May 1, 1948

Dr. E. Davison,
Associated Ethyl Company Limited,
Northwich Cheshire,
England.

Dear Doctor Davison:

For once I shall answer your letter of April 20 with reasonable promptness. I shall also send you as much information as I can in response to your questions and requests. I shall take these up in the order of your letter.

(1) The problem raised in this paragraph is of more than passing importance. I am not quite sure just how your informants have found out that "there is a considerable amount of TEL vapour in the air" of tanks just after their cleaning, but I am quite prepared to agree that this may be the case from time to time. Our observations on small tanks have shown that after the tank has been cleaned thoroughly, the lead concentration in the air within it may increase somewhat during a period in which it is closed and unventilated. Following adequate ventilation, however, this situation has been dissipated, and has not been found to return. It is obvious that the problem relates to the complete removal of sludge which bears TEL. If the tank is cleaned thoroughly, and if all sludge is removed from all parts, and if all moist areas have been thoroughly dried up by mopping and swabbing, there will be little or no TEL left behind in the tank to give rise to TEL vapours. Some calculations can be made and, in fact, have been made to show how little TEL is required to be vaporized in such an enclosed space as a tank in order to produce toxic concentrations. There is no doubt in my mind that in a large tank some period of time should elapse during which the tank is thoroughly aired. We have resolved this problem to our own satisfaction by opening up the tank to the air completely, or by the use of air movers of one kind or another which provide against the pocketing of bad air within the tank. I should feel that it would be hard to prescribe any specific rule. Rather, I should feel that it should be stated that the tank should be thoroughly aired. It was for this reason that I have always been a little skeptical about the mere removal of sludge. This brings us back to the definition of a clean tank. Actually, no matter how you say it, a tank that is clean, from the aspect of what we are concerned with, is one which has had all of the material so thoroughly removed from it that there is not enough residual TEL to vapourize and produce a toxic concentration of TEL in the air. This means a high degree of cleanliness. If this is achieved, whether by washing, scraping, swabbing, or by any other means which will thoroughly dry out the tank and remove all adherent sludge, there need be no fear of danger to workmen, provided the air in the tank is thoroughly swept out. Whatever length of time is required to bring about such an air change, under the existing conditions, is the period which should be established as the necessary

waiting period.

(2) The observations made on the lead content of the air of small tanks (1000 barrels or under), following their cleaning by ordinary means, have resulted in the conclusion on our part that 85 to 90% of these tanks are safe for entrance without any special precautions after such cleaning. Our only difficulty in the application of these results lies in the fact that there were a number of tanks which yielded results above the limits of the color scale of the lead analyzer. We have not issued instructions for the collection of smaller samples so as to keep the result within the scale in these instances, and therefore these indefinitely high results are stumbling blocks. We have requested that additional observations be carried out so as to determine the values actually encountered in tanks of this sort. I feel reasonably certain that we shall find that these tanks can be dealt with after their cleaning without any further risk. However, we have the means of obtaining the specific evidence, and therefore I am not prepared to draw sweeping conclusions until the necessary evidence is in. I shall certainly see that you get a report of these observations when it is available. The present report will not serve your purposes adequately in its present state. There is one word of explanation that should be added on this subject. These tanks are cleaned in the United States without gas-freeing them. Therefore, it is unavoidable that an air-line mask be used during the actual cleaning operations. The certainty that this will be done frees us of any very great fear about the lead hazard during the cleaning operation. Therefore, what we are concerned with is the hazard associated with the entrance into these tanks for repairs and the like, after the cleaning has been accomplished. Generally speaking, it appears that the latter can be done without serious risk.

(3) The symptomatology of ethylene dibromide poisoning in man has not been studied to any considerable degree. As you are well aware, this material has been used principally in relation to TEL, and the risks associated with it have been confined largely to the manufacturing operations and the subsequent blending and handling of anti-knock fluid containing TEL. It cannot be said that we have had any well defined cases of intoxication from ethylene dibromide. There have been several instances of men who have been relatively slightly exposed to its vapours and who have even had cerebral excitation, insomnia, and some degree of prostration for twenty-four hours or more. However, we have had no serious cases for the reason that we have required this product to be handled with the same precautions used in the case of TEL. Therefore, our principal information derives from animal experimentation. Animals poisoned with this compound develop symptoms not unlike that associated with the absorption of other brominated hydrocarbons. The terminal picture is that of massive pulmonary edema associated with that of a greatly dilated heart, especially on the right side, with toxic degenerative changes in the liver and kidneys especially, and in the other viscera. We have not studied the brain with any great degree of care, but it shows the same kind of toxic picture found in the other organs. The material is absorbed through the skin of experimental animals with fair ease.

At the site of contact the skin becomes greatly thickened and terrifically hyperemic, often with hemorrhage. Necrotic changes take place in the local tissue with sloughing. We have seen a few instances of serious damage to the skin of workmen in the plants. These have occurred principally in association with the spillage of small quantities into or upon a shoe. In one instance one of the men spilled some on a shoe which was practically new, and which, therefore, he did not wish to discard for burning as we require. After allowing the shoe to stand on a hot radiator for 24 hours or so, he resumed its wear, whereupon he developed a blister and a slough of the skin in apposition to the contaminated area of the shoe. So far as I know this is the worst of the halogenated hydrocarbons from the aspect of its effect upon the skin. Skin contact must be avoided religiously, or if there should be momentary contact, the part must be washed free of contamination at the earliest possible time. In cases of severe human exposure I should anticipate that the symptomatology would be that of an acute central nervous system irritation, associated with general toxemia, circulatory collapse, and terminal pulmonary edema. I am sending you herewith such references to the literature as are available.

(4) Mrs. Campbell has gathered together all of the information we have on croton aldehyde. This is not much, but such as it is we send it to you gladly.

(5) I am also sending you such material as is available on methyl acetate. I am afraid you will not find the answer to your question in the available information. Unfortunately I have had no experience that would enable me to add anything to the picture.

(6) I am sending to you a sheaf of the literature to which you have referred. As to the translations of the "Lead Studies" it has seemed wise to send you a number of complete sets of these, together with the backs which I have used for the purpose, allowing you to put them together yourself. At present we are rather heavily swamped with work, and I could not find anyone with the time to punch the holes and put the covers on these.

In connection with the gathering of information on ethylene dibromide Mrs. Campbell found the information on ethyl bromide which she considered might just as well be sent to you for such use as it may be. It is enclosed herewith, therefore.

Thanks for your infomation about the Swiss situation. It is my feeling that only time and a little experience will cure this. I trust that in the meantime there will not be some flurry of misunderstanding to complicate the picture.

As I told you before, I believe, I am very hesitant about being away from here in September, even for so pleasant a trip as that of attending the Congress in England, and at the same time visiting my friends and associates there. I shall certainly not find it possible to be there unless something comes up that would justify it more

completely than anything I am aware of at present. It appears that we will be ready to move into part of our new quarters, at least, some time in September, and that will be a bad time for me to be away. Also I hope to have a vacation some time before the end of September.

I am always glad to hear from you, and so keep it up.

Sincerely yours,

Robert A. Kehoe, M. D.

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Copy by Air Mail.
Original by Steamer.

Enc.