

Memorandum on Certain Aspects of the Early and More Recent Attitudes  
of the United States Public Health Service Toward the Potential Health Hazards  
Associated with Lead Discharged into the Air  
From the Exhausts of Automobiles That Use Leaded Gasoline as a Fuel

From: Robert A. Kehoe, M.D.

To: John A. Maga and His Associates In The Department of Public Health  
of The State of California, And To Others Concerned

Reference is made herein to a Report of the Department of Public Health of the State of California, entitled "Lead In The Environment And Its Effects on Humans." Certain comments have been made in correspondence with Mr. Maga, on another part of this Report. It seems advisable, however, to deal with some of the facts in the background of this problem, running back to 1924, in relation to the historical summary referred to in the Report as Section V. Some of the statements made therein represent the repetition or rephrasing of those made in certain public documents that were issued in 1925-1926, and have since been restated or reinterpreted by persons who took them to be the full representation of the facts. Since I may be the only living person who knows exactly what occurred at that time, and since the facts are not fully known to anyone in the Public Health Service at this time, and since, moreover, certain statements in the Report are somewhat misleading, the more so in their implications than in their actual substance, I have thought it advisable to comment on them.

First, with reference to the first paragraph in the report, which is not in the category referred to above. The "voluntary agreement" might well be designated as a formal agreement (since it was acknowledged in a public document) between Ethyl Corporation, (since adhered to by other American manufacturers), and the Surgeon General of U.S.P.H.S. This action with our government at that time, under the

attendant circumstances, was as binding as a law. The implication in the report, whether intended or not, conveys the suggestion that this industry might not be relied upon to carry out its agreement. Its every behavior over the years, belies this suggestion.

In the second paragraph, a statement is made, incorrectly, so as to involve the "production of leaded gasolines" in "serious health considerations," There were, indeed, serious hazards in the manufacture and transportation of tetraethyllead and ethyl fluid, but there had never been any indication of hazard (other than hypothetically) in the production of leaded gasoline. The procedures used early were not satisfactory for continuation, and were abandoned, on my recommendation, when the industry considered the resumption of operations in 1926, but they had not given rise to any difficulties. One of the recommendations made by the Committee, that arose out of these considerations, on my suggestion, was that the mixing operations should be carried out in bulk.

In this same paragraph, it is said that "little or nothing was known of the public health hazard of using leaded gasoline." This also is incorrect, since a considerable volume of toxicological work had been done and reported prior to 1926, and an investigation made by Graham Edgar and myself in 1925 (Edgar was a competent analytical chemist) had demonstrated that service station personnel in the area of greatest (Dayton and Cincinnati) and longest (2 years) use of leaded gasoline had neither suffered any demonstrable illness nor had absorbed demonstrable quantities of lead. This, incidentally, was the first demonstration in the U.S.A. of the presence of lead in the urine of persons in the general population. And when the investigations of the Public Health Service, later in 1925, had seemed to confirm our conclusions on a somewhat wider base (although the analytical information, on the feces of exposed personnel alone, cannot now be regarded as relevant), the decision was arrived at that there was no reason for discontinuing the distribution and sale of leaded gasoline.

Undue emphasis has been placed on the recommendations and regulations of

the Advisory Committee (paragraph three in your report) and the Public Health Service, as a condition to the resumption of the distribution of leaded gasoline, and as a means of safeguarding workmen in the manufacture of ethyl fluid, as well as gasoline refinery workmen, garage mechanics and attendants at gasoline service stations. A glance at the proposed regulations in the light of present knowledge of the subject, will convince any presently well-informed physician or industrial hygienist of the irrelevance and obsolescence of most of them. They were intended as bona fide advice, and it is a fact of history that the industry was essentially free thereafter of casualties due to the absorption of tetraethyllead in these occupations, but that there is any causal relationship between these two facts is wholly without foundation. They had little relationship to the actual hazards or to the manner of their control. They were regarded from the first, by myself, who had the full responsibility in the matter, as having been made in good faith, but as not generally substantial in fact, and it was most fortunate that they were never adopted by any legally constituted body. This is not a reflection on the personnel of the Committee. The fact is that the state of the knowledge and art of the time, in the lead trades generally, was exceedingly defective, and that the information then available, such as it was, had little relevance to tetraethyllead. The restriction of the concentration of lead, the coloration of the gasoline (for the purposes of identification), and the means and the sites at which tetraethyllead was mixed with gasoline were determined wholly by Ethyl Corporation, as was also, of course, the medical and hygienic regimen for the protection of the personnel within the industries involved. In short, this was an excellent example of the public responsibility, (stimulated as indeed it was, by the constant threat of commercial dissolution), of an industrial organization that had entered into an agreement with the Public Health Service to investigate, to instigate appropriate measures of environmental control, and to monitor its own hygienic problems, to report the results to the Public Health Service in such detail as might be required, and to finance such research in a public educational institution

as might be required to ensure the health of its employees and those of the petroleum companies, as well as the public. As to the latter, I can assure you that the Surgeon General of the PHS, Hugh Cummings, M.D., was delighted with this arrangement. The Service had no funds and no readily available facilities or personnel, at that time, with which to undertake an elaborate program of investigation. Moreover, he believed, after frank discussions with Earle Webb, President of Ethyl Corporation, that the work would be financed adequately, and he was confident that it would be done properly in the University of Cincinnati. The relationship between the appropriate authorities in the Public Health Service and the pertinent staff in the Kettering Laboratory became such as to justify this confidence.

Not to go into the historical background of this matter in further detail, it may be said that everyone, in the Public Health Service and elsewhere, after about ten years, relaxed his concern about this series of problems, except the responsible people in Ethyl Corporation and the team of investigators in the Kettering Laboratory. This continued thereafter to be the case until the technical and economic need to increase the lead content of certain gasolines arose in 1958, and brought Ethyl Corporation to seek the advice of the Service, as it had agreed to do in any such situation, years before. I was quite certain that the submission of this matter to the Public Health Service would result in a reexamination of the entire state of our knowledge as to the quantities of lead in the environment of man, and as to their physiological disposition, and I welcomed such a reexamination. I was more than a little surprised by the expressed attitude of the Advisory Committee concerning the inadequacy of the data on the public health aspects of the lead in the environment, and specifically that in the atmosphere, until I learned that they were referring to the lack of information procured by the Public Health Service itself. Unfortunately, this statement, in the text of the report, has been responsible for the belief in certain circles that very little was known about this matter. While, on the whole,

this was not ultimately disadvantageous, since it has resulted in a very considerable amount of investigation by the personnel of the Public Health Service and others, it seems to me that it has distorted the picture considerably. That is one reason for my taking the trouble here, to acquaint you with this background. What is not known by more than a very few people is that, after 1926, there were four fairly elaborate investigations, by the staff of the Kettering Laboratory, of groups of people who were believed to have been the most severely exposed to whatever hazards (of lead absorption) resided in the distribution and use of leaded gasoline - service station attendants, garage mechanics, refinery handlers of gasoline and drivers of cars, plus certain other persons in specific employment, and <sup>others</sup> in the general population, as well as numerous groups of persons employed in lead trades. The principal difference between these surveys and the "Three Cities Survey" was that every person in each group was subjected to a detailed physical examination and a clinical-microscopic survey by a group of well-trained physicians and technical assistants, and that all of these data (analytical, clinical and clinical-microscopic) were tabulated and examined by statistical means. Elaborate reports of the early investigations were made to the Public Health Service and, subsequently, articles summarizing the most pertinent information were published (Jour. Ind. Hyg. 15:273, 1933; 15:306, 1933; 16:100, 1934; 18:42, 1936. The data of the 1954-55 survey were published in abbreviated form along with those of the "Three Cities Survey," but without the clinical and clinical-microscopic data.)

In addition to the foregoing publications, a considerable volume of physiological information, not hitherto available in medical literature, had been obtained in the Kettering Laboratory and published.

Lacking, were the data of an up-to-date investigation, on a somewhat broader base of localities, for comparison with the results of prior field investigations

(especially the data of 1954-55, which had been obtained by the use of analytical methods of the highest precision obtainable up to that time) and to serve as a base-line for subsequent investigations. This information was provided in considerable measure by the "Three Cities Survey," which confirmed the validity of observations made since the development of present analytical methods of high precision.

It is of some importance, I think, to take into account the situation of the U.S. Public Health Service, when in 1965, Claire Patterson took violent issue with the "complacency" of the health authorities of the country concerning widespread and serious "chronic lead insult" visited upon the population by lead in their environment, with particular reference to the contribution made in modern times by the discharge of the combustion products of tetraethyllead by automobiles into the atmosphere. At this time, none of the persons who had dealt with this problem within the Public Health Service in the early period, were on active duty in the Service, and none of those in positions of responsibility in the field of air pollution, had any real familiarity with the matter, historically, experimentally, or hygienically. Their response to the direct accusations of Patterson was erratic and defensive. In actual fact, there was no good reason, except for unfamiliarity with the historical background of the matter and a lack of intimate understanding of the medical and toxicological issues, for a defensive attitude within the Public Health Service. (There was no outstandingly knowledgeable physician (on this subject) in a responsible position in this relationship within the Public Health Service at that time. In earlier periods such persons as Leonard Greenburg, Royd Sayers, Paul Neal or W. C. Dreessen could have provided the first-hand medical knowledge of the subject and the professional stature that would have neutralized the toxicological naivete and brash dogmatism displayed by Patterson. But the technologically competent, responsible staff in the Public Health Service, recognizing their toxicological and medical shortcomings, could not match Patterson's self-assurance. They have continued even yet to appear doubtful of their position, and to react overmuch to the presence of lead in the atmosphere. The response to Patterson could have been made that the extent of the so-called threat was under extensive

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investigation, but, instead, the adequacy of the investigative effort was brought into further question by loud appeals for more investigation.

The lack of a balanced judgment, here, has been displayed further by an undue interest in the establishment, at once, of standards for the quality of the air with respect to its lead content, without waiting until information is available on which to set such a standard. Every well-informed person with whom I have come in contact, in connection with this matter, is agreed that there is no great urgency, at the moment, for setting such a standard, and that the time seems to be near at hand, in terms of information being sought by a variety of investigators, when this can be done on sound physiological evidence.