

File
June 23, 1955

Mr. F. C. Gaugush
Director of Safety
The Sherwin-Williams Company
115th Street and Cottage Grove Avenue
Chicago 28, Illinois

Dear Mr. Gaugush:

Your letter of May 27, to the attention of Dr. C. M. Peterson, Secretary of the Council on Industrial Health of the American Medical Association, concerning the value of the determination of porphyrins in the urine of persons employed under conditions involving exposure to lead, as a means of estimating the extent and significance of their exposure, was referred by Dr. Peterson to me. I am glad to give you my opinion on the matter. I also make certain additional suggestions, for such use as they may be to you.

Persons who have absorbed fairly large quantities of lead and are sustaining a significant degree of interference with the metabolism of hemoglobin on that account, excrete abnormal quantities of coproporphyrin III. Unfortunately, this reaction is not specific in relation to lead, nor is there a graduated relationship between the rate of excretion of the coproporphyrin and the amount of lead absorbed. The presence of highly abnormal levels of excretion of this substance, therefore, when other causes can be eliminated satisfactorily, is an indication, at best, of an early manifestation of a toxic effect of lead in the body. (See the article of Parkinson and Cholak (from this Laboratory) in the American Industrial Hygiene Association Quarterly, 13:153, (Sept.) 1952.) That is to say that it is evidence of the existence of lead intoxication, although there may be no dramatic evidence of illness otherwise. From the aspect of preventive medicine, therefore, this cannot be regarded as an altogether satisfactory procedure. At best it helps to warn one of the existence of prodromal intoxication, and to enable him to head off more serious forms of the disease.

In practice, the procedure is even less effective than the foregoing remarks would indicate. The variability in the excretion of coproporphyrins under normal conditions is considerable, and the variability in the response to the absorption of lead is also great. Therefore, it is difficult to be sure how the results should be interpreted when one uses highly precise methods of determination. The short-cut methods are not always reliable, and their meaning is far from clear. The result is that the procedure, like that of following the microscopic changes in the blood (basophilic stippling, for example) is not adequate.

Mr. F. C. Gaugush - (2) - June 23, 1955

Ideally, what one desires is a method whereby he can measure the extent of the absorption of lead itself, and, on the basis of physiological knowledge and clinical experience, determine when it is that an individual approaches the point of danger, with some margin of safety to spare. This is the purpose of the quantitative analysis of the urine. The method has its shortcomings, in that the limits of physiological variation are fairly wide and must be counter-balanced by carefully chosen methods and frequencies of sampling and by expert interpretation of analytical results on the background of sound knowledge of the physiology of the process. Such knowledge is not widely distributed, unfortunately, and therefore certain rules of thumb have been substituted for it, to the disadvantage of all concerned.

On the background of our considerable experience, I advise you that the procedure which you are now using (assuming that your analytical methods are satisfactory) is much more effective than that of the determination of porphyrins, or of any other procedure, with one exception to which I shall refer later. If you are making your observations on the urine with sufficient frequency, and if you are obtaining proper samples, analysing them properly and interpreting the results properly, you now have a good tool for the purpose which you have in mind, and you will be progressing backward, if you abandon it in favor of a non-specific ^{procedure}, such as the determination of porphyrins by any method.

You can, however, improve your procedure, by analysing the blood of your men instead of, or along with, their urine. On the basis of our present knowledge, it is possible to interpret the significance of the lead concentration in the blood with virtual certainty. It does not vary from hour to hour, except under certain known conditions (sudden absorption of fairly large quantities of lead, or in response to the administration of BAL or EDTA) and therefore it represents the status of the individual in a very representative manner, from the aspect of the general level of lead concentration in the body. One can set criteria for absolute safety and for various degrees of danger, in terms of the lead level in the blood, and, by adhering to these criteria, can avoid the occurrence of lead poisoning in any group of exposed persons. This can be done also by adequate study of the urine, but it is more troublesome and also more costly, since more analyses are required for the same degree of accuracy of interpretation. In practice, we investigate the lead levels in both blood and urine at intervals which vary with the severity of the hazards of a particular industry, and on the basis of the information obtained, we deal with the individuals by transferring them to jobs involving less exposure, or, if need be, to jobs that give no exposure at all, maintaining these situations until the individual has a sufficient margin of safety to return to his former job. This procedure goes hand in hand with measures of environmental control, which, when accomplished satisfactorily, enable one to dispense with transfers and removals.

Mr. F. C. Gaugush - (3) - June 23, 1955

These matters may or may not be known to you or to your medical people, but if you or your physicians (preferably the latter, since this is, strictly speaking, a medical problem) would like to discuss these matters with me and examine the evidence on which these statements are based, I should be glad to find time for the purpose.

Very truly yours,

Robert A. Kehoe, M. D.

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C.C.: Dr. C. M. Peterson

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