

September 1, 1943

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Mr. Ray Bevan,
Associated Ethyl Company, Limited,
Artillery House,
Artillery Row,
London S. W. 1,
England.

Dear Ray:

I had expected to reply to your several letters in person, but inasmuch as there has been some delay in my getting started, it seems wise to send you in advance as much information as I can, leaving more detailed consideration for my arrival in London. Unless there is some additional delay, I should be there in about two weeks from today.

The most significant problem seems to me that of dealing with the high lead concentration in the atmosphere of can filling plants. I quite agree with you that something should be done about this without delay, for if cases of poisoning develop in the British plants, they will not only be serious from the medical point of view, but they will cause great interference with the production of gasoline.

I have looked over all the data you have sent me. I was surprised to know that so much gasoline of high lead content is being handled. (I presume the concentration of 4.8 c.c. per gallon refers to the Imperial gallon.) There is no doubt in my mind that a large proportion of the lead in the air is derived from spillage in one form or another. That which is spilled on the outside of the can or on the table or platform on which the canning is done has an opportunity to be completely evaporated, thereby allowing all or the greater portion of the lead to be volatilized. No doubt the reduction of spillage to whatever extent this can be done will improve the situation. No doubt you are well aware that the evaporation of the gasoline from open containers is much less significant than that evaporated following spillage. If you remember the operation of Raoult's law in connection with the simultaneous evaporation of two mixed liquids of highly divergent vapor pressure, you will recognize that very little of the vapor of tetraethyl lead comes off during the evaporation of the lighter fractions of the gasoline. I have not attempted to make the calculations that might be useful in figuring out the extent of the exposure due to evaporation from open containers. It seems useless

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to attempt to do this without knowing the prevailing temperature in different places and without being sure as to whether you are dealing with American or Imperial gallons. However, these calculations can be made, and in that way you should be able to determine to a practical, useful degree, the contribution made to the lead in the atmosphere as the result of the spillage of gasoline.

There is another point which should be taken into account in connection with the possible intoxication of workmen. It is quite certain that the halogen carrier will be evaporated into the air to an appreciable extent. This may well contribute something to the dangers of intoxication. Thus workmen will be exposed to the vapors of gasoline, to the vapors of the halogen carrier in Ethyl Fluid, and to tetraethyl lead. In the case of the halogen carriers, the concentration in air to which men may be exposed regularly should not exceed 100 parts per million by volume, at the outside. Again I have not made the calculation that would determine the approximate concentration of the halogen carrier under conditions that give rise to the quantities of lead indicated in the data you have sent me. It seems unlikely that the values will be highly significant, but I call your attention to this point in any case, as being one which should not be ignored.

I think I can understand from the data provided me why you have not had cases of lead intoxication. The lead concentrations as indicated are above safe limits for prolonged exposure, but it is not to be anticipated that acute tetraethyl lead poisoning would occur promptly as the result of exposures of this order of magnitude. There is some variability in the picture and at certain points, and I presume also from time to time the concentrations are not far from the threshold values. There is no question in my mind that these conditions should be improved by ventilation and that the goal which should be shot at is a condition in which the lead concentration will not exceed 1.5 mgs. per 10 cubic meters, for more than short periods of time. On the other hand, we have learned that lead excretion is considerably more rapid when the lead compound absorbed is in the organic form. Therefore, lead accumulation takes place to a smaller degree than it does when the exposure is to organic compounds. For this reason the threshold of safety is a little higher in the case of tetraethyl lead than in the case of inorganic dusts. We have set it tentatively, and I believe successfully, at 2 milligrams per 10 cubic meters of air.

In connection with observations on the potential dangers of this work, it would be my opinion that some observations ought to be made on persons whose work involves the most severe exposure. I realize that this is no time to carry out investigative work that

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is unessential, but if there is any question about the necessity of installing additional ventilation, some observations on the men ought to settle the point beyond any question. I believe you are familiar with the results which we have obtained over a period of years in connection with men exposed to tetraethyl lead. I am sure that we know beyond any possible question the critical level dividing safe and dangerous exposure, in terms of the rate of urinary lead excretion. I mention specifically the urinary figures since analyses made on the blood will be misleading. (It has been established beyond any doubt that the lead concentration in the blood following exposure to tetraethyl lead is disproportionately low as compared with the blood levels following exposure to inorganic lead compounds. This is in keeping with the facts with respect to the more rapid excretion of lead when absorbed in this form.)

I believe it is fair to say that the absorption of lead through the skin at the concentrations in gasoline with which you are dealing will be very slight. However, under conditions approaching the critically dangerous level, this factor might not be unimportant. Therefore, in my opinion every effort should be made to avoid frequent or prolonged contact with the leaded gasoline. I am not in position to make any suggestions as to how this might best be done, but certainly anything which can be done to prevent unnecessary spillage, especially the spraying of gasoline on the skin and the clothing of men should be done. I believe it will be necessary to handle these matters by chemical means rather than by the exercise of unusual care on the part of the men. I think this is true not only because it would be difficult to get the men to take more care, but also because if they do work more carefully, the output of gasoline will probably diminish. I take it as axiomatic that the latter must not be allowed to happen. In this connection the suggestions made in the report of Dr. Cassells would seem to be practical and useful.

With reference to this same problem at Abadan, I shall reserve my judgment until somewhat more information is available. It is quite possible that cases of illness could occur as the result of lead absorption, but one would have to have better clinical information than is available to conclude that this had been the case.

With reference to the transportation problem, I shall bring along with me all of the information that I can accumulate together with all the precautionary measures that are being taken or advised by Ethyl Representatives in this country. I am not surprised that occasional cargos of Fluid have been dispatched without regard to

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the usual precautionary measures. We have done everything we possibly could to prevent this, but I can scarcely believe that we have always been successful. On the other hand, if there are any loopholes in our procedure which can be plugged, I shall want to consider them with you in as great detail as possible.

I shall also want to look into the situation in relation to your manufacturing plant and shall bring along with me all of the information which may conceivably be useful.

If any other specific matters come up in which our accumulated data might be useful, I suggest that you let me know about them by cable as soon as you receive this letter, at least advising me of any type of information or data which it might be useful for me to have with me. Obviously I want to have everything that is necessary and as little as possible of unnecessary impedimenta.

With kindest greetings and the hope of seeing you soon,

Sincerely yours,

Robert A. Kehoe, M. D.

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