October 26, 1938

Mr. D. B. Mecorney
Executive Secretary
Harrison Radiator Division
General Motors Corporation
Lockport, ~~Illinois~~ Ky.

Dear Mr. Mecorney:-

In response to your letter of October 21st, I shall attempt to reply to certain of your questions.

The Fairhall method of analysis for lead in biological material has never been fully described in step by step detail in scientific literature. It is thus a little difficult to know precisely what a chemist does when he states that he analyzes for lead by the Fairhall method. Briefly, however, the method consists of the destruction of the organic material either by acid digestion or by ashing in a furnace, or by a combination of both methods, after which lead is separated from the dissolved ash of the sample by means of hydrogen sulphide. The sulphide precipitate is dissolved and is converted into the chromate after which the amount of chromate is determined by titrating against sodium thiosulphite. There are various modifications of this method and numerous criticisms have been made of the method, among which our own criticisms in 1933 rank rather highly in that we pointed out that in our hands the method did not yield consistent results. We found it necessary as early as 1935, to make certain modifications of the method, and subsequently introduced refinements which improved the method as to specificity for lead as well as accuracy to a very considerable extent. However this method was never suitable for use in determining quantities of lead less than 0.1 milligrams. We found it necessary, therefore, to use large samples of material of all kinds which would yield quantities in excess of 0.1 milligrams. For this reason the method was never applicable to the analysis of blood samples, nor was it sufficiently accurate to handle small samples of urine up to and including such quantities as would be voided in twenty-four hours. It is for this reason that Fairhall himself did not use the method in connection with small urine samples, nor did he recommend its use for such purposes. Moreover Fairhall is now using the methods which he, as well as other experienced workers in the field, have found to be more sensitive and more precise.

I refer here particularly to a method which has come to be known as the "Dithizone Method". This method has been studied by a variety of workers whose articles on the subject can be cited, among whom my associate Mr. Hubbard can be mentioned as having developed certain useful modifications. With the development of this method, it now becomes possible to work quite accurately with small quantities of blood and small samples of urine.

As to the methods employed by the Buffalo Hospital, I can only say what I was told by one of the assistants in the chemical laboratory. The method which he described corresponded roughly to the Fairhall method. The method, as described, lacked such chemical procedures as would limit it specifically to the determination of lead. Thus the material estimated as lead may have been in part bismuth or copper, or both. I know nothing of the laboratory equipment, of the care taken in the collection of samples, or of the precautions taken through the use of specially purified reagents. Whatever the facts are in these respects would have to be determined in the cross-examination of representatives of the hospital and of the laboratory. However I was told enough to satisfy me that the lead analyses made in the Buffalo Hospital laboratory were grossly inaccurate.

What is not generally known by people who lack experience in this work, is that lead is so generally present everywhere that it is necessary to take the utmost precautions to prevent its entrance into samples which are being analyzed. In our work, for example, we carry out our analyses in a dust proof laboratory in which no other type of analytical work is carried on. We carefully purify all of the reagents which we use despite the fact that we purchase the highest grade of chemical reagents that can be obtained on the market. Every piece of glassware that may come in contact with the sample either in its collection or in its handling in the laboratory, is cleaned with the utmost chemical precision. We do not even permit smoking in our analytical laboratory not only because the smoke of a cigarette contains a certain amount of lead, but also because the ash which might inadvertently drop into the sample contains quantities of lead which are much greater than many of the samples with which we have to deal. All of these many precautions, which are not understood by the inexperienced worker in this field, are necessary to prevent gross contamination of the samples. It is for this reason that I find it impossible to have any confidence in analytical results which are not obtained in a laboratory which is continually engaged in this type of work. Accurate analyses can not be made by persons who carry out occasional analyses of this type.

You are quite right in believing that in my opinion the quantities of lead reported in the urine samples examined at the Buffalo Hospital contain impossibly high results. Even in the most acute cases of lead poisoning and under conditions of the most serious exposure, we rarely find quantities of lead in excess of .3 milligrams per liter. Values above this level are suspicious even in serious cases, and in a case of the type in question, where the exposure is only known to be very slight indeed, such figures are well-nigh impossible, and are quite beyond the range encountered in my experience. It would be expected that any man whose urine contained such quantities of lead would be acutely ill and that he would show many of the other characteristics of acute toxemia, including the presence of considerable numbers of stippled cells in his blood.

You may be interested in knowing that the recent samples sent in by Dr. Hillenbrand for analysis, confirmed our earlier conclusions that Mr. [redacted] did not have any significant exposure to lead, and that, therefore, the illness from which he suffered which was not in itself characteristic of lead intoxication, was due to some other cause.

I trust that the above information will give you what you require.

Very truly yours,

RAK:is

Robert A. Kehoe, M.D.