

April 7, 1938

Mr. P. A. Combelic
Washington State Agriculture Ass'n.
Spray Residue Committee

Dear Sir:-

Your letter of March 23rd raises a question to which, in my opinion, there is no answer. The problem of spray residues on fruit and, more particularly, on leafy green vegetables is an important problem in public health. Much has been written on both sides of this question but, unfortunately, not much experimental work has been done to justify a sound opinion as to the facts. I personally do not feel that the position of the alarmists is well taken. On the other hand I do not feel that there is any available evidence which would justify the Bureau of Pure Food and Drugs in the Department of Agriculture in raising these tolerances for either lead or arsenic. The tolerances, as they now exist, have no very sound scientific or physiologic background. On the other hand I feel that if this Bureau is to be in error, it should err on the side of safety. Moreover, with all due respect to Dr. Ira Cardiff, with whom I have talked, I do not believe that his position is well taken when he says that it is up to this governmental agency to prove the correctness of its position with regard to lead and arsenic tolerances. It is rather up to the industry to prove that the tolerances established by this department are incorrect. As a matter of fact these tolerances are set by the Department after consultation with quite a number of men who are presumed to be authorities in their field. These men express the combined judgment of experimental workers who know that both lead and arsenic are toxic substances and that their presence in food for general consumption should be limited. I personally disagree with some of the experimental evidence on which their conclusions were reached. However, in the strict scientific sense, and from the point of view of the public health, this is unimportant and if I were responsible for the administration of this Bureau, I would not change the tolerances upward except on the basis of very sound evidence that they were unreasonable and unnecessary. Moreover with excellent scientific evidence at hand as to the level of lead and arsenic intake which could be endured without injury to human beings, I should still want a large safety factor in view of the fact that children and sick people have to be thought of in connection with general

dietary problems. What I have said above would seem to indicate that I lack sympathy for the fruit-growing industry. This is not the case. I recognize the difficulties of their situation, and I am strongly sympathetic with their problem when I realize that they must in a measure choose between a loss of their fruit because of insects and damage to their fruit by various types of washing operations. On the other hand it should not be necessary for the ordinary citizen to have to consider whether or not the food by which he lives is likely to poison him. Wholesome food should be available to him without the exercise of precise precautionary measures.

With regard to the actual dangers of spray residues, I may say that in almost fifteen years of experience, I have not seen a case of lead poisoning or of arsenic poisoning derived from the ingestion of fruit contaminated with spray residues. Moreover I should be disposed to feel that the statement of the twenty-five physicians, referred to in your letter, that they "have never observed or treated a case of arsenic or lead poisoning etc." is true. I have not found any other physician who has seen or treated such cases although the numerous publications of C. N. Meyers (who is not a physician) and his associates would indicate that they have seen numerous examples of "sub-clinical" lead and arsenic poisoning. Just what is meant by "sub-clinical" intoxication is not quite clear to me, and from some of the analytical data supplied by these men, I can not feel that it is very clear to them. However this will indicate that there is a difference of opinion on this subject which official agencies have to take into account. All of the negative evidence has to be regarded with some skepticism since the real issue has to do with whether the quantities of lead and arsenic involved are such as to produce cases in various parts of the country which, for a variety of reasons, may not have been recognized. Those of us who have studied this problem in industry know that there are safe levels of lead and arsenic intake. However in industry exposure is mainly through inhalation. If these materials are ingested, the problem is wholly different, and it seems quite certain that neither lead or arsenic administered by mouth are as toxic as when inhaled. The reasons for this are quite apparent since it has been shown that a considerable proportion of ingested lead traverses the alimentary tract unabsorbed. We have found, for example, that even when soluble lead salts, in solution, are administered to human subjects, that a very large proportion of the lead passes the alimentary tract without absorption. It is probable, and in fact it is almost certain, that a much larger proportion of lead arsenate is unabsorbed than is the case with these soluble salts. The first problem, therefore, from an experimental point of view, with reference to lead arsenate sprays, has to do with the extent of their actual absorption into the body. This question which is as yet unanswered, has a great

deal to do with the magnitude of the toxicity of this substance. The next question is the extent to which absorption from the alimentary tract is taken up by the liver and promptly excreted from the body. No doubt numerous factors influence the fate of such absorbed lead, and obviously persons with liver damage will not behave so well in this regard as will normal persons.

You will be interested in knowing that a very considerable amount of animal experimentation is under way at this time. Rather extensive work is being carried out by the United States Public Health Service under the direction of Dr. R. R. Sayers, in an effort to determine the extent of lead absorption by experimental animals. It will be some time before the data on this study are available, but the results should be very interesting and quite important in relation to this problem. On the other hand it is quite clear that they will not answer the question of the reaction of the human being to these poisonous materials. In my opinion it will not be possible to arrive at sound conclusions as to the safety factor in lead and arsenic intake by mouth until extensive human experimentation has been carried out. I think some extremely valuable information could be obtained by field studies in the orchard sections during the apple picking season. One would find here large groups of people eating unwashed fruit, and it would be possible to study their physical condition and also the magnitude of their lead absorption and lead excretion. In this way one could obtain data which could be compared with that obtained in industry under conditions of known exposure, and from such information one could determine fairly satisfactorily the magnitude of the hazard.

You have asked my opinion as to the maximal quantity of lead arsenate which might be ingested without harmful effects. Anything which I might say on this subject would be pure guess work since there is no information on which to go. I can say, however, from our experimental observations, that if the total lead intake per day by mouth does not exceed 1-1/2 milligrams, cases of lead poisoning will not occur among normal persons. What will happen to infants and sick people under these conditions, I am unable to say. I would be inclined to expect that nothing would occur, but this is a guess based on numerous indirect observations.

You might be interested further in knowing that the lead intake over a period of twenty-four hours among average American adults varies from approximately one-tenth of a milligram to 2 milligrams per day under present conditions of food consumption and distribution. Only rarely does the twenty-four hour food intake contain as much as a milligram of lead. The average figure, however, is

approximately 0.25 milligrams per day. The larger quantities which, I repeat, occur infrequently, usually coincide with the ingestion of more than usual quantities of salads and fruit. We have seen no indication in our own data that lead intake has increased during the period of the past ten years. I should guess, however, that if unwashed fruit were generally distributed over the United States, the average lead intake would be considerably increased. I think it might perhaps be increased by as much as four times its present magnitude without great danger. On the other hand, I can assure you that I would not wish to be responsible for any situation which brought about such an increase. Frankly I would not even experiment with human subjects on increased lead intake except as I could maintain a continual medical supervision of their metabolic response. Even under conditions in which I am administering one milligram a day as a soluble salt, I am maintaining a daily check on the lead intake and output, I am carrying out complete physical examinations once a week, and I am watching the blood daily for microscopic changes indicative of increased lead absorption. This will serve to show you that in my opinion the question of increased lead absorption is considerably more than an academic one.

I trust that in this somewhat lengthy discussion I have given you a general idea of my point of view which is, perhaps, conservative, but in my opinion conservatism is fully justified in relation to this public health problem.

Very truly yours,

RAK:ls

Robert A. Kehoe, M.D.