

September 16, 1968

D. J. Moore, Esq., Editor
Atmospheric Environment
Central Electricity Research Laboratories
Cleeve Road
Leatherhead, Surrey
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Dear Mr. Moore:

I am pleased to have the paper on "The Influence of Traffic on Atmospheric Pollution," by Bulloch and Lewis, which came to me with your letter dated August first. This was seen by me only a few days ago, when I returned from a vacation in the American Rocky Mountains on August 30. Having had an opportunity to deal with some of the more urgent matters that accumulated during my absence, I have reviewed this report and am pleased to comment on certain aspects of it.

I have little or nothing to say about the survey, its methods, results and interpretation. It is only when the report undertakes to deal with the appraisal of the hazard of lead in the general atmosphere of cities and other areas of variably heavy motor traffic, that it runs into imponderable issues. The matter of the fate of inhaled particulate lead compounds has been under investigation at our hands for over fifteen years, and we have employed the physiologic methods of balance experiments in getting at it in the Laboratory. It is not possible, in the intact living organism, at present, to carry out a true balance experiment in this field of respiratory physiology for the reason that we are not able to describe, quantitatively, the fate of the lead which is retained in the lung itself. Our experiments show that some 35 to 40 percent of a specific compound of lead (the sesquioxide) in a dispersion of particles of the mean diameter of 0.05 micron is retained in the lung. It is apparent, however, that not all of the retained lead is absorbed in the lung, even when it is in such minutely divided form. We are attempting to solve this problem, but until we, or someone else achieves this, we shall have to depend upon a degree of conjecture. Certain models, along with statistical and theoretical considerations, have yielded an estimate which holds that about 10 percent of that which is inhaled is absorbed in the lung, while the balance of that which is retained is cleared to the alimentary tract, from which it is poorly absorbed. If these estimates are even approximately true, the discussion of the amount of lead absorbed from the air is very wide of the mark.

We are attempting to establish the upper level of the concentration of lead in the air, which when breathed by normal, healthy human subjects (who are ingesting lead with their food and beverages at the prevalent level of normal adult citizens in the U.S.A.) fails to induce an increase in the rate of their urinary excretion of lead, or in the concentration of lead in their blood. This work has been in progress since 1959, and in its present form which we believe to be adequate to reveal the truth in this respect, since late in 1963, appears to be about to yield the answer. The threshold value (for healthy persons) will be somewhat greater than 10 micrograms of a nearly ideal respirable and absorbable compound of lead (expressed as Pb), and less than 20 (probably nearer 10 than 20), as the results now indicate. By "tolerable," I mean that this concentration of lead in the air can be breathed continuously (24 hours per day and 7 days per week), indefinitely without progressive accumulation of lead in

the body; that the metabolism of lead in the human body is such as to excrete as much as it absorbs, or that the quantity retained in the body from day to day is too small to be measured by physiologic methods, and too small to amount to a significant quantity in a life time. In practical terms, what this means is that the quantity of lead absorbed from the air, under tolerable conditions, is too small in comparison with that absorbed from the alimentary tract because of the lead content of food and beverages, to create a measureable factor of increase.

Let me say, emphatically, that this is yet to be proved to the satisfaction of critical scientists and health authorities. The available evidence at this time indicates strongly the likelihood that the figures I have given you are valid.

Incidentally, the figure of 10 percent for the pulmonary absorption of a particulate, inorganic lead compound in the fine state of subdivision employed in our experiments (which is not very different from that encountered in the general atmosphere), is derived from the data published in Health Physics (Pergamon Press) 12:173-207, 1966. A report prepared by the Task Group on Lung Dynamics for Committee II of the International Commission on Radiological Protection, entitled "Deposition and Retention Models for Internal Dosimetry of the Human Respiratory Tract."

Cordially yours,

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Professor Emeritus of
Occupational Medicine

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