

March 8, 1940

Mr. W. Harrison
Shell Oil Company
San Francisco
California

Dear Mr. Harrison:

Your letter of February 28th addressed to the Ethyl Gasoline Corporation, concerning the undesirable effects of the pollution of the atmosphere by exhaust gases containing lead, was referred to me by New York and came to my desk on March 7th. I hasten to reply.

The problem which has been raised by your correspondent is not a new one of course. It was raised many years ago by the technical staff of Ethyl Gasoline Corporation and of its predecessor the General Motors Chemical Company. The investigations begun in 1923 by the United States Bureau of Mines had as their purpose the determination of the degree of hazard to the public which might arise from this source of air pollution. These studies were carried on for several years and were made the subject of a very comprehensive report, the details of which can be supplied to you by the simple statement that no evidence was found that the lead content of the exhaust gas constituted any hazard to the public health. This work naturally was done on experimental animals. Other work of more or less comparable type has been carried on from time to time over a period of years with corresponding results. I and my associates carried out the first field investigations among garage mechanics and filling station employees in 1924 and 1925, making detailed comparison between such men who came in contact with leaded gasoline, and corresponding men with no such exposure. Somewhat more comprehensive observations of this same type were repeated at public expense by the United States Public Health Service in 1925, their work being under the direction of a committee of seven distinguished American scientists. In 1928 corresponding observations were made in England by the British Ministry of Health, and other observations were made in France and in Denmark. Over this whole period of time, studies were being carried out of a rather comprehensive nature in this laboratory which, I believe,

it is fair to say is now recognized as one of the most reliable sources of general information on the subject of lead poisoning in the United States. The expense of this work, of course, was borne by Ethyl Gasoline Corporation, and for a time there were people who believed on that account our work could not be regarded as unbiased. I believe that idea has largely disappeared among workers in this field and among our scientific colleagues in general. In this connection it may interest you to know that we are consulted with reference to the problem of lead poisoning by the Ohio Industrial Commission, and that we have been asked to testify by the Pure Food and Drugs Department of the Department of Agriculture in certain controversial cases. I mention these matters only because I think it is necessary to establish the integrity of our work as a source of unbiased information.

In the course of the years, we have examined several hundred garage mechanics in various parts of the United States, a corresponding number of filling station attendants and a considerable number of refinery handlers of gasoline. In so far as the exhaust gas problem is concerned, we have concluded as a consequence of rather wide experience these are the persons who are most exposed to exhaust gases for the longest period of time per day and over a period of years, as well as to the highest concentrations. Indeed it is our common knowledge that a fair percentage of these garage mechanics are sufficiently exposed to exhaust gas to have evening headaches fairly frequently, and almost regularly in the winter months in cold areas of the country. Certainly these men have had the maximal opportunity to absorb lead from this source. In the course of our studies, we have examined a considerable number of these men who have been working on cars using leaded gasoline exclusively since 1924. These men undoubtedly represent the most serious exposure to this particular situation in any part of the world. We have been concerned, of course, with an attempt to determine whether these men had shown any illness or injury as a consequence of their work. From a strictly scientific point of view, however, this is not the most important aspect of the problem, and for that reason we have sought chiefly to determine whether they had been absorbing measureable quantities of lead as a consequence of their occupation.

To summarize briefly all of the experimental work which has been done by governmental agencies and ourselves, it is fair to say that no one has been able to discover the slightest evidence that the inhalation of lead by way of the exhaust gas of automobiles is in any way dangerous or harmful to anyone. I can provide you with the documentary evidence in support of this statement

in the form of governmental reports of this country, Great Britain and Denmark. I can also supply you with our published work in this field. I should be glad to do this if you consider it necessary. On the other hand it all boils down to the simple fact that this danger was considered worthy of exceedingly careful investigation, and that all of the investigations have failed completely to demonstrate the existence of even the slightest danger.

Certain persons who originally put themselves on record as believing that this constituted a serious danger, have been loathe to admit publicly that they were wrong. Certain other persons who, perhaps, have something of an ax to grind, have kept alive the issue of danger and have tried to arouse fear in the community on this score. One of the most potent agencies in this direction has been the Consumer's Research Incorporated, and I have no doubt that that is the source of the inquiry which has come to you. This agency, which can scarcely be regarded as completely unbiased, has continued to raise this issue in their publications and has attempted to warn the consumers of gasoline against the use of gasoline containing lead on the score that this constituted a means of increasing the lead exposure of the community. It would be somewhat strange if this group, who have never made any investigations in this field, were in position to express a wisdom far superior to that of the United States Public Health Service, the United States Bureau of Mines and ourselves. Nevertheless I have considered it wise to make mention of this group as the probable origin of your correspondent's point of view.

I believe you will have very little difficulty on this score and I think you will hear very little about it among your customers. Generally speaking, the point of view of technical and medical people is that this problem which was controversial in 1926 is no longer in that category. It is quite generally accepted that the Public Health Service was unbiased and competent in their investigation, and that this problem has been answered. Meanwhile you may be further interested in knowing that we are carrying on further investigations since, in our opinion, it is wise to know at all times the extent to which the atmosphere of cities is polluted by exhaust gases. I may say in this connection, however, that the question of exposure to carbon monoxide is relatively more important from the hygienic point of view than the question of lead exposure. The reason for this is that carbon monoxide is taken up very readily by the human body, and that it too, by reason of certain unusual physiologic processes, tends to accumulate in the body. That is to say, carbon monoxide even in low concentrations is taken up almost quantitatively by the blood so that its

poisonous properties can be expressed in terms of a given concentration of carbon monoxide times the duration of the exposure in hours. Automobiles give out carbon monoxide in concentrations of from 5 to 7 per cent, whereas the highest endurable concentration with safety is somewhat under .03 per cent. It thus happens that if exhaust gas from automobiles is diluted enough to maintain the carbon monoxide within even moderately safe limits, the lead concentration would be so greatly reduced as to be insignificant from a hygienic point of view. There is a further fact that individuals in the United States and in all other countries that have been studied, take in regularly small quantities of lead with their food. At least half of this is the result of the natural occurrence of lead in soil, water, vegetation and animal tissue. The rest of it comes from small sources of contamination which are unavoidable in large measure. The result is that an adult takes in on the average of a third of a milligram of lead per day in his food. As a consequence of this fact, the minute quantity of lead which is present in the air that we breathe, is too small to be demonstrated. That is to say, it makes such a small contribution to the total unavoidable lead intake of modern man as to be within the limit of experimental error of our observations on the total lead intake and total lead output in the human being.

I believe this will answer the question raised in your letter. If, as I have said above, you require documentary evidence in proof of the correctness of these statements, I shall be glad to supply them to you.

Very truly yours,

RAK:is

Robert A. Kehoe, M.D.