

December 30, 1944

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Dr. Carey P. McCord,
The Industrial Health Conservancy Laboratories,
10 Peterboro Street,
Detroit 1, Michigan.

Dear Dr. McCord:

The question raised in your letter of December 20 has not been answered adequately on the basis of experimental or clinical work. The relationships between dosage and time when the lead is ingested are reasonably clear. The situation, however, is a bit different when the lead is inhaled, and therefore anything that is said on this will be somewhat of a guess. From the point of view of the behavior of absorbed lead, however, we can be reasonably certain of our ground. I think there is very little question that the absorption of a given dose per day for a series of days is more dangerous than the absorption of the equivalent dosage in one day, so long as we stay short of importantly toxic doses. In order to be quite concrete I can say that I should prefer to take 9 mgs. of lead in one dose in one day than to take 1.5 mgs. per day for six days. Actually neither of these situations is very dangerous in my opinion, for short periods of time, but the interval of six days between doses would provide for a much higher level of excretion than would be occasioned by the dosage of 1.5 mg. per day. In my mind there is very little question that the patient mentioned in your letter took lead in excess of your theoretical postulation.

The experimental basis of my statements above is as follows. When a rather large dose of lead is swallowed, the absorption is proportionately large in unit time, and the concentrations of lead in the tissues, blood and excreta are proportionately high. Excretion continues at a high rate for a short time, thereby removing an appreciable proportion of the absorbed lead from the body. When the same dose is divided into a series of daily doses, the rate of absorption in unit time is diminished, and therefore the concentrations in the tissues and excreta are relatively low. The effect is to distribute the lead over a longer period of time more evenly in the body, thereby diminishing the total quantity excreted. The evidence for this, as I stated above, has been obtained when the lead was taken by mouth. I am not sure, but I suspect that the conditions will be somewhat the same when lead is inhaled. There may well be conditions, however, based on the operation of two factors that will work

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in opposite directions; (a) the actual quantity retained in the lung will vary with the concentration of lead in the air, as well as with time, and therefore it may be that the amount absorbed will vary appreciably under the two conditions; (b) that which is actually deposited in the lung will eventually be absorbed, since there is no mechanism for its elimination from the body comparable to that in the alimentary tract. On the whole I think the higher concentration for the shorter period will be less favorable to the absorption and retention of lead, and therefore less dangerous, so long as we remain within the rather narrow limits postulated.

I should make one other remark. The standard of 1.5 mgs. of lead per 10 cubic meters of air assumes that 1.5 mgs. of lead may be retained in the lung and actually absorbed. In my opinion, this is almost never true. The quantity available for absorption is probably always less than half of this quantity, first because the ventilation is rarely as much as 10 cubic meters for 8 hours, and second because a sizable proportion of the lead in the air never gets to a point where it can be absorbed. A part of the particulate lead is exhaled, and this part may be as much as 40 to 50% of that actually in the air. Another part is trapped in the upper respiratory tract and swallowed, and eventually evacuated in the feces. This part under suitable conditions may be as much as 75% of that in the air breathed. The quantity actually absorbed is therefore only a small proportion of that represented in the standard. I am quite confident that if 1.5 mgs. of lead per day were made available for pulmonary absorption, lead poisoning would occur with reasonable promptness. Our theoretical argument with respect to dosage is, therefore, an impractical one. The problem, therefore, assumes a purely pragmatic character. Our standard merely states that under certain specified conditions lead poisoning does not occur. For my part I should be entirely willing to say that if exposure takes place only one day per week, such exposure could be approximately six times the severity permissible for six days per week of exposure. Actually I would regard the former condition as safer than the latter. As you will remember I have been advocating an interval of freedom from exposure as being the most effective means of combatting the otherwise dangerous effects of exposures in excess of the safe level. I have only required that the interval of freedom from exposure be longer than that of exposure.

I trust this is a clear exposition of my views. I think they are right, but it will require further experimentation to convince me one way or the other.

Cordially yours,

Robert A. Kehoe, M. D.

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The Industrial Health Conservancy Laboratories

Administrative Offices
10 Peterboro Street, (1) Detroit

December 20, 1944

Dr. Robert A. Kehoe
Kettering Laboratory
University of Cincinnati
Cincinnati, 19, Ohio

Dear Bob,

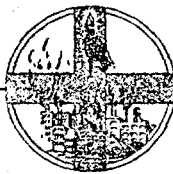
A point has recently come up in connection with a lead poisoning case about which I hope you will write me at your pleasure.

On the basis of a standard of 1.5 mg. of lead per 10 cubic meters of air, in the course of an assumed six day work week, a worker will have a theoretical intake of 9 mg. This, under present belief, is tolerable. Now let it be assumed that a worker is exposed to lead at higher concentration but is exposed only one day weekly, but on that one day, has an intake of 9 mg. Thus his weekly intake is the same as the first individual. Have you any reason to believe that the second assumed individual is any more likely to acquire lead poisoning than the first?

This point came up in a trial recently. I took the position that a person exposed only one day a week to a maximum of 9 mg. probably would acquire lead poisoning. This patient in fact did suffer from lead poisoning and the assumption was that his exposure was greater than 9 mg. per week even though his exposure was limited to one or two days. To just what quantity of lead the patient was exposed never can be determined as the patient is dead. No less, the theoretical question arose and I am wondering just what your attitude might be if it had been proved that the exposure in fact did not exceed 9 mg per week, all taken into the body on one day.

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Dr. Robert A. Kehoe

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December 20, 1944

Very best of wishes for you at this Christmas
time.

Very truly yours,

Carey P. McCord

Carey P. McCord, M.D.
Medical Director

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