

AIR POLLUTION

SECTION 3

ANTIKNOCK COMPOUNDS AND PUBLIC HEALTH

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Q-1: Are smog and air pollution the same thing?

A-1: No. You can have air pollution without smog, but you can't have smog without air pollution.

Q-2: Is the presence of lead in the atmosphere a phenomenon of the automobile age?

A-2: Definitely not. We've always had lead in the air, originating from many sources. The soil, for example, has lead in it ranging up to 15 or more parts per million. The combustion of other fuels, including coal and even wood, results in the distribution of the lead that exists in these fuels into the atmosphere.

Q-3: What is the connection between antiknock compounds and questions of public health?

A-3: After an antiknock compound has done its job of controlling combustion inside an automobile engine, the waste products of the antiknock compound are discharged through the automobile tailpipe and practically all fall to the ground. A small portion of these waste products enters the atmosphere. Consequently, the question is raised from time to time as to whether this lead in the atmosphere is a hazard to public health.

Q-4: Have the public health aspects of antiknock compounds been investigated?

A-4: Tetraethyl lead, the principal antiknock compound in use, has been one of the most comprehensively studied of industrial products, from the standpoint of public health, in the last 35 years. This work has included two investigations sponsored by the U. S. Public Health Service in 1925 and again in 1959. It has also included years-long investigations by the Kettering Laboratory in the Medical College of the University of Cincinnati, under the financial sponsorship of the manufacturers and distributors of antiknock compounds in the United States. It has also included an extensive study of leaded gasoline, from the standpoint of smog, conducted by the Midwest Research Institute a few years ago. The results of these and other investigations have been published in scientific and medical journals. (Continued on Page 2.)

Most recently the U. S. Public Health Service and the California Department of Public Health, cooperating with industry, completed the "Three-City Study" for the purpose of
1) Establishing a base line of lead content in the atmospheres and in the blood and urine of selected population groups; 2) Ascertain differences in lead level for the blood and urine of groups exposed to varying amounts of lead, and 3) Obtain data to permit a review of the effects of atmospheric lead on the population.

Q-5: What have these investigations shown?

A-5: These investigations have repeatedly shown the following:

1. The lead compounds discharged in the exhaust of automobile engines have not created a public health hazard.
2. Antiknock compounds do not contribute to the formation of smog.
3. The concentrations of lead (from all sources, including anti-knock compounds) generally found in the air of American cities are low.
4. The amounts of lead to which the general population is exposed (from all sources, including foods and beverages) are well below hazardous limits.
5. In the past twenty-odd years, there has been no demonstrable change, on the part of the average American, either in his intake and output of lead, or in the amounts of lead retained in his body.

Q-6: Are any current investigations underway?

A-6: Lead is but one of many air-borne ingredients now being measured on a continuing basis by the National Air Sampling Network.

Q-7: Do antiknock compounds play any significant role in air pollution?

A-7: No. After well over three decades of sustained use in gasoline, repeated investigations have failed to demonstrate that lead antiknock compounds create hazards to public health or contribute significantly to the general problem of air pollution.

Q-8: Do antiknock compounds play any role in the formation of smog?

A-8: No. The Midwest Research Institute study, whose findings were reported to the Air Pollution Control Association in Los Angeles, demonstrate that tetraethyl lead, the principal antiknock compound in use, does not contribute in any manner to any of the manifestations of smog.

Q-9: If antiknock compounds aren't to blame for smog, why are so many fingers pointed at them so often?

A-9: The answer is simply that charges are made from time to time without any scientific foundation or basis in fact.

Q-10: Are antiknock compounds the only source of lead in the atmosphere?

A-10: No. Antiknock compounds contribute only a portion of the total amount of lead particles found in the atmosphere. Other sources include the combustion of wood, coal and vegetable matter; lead in the soil; industrial processes involving the use of lead; and man-made products containing lead.

Q-11: How much lead in the atmosphere comes from auto exhausts?

A-11: As stated before, antiknock compounds account for only a portion of the total amount of lead in the atmosphere. It would be extremely difficult to express this in exact proportions because of the variability of other factors.

Q-12: Is the amount of lead in the atmosphere, from all sources, of hazardous proportions?

A-12: No. Repeated investigations have shown that the amount of lead in the atmosphere, from all sources, is well below hazardous limits. The recently completed Three-City Study has shown that the average concentration of lead in the atmosphere in these cities was 3 micrograms or less per cubic meter. These concentrations contrast with the concentration of 200 micrograms per cubic meter which has been accepted in the United States as the satisfactory specification of the safe concentration of lead in the air of industrial establishments. (This specification is not directly applicable to the general atmosphere because the occupational exposure to lead is approximately 40 hours per week, whereas the concentration of lead in the general atmosphere continues 24 hours per day or 160 hours per week.)

Q-13: Does increased usage of leaded gasoline mean a proportionate increase in lead-in-air concentrations in metropolitan areas?

A-13: No, indeed. An extensive study of atmospheric lead in Cincinnati shows precisely the opposite. The Cincinnati study shows there has

been a significant reduction in the lead content there since the late 1940's. This is traceable in part to a reduction in airborne lead contributed by the combustion of coal, and in part to changes in the commercial activities and traffic patterns in Cincinnati during that period. This reduction took place despite the progressive increase in vehicular traffic and in the consumption of gasoline.

Q-14: If antiknock compounds were eliminated, would that not greatly reduce the amount of lead in the atmosphere?

A-14: Any such restrictions would not eliminate lead from the atmosphere. In fact, as indicated immediately above in Question 13, there might be little measurable change of the lead-in-air content.

Q-15: Are the waste products of antiknock compounds the only air-borne contaminants?

Q-15: By no means. Every activity connected with our daily life contributes one or more contaminants to the general atmosphere.

Q-16: What is meant by particle size and is it significant in lead absorption?

A-16: Particle size is an important consideration for two reasons - it determines the amount of lead which does not settle out of the air but which remains suspended in the atmosphere, and in addition, it determines the amount of lead that will enter the lungs and will be retained there. Large particles of lead fall to the ground rapidly and are, therefore, not an air pollution hazard. Of those particles that are inhaled, if they are larger than 5 microns in diameter, they will be filtered out of the air in the upper respiratory tract and, therefore, not reach the lungs. Those particles that are small enough to behave like a gas (a few microns in diameter) tend to be exhaled rather than to be retained within the lung.

When an antiknock compound has done this job inside an automobile engine, its waste products are discharged in the exhaust gas. Generally speaking, up to 75% of the lead entering an automobile is exhausted. However, larger lead particles fall to the ground. It is only the small lead particles which remain suspended in the atmosphere.

So far as the average person is concerned, the larger lead particles - again from all sources - would not be inhaled by a person.

Q-17: Do antiknock compounds present any hazard to human beings?

A-17: Suitable protection is provided by regulation for all men who handle antiknock compound. All others are denied access to the material. None of these protected men have ever suffered lead poisoning.

Q-18: How much lead is inhaled and absorbed by the average person?

A-18: The quantities of lead taken into the body from food and drink greatly exceed the amounts taken in with the air in breathing. While the average of a large number of observations on the human intake of lead in food and drink approximates one-third of a milligram per day, that taken in, in the air, within the 24-hour period may be as little as one-twentieth of that amount or as much, perhaps, as one-fourth of it, depending upon where and how one spends the hours of the entire day.

Of more significance is the amount of lead absorbed into the body. The absorption from the digestive tract is slow and incomplete, somewhat less than 10% of that swallowed under ordinary conditions being absorbed. On the other hand, that absorbed from the respiratory tract may be as much as 50%, or somewhat less than 35%, of that which is inhaled.

Exhaustive studies have shown that the output of lead daily from the body of the average person is so nearly equivalent to the total intake daily, that any accumulation of lead which may occur over a long period of years, or a lifetime, is too small to be detected.

Q-19: Is lead which enters the body thru inhalation more hazardous than that which enters by ingestion?

A-19: The matter of danger from the absorption of lead within appropriate limits of dosage is greater, generally, in the case of inhaled lead because the absorption is more rapid and more complete. However, when the quantities involved are sufficiently low there is no risk in either case.

Q-20: What is the average lead level in the blood of people? What is considered to be the safe limit?

A-20: This varies somewhat from person to person, but averages slightly under 30 micrograms per hundred grams of whole blood.

The upper limit of safety is about 70 micrograms.

Q-21: What is the difference in the significance of lead in blood and lead in urine?

A-21: The answer to this question might better come from medical people.

Q-22: What is the ultimate test of any lead hazard to human beings?

A-22: The ultimate criterion of safety, in relation to human exposure to lead, is the freedom of the individual from a rate of intake and absorption which will result in the progressive accumulation of lead in his body over a long period of time. All available evidence indicates that, under the present general conditions of exposure, no such accumulation occurs.

The additional evidence which is being sought through future experimentation is intended to define the threshold point in the overall exposure to lead from all sources, which will result in a barely demonstrable accumulation of lead in the body. By such means, the margin of safety between present conditions and potentially hazardous conditions can be established, and a standard for the future made available. However, you may wish to develop this further with medical people.

Q-23: What do you mean when you use the term "potential hazard"?

A-23: A potential hazard is one which has the capability of producing a deleterious effect and is one which produces the possibility of risk. The hazard becomes real only when some factor changes in some manner.

Our purpose is to avoid any risk by insuring that the exposure is never sufficiently great, such that it would result in the accumulation of lead in the body.

Q-24: Do antiknock compounds create a public health problem?

A-24: Based on our studies and those of others, there is no evidence that antiknocks create a public health problem.

Q-25: Are Americans absorbing more lead into their systems than they used to?

A-25: No. A study shows that the average citizen, even if residing in a metropolitan area with heavy highway traffic, has shown no measurable increase in the concentration of lead in his blood or in the daily output of lead in his urine during the past 13 years.

Q-26: Is there any connection between antiknock compounds and lung cancer?

A-26: We have no evidence that antiknock compounds are in any way related to lung cancer.

Q-27: Are there other toxic materials in antiknock compounds besides lead?

A-27: There are other materials in a complete antiknock compound, principally chlorine and bromine. These, in general, are burned with the combustion of the fuel and occur in the exhaust gas in low concentrations and of hygienically insignificant proportions.

Q-28: Is there any connection between antiknock compounds and the death rate in the general population?

A-28: The death rate in the United States has decreased steadily during the period in which the use of antiknock compounds has been increasing.

Q-29: Have commitments to mental institutions risen in proportion to the use of lead antiknock compounds?

A-29: During the period in which the use of antiknock compounds in the United States has been increasing, and particularly in the last ten years, there has been an increase in the proportion of mental illness in the American population.

Any relationship between these two phenomena must be regarded as purely coincidental.

The essential fact is that an increasing awareness of the problems of mental health has come about through important advances in the recognition of these diseases by medical practitioners.

Q-30: Is there any connection between antiknock compounds and mental health?

A-30: In acute severe poisoning by antiknock compounds, there is a typical and acute form of mental illness that is completely reversible. This type of poisoning occurs only rarely and then only as the result of accidental, industrial conditions. There is no relationship between antiknock compounds and other forms of mental illness.

Q-31: Does smog cause lung cancer?

A-31: It is not known whether the chemical constituents of general air pollution can produce lung cancer. Cancer-producing chemicals have been identified in the air, but it is not known whether they can produce cancer in man or whether the concentrations that are found are sufficient to produce a cancer in man.

Q-32: It is reported that automobiles in Los Angeles discharge 16 tons of lead daily into the atmosphere. Is this true? What effect does it have on the public?

A-32: If it is true, it would take 3.5 million cars using somewhat more than 6 million gallons of gasoline to do it. Theoretically, then, it is possible that automobiles could discharge that much lead- although it must be remembered that a good part of the lead falls to the ground. Actual measurements have shown that the dissipation of lead is quite rapid, both because of rapid settling of the particles and the dilution in the atmosphere.

Q-33: What are the average concentrations of lead in the atmosphere of American cities? What are the highest reported concentrations? How do they compare with industrial safety limits?

A-33: As previously noted, the concentration of lead in the atmosphere of American cities, as indicated by the Three-City Study, averages 3 micrograms per cubic meter or less. One isolated sample showed a concentration as high as 71 micrograms per cubic meter for a brief period of time on a heavily travelled highway, but even here, the concentrations average only 25 micrograms per cubic meter. These atmospheric lead concentrations compare with a safety standard of 200 micrograms of lead per cubic meter which has been accepted for industrial occupations.

Q-34: Why should the public health limits for lead in the atmosphere be lower than those for industrial occupations?

A-34: Chiefly because occupational exposure is generally limited to 40 hours a week, whereas community exposure under variable conditions is continuous.

Q-35: Are the more volatile antiknock compounds, such as tetramethyl lead, more hazardous to public health than tetraethyl lead?

A-35: No. Under the conditions of use there is no evidence of any public health hazard in either case.

Q-36: Didn't a Yale professor once predict that pedestrians would "drop like flies" on Fifth Avenue in New York City if vehicles used leaded gasoline?

A-36: Prior to the use of leaded antiknock compounds on a large scale, dire consequences were predicted by a number of people, including some university professors in the United States and abroad. These predictions were made without knowledge of the manner and extent of the use of these compounds and of the many variables that would exert their influence.

Investigations have shown that the actual conditions of use have borne very little resemblance to those that were postulated prior to experience.

Q-37: Are enclosed vehicular tunnels and other heavily travelled highways the source of greater concentrations of lead than other areas?

A-37: The concentration of lead along heavily travelled highways is higher than that in other areas, but the rapid movement of the atmosphere rapidly dissipates the lead so that highway levels are not sustained. In vehicular tunnels where relatively high levels have been measured when compared to the general atmosphere (average 44.5 micrograms per cubic meter in the outlet air of the Sumner tunnel), the tunnel employees showed no evidence of exposure.

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