

January 4, 1955

Mr. Lewis H. Rogers
Southern California Air Pollution Foundation
704 South Spring Street
Los Angeles 14, California

Dear Mr. Rogers:

Mr. Cholak showed me your letter of December 15 in which you ask for information on the lead compounds in the exhaust gas of automobiles, and on the other sources of lead in the atmosphere. It seemed best that I reply, despite the fact that we have made no observations on the exhaust gas, and our knowledge of the proportional representation of various sources in the composite source of lead in the atmosphere is based largely on inferences which are reasonable but unproved.

The composition of the lead in the exhaust has been investigated by the Detroit Laboratories of Ethyl Corporation, but so far as I know the data have not been published. In general, it may be said that the lead burned in the engine is converted into salts by the cations available in the mixture on the basis of a normal equilibrium. The halogen carriers are added to convert most of the lead to the chlorides and bromides, and this is accomplished. In addition, there is sulfate, carbonate, phosphate and some nitrite, with perhaps minute amounts of other salts. The proportions vary with the composition of the fuel, but it is to be anticipated that the halogen salts greatly predominate. As you are aware, no doubt, aviation gasoline contains ethylene dibromide as the halogen carrier, while automobile gasoline has both bromide and chloride carriers. The exhaust gas is the principal contributor of lead bromide, lead chloride and lead chlorobromide to the atmosphere. The nature of the other lead compounds in the atmosphere derived from soil, from the combustion of coal and vegetation, from various industrial processes, and from other, perhaps trivial, sources, is conjectural.

We have only indirect information on the contribution made by the combustion of coal; when the City of Cincinnati put its smoke reducing ordinance into operation after the last war, the lead content of the atmosphere decreased generally to something more than half of its previous level.

I think, if I may say so, that present attempts to estimate the proportional contributions made to the lead in the atmosphere in Los Angeles

KE 0004252

Mr. Lewis H. Rogers - (2) - January 4, 1955

will be highly speculative and largely futile until and unless specific compounds or forms of lead have been identified and related to specific sources. The potential sources have not been explored even qualitatively, so far as I know, by anyone, and assumptions concerning them will be a bit naive to say the least, since the situation there may differ appreciably from those that may be encountered elsewhere, because of differences in the pattern and directions of major and minor air currents and in the location, number and type of sources of particulate lead.

We have given some consideration from time to time to means of identifying various lead-bearing materials in relation to sources, but we have not made much progress in the development or application of such methods. I suspect that this could be done eventually if there were adequate reasons for so doing, but in view of the smaller significance of lead in the atmosphere of urban centers (apart from specific industrial environments) as a source of human lead absorption, in comparison with the quantities which occur regularly in human food and beverages, the impetus for such work has been that of scientific curiosity rather than utility. To be a bit more specific as to the amounts of lead involved in the daily life of normal individuals, it is fair to say that the amount of lead in the air breathed in (not absorbed) by the average urban citizen is appreciably less than 0.1 mg. per day. Of this quantity something less than half, on the average, in all probability, is retained in the respiratory apparatus, the remainder being carried out of the body in the expired air. Practically all of the lead of this type that is retained in the lung is absorbed eventually, and part of that which is trapped in the upper respiratory apparatus is swallowed, the remainder being expectorated or carried out with nasal discharges. Thus it may be seen that a series of variables which relate primarily to the size of the particles of lead compounds in the atmosphere determine their fate in the body. It is reasonably certain, however, on the basis of balance metabolic experiments, that something less than 0.03 mg. of lead per day is absorbed from the atmosphere (in Cincinnati); the amount may well be as small as 0.01 mg. per day, and it is not much different in other American cities, including Los Angeles, as judged by the available data.

In contrast, the average amount of lead taken in by the average American in food and drink is approximately 0.33 mg. per day, this being the principal source of his regular absorption of lead. Something of the order of 1/10 of this quantity is absorbed into the body daily under average conditions, the remainder being evacuated in the feces.

KE

0004354

Mr. Lewis H. Rogers - (3) - January 4, 1955

The foregoing quantities of lead are taken care of quite adequately in the human economy, and there is good evidence that there is a satisfactory factor of safety. We are engaged in determining, among other things, in current experiments on the metabolism of lead in human subjects, the actual magnitude of this factor of safety.

I have gone to some length in commenting on several aspects of the situation in which you are interested, largely because there has been a series of foolish and irresponsible statements concerning it in a number of so called news releases. It seems the better part of wisdom not to augment these in the public press by further speculative comments on the subject.

Sincerely yours,

Robert A. Kehoe, M. D.

RAK ef

C.C.: Mr. J. Cholak

KE 0004355