

May 17, 1954

Mr. R. R. Fulton
Industrial Hygiene Department
Workmen's Compensation Board
Vancouver, British Columbia
Canada

Dear Mr. Fulton:

The general principles concerned in the control of the hazards of the lead trades and the viewpoint which I hold concerning the problems involved in them, is expressed fairly completely in the chapter in the second volume of Patty's book "Industrial Hygiene and Toxicology," to which no doubt you have access. I refer you to this chapter, therefore, and in the factual sense I add here only such comment as may be required to extend the knowledge of the subject beyond the date of that publication. It is not feasible, otherwise, to answer your questions within reasonable limits of time and space.

I refer you further to the booklet "Occupational Lead Exposure and Lead Poisoning," a report prepared by the Committee on Lead Poisoning of the Industrial Hygiene Section of the American Public Health Association in 1943, of which I had the honor to be the chairman. This covers the principles and the facts of the matter adequately, with certain exceptions which I shall attempt to remedy by further remarks. I shall not refer to the treatment of lead poisoning, which is not dealt with entirely satisfactorily in this booklet, in view of later developments. The booklet is available at a cost of 75 cents in the office of the A. P. H. A., 1790 Broadway, New York 19, New York.

It is not possible to describe a satisfactory medical regimen in the form of dogmatic rules, since there is no substitute for a sound understanding of the problems involved on the part of the responsible physician. Any physician who is aware of his responsibilities will acquire the necessary knowledge to do his job satisfactorily, and if he does not do so, no set of rules will avail. For example, the frequency of examination is not, and cannot reasonably be, a matter of rule, since both the frequency and the character of the examination must depend on the quantitative extent of the hazard that exists. The prescription of monthly or quarterly, or semi-annual examinations, is meaningless, regardless of its source or the apparent reasons for it. Such rules merely perpetuate the irrelevance of many of the present regulations on the subject, and the failure of responsible people to acquire a genuine understanding of their responsibilities. The rotation of workmen is a like situation. It can be

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done intelligently only on the basis of precise knowledge of the extent of the lead absorption of men who are employed in specific jobs. It is not good technique or good morals to deal with risks of this type on the basis of guesswork, now that we have exact methods for arriving at the facts.

Specifically, the threshold limits for safety, on the part of men engaged in the lead trades, as expressed in terms of physiological evidences of absorption, may be expressed as follows:

1. The lead levels in the blood shall not be permitted to reach 0.08 mg. per 100 grams of whole blood, and men who reach this level should not be permitted to continue under conditions of exposure. (The matter of analytical precision here is of the utmost importance. The best methods available have an intrinsic error (variability in reproduction) of approximately 0.01 mg. per 100 grams when quantities of blood ranging from 10 to 20 ml. are taken for analysis. Thus a single analytical value of 0.08 may actually be 0.09 or 0.07. Many of the methods yield much larger errors, and therefore one may not prescribe a threshold value without linking it to the precision of the method used. I speak above of values obtained by methods comparable in precision to those employed in this Laboratory, knowing that such precision is not generally achieved.)
2. The mean urinary value which corresponds to that of the blood given above varies from 0.12 to 0.14 mg. per liter, depending on the method of sampling the urine. Spot samples of urine, taken during work, yield higher mean values - by approximately 0.02 mg. per liter - than do samples of large volume of the urine of the same individuals obtained during hours of leisure. Moreover, correct interpretation of the result obtained on a single spot sample of a single individual is quite impossible. It is necessary to obtain multiple samples from the same individual, and/or to obtain individual samples of the urine of a fairly large group of men working at the same kind of job, in order to appraise the approximate level of the lead absorption of the individual or group. A number of subterfuges have been employed by various persons to correct for the consequences of the physiological variability of the urinary lead excretion - such as, for example, using a correction factor based on the specific gravity. These are all unsatisfactory. The only procedure that works is that of multiple sampling or the collection of samples of large volume under suitable conditions.

We solve this problem, in regular determinations of the status of individuals or groups, by obtaining samples of blood and samples of urine (spot samples of urine taken under the supervision of a responsible person to prevent contamination). Study of the combined results provides us with entirely satisfactory information on which to recommend or to take appropriate action.

The matter of obtaining satisfactory samples of urine for analysis is exacting

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Unless this is done with meticulous care, the results are usually useless but grossly misleading. I send you copies of which we follow and require of others.

When men are at too high a level of absorption, as shown by these results, they are removed from exposure, until they return to levels well within normal limits. This, of course, is not a matter of rule, but of observed facts.

With respect to the procedures of control based on hematological findings, or those based on the measurements of coproporphyrin excretion, I have only this to say. If the lead exposure of workmen is kept within safe limits by means of adequate environmental control, these methods will appear to be satisfactory, and can be employed in practice as well as any others. If, however, the men are actually exposed to dangerous conditions, from time to time or irregularly, within a plant, i. e. if the measures of environmental control are unsatisfactory or irregular in their application, dependence upon the hematological or biochemical findings (porphyrins) will result in failure to prevent lead poisoning. These methods are lacking both in specificity and in quantitative relevancy, with respect to lead absorption, and they are deplorably poor tools for the intended purpose. They will increase the batting average of the physician to some slight extent, in picking up incipient cases of lead intoxication before they reach the stage of severe illness and disability, but they are not, strictly speaking, preventive measures. They deserve to be condemned, for the reason that they represent traditionally sanctioned makeshifts which we were justified in using for preventive purposes before we had adequate methods. At present, they serve to demonstrate the characteristic inertia of the human mind, which finds it easier to cling to the comfortable past than to exert itself to understand the present. I do not speak here of the significance of these matters in relation to the diagnosis of lead poisoning, or more importantly, of the physiological mechanisms of which they are a manifestation well worthy of further investigation. Rather, I am talking of the relative value of procedures in the field of preventive medicine. Here they are poor substitutes for sound procedures.

I realize fully, of course, that a governmental agency, in its attempt to mitigate the evils of inadequate control of industrial hazards, including those of occupational lead absorption, feels the necessity of adopting regulations which, generally applied, will tend to exercise some degree of control in the right direction. I find it difficult to visualize any approach to this matter that will be even reasonably satisfactory, except that based on mechanisms (governmental or otherwise) of critical inspection of industrial plants, implemented by the competent investigation that will establish the facts, laws that fix responsibilities where they belong, and provisions for the educational efforts which will provide the responsible people with the knowledge which they require to handle their own responsibilities. American industry, to a considerable degree, is immature in its handling of these matters, and American physicians, as well as medical educators, are just beginning to realize their responsibilities to industry for competent medical service and adequate professional training. I suspect, with-

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that your position and that of your associates in the government, in this matter, is not especially happy. I would not wish to seem unsympathetic therefore. I only express the belief, based on many years of experience, that there is no panacea, no rule of thumb, and no short cut, which can have more than a moderate palliative effect in the handling of this situation.

Cordially yours,

Robert A. Kehoe, M. D.

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Dictated but not read.

Enc. Instructions for taking blood, spot urine and large urine samples.

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