

July 22, 1937

Dr. W. R. Whitman
Norfolk and Western Railroad Company
Roanoke, Virginia

Dear Doctor Whitman:

From what you have told me in your letters concerning cases of illness in men engaged in oxy-acetylene cutting operations, I am in no position to say that you were dealing with lead poisoning. However, that lead poisoning of the most severe types may occur from the cutting or burning of metal coated with lead paints is so well known in certain trades, especially in bridge building and ship breaking, as to require no proof from me. The chemical department of your company is taking a very vulnerable position in constructing their very original hypothesis concerning the impossibility of the inhalation of lead under these conditions. Indeed, no hypothesis is required here at all, since the facts are well known. However, just a little discussion of the theoretical issues at stake may be justified. You quote some technical person as stating that, "To be inhaled into the system through the respiratory organs it would be necessary for the lead to be converted into a gaseous state, and we have never known of lead being converted into such a form." Perhaps you should chide your informant for his naivete in physiological matters, but we can let that pass. He should know the facts in his own field better than to doubt that lead is volatilized at the temperatures occurring in the oxy-acetylene flame. The temperatures here are approximately 2700°C , while many lead compounds begin to be volatile at temperatures around 500° , lead oxide boils at "white heat" (about 1500°C , and metallic lead boils at about 1525°C . Thus the lead oxide literally boils off from the melting surface, and is thrown into the air in the form of the oxide in a finely divided state. These particles may be inhaled and are fairly readily absorbed from the pulmonary surface. (That lead must exist as a gas to be absorbed by the lung is indeed a new and delightful hypothesis. I could wish it were true, for if it were, industrial lead poisoning would be largely nonexistent. It is well known that finely divided metallic lead, lead oxide, lead carbonate, and indeed, practically any other lead compound suspended in the air will cause lead intoxication in men and animals permitted to breathe such atmospheres. It is also generally accepted that lead

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poisoning will occur among human beings exposed to atmospheres containing lead compounds in particulate form in excess of 1.5 to 5.0 mg. Pb per 10 cu. m. of air.)

The test mentioned in your letter, if carried out as described, was a rather crude and inadequate one. The air stream from the hood should have been taken through a solution that would dissolve lead oxide promptly, and at the same time prevent the escape of particles through the solvent i.e. using an impinger; or the stream should have gone through a strong electro-magnetic field i.e. a Cottrell precipitator. After collecting the material and getting it in solution, a precipitation with H_2S could then be done at the proper reaction. I can assure you that if the air stream from a lead-oxide-coated plate which is being cut by an oxy-acetylene torch is properly examined, it will be found to have considerable quantities of lead in it.

The diagnosis in cases of exposure of this type can usually be made from the clinical picture alone. However, in doubtful cases one can determine the approximate magnitude of the exposure and absorption by the analysis of the blood and the excreta, if samples are obtained shortly after the cessation of exposure. The lead content of the blood and also the urine vary with the severity of the exposure. In severe cases the blood and excretory lead remain at abnormal levels for months. In less severe cases, and particularly those with short periods of exposure, definitely and significantly high lead levels remain for only a few weeks.

If you would care to send me all the available information on the cases at issue, I should be glad to give you my opinion about them.

Cordially yours,

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Robert A. Kehoe, M.D.

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