes of one or other qualitative difference. But to speak of different branded "gasolines" is very misleading.

One cannot speak of what the ideal gasoline should be, since the unpredictable criteria of environmental compatability has not been developed. However, it will be shown in the next section that lead stemming from antiknock compounds is a major pollutant and must be removed. In removing the lead four accompanying classes of additives can be done away with. However, it is highly likely that the ideal automotive fuel is not gasoline at all.

(e) Conclusions and Recommendations

There are about 80 dyes registered and yet there are only five different compounds; there are 30 antiknock packages but only six antiknock agents and two scavengers used in them. Essential additives must

remain; detrimental additives must be removed; optional additives should be added at low cost at the station. Let all gasoline meeting Federal Specifications be called the same within certain octane quality standards

Gasoline companies have striven to build brand loyalty by means of marginal differentiation. TV glamor and persuasiveness do not make the difference in gasoline but do add to brand loyalty.

Other fuels are treated as interchangeable. Fuel oil and kerosene were held fungible in the Maritime Petroleum Corp. v. Jersey City case and coal in the Wyoming Valley Collieries Co. bankruptcy case. Yet coal is hard or soft and of this or that quality, varying in chemical composition; its fuel content is the important factor.

Gasoline is analogous to coal. Several factors lend to making gasoline fungible: an interchange of refined gasoline; measurement by accepted standards; a rising quality of gasoline due to processes more than brand additives; the presence of optional additives; seasonal and regional variations common to all gasoline brands; the actual detrimental effects of certain additives.

It is recommended that consumers purchase the cheapest gasoline from local dependable dealers; they should experiment with lower octane gasoline (about 40% overbuy in higher octane fuels); they should pressure the Federal Trade Commission to demand substantiation of advertisements and demand that additive and octane information be posted; they should seek Federal standards on all gasoline and demand that a monitoring system be established both to protect independents and to insure high quality fuel. They should continue to seek the removal of lead and other detrimental additives from gasoline.

The ramifications of a stricter control on

gasoline ads and sales may include a whole restructuring of gasoline marketing practices. If a company has a good cleaner or an environmentally safe package, fine. They should sell their package at any service station along with STP and Bardahl. But let's forget the cash prizes and glassware; the consumer wants gasoline at the service station--high quality, low-priced gasoline. He also wants the freedom to know what he is buying. Sophisticated technology and a plethora of alphabetized products should not erode that right.

Part II Lead In Gasoline

(a) The Dangers of Lead

Lead has been known for thousands of years to be a highly toxic material. The disease, sometimes called plumbism or saturnism was first described over 2000 years ago by the Greek physician Nicander. This disease was not understood among the Romans and the accidental ingestion by upper-caste citizens of the Empire of lead from pottery and metal cups has been considered a possible cause of the decline of Rome. Franklin in the 1700's knew that people could be poisoned from rainwater collected from lead-covered roofs on which acidic leaves had fallen. Industrial workers in the 19th and 20th centuries have frequently experienced "wrist drop," nausea, and other symptoms of lead poisoning.

Modern Americans seem to have a very low awareness of the dangers of lead, whether derived from water pipes, wall paint or leaded gasoline. Recently reports of children with pica suffering irreparable brain damage and sometimes dying from eating paint chips have been highly publicized. People drinking illicit, distilled lead-contaminated whiskey have been known to suffer from lead poisoning. Unglazed

pottery , sold chiefly in small art shops, have given rise to cases of lead poisoning.

No one now doubts the heavy weight of medical evidence demonstrating the toxicity of lead; the question is whether a small amount of lead is hazardous. In the absence of overwhelming documentation on the toxicity of small amounts of lead, we must decide whether this nation wishes to take chances on living with ever-increasing amounts of lead until such time as the safety of small amounts of lead is conclusively proved or disproved.

The average American ingests or inhales approximately 100 to 500 micrograms of lead per day. Typically, about 20 µg/liter is ingested from drinking water and about 300 µg (micrograms) is ingested in food. Between 5 to 10% of ingested lead is absorbed (Kehoe, 1961). Thus the average daily dietary contribution of lead to the body burden is about 10 to 30 µg.

The airborne lead intake varies considerably, ranging from less than one µg lead/day in rural areas to 8 - 23 µg lead/day in central city areas (Engel, 1971). This is based on 15 cubic meters air/day and a 25 to 50% absorption rate. One study reports that 22 to 63% of 0.1 to 1.0 micron diameter particles were deposited in the lungs (Nozaki, 1966). In another study 14 to 45% of 0.2 micron particles were deposited with more than 90% of the deposited particles retained by absorption (Hursh, 1969). Lead in the air is almost entirely derived from leaded gasoline additives--a fact we must remember in any discussion of gasoline environmental problems.

Lead is not one of the essential elements needed by the human body. Yet lead accumulates in the human body with prolonged and repeated exposure. American urban dwellers carry significantly more lead than do people living in rural areas and by

members from pre-industrial cultures. Patterson has estimated that 200 mg (milligrams) of lead that reside in an average adult American human body is about one hundred times greater than the natural load. He concluded that "[t]his clearly and strongly suggests that the average resident of the United States is being subjected to severe chronic lead insult"(Patterson, 1965).

Any amount of lead accumulating in the body is undesirable. It can possibly cause harm to the central nervous system and brain damage to children. It is most important that we cease speaking of "average" or "standard" men; some individuals have too much lead already--especially children in the poorer sections of our cities. Certain subgroups of the society may be exceptionally sensitive to lead insults; examples are children and persons with particular diseases or genetic characteristics.

(b) Lead Content in Blood

Studies on human adult volunteers have indicated that blood lead content may serve as an index of the degree of current or recent absorption of lead. However, blood levels are not the only criteria. A three and a half year old child had normal blood lead (5 - 30 µg/ 100 ml. of whole blood) and normal urinary lead levels (25 µg/liter) and yet he suffered from peripheral neuropathy (general weakness, foot drop, etc.). X-rays showed heavy deposits of lead in the bones and investigation showed a history of pica (Seto, 1964).

Blood levels serve as a reasonable index of high levels of lead intake. Virtually all cases of fatal encephalopathy contain blood lead concentrations of 150 µg/100 grams or more of whole blood.

Blood lead concentrations are higher in urban areas than in rural areas. Parking lot attendants in Cincinnati were found with up to 34 µg/100 grams,

over three times that of suburban non-smokers in Philadelphia (11 µg/100) (California, 1967). Blood lead levels among Frankfort Germany street cleaners were found to be significantly higher than those of the general population. Although no clinical lead poisoning was apparent, urinary delta-aminolevulinic acid (ALA) (an indicator of lead poisoning) was at dangerous levels in about 15% of the cases (Lehnert, 1970). Herberg and co-workers have shown a direct relation between the concentration of lead in the blood and the activity of a biochemical enzyme called ALA dehydrase (Hernberg, 1970,1970a). No amount of lead is so small that it does not decrease ALA-dehydrase to some extent (Chisolm, 1971). It is generally conceded that the interpretation of these laboratory (in vitro) findings is highly pertinent to the question of airborne lead (NAS, 1971, p. 145).

High blood levels of lead have been found in large numbers of children living in poor urban areas. Recent surveys of large city infants and young children indicate that many have blood lead concentrations in the range of 40 - 60 µg/100 grams of whole blood. The high blood lead concentration have been attributed most frequently to indoor house paint. The Washington, DC city government (1971) found that 115,000 dwellings in the city, approximately 40% contained hazardous levels of lead; 30 to 50% of children living in those units have dangerously elevated levels of lead in their blood (Fisher, 1972).

High blood lead concentrations in urban children could be partly due to inhalation of airborne lead derived from leaded fuels (Tables II, III, IV). Near busy freeways in Los Angelos air concentrations can sometimes exceed 50µg/cubic meter (25 to 50 times what is considered safe levels)(Goldsmith).

Blood lead may also be derived from urban dust

containing lead. Lead concentrations in some urban dust reaches 2,000 µg/gram (NAS 1971, p. 328) and near heavily travelled highways can reach to 4,436 µg/gram (Shy, 1971). This approaches the level of 0.5% lead content in dust. It should be remembered that present regulations call for reduction in house paint to below that concentration. The child who is susceptible to lead poisoning from paint chips is also susceptible to poisoning from road dust. In fact the dust from a dirty hand (one-sixth of a gram of dust) could give a child lead poisoning if ingested over an 8 month period (Shy).

The New York Department of Air Resources reports that samples have been found in midtown Manhattan to consistently have lead concentrations in the range of 13 to 18 $\mu g/m^3$ (N.Y. Daily News, 1971). The blood samples of small children, the most affected age group, in well-maintained Manhattan apartments have been found to reach 40µg/100 ml. of blood (New York Times, 1971; Medical World, 1971).

The effects of high levels of lead on the body are well known: high levels of lead damage the brain and nervous system; lead can affect the liver and kidney, causing chronic nephritis, a disease characterized by a scarring and shrinking of kidney tissue; chronic over-exposure to the metal can result in peripheral nerve disease, affecting primarily the motor nerves of the extremities; it is associated with the development of artherosclerosis.

With reference to possible brain damage, Dr. Patterson states:

> The course of human events is determined by the activities of the mind. Intellectual irritability and disjunction are associated with classical lead poisoning, and it is possible, and in my opinion probable, that

> similar impairments on a lesser but still significant scale might occur in persons subjected to severe chronic lead insult.
> (Patterson, 1965)

Dr. H. Schroeder of Dartmouth Medical School, an expert on toxic effects of heavy metal, states: "there can be little doubt that exposure of mothers to lead has a damaging effect upon fertility, the course of pregnancy, and the development of the fetus." (Schroeder, 1970).

It is highly possible that low concentrations of lead can help cause metal retardation in children.

> I think that many children get chronic encephalitis from lead, as well as acute... This group of children deteriorates gradually without ever having had an acute lead encephalitis...I think that lead does something to the growing brain which is different from what it does to the adult brain.
> (R.K. Byers, 1958)

Dr. Harriet L. Hardy has expressed the opinion that:"There must be a departure from the present U.S. attitude that prevention of occupational disease is the only requirement of those responsible for the use of toxic agents of lead."
(Hardy, 1965)

(c) Increased Lead Concentration in the Atmosphere

Since atmosphere lead concentrations are higher in urban areas and greater numbers of our people live in these congested areas, the amount of exposure to high lead concentrations is increasing. Amounts of lead in urban atmosphere range from 0.1 to above 50 $\mu g/m^3$ dependent upon sampling sites and climatic and seasonal conditions. Most normal urban areas average between

0.5 and 2.0 $\mu g/m^3$, but a number of congested areas far exceed this range (see Table IV). Preliminary reports from the "Seven Cities Study" show that at 19 sampling locations in Cincinnati, Los Angelos and Philadelphia at which ambient lead levels were measured both for 1961-2 and 1968-9 the later levels were higher at most sites: in Cincinnati (13-33%); in Los Angelos (33 to 64%); and in Philadelphia (2-26%) (Tepper, 1971).

The National Academy of Science's Airborne Lead in Perspective" study fails to mention this analytical data. Instead the study says:

> In view of the disparate results from different cities, it is not possible to make any generality about trends (increase or decrease in lead concentrations). But it is possible to say that, if there are any upward trends, they are not very substantiated. (NAS, 1971, p.24).
>
> In spite of the rapid increase in the consumption of lead alkyls used in automobile fuels, however, the concentration of lead in urban air is, in general, rising only slowly, presumably because of dispersal. (NAS, 1971, p.32).

This study concludes that the average lead content in the air over major cities has not changed greatly over the last 15 years. This statement is inconsistent with the comparative measurements of the "Three Cities Study" and the "Seven Cities Study" referred to above. It is also inconsistent with the findings of Chow (1970) in San Diego and Bove" (1970) in New York. The last reference was completely omitted from the NAS report. Several have suggested that these inconsistencies were due to the heavy influence of lead spokesmen in the final draft of the report.

Chow and co-workers have shown that there is an increase in lead concentrations from mid-oceanic atmosphere to remote mountains, to seashore, to light suburban traffic, to heavy urban traffic (Chow, 1970). Polar snow strata record steadily increasing fallout of lead aerosols since the beginning of the industrial revolution; Greenland has snow with lead concentrations 400 times above natural levels (Murozumi, 1969). The Greenland ice studies have received strong support from an independent study in Scandinavian mosses. These mosses can absorb airborne nutrients, and serve as sensitive indicators of air pollution (Bryce-Smith, 1971; Ruhlung, 1969). Chow has found that oceans are being contaminated with industrial lead at ten times the rate of introduction by natural weathering (Chow, in press).

(d) Increased Lead Fallout in Soil and Plants

Lead has long been known to be a natural constituent in soils. Concentrations average about 16 ppm (parts per million)(Goldschmidt, 1954). Cholak has reported lead content in soils near repainted buildings to range from 16.4 to 360 ppm (Cholak, 1961). Some lead concentrations in soils near smelters can reach several thousand parts per million (USPHS, 1965). Besides the weathering of outdoor painted surfaces and accumulations from lead processing, a major contributor of lead in soils (especially near highways which are heavily travelled) is automotive emissions (Purves, 1967; Page, 1970; Cannon, 1962; Darnes, 1970).

The question whether lead translocates from soils to plants has puzzled scientists. Additive manufacturers have gone to great length to show that edible portions of certain plants obtain their lead from naturally present lead and that these plants are insensitive to marked changes in lead concentrations in the soil (Ethyl, 1970; Ter Haar, 1970). In some circumstances plants in areas re-

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mote from highways and insecticide use have been found with high lead concentrations (Allaway, 1968). Uptake of lead is highly dependent both on type of soil and species of plants considered.

Lead concentrations due to direct fallout of airborne lead on food plants (leaves, flowers and fruits) can reach serious levels. California lettuce less than 100 yards from a highway has lead of mean concentrations of 0.91 ppm (washed 0.48) and 100 yards or more 0.51 (washed 0.12)(California, 1965). Airborne lead materials from automotive exhausts accumulate in heavy amounts on grasses near highways (Dedolph, 1970) and can add to the body burden of lead in cattle and herbivorous animals.

J.L. Wolfe of Mississippi State University says that roadside rats (rice and cotton rats) have an accumulation of around 50 µg lead/ gram (dry weight) of liver tissue as compared to around 5 µg/ gram in livers of individuals living away from moderately travelled roads. This work has important implications as to the effects of tetraethyl lead emissions on human inhabitants living near heavily congested highways and streets(Wolfe, 1971).

Lagerwerff emphasizes the important contribution of lead contamination of plants by deposition from atmosphere rather than by uptake from the soil (Lagerwerff, 1967). Studies in England show that there are twenty times more radioactive Pb^{210} originating from aerial contamination in comparison to the natural concentrations in the native soil (Hill, 1965).

As with other heavy metals lead from soil is more concentrated in the roots and stems than in the flower and fruit (Motto, 1970). With rapid changes in agricultural technology, soils can be vastly modified and new plants introduced. In such cases, root and stem crops could accumulate unusual amounts of lead which would raise the total intake

when consumed by man. Patterson has expressed concern about the magnitude of the differential between actual and permissible values of various food products (Patterson, 1965). We may observe increasing amounts of lead in and on edible plants in the coming decade due to airborne lead pollution.

(e) Sources of Lead Contamination

Antiknock additives are the second largest use of lead in industry (see Table III). About 525,000,000 pounds of lead were consumed last year as antiknock additives and about 80% of this enters the environment as emission products (airborne) in varying sized particulate matter. Likewise, a considerable proportion of the remainder finds its way to crankcase oil which eventually is dumped on highways, footpaths, into the sewers or burnt.

Coal combustion is not a major source of lead pollution. Savul reports that lead in coal varies from 0.005 to 1.67 ppm (Savul, 1958). Abernethy and co-workers estimate that the weighed average is 7ppm of lead in coal (Abernethy, 1969). Thus coal combustion contributes less than a thousand tons of lead to the atmosphere as contrasted to about 181,000 tons from leaded gasoline (see Table III).

There has been little marked change in lead consumption in the past few years (see Table II). The lead-free grades of gasoline introduced by a number of companies in the past two years have small sales (about 2% of the total) and are often made by draining gasoline from the high octane pool. More lead is then used to bring the depleted residual low octane stock up to sales demand (Sullivan and Fritsch, 1970). The year 1971 saw at most a 5% decline in lead use in gasoline.

(f) Conclusions and Recommendations

Lead contamination of our environment is a very serious problem and certain steps must be taken immediately to remedy this situation. After considerable study and procrastination, the Environmental Protection Agency finally published some proposed rules (February 23, 1972, Federal Register) which would make an unleaded grade of gasoline available by 1974 and likewise recommends a moderate reduction of lead in all grades of gasoline by 1977.

However, even a two-thirds reduction of lead in gasoline by 1977 allows for the dispersal of about two billion pounds of this toxic substance by that date, and an indefinite amount after that time. Cumulative effects of reduced airborne lead on urban dust were not considered in the proposed rule-making. The EPA did recognize (over the objections of the NAS report) lead to be a health hazard, but the Agency only considered airborne lead and not lead in urban dust.

It is recommended that the EPA issue at the earliest possible date a lead criteria document; the Agency should promulgate an atmospheric lead ambient air standard of not greater than 1.5 $\mu g/m^3$ (the California standard); it should notify areas of high lead concentrations of dangers and act to reduce lead consumption in these areas first. The EPA should develop a national program to achieve a total elimination of automotive lead emissions by 1977. It should require manufacturers to affix notices of fuel requirements (both octane and lead) to 1973 and later model vehicles and the manufacturers should also disclose to car-owners the octane and lead requirements of 1968 and later model year vehicles. The EPA should require octane and lead content of gasoline to be posted on gasoline pumps and commence a public education campaign to encourage the use of lead-free fuels and to discourage excess emissions resulting from overbuying

of high octane fuels.

The facts are clear for anyone to see: lead is toxic; airborne lead is a contributor to the body burden of lead; this airborne lead comes mainly from leaded gasoline; urban dust contains large amounts of lead resulting from the settling out of airborne lead. This urban dust is a source of lead poisoning to poor children in our cities. Every means must be taken to reduce emissions of lead into our environment.

Part III Lead-Free Gasoline

(a) The Quality of Lead-Free Gasoline

Prior to 1923 all gasoline was unleaded and since that time some has always been essentially lead-free. Thus leaded gasoline is not a necessity for today's automobile.

It is argued by additive manufacturers and the lead industry that unleaded fuels will cost more, will be of lower quality and will demand waste of our petroleum resources. Even though the normal lead additive costs about a half a cent per gallon, change in processing* will be passed on to the consumer in the form of higher gasoline prices. Assuming a strict phase-out of lead, gasoline will cost about 0.9cents more a gallon (Bonner and Moore, 1971) and this will produce an increase of two cents at the pump.

However, this gasoline price rise is deceptive. As will be seen in a later section there should be considerable savings on maintenance. This should more than compensate for higher gasoline prices.

* Higher octane fuels need not be prepared with lead additives. The gasoline itself can be reformed into higher octane fuels (see Appendix 4).

Present processing methods require about 5% more crude stock of gasoline for unleaded than for leaded gasoline. Universal Oil Products (a processing equipment company) states that processes are available that require no increase in crude petroleum stock (UOP, 1970). This company also argues that gasoline mileage increases 11% using high-octane lead-free gasoline, or a net reduction in total gasoline consumption. However, some contest these predictions. The effect of lead-free gasoline upon automobile mileage is not yet certain, but at most is only a few percent.

(b) Possible Engine Troubles

A report by the Mobil Research and Development Corporation states that operation of current passenger car engines on unleaded gasoline can cause excessive valve wear and failure of exhaust valve and seats, due to lack of the solid lubricating effects of lead ash (Mobil, 1970). American Oil Company contests this report and says customers do not drive at speeds and loads used for the tests (American, 1970). It says that it hasnever had a complaint from lead-free customers. However, the fact that traces of lead have been found in various states in "certified free" unleaded Amoco may complicate this opinion.

Upon a visit to an independent gasoline research laboratory, this author was shown data showing no valve recession due to lead-free fuel. Volkswagen anticipates no exhaust valve seat problems. Data obtained by a controlled fleet test program for vehicles using no-lead fuel gave no apparent wear on valves. All 1971 cars now have hardened exhaust valve seats. If all lead were removed by 1977, in that year only 35% of the cars still on the road would be pre-1971. Since only a small percentage of these would be used for heavy loads, and the possibility of recession would be present for only certain models, the problem

is far smaller than some lead industry people would have us believe.

On the other side of the coin, there is no doubt that leaded fuels and associated scavengers cause excessive damage to automobile parts. Ethylene chloride, added because it is cheaper to produce, is considered the worst offender.

> That corrosion is caused by the products of combustion is not surprising; analysis of exhaust gas showed the presence of hydrochloric, sulfuric, sulfurous, hydrobromic, phosphoric, and carbonic acids. The presence of compounds of elements not found in petroleum is due to the use of additives; for instance, the compounds of chlorine, bromine, and phosphorus trace directly to the lead scavengers and the surface ignition suppressors added to gasoline. Statements have been made in which ethylene dichloride has been blamed for much of the corrosive action under discussion here; it has been known for many years that ethylene dibromide is less harmful. (Gruse, 1967)

Though ethylene dichloride is more harmful to the automobile, ethylene dibromide has its share of problems:

> Corrosion of valve heads and seats by bromine compounds from the tetraethyl lead fluid is a relatively common variety of valve trouble. It is likely to be induced in an engine in which the mixture temperature is too low to give good distribution. The usual course of this type of difficulty is general corrosion of both the valve head and the valve seat until a channel forms in one of the seating surfaces. Gas leakage and valve burning result. (Fraas, 1948)

Among the savings in maintenance that might accrue to the average consumer if scavengers were removed

include less spark plug fouling, engine corrosion and exhaust system deterioration. The most recent assessment of the effects of lead additives concludes that there is a differential fuel-related maintenance cost of 0.095 cent per mile which is indicated in favor of unleaded fuel operation (Aerospace Corporation, 1971). This amounts to a saving of approximately $81 over the lifetime of an average automobile and almost equals any increase in unleaded gasoline by itself.

It is difficult to calculate the savings due to less rusting when scavengers are removed:

It is generally accepted...that engine rusting with leaded gasoline is due to the chlorine- and bromine-containing scavengers required by the lead antiknock compounds, rather than by the lead compounds themselves. Reducing scavenger concentration reduced rusting severity. In our tests, eliminating the scavengers (by omitting the lead antiknocks) showed even greater improvement. (Piess, 1970)

Removing the scavengers and lead will lead to fewer oil changes and less changing of filters. These compounds have been added as technical shortcuts to higher octane fuels; their ill effects have been patched over by a series of other additives to make the consumer think his gasoline is both different and better. What the consumer does not realize is that these additives have proved profitable--or why the reluctance to get rid of them by the industry? The consumer does not also realize that this profit is made at the expense of his car's lifetime. Removal of lead may turn out to be a blessing to the consumer. Some have estimated savings of 3.5 to 4.8 cents/gallon on controlled fleet service and 1.8 cents/ gallon in consumer type service (Tallaferro et al, 1970).

On every count except perhaps valve wear the use of unleaded gasoline is advantageous to the

consumer. Even the problem of possible valve deterioration has already been successfully solved:

> All vehicles after 1972 models and most of the 1972 models, will be able to use the same fuel as will probably be required for 1975. The pre-1971 cars will need either some lead or other anti-scuff additive to prevent valve deterioration. (Heinen, 1971)

n.b., that lead is not the only additive which is an anti-scuff agent.

(c) Health Considerations: PNA Emissions

The reason given by the EPA for a moderate lead reduction*(1.25 g/gal by 1977) is health, not economic. The back-up material, "Effects of Reduced Use of Lead in Gasoline on Vehicle Emissions and Photochemical Reactivity," (Altshuller, 1972) states that a stricter lead removal schedule (Bonner & Moore (N)) would result in increases in cancer-causing polynuclear aromatic hydrocarbons (PNA's) from the lead-free gasoline.

PNA's are certainly toxic and most especially benzo(a)pyrene (BaP); thus added health dangers must be investigated. However, PNA from the automotive sources is small compared to that from coal-burning sources (2% of total from cars, 2.5% from gasoline-powered trucks and 0.5% from diesels). On the other hand over 95% of the lead emitted into the atmosphere comes from automotive sources. If the PNA problem is so serious, why has not the EPA taken the initiative to reduce the 80% caused by coal-stoked furnaces? Why have no statistics on PNA emissions been gathered?

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* CSPI in conjunction with the Environmental Defense Fund petitioned (Nov. 2, 1971) the EPA for the fastest feasible phase-out schedule (remove lead by 1976).

It is true that the most practical means of producing higher octane (non-leaded) gasoline in the next few years is by increasing the aromatic content of the gasoline. Likewise studies show that aromatic content of gasoline affects PNA emissions even though these effects are greater in cars with lead deposits than with clear ones. (CRC, 1970; 1971). In fact, these studies show that 1970 cars with no lead deposits give less PNA emissions than older ones with deposits.

A strict schedule would demand that older automobiles (with lead deposits) eventually use gasoline of higher aromaticity resulting in increased PNA emissions. However as Altshuller points out estimated increases in PNA do not include the compensation in effects of decrease in overall emissions reported to occur from substitution of unleaded deposits from lead-free usage for the present lead deposits. If workable emission devices will be installed by 1975, one should actually see a total decrease in PNA from 1971 levels. However, this decrease will be lessoned by a stricter phase-out schedule. Moreover, provided emission devices work, there should be only decreases in PNA (following the 90% hydrocarbon reduction schedule by 1975). The PNA scare has no validity in fact.

The Commerce Department panel did not find any reason to be concerned about PNA emissions:

> It should be noted that a significant correlation exists between the PNA content of exhaust gases and the PNA content of the fuel used. This implies that controls on the PNA content of fuels could be used to reduce exhaust PNA's.
>
> In view of the fact that automotive sources currently constitute only between 2 and 10% of total PNA emissions nationally, and that

incorporation of advanced exhaust gas treatment systems, especially a catalytic system, will result in selective decreases in polynuclear aromatics, the Panel concluded that present evidence was not sufficient to warrant a recommendation on PNA's. (Commerce Dept., 1971).

(d) Conclusions and Recommendations

The Environmental Protection Agency has finally recognized the health hazards of lead to some degree. While providing for a lead-free grade of gasoline for use in vehicles containing catalytic emission devices, it still took a moderate step in lead reduction. While stating that the reasons for selecting a moderate (0) schedule were health, actually the reasons were purely economic. This will allow for only a reduction to 1.25 grams of lead per gallon after January 1, 1977.

This failure to conclude that lead should be eliminated shows a compromising attitude towards the safety of the American people, especially the health of the poor in our inner cities. However, this false compromise may have an added bad effect which is often overlooked: the mere presence of leaded and unleaded gasoline side by side at the station cannot help but lead to contamination of unleaded gasoline, and then to the destruction of effective catalytic devices. The intermingling of gasoline has been a common practice and there is no guarantee it will cease now. The mere change of nozzle spout at the pump will not stop previous contamination of unleaded by leaded fuel.

The overall result of this compromise will be increased automotive exhausts due to ineffective catalytic devices. No scientist seeing the practice of this industry could guarantee that unleaded gasoline will remain lead-free to the degree demanded by the automotive manufacturers. Even traces of lead will foul the device and the purity of the

unleaded gasoline demands separation from proximity to leaded fuel. Unless this country makes a deliberate effort to purge its gasoline transport and storage systems of lead by 1975, the traces will most certainly appear in the lead-free grades.

There is a simple solution to this contamination problem: a strict schedule for removal of lead by 1977. A feasible plan has been suggested which could be in complete operation by 1977 (Bonner & Moore Schedule L). The oil industry will undoubtedly object to a rapid phase-out, claiming they would have to invest about two and a half billion dollars (a sum which is hardly excessive to an industry which plans to spend a billion dollars on TAP (Trans-Alaskan Pipeline).

Since the Schedule L lead phase-out will demand increasing aromatic content of gasoline from about 22% (current amounts) to 38%, it would be wise to couple the lead phase-out with other requirements:

1) thorough checking of pre-1971 vehicles for excessive emissions (oil burning cars emit more PNA); some regulation requiring cleaning of lead deposits at time of conversion to lead-free gasoline.

2) tighter state and city ordinances against dirty coal-burning furnaces (source of 80% of PNA emissions); likewise city ordinances against burning of grass and leaves within urban areas (a source of PNA equaling current automobile PNA emissions).

3) notification of owners of pre-1971 cars that heavy loads and service might result in some valve seat wear. They should have anti-scuff additives inserted at stations during long trips and heavy service.

This country has the power to begin a deliberate lead phase-out program. We must operate on the principle that no lead should be used in practices

wherein the heavy metal cannot be retrieved. This principle is now operative in mercury control.

We have often allowed economic considerations to take precedence over those of health; this is especially true where the economic ones refer to the pocketbooks of the rich and the health to that of the inner city poor. The leaded gasoline question is a perfect example of economics versus health. Our country is asked to decide: which is more important?

References from p. 50 Continued

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Table I

Sources and Types of Air Pollutants

	(millions of tons/year)	(percentage)
Motor vehicles*	124.3	44.3
Other forms of transportation	20.1	7.1
Fuel combustion from stationary sources	44.3	15.7
Industrial processes	39.6	14.1
Solid waste disposal	11.9	4.2
Miscellaneous	41.0	14.6

*Types of pollutants from motor vehicles:

(pollutant)	(millions of tons/year)	(percentage)
Carbon monoxide	97.8	64.0
Hydrocarbons	17.1	45.7
Oxides of nitrogen	8.7	36.6
Particulates	0.4	1.1
Lead	0.2	98
Oxides of sulfur	0.3	0.3

Table II

*Consumption of Lead In Antiknock Additives in the United States (short tons)

1969	1970	1971	(month)
20,818	25,997	21,444	Jan.
18,831	22,927	18,941	Feb.
21,589	25,826	20,254	Mar.
22,017	23,926	21,846	Apr.
21,635	24,167	22,364	May
23,562	24,630	22,886	Jun.
23,828	26,360	22,182	Jul.
22,789	23,039	23,152	Aug.
23,436	22,633	23,371	Sept.
24,193	20,510	22,506	Oct.
21,777	17,199	23,437	Nov.
26,653	21,295	21,857	Dec.

1971 totals (preliminary) were about 5% below 1970 figures.

The latest statistics for January, 1972 show a 6% drop from December, 1971 (20,532 short tons).

Reference:

Mineral Industry Surveys, U.S. Department of Interior, Bureau of Mines, Washington, DC.

* The figures on this table reflect purchases by additive and fuel manufacturers and do not reflect month by month consumption by the consumer.

Table III

Lead Emission into the Atmosphere in the U.S. (1968)

(Emission source)	(tons of lead/year)
Gasoline combustion *	181,000
Coal combustion	920
Fuel oil combustion	24
Lead alkyl manufacturing*	810
Primary lead smelting	174
Secondary lead smelting	811
Brass manufacturing	521
Lead oxide manufacturing	20
Gasoline transfer*	36
Total....	184,316

Reference: National Inventory of Air Pollutant Emissions and Controls, EPA, Durham, NC.

*Gasoline uses.

Table IIIa

Total Lead Consumption in the United States (1968)

(Products)	(tons of lead)
Storage batteries	513,703
Other metal products	401,797
Pigments	109,734
Gasoline additives	261,897
Other	41,659
Total...	1,328,790

Reference: Minerals Yearbook, p. 47.

Table IV

Maximum Quarterly Composite Lead Levels Exceeding 2.0 Micrograms Per Cubic Meter

(city)	($\mu g/m^3$)
Oklahoma City	2.1
Baltimore	2.1
Miami	2.1
Kansas City (Kansas)	2.2
Fort Worth	2.3
Cleveland	2.3
Springfield (Mass.)	2.4
Shreveport	2.4
Las Vegas	2.4
Richmond	2.6
New York	2.8
Houston-Galveston	2.8
Seattle	2.9
N.W. Nevada	3.0
Detroit	3.2
Denver	3.4
Salt Lake City	3.6
Chicago	3.6
El Paso	3.6
Philadelphia	3.6
Phoenix	3.9
San Francisco	3.9
Puerto Rico	4.2
San Diego	4.2
Fairbanks	4.8
Dallas	5.2
Los Angelos	5.7

Reference: NASN data on file at the Division of Atmospheric Surveillance, EPA, Research Triangle Park, NC. Reported in "Health Hazards of Lead," EPA, 1972.

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APPENDIX 1—ADDITIVES IN GASOLINE

PART I: WHAT AND HOW MUCH

(1) Anti-oxidants.—Anti-oxidation agents are generally amines or alkylated phenols; common usage is a concentration of 2-16 lbs. per 1000 barrels, which is the equivalent of about 8-60 parts per million by weight. A typical concentration would be about 5 lbs./1000 bbls., or about 20 ppm. With the use of newer refining processes which reduce the olefin content of gasoline, less anti-oxidant will be required.

(2) Metal deactivators.—Metal deactivators are usually amine derivatives (such as N,N'-disalicylidene-1,2-diaminopropane); they are present in concentrations of approximately 1-3 lb./1000 bbl., or about 4-11 ppm by weight.

(3) Anti-rust agents.—Anti-rust agents are fatty acid amines, sulfonates, alkyl phosphates, or amine phosphates. They are present in concentrations of 1-15 lb./1000 bbl., or about 5-50 ppm.

(4) Anti-knock compounds.—The most common antiknocks are tetraethyl lead (TEL) and tetramethyl lead (TML). Other organic lead or manganese compounds are sometimes used. Concentrations of TEL reach a maximum of slightly more than 3 milliliters per gallon; this is a value of about 3.15 grams of metallic lead per gallon. In summer 1970, regular gasolines averaged 2.43 grams of lead per gallon, while premium fuels averaged 2.81 grams/gal. In winter 1970–71, the figures were 2.02 and 2.60 g/gal., respectively.

(5) Lead scavengers.—The usual scavenger for automotive gasoline is a mixture of ethylene dichloride and ethylene dibromide. Concentrations used are approximately 1.4 grams/gal. for ethylene dibromide and 1.5 grams/gal. for ethylene dichloride.

(6) Deposit modifiers.—The common deposit modifiers belong to two groups: (1) organic phosphorus compounds and (2) boron compounds. The phosphorus compounds are usually aryl, alkyl, or aryl-alkyl phosphates. This group includes tri-cresyl phosphate (TCP). They are used in concentrations of 0.01–.02%. The most common boron deposite modifier istributyl boron.

(7) Dyes.—There are about five common dyes used in gasoline; of these, one is an anthraquinone and the others are azo compounds. Concentrations vary widely, from 0.2–2.6 lb./1000 bbl., or from 0.8–10 ppm.

(8) Anti-icers.—Anti-icing agents are of two major types: (1) alcohols, glycols, and formamides, and (2) amine or ammonia salts of phosphorus. Concentrations are approximately 1–2% for alcohols, 0.1% for formamides, and 0.005% (50 ppm) for type (2) anti-icers.

(10) Upper cylinder lubricants.—These lubricants are usually light mineral oils or low viscosity napthenic distillates; typical concentration is 0.5% by volume.

PART II: WHY THEY ARE THERE

(1) Anti-oxidants.—Gasoline in storage has a tendency to decompose slightly (oxidize) and form resinous gums which can cause clogging of fuel lines and jets. This undesirable gum deposition can be minimized by the use of anti-oxidants which increase the gasoline's storage stability. These compounds are added at the refinery before storage or transportation.

(2) Metal deactivators.—The oxidation process of gasoline is greatly accelerated by the presence of even small quantities of metals, especially copper. Concentrations as low as a few ppm (parts per million) can have a major catalytic effect. To counter this effect, metal deactivators are added to the gasoline before storage or shipment.

(3) Anti-rust agents.—Although every attempt is made to keep water out of gasoline, small concentrations are unavoidable, especially in storage. To keep this water from rusting containers or pipelines, anti-rust agents are used to forestall its effects. These agents are usually "surface active"; that is, they tend to coat metallic surfaces and keep the water away. While these agents are added for storage and transportation of gasoline, they may have some similarly beneficial effect in the automobile's fuel system.

(4) Anti-knock compounds.—Organic lead compounds and other antiknocks have long been considered the most economical method of raising a gasoline's resistance to knock (its octane rating). For a full discussion of knock resistance and octane rating, see Appendix Three. Tetraethyl lead (TEL) and tetramethyl lead (TML) act as negative catalysts (chemical "slow down" agents) to prevent the type of explosive combustion known as knocking. TEL has made

possible the easy production of high octane fuels, which in turn permit the use of high compression ratios for maximum engine performance. While there are other quite feasible methods of making gasoline of any desired octane, none are quite so simple as the addition of lead antiknocks; this is the reason for their great popularity.

(5) Lead scavengers.—Although lead antiknocks are quite attractive in many ways, they bring with them a peculiar set of problems. One of these is that during combustion the organic lead compounds are converted to lead oxide; this lead oxide tends to deposit on valves, cylinder walls, piston heads, and spark plugs. It causes spark plug fouling, makes engine deposits glow hotter (thus ironically making knock more likely), and brings on other problems. For this reason, some attempt must be made to render this lead oxide harmless; it is for this reason that lead scavengers are added to gasoline. Organic halides (chlorides and bromides) are used to convert the lead oxide into lead halides, which are more volatile and tend to leave with the exhaust. In order to get as much of the lead as possible, it is common practice to use 50% more halides than are theoretically needed to convert all of the lead oxide. Even so, as much as 20% of the lead may not be recovered in this way.

The overabundance of lead scavenging agents brings problems of its own. The unreacted organic halides form hydrobromic and hydrochloric acids and are generally considered the major cause of engine corrosion, especially in stop-and-go driving. They contribute to spark fouling, exhaust valve corrosion, and muffler and tailpipe deterioration. Tests have shown that maintenance costs of vehicles operated without lead antiknocks and scavengers are reduced by two to five cents per gallon of gasoline. Ethylene dibromide is less harmful to the engine than is ethylene dichloride, but its higher cost has made the standard automotive formulation 2 parts ethylene dichloride for every 1 part of ethylene dibromide, measured in reactive units (moles).

(6) Deposit modifiers.—Combustion chamber deposits tend to make an engine more knock-prone, both by raising the effective compression ratio and by causing hot spots which make it easier for the fuel mixture to ignite spontaneously and explosively. This problem is compounded by the presence of lead oxides and halides formed by the combustion of the lead antiknocks. These lead compounds catalyze (promote) the glowing of carbonaceous deposits at temperatures below their normal glow point. This process is somewhat self-feeding, as the hot, sticky deposits act as a binder for more lead buildup. In an attempt to neutralize this effect, deposit modifiers are added to counteract the lead's catalytic role. The most common modifiers are phosphates; they convert lead oxides and halides to lead phosphates which exhibits less catalytic action. In addition these organic phosphates form lead compounds with lower electrical conductivity, thus helping to alleviate problems of spark plug fouling. Boron deposit modifiers also can be used; these have the additional effect of helping to promote the antiknock properties of tetraethyl lead.

(7) Dyes.—Dyes are used in gasoline to advertise the presence of tetraethyl lead or for aesthetic reasons. Common base coolers are red, blue, yellow, and orange. There are only about five or six common dyes. Dyes are sometimes used to distinguish grades of gasoline, especially for aviation fuel.

(8) Anti-icers.—Under high-humidity spring and fall (30–60° F) conditions, ice buildup in the carburetor can get to be a problem. The fast-moving air stream (venturi) through the carburetor and past the throttle plate tends to cool metal surfaces and form ice which can block flow of the fuel mixture through the carburetor. Alcohols are often added to gasoline to dissolve in the water present and lower its freezing point below the temperatures reached. Other anti-icers can be used which are "surface active" and tend to isolate ice crystals by coating them and keeping them from growing. Anti-icers became standards additives with the advent of the automatic transmission and automatic choke, since these gave the driver less control in keeping a faltering engine running. In colder weather, anti-icers can help prevent fuel line icing which can stop or hinder the flow of fuel. Anti-icers are also known as anti-stall agents, since they prevent stalls due to icing at idle.

(9) Detergents.—In an attempt to minimize carburetor and intake manifold deposits and to dissolve gum deposited by fuel oxidation, many gasoline producers have added some type of detergent to their products. They are included to take care of the gum formed in spite of the presence of anti-oxidants.

(10) Upper cylinder lubricants.—Since normal lubrication is circulated from below the piston, the upper piston (compression) rings may run with less lubrication than the lower rings. In an attempt to compensate, light oils are added to gasoline. While such oils are most effective when administered through the carburetor or air cleaner, they may have some effect in mixture with the fuel.

APPENDIX 2—INTERCHANGEABILITY OF GASOLINE

1. Statement entered into the records of the F.T.C.'s hearings on Octane Ratings, held October 14, 15, and 16 of 1969. Statement made by George Washington Law School entitled "Request for Promulgation of a Rule."

"An exchange agreement is a contractual arrangement between two refiners in which one produces a specified quantity and grade of gasoline and exchanges it for a like grade and volume of gasoline produced by the other. Exchange agreements are entered into to save the expense of gasoline cross-hauling into an area in which a company markets gasoline, but in which it has no refinery or product pipeline." p. 12–13

2. Statement made at F.T.C. hearings on Octane Ratings, held October 14, 15, and 16 of 1969 by a Mr. Rodman, Chairman of the Board of APCO Oil Corporation. In a discussion of the Great Lake Pipeline he said:

". . . we simply have to make gasoline that meets the specifications of the Great Lake Pipeline system because they take gasoline of the same quality into that line from all manufacturers and deliver it to them at the other end—without the slightest conception of who made it." p. 111

3. Statement made at F.T.C. hearings on Octane Ratings, held October 14, 15, and 16 of 1969 by a Mr. Moore, President of Derby Refining Company, a division of Colorado Oil & Gas Corporation.

"But when it goes into a common carrier, it is comingled inventory. Then they add it (additives) at the point of delivery at the truck route." p. 180

4. Statement made at F.T.C. hearings on Octane Ratings, held October 14, 15, and 16 of 1969 by a man representing an independent refinery located in Oklahoma. He indicated that his product is fed into a common carrier or pipeline with products from other refineries. So long as the gasoline meets minimum specifications his product is mixed in common with other companies' products. He said:

"I do not know how you can segregate the products . . . it would be physically impossible to do this." p. 164

5. Statement entered into the record of the F.T.C.'s hearings on Octane Ratings, held October 14, 15, and 16 of 1969 from an article in *Advertising Age* by Mr. N. A. Pritchard, Vice-President for Automotive Planning and Analysis, TRW, Inc.

"If we continue to insist . . . that a gasoline is better because it contains a certain ingredient, when practically all of them do, are we not asking for a 'truth in advertising' bill that would extend far beyond what exists now?" p. 21

6. Statement made at hearings before the Senate Subcommittee on Antitrust and Monopoly held July 14-16, 1970 on Marketing Practices in the Gasoline Industry. Statement made by Mr. Cohen, Council for the National Congress of Petroleum.

"I think most majors, at least trade their gasolines back and forth among themselves, according to specifications. Lead-free gasoline, some of the premium gasoline is a bit different, but even in lead free the specification could be that the gas be free of lead." p. 15

7. Statements made at hearings before the Senate Subcommittee on Antitrust and Monopoly held July 14–13, 1970 on Marketing Practices in the Gasoline Industry. In answer to the question: Do you think the gasolines supplied to Tulsa Oil Company are the same, Mr. F. Lichtman, Chairman Legislative Committee of the Society of Independent Gasoline Marketers of America said:

"Yes; I think basically it is . . ." p. 116

In further testimony he said:

"To differentiate it (Ford Benzol) from Tulsa gasoline, we add something. We add an ethyl compound ICC–1 and we add it to the product after we pick it up at the terminal because we have to have some difference in order to maintain that Benzol trademark and to sell it a price different from our others . . . it doesn't do a darned bit of good." p. 110

8. Statement made at hearings before the Senate Subcommittee on Antitrust and Monopoly held July 14–16, 1970 on Marketing Practices in the Gasoline Industry. Statement by Mr. W. S. Jones, President of the National Oil Jobbers Council.

". . . and so nearly as I have been able to ascertain, through the mysterious workings of exchange programs and so-called refinery back-gate sales, their product is frequently identical. (referring to products sold by branded vs. non-branded dealer) Private branders of course, admit getting most of their product from major refiners." p. 125

9. Statement made at F.T.C. Industry Conference on Marketing of Automotive Gasoline before the Select Committee on Small Business of the House of Representatives held May 3–6, 10–12, 20, and July 19 of 1965. Statement of Humble Oil & Refining Company, Section VII.

"About 17% of Humble's total motor gasoline supply is obtained from exchanges. When exchange agreements are made, a primary consideration is to obtain a quality of gasoline equivalent to that produced at our own refineries . . . in those cases where Humble takes delivery from nonsegregated tankage, Humble has satisfied itself that the refiners specifications do not vary materially from its own. To about 96% of the gasoline received on exchange Humble adds its unique additives in proper quantities. The remaining 4% contains additives acceptable to Humble." p. 1782

Appendix 8.—Octane Ratings: What They Mean

(By Mark J. Sebern)

I. What's the problem?

When the compressed fuel-air mixture is ignited by the spark plug, it should burn smoothly and evenly from the point of ignition throughout the cylinder. This type of flame front gives the best useful power output from the available fuel energy. Unfortunately, there are factors which work against this type of combustion. As the cylinder temperature increases, it becomes possible for parts of the fuel mixture not yet reached by the flame front to ignite spontaneously. Usually this type of spontaneous ignition is accompanied by a rapid, explosive combustion which decreases the amount of available useful power and normally accomplishes only further engine heating. When severe, this "knocking" combustion can also cause damage to engine components. If a similar auto-ignition takes place even before the spark plug fires, it is known as "pre-ignition"; when it causes an engine to continue running after the ignition is turned off, the result is called "run-on." Under other conditions a wildly erratic form of auto-ignition may occur; this is commonly designated "wild ping."

II. What factors affect knock?

Knocking combustion is made more likely by raising compression ratio, decreasing engine speed, advancing ignition timing, increasing engine temperature, or by bad combustion chamber design. Compression ratio and ignition timing are important; in modern engines, high compression ratios and advance ignition timing are used to increase the useful power recovered from the fuel. Unfortunately, such engines are much more prone to knocking combustion than their predecessors.

III. What kind of an effect does the fuel have?

Gasoline is a mixture of many different types of hydrocarbon compounds. Some of these are more conductive to knock-free combustion than are others. For example, normal heptane used as motor fuel is a really first-rate knocker, while iso-octane (2,2,4 tirmethyl pentane) has a very low susceptibility to knocking. These very different characteristics gave fuel researchers the idea of making a numerical scale of knock-resistance. They decided to arbitrarily denote normal heptane as zero on the scale, with iso-octane given a rating of one hundred. This scale was given the designation *octane*. Heptane and iso-octane could then be mixed to produce a standard fuel anywhere on the octane scale. For example, a mixture of 70% iso-octane and 30% heptane would be rated as 70-octane fuel; this fuel could be compared in a special engine with a given fuel under test until one of the standard mixtures matched—the test fuel's rating would then be known.

IV. How do you make gasolines of different octanes?

As mentioned before, gasoline is a mixture of many different hydrocarbons; some of these components are naturally high-octane and others are naturally lower in octane. Simple, straight-chain resistance (like parafins) normally have a lower knock resistance than more complicated, branched-chain types (even when these branched-chains are only other geometric arrangements, or isomers, of the same basic compounds). One way to raise octane, then, is to include a larger proportion of these naturally high-octane components.

Another method is to convert some of the low-octane components, by means of various refining processes, into their higher-octane reaitives. Some such processes are reforming, alkylation, and isomerization. (Cf. Appendix Four for a fuller discussion of refinery processes.)

V. Isn't there an easier way?

While any of the above refining processes are quite practical means of producing high-octane gasoline, refiners still began seeking a short cut. It soon seemed they had found it, in the discovery that various types of gasoline additives could appreciably raise a fuel's knock resistance. The most successful of these antiknock additives have been organic lead compounds. Of these, the most common is tetraethyl lead, otherwise known as TEL. It was discovered that the addition of small amounts of TEL could raise a gasoline's octane rating by as much as ten octane numbers. Most refiners felt that this was easier than the most extensive refining which was the alternative. Since the discovery of TEL, much research has failed to turn up any other antiknock additive to compete with it.

The lead antiknocks seem to function by slowing down certain intermediate chemical rections in the combustion chamber, thus making it harder for knocking ignitionto take place before the flame front reaches the end of the fuel-air charge.

In spite of the acknowledged effectiveness of TEL, it would be a mistake to think that it is the only practical way to produce high-octane fuel. Presently known technology in refining is capable of producing the required high-octane components. This technology is presently quite competitive with the use of lead lead antiknocks; in addition, as interest in refining research becomes more intense, it is quite possible that this technology could become more economical than the use of lead antiknocks.

VI. What happens to the octane number if you just remove the lead from gasoline?

Removing lead from gasoline will, of course, give a gasoline of lower octane number. The "clear pool" (gasoline before lead has been added) will vary depending on the amount of TEL the manufacturer plans to add. For most gasoline presently on the market containing about 2½ grams of lead per gallon, the clear pool research octane number is 85–87 for regular gasoline (93–94 with TEL added) and 90–91 for premium gasoline (98–1000 with TEL). These numbers are typical, but a manufacturer who used more than 2½ grams per gallon of lead could operate from a lower octane clear pool.

VII. What are the new 91-octane "no-lead" and "low-lead" fuels?

Again, practice varies from company to company, but in most cases a "low-lead" 91-octane fuel can be made from the same clear pool as regular (94 octane) simply by adding less lead (½ gram per gallon). Thus this is basically a regular fuel with less antiknock added.

No-lead fuels, on the other hand, are usually taken from the premium clear pool. Despite their lower octane rating, they may represent a more highly refined product than regular.

VIII. Are there any compensations in the use of lower octane, unleaded fuels?

Yes. For all of their beneficial effects, lead antiknocks do create some serious problems. One of the main difficulties is caused by the corrosive and fouling nature of the lead compounds and of other additives made necessary by the lead's presence. These compounds can attack spark plugs, valves, and exhaust systems. Tests have indicated that maintenance costs for vehicles run on unleaded gasoline show a saving of two to five cents per gallon of fuel consumed. This type of saving can help to offset the possible slight initial increase in the cost of unleaded gasoline.

IX. Are high-octane fuels more powerful?

The amount of power that can be recovered from the fuel is limited in many ways. Some of these limitations are theoretical, having to do with the amount

[illegible] not recovered due to the fact that real engines do not operate at in[illegible] temperature extremes; some are practical considerations based on engine [illegible] other factors. Knock is one factor that limits the amount of power that can be recovered without engine damage or loss of performance. As higher and higher compression ratios are used to get more and more power from the fuel, knock becomes a primary limitation. In this sense, then, high-octane fuels make possible the use of more efficient engines, which in turn can recover more power from the motor fuel.

However, it is important to note that the energy content of gasoline is not dependent on octane at all; in addition, knock is only one limitation on the recovery of that energy. In other words, high-octane fuel is not "hotter"; you certainly don't have to worry about burning up your engine by using fuel of too high an octane rating. What you do have to worry about is wasting your money: once you have minimally satisfied your engine's octane requirement, any higher octane does you absolutely no good. Knock merely puts a ceiling on the power recovery of your engine; once that ceiling has been raised enough to no longer be the limiting factor, raising it further accomplishes nothing whatever.

X. What octanes do most cars require?

Fuel octane specifications are normally given in the owner's manual for each model. Pre-1971 cars are designed for the most part to run on regular (93–95 octane) or premium (98–100 octane) fuels. Most 1971 and later models have been designed to run on a 91-octane subregular grade of fuel; this is part of the move to unleaded gasolines. With lead being removed from gasoline, only time will tell whether another "octane race" will necessitate the production of fuels reaching high-octane levels without the use of lead. A lot will depend on whether the driving public will be willing to tolerate a small decrease in the performance they are used to.

XI. Is there only one method used in rating octane?

Unfortunately, no. The great variation in engines means that not all react in the same way to a given fuel. The three common octane rating methods are research octane number (RON), motor octane number (MON), and road octane number. Road octane is most closely related to actual performance, since it is determined for a given engine; however, rating a fuel in every different car on the road is not a highly practical procedure. Thus, somewhat more arbitrary methods must be adopted. Research and motor octane numbers are determined in a special one-cylinder engine; the research rating is done at lower engine speed and intake temperature than the motor rating. Research octane is thus best correlated with normal passenger car driving, while motor octane corresponds to high load, high speed conditions. The difference between research and motor octane is known as the sensitivity of the fuel. RON is the common standard used in characterizing fuel performance.

Appendix 4.—Refining Processes

Part 1.—Types of Chemical Compounds in Petroleum

Petroleum is a mixture of compounds which belong to a category called hydrocarbons (i.e. containing only the elements carbon and hydrogen). As the number of carbon atoms in a molecule (the smallest unit of a compound; it would take a 26- or 27-digit number to represent the number of molecules in a gallon of gasoline) increases, the weight, "thickness", and boiling point of the compound also increase, while the volatility decreases. Compounds with fewer than four carbon atoms per molecule are gaseous, and form pockets of "natural gas" above petroleum reservoirs. Crude oil may contain compounds with as many as thirty carbon atoms per molecule. For the most part, gasoline contains molecules having from five to eight or nine carbon atoms. Sizable amounts of butane (a four-carbon hydrocarbon) may be included in winter gasoline to give it the desired volatility.

Petroleum chemists frequently divide the hydrocarbons in petroleum into four classes: paraffins (or alkanes), aromatics, naphthenes, and olefins (or alkenes). The paraffins are the majority components, and can be further subdivided into normal or straight-chain paraffins, in which all the carbon atoms are in a line, and isoparaffins or branched-chain paraffins, in which the chain of carbon atoms

is "branched". This last distinction is very important from a practical point of view: the normal paraffins are the lowest-octane constituents of gasoline, while the isoparaffins are among the highest-octane constituents. Aromatics and olefins are fairly good antiknock components, although olefins have been largely eliminated from modern gasoline because of their unfortunate effects on automotive emissions and on the storage stability of the fuel. Naphthenes have relatively low octane numbers, but are readily converted to aromatics in the refinery.

Natural petroleum usually contains some compounds containing oxygen, nitrogen, sulfur, arsenic, metals, or other elements. These are generally regarded as impurities in an essentially hydrocarbon product. In some cases, they may not be removed by the refining process and could appear in the finished gasoline. Most refiners take pains to remove at least the sulfur compounds.

PART 2.—PROCESSES USED IN REFINING CRUDE OIL

Distillation

Distillation is the first step in the refining process. Originally, it was the only step, but today it is invariably followed by a number of other processes for improving the quantity and quality of desirable products, mainly motor fuel. The exact nature of these processes may vary from one installation to another, but those commonly used are discussed below. Typical distillation practice might result in the fractions listed in Table 4-1; however, the number and boiling ranges of crude oil fractions are not set by any industry-wide standard. Naphtha fractions not subjected to further refining are sometimes referred to as virgin naphtha or straightrun gasoline. By present standards, this is usually a low quality fuel requiring considerable upgrading before it can be marketed.

TABLE 4-1.—TYPICAL DISTILLATION FRACTIONS

Fraction	Boiling point (° F.)	Products made from fraction [1]
Light naphtha	30-200	Gasoline.
Heavy naphtha	200-400	Gasoline, jet fuel.
Light gas oil	400-600	Kerosene, jet fuel, diesel fuel.
Heavy gas oil	600-800	Diesel fuel fuel oil.
Reduced crude	800-up	Lubricants, waxes, asphalt.

[1] In addition, petrochemicals may be extracted from the lighter fractions, and the heavier fractions may also be cracked to give gasoline components.

Thermal cracking

Thermal cracking converts high-boiling fractions into lower-boiling materials by application of intense heat. The compounds cracked are usually paraffins, and the products are paraffins and olefins. Although the oldest refining technique (other than distillation), it has now been largely replaced by catalytic cracking.

Catalytic cracking

By use of natural aluminum clay or synthetic zeolite catalysts, it is possible to crack heavy (i.e. high boiling) petroleum fractions at much lower temperatures and pressures than those required for thermal cracking. This process converts fuel oil, for example, into gasoline components, mainly olefins. Under catalytic cracking conditions, naphthenes are converted to aromatics, and paraffins may be converted to olefins even without cracking (i.e. breaking the carbon chain). Cracked gasoline may be blended into the final product directly, but it is usually reformed first.

Hydrocracking

This relatively new technique is now in wide use. It is basically a combination of catalytic cracking and hydrogen treating. By introducing hydrogen gas into the starting material (feed) and supplementing the cracking catalyst with another, usually of platinum, nickel, or tungsten, one can convert the olefins formed in the cracking process, as well as any olefins present in the original feed, to paraffins with the same numbers of carbon atoms. This lowers the octane number of the product, but improves its stability; olefins are considered

[illegible]-grade gasoline components for environmental reasons as well. The process [illegible] virtually removes virtually all of the sulfur and some of the nitrogen from [illegible].

Catalytic reforming

This is the key process for upgrading low quality gasoline. Unlike cracking, which uses a high-boiling feed (starting material), reforming starts with gasoline and improves its quality. Frequently, the feed for a reformer is provided by a cracker. Catalytic reforming is accomplished by heating the gasoline with a catalyst, which is usually based on platinum or molybdenum. The process increases the volatility and the octane number, and decreases the sulfur content all at the same time. The reactions that occur include conversion of naphthenes, paraffins, and olefins into aromatics, conversion of olefins into paraffins, conversion of normal paraffins into isoparaffins, and desulfurization. The product from a reformer is referred to as reformate.

Isomerization

Isomerization is a technique for converting low-boiling normal paraffins (four to six carbon atoms) into isoparaffins of the same size. These can be used in gasoline directly or as feed for an alkylation unit.

Alkylation

In alkylation, a low-boiling or gaseous olefin (two to five carbon atoms) is combined chemically with a low-boiling isoparaffin, usually isobutane (four carbon atoms). This gives an isoparaffin boiling in the gasoline range. Frequently, compounds made this way have exceptionally high octane numbers, and alkylate is among the most desirable blending components.

Polymerization

It is possible to react gaseous olefins with themselves to obtain gasoline-sized paraffins. Use of this process is limited, however, because these olefins are frequently more valuable for other applications.

Hydrogen treating

This technique converts olefins to paraffins and removes sulfur and some other impurities. It is often used to prepare feed for catalytic cracking or catalytic reforming, where large amounts of sulfur or metals could adversely affect the catalyst. It may also be used on virgin naphtha or cracked gasoline to enable it to meet standards set for environmental reasons. Although hydrogen treating uses a relatively inexpensive catalyst (most often cobalt molybdate), it, like hydrocracking, is dependent upon an external source of hydrogen gas.

Blending

Finished gasoline is prepared by mixing several materials, each of which has been treated with one or more of the above processes. It may or may not contain some straightrun gasoline. A properly run refinery should give maximum amounts of product meeting the desired specifications for volatility, octane number, and gum and sulfur content. The blending process may sometimes include the addition of some additives.

APPENDIX 4.--REFINING PROCESSES

PART 3.--NAMES FOR SOME REFINING PROCESSES

Process	Owner	Type of process
Airlift Thermofor	Mobil	Catalytic cracking.
Autofining	BP	Hydrogen treating.
Butamer	UOP	Isomerization.
Butamerate	Union	Do.
Catforming	Arco	Catalytic reforming.
Desulfoming		Hydrogen treating.
Ferrofining	BP	Do.
Gudfining	Gulf	Do.
H-G	Gulf, Houdry	Hydrocracking.
H-Oil	Cities Service, Hydrocarbon Research.	Do.
HDDV	Esso	Do.
HDS	Gulf	Do.
Houdresid	Houdry	Catalytic cracking.
Houdriflow	Houdry	Do.

APPENDIX 4.—REFINING PROCESSES

PART 3.—NAMES FOR SOME REFINING PROCESSES—Continued

Process	Owner	Type of process
Houdriforming	Houdry	Catalytic reforming.
Hy-C	Cities Service, Hydrocarbon Research.	Hydrocracking.
Hydrobon	UOP	Hydrogen treating
Hydrodesulfurization		Do
Hydrofining		Do
Hydroforming		Catalytic reforming.
Hydropretreating	Houdry	Hydrogen treating.
Hydrotreating	Texaco	Do
Hyperforming	Union	Catalytic reforming.
Iso-Kel	Kellogg	Isomerization.
Iso-Plus	Houdry	Catalytic reforming.
Isocracking	Chevron	Hydrocracking.
Isomate	American	Isomerization.
Isomax	Chevron, UOP	Hydrocracking.
Isomerate	Union	Isomerization.
Lomax	UOP	Hydrocracking.
Orthoflow	Kellogg	Catalytic cracking.
Penex	UOP	Isomerization.
Pentafining	Arco	Do.
Platforming	UOP	Catalytic reforming.
Platinum reforming	Mobil	Do.
Platreating	UOP	Hydrogen treating.
Powerforming	Esso	Catalytic reforming.
Rexforming	UOP	Do.
Sovafining	Mobil	Hydrogen treating.
Sovaforming	Mobil	Catalytic reforming.
Suspensoid		Catalytic cracking.
Thermofor	Mobil	Catalytic reforming.
Unicracking	Union, Esso	Hydrocracking.
Unifining	Union, UOP	Hydrogen treating.
Ultrafining	American	Do.
Ultraforming	American	Catalytic reforming.
Visbreaking		Thermal cracking.
Viscosity breaking		Do.

APPENDIX 5

FUEL ADDITIVES REGISTERED AS OF FEBRUARY 28, 1971

Allied Chemical Oil Blue PEL Dye.
Allied Chemical Oil Orange PEL Dye.
Allied Chemical Oil Red B PEL Dye.
Allied Chemical Oil Red PEL Dye.
ALOX 1846.
American Aniline Aviation Blue AP Dye.
American Aniline Liquid Oil Bronze Dye.
American Aniline Liquid Oil Orange E Dye.
American Aniline Liquid Oil Orange G Dye.
American Aniline Liquid Oil Red Dye.
American Aniline Oil Bronze 3696 Powder/Granuflow Dye.
American Aniline Oil Fast Blue Whitener TA Dye.
American Aniline Oil Orange Conc. Powder/Granuflow Dye.
American Aniline Oil Orange G Powder Granuflow Dye/
American Aniline Oil Red OB Powder/Granuflow Dye.
American Aniline Oil Red O3B Powder/Granuflow Dye.
American Aniline Oil Red 120 Powder/Granuflow Dye.
AMOCO 521 Metal Deactivator (A-521).
AMOCO 522 Metal Deactivator (A-522).
AMOCO 523 Metal Deactivator (A-523).
AMOCO 531 Antioxidant (A-531).
AMOCO 532 Antioxidant (A-532).
AMOCO 535 Antioxidant (A-535).
AMOCO 550 Valve Wear Inhibitor (A-550).
AMOCO 575 Multifunctional Gasoline Additive (A-575).
AMOCO 577 Multifunctional Gasoline Additive (A-577).
AMOCO 578 Multifuncational Gasoline Additive (A-578).
AMOCO 662 Two Cycle Engine Oil Additive (A-662).
Apollo PRI-19.

Armeen OD (primary aliphatic amine-[illegible]).
Atlas [illegible] Concentrate.
Atlas Kelfoam NL-70 DM.
Atlas Kelfoam NL-70 DMX.
Atlas Kelfoam RD-302.
Atlas [illegible].
Atlas [illegible].
Atlas [illegible]
Atlas H-450.
Calco Oil Blue V Dye.
Calco Oil Bronze Y Liquid Dye.
Calco Oil Orange RNC Dye.
Calco Oil Orange Y Liquid Dye.
Calco Oil Orange 707SV Dye.
Calco Oil Red BNC Dye.
Calco Oil Red Y Liquid Dye.
Calcogas Orange NC Dye.
Calcogas Rocket Red Dye.
Cardinal Metal Deactivator (50% in Xylene).
Cardinal Metal Deactivator (80% in Xylene).
Control S-41-KF.
Control S-41-KF-80.
Chevron Air-O-Zone HD.
Chevron F-310.
Chevron OGA-290.
Chevron OLOA 232E.
Chevron OLOA 340D.
Chevron OLOA 1200.
CITGO—Multifunctional Gasoline Additive No. CGA-24.
Cooper PA-1260.
Deactimine Cooper Metal Deactivator.
Dow Corning 200 Fluid.
Du Pont AFA-1 (Corrosion Inhibitor).
Du Pont Antioxidant—Metal Deactivator Mixture.
Du Pont Antioxidant No. 5 (AO-5).
Du Pont Antioxidant No. 21 H (AO-21 H).
Du Pont Antioxidant No. 22 (AO-22).
Du Pont Antioxidant No. 23 (AO-23).
Du Pont Antioxidant No. 23 Concentrate.
Du Pont Antioxidant No. 26 (AO-26).
Du Pont Blue Aviation Mix 26 Antiknock.
Du Pont Cresyl Diphenyl Phosphate.
Du Pont DMA-Q.S. (Multifuncational Additive).
Du Pont DMA-4 (Multifunctional Additive).
Du Pont DMA-4A (Multifunctional Additive).
Du Pont DMA-5 (Multifunctional Additive).
Du Pont DMA-101 (Multifunctional Additive).
Du Pont DMA-111 (Multifunctional) Additive).
Du Pont DMA-115 (Multifuncational Additive).
Du Pont Hexylene Gylcol Diborate (HGB).
Du Pont Metal Deactivator (DMD).
Du Pont Metal Deactivator No. 2 (DMD-2).
Du Pont Metal Suppressor (DMS).
Du Pont Oil Blue A Powder/Flake Dye.
Du Pont Oil Blue B Liquid Dye.
Du Pont Oil Blue Whitener Liquid Dye.
Du Pont Oil Bronze Liquid Dye.
Du Pont Bronze M Liquid Dye.
Du Pont Oil Bronze Powder/Flake Dye.
Du Pont Oil Orange B Liquid Dye.
Du Pont Oil Orange Liquid Dye.
Du Pont Oil Orange Powder/Flake Dye.
Du Pont Oil Red A Powder/Flake Dye.
Du Pont Oil Red B Liquid Dye.
Du Pont Oil Red G Pellet Dye.
Du Pont Oil Red Powder/Flake Dye.
Du Pont Oil Yellow NB Pellet Dye.
Du Pont PM-10 Antiknock—Red-01.
Du Pont PM-75 Antiknock—Red-01.
Du Pont TEL Motor Antiknock—Orange-62.
Du Pont TEL Motor Antiknock—Red-01.
Du Pont TEL Motor Antiknock—Red-36.
Du Pont TEL Motor Antiknock—S-1 Red-01.
Du Pon TML Antiknock—Red-01.
Du Pont "Tetramix" 25 Antiknock—Red-01.
Du Pont "Tetramix" 50 Antiknock—Blue-37.
Du Pont "Tetramix" 50 Antiknock—Orange-62.
Du Pont "Tetramix" 50 Antiknock—Red-01.
Du Pont "Tetramix" 50 Antiknock—Red-36.
Du Pont "Tetramix" 50 Antiknock—Red-52.
Du Pont "Tetramix" 50 Antiknock—S-1 Orange-67.
Du Pont "Tetramix" 50 Antiknock—S-1 Red-01.
ECA 4319.
ENJ 344S.
East Coast Cresyl Diphenyl Phosphate.
Eastazone 33 Antioxidant.
"Ethyl" Antiknock Compound—MLA-250 Motor Mix (White No. 1)
"Ethyl" Antiknock Compound—MLA-500 Motor Mix (White No. 1).
"Ethyl" Antiknock Compound—MLA-500 Special-1 Mix (White No. 1).
"Ethyl" Antiknock Compound—Manganese (Comm.).

"Ethyl" Antiknock Compound—TEL CB (White No. 51).
"Ethyl" Antiknock Compound—TEL-Motor Mix (White No. 1).
"Ethyl" Antiknock Compound—TEL Special-1 Mix (White No. 1).
"Ethyl" Antiknock Compound—TEL-MEL-10 Motor Mix (White No. 1).
"Ethyl" Antiknock Compound—TEL-MEL-25 Motor Mix (White No. 1).
"Ethyl" Antiknock Compound—TEL-MEL-50 Motor Mix (White No. 1).
"Ethyl" Antiknock Compound—TEL-MEL-75 Motor Mix (White No. 1).
"Ethyl Antiknock Compound—TML-Motor Mix (White No. 1).
"Ethyl" Antioxidant—PDA ("Ethyl" PDA).
"Ethyl"Antioxidant—PDA (Diisopropyl) ("Ethyl" PDA (DI)).
"Ethyl" Automate Liquid Dye—Blue.
"Ethyl" Automate Liquid Dye—Bronze.
"Ethyl" Automate Liquid Dye—Green.
"Ethyl" Automate Liquid Dye—Orange.
"Ethyl" Automate Liquid Dye—Orange R.
"Ethyl" Automate Liquid Dye—Red B.
"Ethyl"Automate Liquid Dye—Red G.
"Ethyl" Automate Liquid Dye—Yellow.
"Ethyl" Blue No. 2 Dye.
"Ethyl" Bronze N Dye.
"Ethyl" Cresyl Diphenyl Phosphate.
"Ethyl" DII.
"Ethyl" DII-2.
"Ethyl" Ignition Control Compound No. 1 ("Ethyl" ICC 1).
"Ethyl" Ignition Control Compound No. 3 ("Ethyl" ICC 3).
"Ethyl" Ignition Control Compound No. 4 ("Ethyl" ICC 4).
"Ethyl" Liqui-Di Dye—Bronze.
"Ethyl" Liqui-Di Dye—Red B.
"Ethyl" Metal Deactivator ("Ethyl" MDA).
"Ethyl" Multi-Purpose Additive ("Ethyl" MPA).
"Ethyl" Multi-Purpose Additive—9 ("Ethyl" MPA 9).
"Ethyl" Multi-Purpose Additive—85 ("Ethyl" MPA 85).
"Ethyl" Multi-Purpose Additive—90 ("Ethyl" MPA 90).
"Ethyl" Orange Dye.
"Ethyl" Red B115 Dye.
"Ethyl" Red B140 Dye.
"Ethyl" Red 100 Dye.
"Ethyl" Red 105 Dye.
"Ethyl" Red 116 Dye.
"Ethyl" Yellow DE Dye.
FMC Cresyl Diphenyl Phosphate.
FMC Methyl Diphenyl Phosphate.
FMC Tricresyl Phosphate
Gulf Agent 919.
Gulf Agent 929.
Gulf Agent 1032.
HCC Antiknock Compound—MAF-10R-TR.
HCC Antiknock Compound—MAF-25R-TR.
HCC Antiknock Compound—MAF-50R-Blue.
HCC Antiknock Compound—MAF-50R-Bronze.
HCC Antiknock Compound—MAF-50R-Orange.
HCC Antiknock Compound—MAF-50R-Red No. 2.
HCC Antiknock Compound—MAF-50R-TR.
HCC Antiknock Compound—TEF Motor Mix-C+-TR.
HCC Antiknock Compound—TEF Motor Mix-Orange.
HCC Antiknock Compound—TEF Motor Mix-Red No. 2.
HCC Antiknock Compound—TEF Motor Mix-TR.
Hallowax 1000.
Hitec E-515 (Santolene C).
Hitec E-573 (Santolene CX).
Humble Detergent (HTA).
Kontol 77 Corrosion Inhibitor.
Kontol 407 Corrosion Inhibitor.
Kuplex Metal Deactivator.
Lubrizol 221.
Lubrizol 545.
Lubrizol 546.
Lubrizol 580.
Lubrizol 581.
Lubrizol 582.
Lubrizol 587.
Mobile RT-125A (Cresyl Diphenyl Phosphate).
Mobile RT-130A.
Mobile RT-202H.
Mobile RT-421B.
Mobile RT-421C.
Monsanto Cresyl Diphenyl Phosphate.
Monsanto M-5040.
Monsanto Tricresyl Phosphate.
Montrose Cresyl Diphenyl Phosphate.
Montrose Tricresyl Phosphate.
Morton Automate Blue No. 8 Dye.
Morton Automate Blue Whitener Dye.
Morton Automate Bronze No. 1 Dye.
Morton Automate Orange No. 2 Dye.
Morton Automate Orange R Dye.
Morton Automate Red B Dye.
Morton Petrol Ero Blue Dye.
Morton Totem Bronze Y Dye.
Nalco Oil Bronze Dye.
Nalco Oil Orange Dye.
Nalco 160-T Corrosion Inhibitor.
Nalco 537-DA.
NALKYL E-1 Motor Mix.

NALKYL M-1 Motor Mix.
NALKYL MB-25-1 Motor Mix.
NALKYL MB-56-1 Motor Mix.
NASUL LP Corrosion Inhibitor.
Paradyne 55 (ENJ 3912).
Paradyne 501 (ECA 4306).
Paradyne 502 (ECA 4307).
Phostane MDP.
Sohio Boron.
Stauffer Cresyl Diphenyl Phosphate.
Stauffer Tricresyl Phosphate.
Tenamene MD-50.
Tenamene 2 Antioxidant.
Tenamene 4 Antioxidant.
Tenamene 5 Antioxidant.
Tenamene 5C Antioxidant.
Tenamene 7 Antioxidant.
Tenamene 60 Metal Deactivator.
Tenneco Oil Orange Dye (Solvent Yellow 14).
Texaco Metal Deactivator.
Texaco TFA-203.
"Tolad" MFA 2 Multifunctional Additive.
"Tolad" 244 Rust Inhibitor.
"Tolad" 245 Rust Inhibitor.
UOP AID-3.
UOP AID-5.
UOP Copper Deactivator AW-50.
UOP Copper Deactivator Regular (80%).
UOP No. 5 Antioxidant.
UOP No. 5-S Antioxidant.
UOP No. 12 Antioxidant.
UOP No. 16 Antioxidant.
UOP No. 17 Antioxidant.
UOP No. 88-S Antioxidant.
Unicor.
Unicor LHS.
U.S. Borax B-2 Gasoline Additive.
Waxoline Orange/Yellow IS Powder Dye.
Waxoline Red OS Powder Dye
Witco Copper Naphthenate, Cutback (4% Cu).

Additional Additives Registered March 1971

Du Pont Oil Green Liquid Dye.
Du Pont SSMGA-02597 (Multifunctional Additive).
"Ethyl" Antiknock Compound—MLA-750 Motor Mix (White No. 1).
"Ethyl" Liqui-Di Dye—Orange.
"Ethyl" Liqui-Di Dye—Orange R.
Hounslow Oil Orange E Flake Dye.
Hounslow Oil Red Tax Powder Dye.
Naugalube—143.

APPENDIX 6.—POPULAR ANTIKNOCK PACKAGES

Product and company	Composition	Number of fuel manufacturers reported
Ethyl antiknock compound MLA-500 motor mix (white No. 1), Ethyl Corp.	Mixed lead alkyl-500, 56.16 percent Ethylene dibromide, 17.86 percent Ethylene dichloride, 18.81 percent Ethyl red 100 dye, 0.001 percent minimum Ethyl antioxidant, 0.06 percent Plus toluene and kerosene to 100 percent	37
Ethyl antiknock compound TEL motor mix (white No. 1), Ethyl Corp.	Tetraethyl lead, 61.49 percent Ethylene dibromide, 17.86 percent Ethylene dichloride, 18.81 percent Ethyl red 100 dye, 0.001 percent minimum Ethyl antioxidant 733, 0.06 percent Plus kerosene to 100 percent	36
DePont TEL motor antiknock Red-01, E. I. du Pont de Nemours & Co., Inc.	Tetraethyl lead, 61.49 percent Ethylene dibromide, 17.86 percent Ethylene dichloride, 18.81 percent Dye, antioxidant, solvent, inerts, 1.84 percent.	27
Du Pont "Tetramix" 50 antiknock Red-01, E. I. du Pont de Nemours & Co., Inc.	Confidential	26
RCC antiknock compound MAF-50R-TR, Houston Chemical Co.	Tetramethyl lead, 2.13 percent Ethyl-trimethyl lead, 13.14 percent Diethyl-dimethyl lead, 23.8 percent Triethyl-methyl lead, 14.37 percent Tetraethyl lead, 2.70 percent 1,2-dibromoethane, 17.86 percent 1,2-dichloroethane, 18.81 percent 2,6-di-tert-butyl-4-methyl phenol, 0.09 percent. Toluene, 7.09 percent Dye (azo benzene-4-azo-2-naphthol), 0.001 percent.	17

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