

September 19, 1961

Mr. Pelle Isberg
Representative of The Royal Swedish Academy of
Engineering Sciences
Swedish Embassy
2249 R. Street, N.W.,
Washington 8, D.C.

Dear Mr. Isberg:

Having returned to my desk and having cleared away some of the most urgent matters, I shall undertake, as well as I can, to answer your letter of July 31st, 1961. I say "undertake", because I am not at all certain of the scope of your interest and concern, and the relevance of our knowledge and experience to your problem or problems.

It is not true that we are "working on this problem" or even that we have worked on it in any systematic manner. We have had questions and problems referred to us from time to time in connection with several specific sources of water which had been contaminated with gasoline containing tetraethyllead. The usual situation was that of a well so situated that a leaking gasoline storage tank had contaminated the underground water with which the well was supplied. In any such situation samples of the water were sent to us for analysis for lead, and of course in examining the water we observed and estimated the gasoline contained therein.

In the course of a series of incidents of this type, referred to us, as a rule, by petroleum distributors, for advice and analytical services we learned some things by experience. We had a background of toxicological information, and with this and the experience referred to, we were able to help in clearing up the problem. I shall recite the general facts and principles which relate to the problem, and if these are relevant to your inquiry, they may serve as answers or at least partial answers. If, on the other hand, you are concerned with other problems or details, I may or may not be able to help you with information, but I shall be interested in any case.

First let me point out that the gasoline in the water is, of itself, the main problem. Gasoline, when swallowed is highly irritating to the alimentary tract, even in quite low concentration, producing a severe diarrhea which is likely to be hemorrhagic. Following its absorption from the alimentary tract, it induces serious nervous reactions and if taken even in dilute form in water over days or weeks, the effects on the person concerned are likely to be dramatic and alarming, as well as disabling.

The quantity of lead taken in by this means in gasoline is insignificant for all practical purposes because of the low concentration of tetraethyllead

in gasoline. Any dose of swallowed gasoline that is capable of taking into the body a toxic quantity of tetraethyllead exerts such prompt and dramatic effects as to operate against the absorption of the lead compound. In any case the lead taken into the body by this means would amount to only a few milligrams - 125 ml. of gasoline (equivalent to an ordinary drinking glass or tumbler) containing the maximum concentration of tetraethyllead would have in it only (about) 0.125 ml. of tetraethyllead or 125 milligrams of lead (Pb). This, whether taken as one dose or as a series of small doses over a period of time, has little toxicological significance. (Most people forget or do not know that tetraethyllead owes its lethal properties to its lead content, and that it has no greater capacity to kill outright than that possessed by the soluble salts of lead. Moreover, it is poorly absorbed from the alimentary tract, and small doses by mouth, therefore, are not very potent.)

The problem of water contaminated with gasoline containing tetraethyllead is essentially the same as that of water contaminated with non-leaded gasoline. Any drinking water that contains delectable quantities of gasoline is disagreeable to the taste and dangerous to health. We apply a very simple test to such water. If a corked gallon jug not quite filled with water and allowed to stand over-night in the laboratory develops a visible layer or film of gasoline on its surface it is highly dangerous; if no gasoline is actually visible on the surface of the water, but gasoline can be detected by smell in the air-space overlying the gasoline, it is unsafe (from the aspect of its content of gasoline) for human use. We do not bother to analyse the water for hydrocarbons or lead, until this test is entirely negative. At that time we may find a trace of hydrocarbon, but no demonstrable elevation of the lead content over the expected amount of lead (up to 0.03 mgm. per liter). If the lead content is elevated, some source of contamination, other than tetraethyllead is looked for, for if there is only a trace of gasoline there is bound to be an insufficient amount of tetraethyllead to measure. Nevertheless, we cannot take a chance on declaring the water to be essentially free of lead if it is free of gasoline, since there are (infrequently) other sources of contamination of ground waters with lead. Therefore, we analyse both for hydrocarbons and lead and report both results.

The elimination of the gasoline from the water depends upon cutting off the source of contamination (by identifying the source and eliminating it) and then freeing the drainage area of gasoline by pumping the water out and discarding it until the stream flowing through the pump is free of gasoline. This may require days, weeks or months of pumping and discarding, dependent upon the capacity of the drainage area, the capacity of the pump or pumps, the quantity and duration of the leakage or spillage, the topography and, of course, other factors. In our experience to date, however, the desired end can be achieved at a price in time, effort and cost. I can imagine circumstances under which this would not be the case, but I do not remember that we have encountered such a situation.

I know of no other observations of this type. For a variety of reasons such problems would likely be referred to us, and I am not aware that they have been referred elsewhere. It seems likely that there have been

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other cases, but I have no knowledge of them.

We issued a report some years ago on the elimination of gasoline from water under certain circumstances, and I forward a copy of this report for such use as it might be to you.

If I have missed the point of your inquiry I trust that you will let me know.

Cordially yours,

Robert A. Kehoe, M. D.

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Enclosure

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