

November 28, 1951

Dr. A. G. Cerchione
Medical Examiner
The Pennsylvania Railroad
9th Avenue and 12th Street
Altoona, Pennsylvania

Dear Doctor Cerchione:

Doctor Princel handed me your letter of November 23 concerning our efforts to check the results of your (and other) analyses of blood and urine. Since the results relating to lead go through my hands eventually, I am pleased to comment on the results you forwarded and to reply to your question. With reference to the latter let me say that we shall be glad to have you submit samples of blood for our check. We should prefer to supply the equipment for collecting the samples, since by this means we can probably reduce the risks of the contamination of samples. We have checked with a number of laboratories in this manner and we shall continue to help out when we can. Let me know what you want, and we shall forward the equipment.

My comments on the tabulated analytical results may be open to certain criticisms, but I shall point out what my experience leads me to believe concerning them. Starting with our own, you will note that our results disagree with each other in two of the four sets of parallel findings. The disagreement is significant, percentagewise, in both instances. Thus it is apparent that there is an appreciable intrinsic error in the procedures. The error of the spectrographic analysis is greater, as a rule, than that of the dithizone method. That is, the reproducibility of serial results is lower. Accordingly if there is much discrepancy, we would tend to choose the result of the dithizone procedure as the better. In general, however, if the discrepancy is not great, we would take the average of the two results as the best figure.

In general our results tend to be lower than those of most good laboratories, for the reason that we have a smaller blank value (a blank includes the minute contamination of reagents, glassware, and laboratory atmosphere, which we control with minute care), than most laboratories would find possible to achieve. In general, also our parallel results will vary less among themselves than they will in comparison with those of other laboratories, because of our greater experience and our better facilities for this type of work. In general also, the dithizone method is better (more uniform) than the spectrographic, while the latter is better than the polarographic.

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You can look at the tabulated results from this viewpoint and judge them as well as I can. I would say that your results - P. R. R. -, which agree with our average (or preferred) result in only one instance, are somewhat unduly variable, in that they tend to be high but not uniformly so. The Brake Shoe results compare favorably with ours in two instances, but are much too high in two others. (My impression from their published data and from my knowledge of some of their unpublished results, is that they tend to run high.) No matter how you look at these results, however, you are bound to conclude that there is an appreciable possibility of significant error in the use of the best of methods and laboratories, and that some duplication of the results is desirable. That is why we carry out parallel analyses on the blood.

In the matter of the results on the urine, there are much greater possibilities for errors in the results and in their interpretation, not in the analytical procedures, but in the likelihood of contamination of the samples in their collection and in wide variations in the rates of excretion of lead under varying physiological conditions. There are certain advantages in the analysis of the urine, but we prefer to analyse both blood and urine.

In sampling the urine, especially in medico-legal cases, we prefer to avoid samples of large volume, which can be collected satisfactorily only under very close supervision, and to adhere to a spot sample voided directly into the appropriate container (a chemically clean bottle) in the presence of the examiner. In illustration of the advisability of such procedure, I call attention to your two series of results on the same persons: - J. L. Benton apparently excreted lead at the rate of 0.48 mg. per liter on 11-14-50 and only 0.04 mg. per liter on 11-24-50. This is not an impossible variation, but a very unlikely one. It is likely that the first sample was contaminated. In any case the interpretation for such results is quite impossible, and we would have to make other analyses if we were to depend on the results obtained on samples of urine. Thus the inclusion of duplicate samples of blood in the diagnostic procedure will clear up any such question.

You may ask "Why analyse urines at all, if this is true?" That is a good question. The answer lies in the fact that when the concentration of lead in the blood is at or a little below the threshold value (around 0.08 mg. per 100 grams), the urinary lead concentration is an extremely useful bit of information. I shall not go into this in detail since I have said enough on the entire subject to clarify the background of our procedure, without, I hope, introducing confusing facts. The problem, as you can see, is not an altogether simple one, and therefore you are quite right in wishing

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to check your results from time to time.

Cordially yours,

Robert A. Kehoe, M. D.

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