

October 1, 1941.

Miss Leota Pekarul,
Department of Medicine,
University of Colorado,
4200 East Ninth Avenue,
Denver, Colorado.

Dear Miss Pekarul:

I am glad to answer your questions as well as I can. With reference to the collection of samples of workmen, you have raised one of the most difficult problems with which we are confronted in work of this type. Let me say at the outset that you will find large samples much more satisfactory than small ones for a variety of reasons. Also, although there are certain practical advantages in the technique used by Barnes for the study of samples of urine, his conclusion that lead excretion can be expressed on a time basis with reasonable accuracy, is incorrect. Therefore, if you are planning to use small samples, it will be necessary for you to repeat your observations more frequently on individuals, and it will also be desirable to obtain blood samples for analysis in order to avoid otherwise inevitable errors of interpretation. The obstacles to collecting samples at the workers' homes are not as great as you and your associates believe. First, it is not necessary to have sterile jugs. They only need be chemically clean. If they are stoppered with new cork stoppers and sealed in paper bags, and if each man is given written instructions for the collection of the samples, I can assure you that you will have very little trouble. We have obtained thousands of samples in this fashion, and it is only occasionally that we have any difficulty. We use gallon jugs such as are employed for fruit juices and we issue instructions for the collection of samples. I am sending you a copy of these instructions. If the bottles are properly sealed in paper bags, they can be carried home by the workmen. It is better, however, if they are picked up when they are ready, by some responsible person, although they can be returned to a suitable place by the men themselves, if they are properly instructed and if they are reasonable cooperative.

Returning to the question in your second paragraph, I can show you by a huge mass of data that the daily lead output is quite as variable as the daily lead concentration. The one is not one whit better than the other from the point of

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view of its variability. Despite this fact, it is perfectly possible to use spot samples of urine as a measure of the lead exposure of groups of individuals, if you will not put too much stress upon individual results. To say this differently, 24-hour samples of urine, or larger volumes, in the case of normal individuals vary between 0.02 milligrams per liter and 0.08 milligrams per liter. Spot samples on the same individuals vary from slightly under 0.01 milligrams per liter to 0.12, or occasionally as high as 0.14 milligrams per liter. Anything within these ranges, therefore, must be regarded as within the limit of normal human variation, despite the fact that the average of a series of results obtained on either type of sample will come out at the same figure. Accordingly, if you will take a group of results and average them, you will be able to see the significance of the exposure of the group as a whole. If, however, you wish to determine the status of a particular individual, you will either have to make repeated analyses or you will have to sample the blood. On the whole, therefore, we believe it is desirable if only urine samples are to be studied, to obtain large samples. If you will take the trouble to collect one to three liters of urine, you will rarely make a significant error in the interpretation of a man's general level of lead excretion.

I trust this will help you in solving your difficulty, but if I can be of any further help, do not hesitate to call upon me.

Sincerely yours,

Robert A. Kehoe, M. D.

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