# ETHYL GASOLINE CORPORATION

RESEARCH LABORATORIES

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DETROIT, MICHIGAN

April 27, 1938.

Dr. Robert A. Kehoe

Dear Bob:

I will attempt to give you below a summary of our findings to date on the problem of determining the best mix to use for the test of the Dayton fleet.

I understand from my conversation with you that you do not consider the spillage of leaded gasoline to be of great importance, on account of its extremely infrequent occurrence, and that you think that the hazard, if any, lies in the day in and day out exposure of the filling station attendants to the fumes emanating from the tank which is being filled. In accordance with your suggestion we have therefore considered that the data which was of importance was the amount of lead present in the 1% cuts of gasoline vaporized at room temperature from 0 to 10%.

The above mentioned data on the vaporization of lead in gasoline can be obtained experimentally, and can also be calculated, making reasonable and justified assumptions regarding the vapor pressures of mixtures of lead compounds and gasoline hydrocarbons. On that basis the first result we obtained was as we expected, that the amount of lead in the vapor will be a function only of the over-all vapor pressure of the compound or mixture of lead compounds involved. More specifically, it does not matter whether the fluid used contains some tetramethyllead or none at all, and a larger amount of the slightly less volatile compounds would have the same effect as the small amount of the more volatile tetramethyllead.

Another related observation of importance is that the amount of lead vaporized in the first 1% cut is not greatly different from that vaporized in the tenth 1% cut, so that the average figure may well be used for comparative purposes.

We have calculated these figures in terms of milligrams of lead per cubic meter of gasoline vapor, and have then converted them over in terms of milligrams of lead per cubic meter of gasoline-air mixture containing 2% gasoline vapor by volume as per your suggestion. These figures are given in Table I below:

TABLE I - VAPORIZATION OF LEADED GASOLINE

| Lead Mix: | mgr. $Pb/m^3$ vapor | | mgr. $Pb/m^3$ of 2% gasoline-vapor mixture |
|---|---|---|---|
| | Calc. | Observed | |
| $PbMe_4$ | 209 | (142) | 27 |
| M-500 | 37 | (54) | 4.6 |
| M-501 | 25 | (41) | 3.1 |
| Dd | 10 | | 1.3 |
| $PbEt_4$ | 2 | (6) | 0.27 |

The figures given between parenthesis in the second last column, are experimental values obtained some time back. Considering that the gasoline used was not of the composition assumed in our calculations, I think that the check indicates that the figures we obtained by calculation are fair enough for the purpose of comparison.

Considering now the question of which mix we contemplate putting on the market, it is Earl's present feeling that the preferred mix will be either Dd or something very similar. The mix marked M-500 is approximately the material which we have now accumulated in large quantities and are prepared to use as is in Dayton, or to fractionate to any desired composition.

On the basis of our figures, Dd would give about 5 times as much lead in air as tetraethyllead. Some of the other mixes which we might consider substituting for Dd primarily for the sake of decreasing the cost of manufacture, would run not higher than 1.8, or 7 times as high as tetraethyllead. M-500 on the other hand is 2½ times as high as this last high figure of 1.8. The chief question I want to put up to you now is whether you think we would be justified in using such a high safety factor of 250% on our experimentation. The chief advantage of that, of course, would be to be on the safe side if the material should prove entirely satisfactory. The two drawbacks are that if this should prove to be on the border-line we might regret later on to have gone so far above what we really anticipate using, and second, that by using this material we might be alarming the Public Health Service quite unduly. If you feel that using M-500 is the best think to do, we can arrange very easily to have the material made up into fluid, canned and shipped to Dayton by July 1. If you feel that it would be wiser to decrease the hazard somewhat, we could decide to cut this down to a figure around 3.0, which would still be 2½ times as high as Dd and 1.6 times as high as anything we contemplate using. In the latter case, the second question arises as to whether the material should also approximate the actual composition of those fluids we would use or whether we could make up at this time fluid of the same overall vapor pressure, but of different composition. The latter would be obtained by mixing M-500 with tetraethyllead. While this would reduce the amount of work involved, we should not be influenced by that consideration, as we are fully prepared to put in whatever amount of work is necessary to make the fluid fully satisfactory for the test. Possibly another argument in favor of using this mixture, however, is that it would contain more tetramethyllead than any of the others, and therefore might be considered to give us a more exacting test than the stripped mixes.

In addition to the above two major queries, I would also like to have you advise me promptly whether you think we should further support our figures by actual determinations of vaporization of lead under the conditions involved, or whether you consider the above figures satisfactory.

I hope you will find it possible to let me hear from you soon on the subject, since depending on your answer we may still have a fair amount of work to do in a comparatively short time. I can also send you a more elaborate report including all our calculations and plots, or still better, we could arrange a conference to discuss the whole matter.

Very truly yours,