LEAD INDUSTRIES ASSOCIATION, INC.
292 MADISON AVENUE
NEW YORK, N. Y. 10017
TELEPHONE — AREA CODE 212
OR 9-8000

December 2, 1966

TO: All Members of the Lead Industries Association, Inc.

RE: "Lead in the Environment", by J.C. Calandra, M.D.

Enclosed you will find a reprint of the above paper which was presented at our Annual Meeting in St. Louis, Mo. this year.

We are sending you the enclosed paper as we feel it is an excellent summary of the present situation concerning the general field of lead and health. The information contained therein can be used in answering any questions you might receive on the subject of environmental contamination from lead.

Extra copies of the reprint are available as long as the supply lasts.

Very truly yours,

Don C. Fowler

DCF/jv
Enc.

Look Ahead with Lead

LEAD IN THE ENVIRONMENT

By

J. C. CALANDRA, M.D.

Professor of Pathology, Northwestern University
President and Director, Industrial Bio-Test
Laboratories, Inc., Northbrook, Ill.

Presented at 38th Annual Meeting of the
Lead Industries Association, Inc.
Chase Park Plaza Hotel, St. Louis, Mo.

March 31-April 1, 1966

LEAD IN THE ENVIRONMENT

J. C. Calandra

The importance of chemicals in man's social, economic and occupational environment has reached the highest level in history.

This interest has resulted in an increase in exposure of man to chemicals under a wide variety of circumstances. Chemicals are added intentionally or incidentally to our diets, the air we breathe, the drugs we use, the streams we fish, the lands we hunt and for many of us, chemicals are important and necessary in the jobs we perform and the products we produce.

Some would have us to believe that these exposures are not being regulated, monitored or supervised. That man is being indiscriminately subjected to many unknown and indescribable dangers is far from the truth.

[illegible] are being carried on in all situations where chemicals and other substances are used and the possibility of limited or mass population exposure is present.

Food additives, pesticides, drugs, cosmetics and air and water contaminants undergo extensive and intensive study by industry and government agencies. The scientific research programs involved are highly sophisticated and are designed to define very critically the biological effects of these materials. The Food and Drug Administration, U. S. Public Health Service, Department of Agriculture, Department of Interior, Fish and Wildlife Service and Air and Water Pollution Commissions on a local and national level are among government agencies involved in this extremely important task.

Industry provides similar safeguards and information through the integrated activities of the industrial physician and nurse, the industrial hygienist and toxicologist and the safety engineer. As a team these individuals define the biological and physiological effects of chemicals. This information is used to develop the measures required to control or eliminate possibly dangerous or offending agents.

The total effort is extremely large and carries with it a great moral responsibility. Unfortunately, it is little understood or appreciated by the general public. This results in our falling prey to such scare situtations, among others, as were created by the publication of "Silent Spring," the "cranberry case," the paraffin wax and cancer claims. One recent allegation that the average resident of the U. S. is being subjected to severe chronic lead exposure in the atmosphere was widely publicised in spite of carefully assembled fact showing that this is not so.

Readers of the book, "Silent Spring," were led to believe that pesticides were being used unnecessarily and indiscriminately, that the general public was being poisoned, and that in a few years most forms of fish and wildlife would be extinct.

Little mention was made of the intensive research programs that are carried out on each individual agricultural chemical that may enter the biosphere. The research programs define the biological properties of these materials as precisely as possible using all of the research tools available. The levels of use that are established as a result of this effort are safe levels with margins of safety ranging from 100 to several thousand fold.

Extensive investigations proved that there was no danger in eating cranberries treated with a certain chemical. Paraffin wax was cleared for use by the Food and Drug Administration after sufficient evidence was presented to reconfirm the belief that it was not a carcinogen.

[illegible] tributor to air pollution in general and to dangerous lead exposure specifically. Because of these allegations a symposium of scientists was held in Washington, D.C. last December on environmental lead contamination.

The stated purposes of the symposium were:

A. To evaluate the degree of exposure to lead from all sources.

B. To appraise the need for research and control measures.

One subject for considerable discussion was whether there was a biological basis for the reduction or elimination of lead compounds from gasoline.

Although useful suggestions for continued research on lead were developed at this meeting, there was no evidence presented that contradicted existing knowledge about lead in the environment and its relevance to man. Let us examine some of this knowledge in the proper historical and scientific perspective.

The intensive study of lead first came into focus in 1923 when the question was raised as to the extent and possible effects of emissions of lead compounds from exhausts of automobiles using leaded gasolines, then a new development. Under the aegis of the U.S. Surgeon General, a scientific study was made, including examination of people in close contact with leaded gasoline and exhausts. A Public Health Service report was issued saying there was no reason not to use the leaded gasoline but that studies should be continued.

Research did continue -- on an ever-broadening scale -- and thus it was that 35 years after this first report, a proposal was made to increase the permissible lead content of gasoline to meet requirements of newer high powered engines, particularly in aviation. Another thorough and critical review was undertaken to assess once again the question of biological significance of lead in the atmosphere, and once again the Public Health Service could find no scientific reason not to permit the increase in the upper level of lead content. It should be noted, in passing, that even today, the average content of lead in gasoline is not up to the previously accepted level. Only a few specialized gasolines, such as high test aviation gas, utilizes the higher lead level contents.

Thus, throughout this entire period there have been accumulated findings by distinguished scientists of government, industry and universities which have been reported in detail in scientific journals and in monographs issued by the U. S. Public Health Service. It is important, therefore, to point out that lead in the atmosphere has been the subject of scientific study for at least 40 years and that the biological effects of lead in the biosphere are among the most thoroughly investigated areas in the field of [illegible].

Minute amounts of lead enter the body with food and water taken in. Approximately 90 percent of whatever lead enters the body comes in this way, and the rest -- about 10 percent -- enters by inhalation. The normal intake -- which varies from time to time and place to place with individuals -- is approximately three-tenths of a milligram. That's roughly one one-hundred-thousandth of an ounce. Dealing even with this tiny amount, science has developed the know-how to determine what happens to this intake. It is by and large eliminated by natural body processes. The result is a dynamic equilibrium under average exposure conditions -- in a word, the output equals the input. This is a greatly simplified summation of the results of years of study of the metabolism of lead in the body.

Everyone recognizes that too much lead is toxic and under conditions of massive accidental exposure may cause illness as well as death. This same statement can be made about many chemicals and other every day substances. But because of the ability to measure lead and the knowledge of its action, today even industrial and accidental cases of excessive lead exposure are relatively rare. This is because we are able to know how much exposure may be the point of "too much" and to measure the conditions under which this could happen and to determine in individuals when it might be happening. Let us examine the present day situation as it relates to man's exposures to lead from various sources in the environment.

Man's diet accounts for 90% of his lead intake. Extensive studies on this point have conclusively proven that the lead intake from foods has decreased in the last 30 years.

Lead is a component of drinking water. The results of 531 analyses of municipal water supplies in this country showed that all were below the prescribed standard for lead in water and that 88% contained 1/5 or less of the maximum allowable concentration.

The industrial or occupational exposure to lead has decreased in the past 30 years. The lead levels of workers exposed in foundries, auto body plants, printing shops, battery plants, etc. have decreased. This situation has resulted because of improved working conditions achieved through the efforts of management and the industrial health team.

Many of you have heard of the Tri-City Survey which involved multiple air analyses for lead in Los Angeles, Cincinnati and Philadelphia. Analyses for lead in blood and urine of selected groups of hundreds of people in the population of these cities were also conducted. Limited investigations were made of the concentration of atmospheric lead in heavy traffic and in a vehicular tunnel.

The purposes of this survey were -- in brief:

-- to set up benchmarks for watching the lead content in the air of cities, and in the blood and urine of selected populations.

-- to get information that will permit continuing review of the effects, if any, of lead concentrations in the air and in the population.

-- and to see whether there were any important differences in the blood and urine levels of people with different types of exposure to community atmosphere.

The sponsors of this extensive and revealing project were the U. S. Public Health Service, the manufacturers of lead antiknock additives, the petroleum industry and other appropriate organizations.

The concentrations of lead in air found in this study agreed with those obtained during the same period by the National Air Sampling Network of the Public Health Service. There was no evidence of an upward trend in the lead content of the atmospheres of the three cities studied. In fact, the trend in Cincinnati appeared to be <u>downward</u> since 1946. The lead in air analyses may be brought into better focus by pointing out that the levels found are 50 to 150 times less than those considered to be safe for an occupational exposure of eight hours per day for a working lifetime.

The lead in blood analyses for 2300 persons and urine analyses for 1700 males of the same group revealed that persons not having a high occupational exposure to lead had normal blood and urine lead values. Only 11 persons were found to have concentrations of lead in their blood equal to or in excess of the amount generally believed to be normal. And these 11 persons were from groups that had an opportunity for industrial exposure to lead. Even so the lead levels obtained in all groups -- including these 11 -- were within the presently accepted normal range for humans and were not significant in terms of lead intoxication.

These results are comparable to those found in previous studies. It is important to note that the data were obtained during a period in which there has been a large increase in the consumption of leaded motor fuels.

These findings are reinforced by data presented at a World Health Organization meeting in Geneva at which was reported the results of approximately 2500 analyses for blood and urine levels involving men and women of 15 countries in different parts of the world. These [illegible] and urine levels have not occurred in the past 30 years.

How the tiny amounts of lead get into and out of the body, and what form the lead is in are important aspects of this lead question. All of the lead which enters the body or is present in the environment is not biologically active. This is certainly true at the levels of environmental exposure to lead. The body adjusts to increased lead intake by increasing the output via the kidneys and gastrointestinal tract and thereby maintains its lead balance and avoids toxic symptoms.

Another protective mechanism available to the body is the storage of lead in the skeleton. Recently, a number of studies have shown no correlation between bone lead concentrations and time of residence in an area, and no correlation between concentration and age. These and other results definitely show that there has been little change in bone lead concentration in the past 30 years during which time the consumption of leaded gasoline has increased.

It is important to keep in mind that more is known about the biological effects of lead than about almost any other air borne substance. This knowledge has been gained through industrial hygiene experience as well as by sophisticated animal and human experiments.

Although there are differences of opinion as to what is "normal" and safe, present evidence indicates that the established levels of lead in blood are safe or normal physiologically. The present threshold values for lead in the air, blood and urine, in my opinion, are sound and useful guides. However, one cannot exclude the possibility that minimal biological changes may occur at low levels of lead exposure. A few scientists, some of them non-medical, have questioned whether the present guides on lead values and effects of lead are adequate, although they offer no evidence to show otherwise.

No one will argue that additional information relative to the medical, toxicological and metabolic aspects of lead exposure is necessary. This information is desirable in relation to -- to use technical terminology -- ribosomal and mitochondrial enzyme effects, reproduction, mental development, the integrity of the central nervous system, the cardiovascular system and hematopoietic system and the industrial and urban environments wherein large segments of the population are involved.

In medicine, as in most situations, it is practically impossible to prove the negative. However, everyone has the same goal -- the protection of the health and welfare of the general and industrial population. The more knowledge that can be developed the better we will be able to cope with questions and problems if and as they arise.

In fulfillment of this responsibility the Lead Industries Association, the U. S. Public Health Services, the American Petroleum Institute and Lead Alkyl Manufacturers are cooperating in the development, implementation and financing of scientific research programs in depth to attempt to resolve the important questions concerning the subclinical and subcellular effects of lead in the research areas mentioned above.

To sum up the present situation concerning the general field of lead and health, with facts based on recognized research:

1. Amounts of lead from all sources to which the general population is exposed do not constitute a health hazard.

2. There has been little change in the last 20 years in lead intake, output and body retention in the average American adult.

3. Lead concentrations in the air from all sources are low -- far below levels known to be safe for industrial workers.

4. Emissions of lead from automobile exhausts are not creating a public health hazard and there is no evidence that dictates a need for elimination of lead from gasoline.

5. Continued and expanded research into lead in the environment and its significance to human beings is necessary and is being done.

I respectfully submit that fair play and the proper professional recognition of the large body of scientific data on the toxicology of lead prevail until such time as the research program presently under way can provide specific information about the areas in possible question.

The lead in blood analyses for 2300 persons and urine analyses for 1700 males of the same group revealed that persons not having a high occupational exposure to lead had normal blood and urine lead values. Only 11 persons were found to have concentrations of lead in their blood equal to or in excess of the amount generally believed to be normal. And these 11 persons were from groups that had an opportunity for industrial exposure to lead. Even so the lead levels obtained in all groups -- including these 11 -- were within the presently accepted normal range for humans and were not significant in terms of lead intoxication.

These results are comparable to those found in previous studies. It is important to note that the data were obtained during a period in which there has been a large increase in the consumption of leaded motor fuels.

These findings are reinforced by data presented at a World Health Organization meeting in Geneva at which was reported the results of approximately 2800 analyses for blood and urine levels involving men and women of 15 countries in different parts of the world. These results confirmed that physiologically significant changes in blood and urine levels have not occurred in the past 30 years.

How the tiny amounts of lead get into and out of the body, and what form the lead is in are important aspects of this lead question. All of the lead which enters the body or is present in the environment is not biologically active. This is certainly true at the levels of environmental exposure to lead. The body adjusts to increased lead intake by increasing the output via the kidneys and gastrointestinal tract and thereby maintains its lead balance and avoids toxic symptoms.

Another protective mechanism available to the body is the storage of lead in the skeleton. Recently, a number of studies have shown no correlation between bone lead concentrations and time of residence in an area, and no correlation between concentration and age. These and other results definitely show that there has been little change in bone lead concentration in the past 30 years during which time the consumption of leaded gasoline has increased.

It is important to keep in mind that more is known about the biological effects of lead than about almost any other air borne substance. This knowledge has been gained through industrial hygiene experience as well as by sophisticated animal and human experiments.

Although there are differences of opinion as to what is "normal" and safe, present evidence indicates that the established levels of lead in blood are safe or normal physiologically. The present threshold values for lead in the air, blood and urine, in my opinion, are sound and useful guides. However, one cannot exclude the possibility that minimal biological changes may occur at low levels of lead exposure. A few scientists, some of them non-medical, have questioned whether the present guides on lead values and effects of lead are adequate, although they offer no evidence to show otherwise.