2 or 3 copies of report on TML

2 or 3 copies of [illegible] particulate lead in [illegible] from exhaust.

ETHYL CORPORATION

RESEARCH AND ENGINEERING DEPARTMENT
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FERNDALE 20, DETROIT, MICHIGAN

January 15, 1960

Dr. R. A. Kehoe
University of Cincinnati
Kettering Laboratory
Cincinnati 19, Ohio

Dear Dr. Kehoe:

Subject: An Estimate of the Probable Effects on the Lead Content of Urban Air Due to Substitution of TML for TEL

In considering the effects which the substitution of TML for TEL might have on the overall level of lead in urban air, one can examine separately the three possible avenues by which lead from gasoline can reach the air, and compare the effects of the two compounds:

1. Particulate Lead in Exhaust Gas -- Regardless of its form, organic lead in gasoline is burned during combustion to the same inorganic products. Therefore, it can be seen that the nature of the lead alkyl used will not influence the amount or character of the exhaust products, if the same concentration of lead is present in the fuel.

2. Organic Lead From Spilled Gasoline -- The volatility of different organic lead compounds will affect the relative rates at which gasoline and its contained organic lead compound will evaporate. However, in the case of gasoline spills, these different evaporation rates will not affect the total amount of Pb ultimately transferred to the air, since all of the gasoline and all of the contained lead compounds will eventually vaporize.

3. Vapor Losses During Fuel Handling and Transfer -- In this type of situation, such as with vapors displaced during tank fillings, an increase in the volatility of the organic lead compound will increase the amount of lead which reaches the air. However, even in the case where fuel vapors are displaced during automobile tank filling, studies have shown that an appreciable part of the hydrocarbon is lost in droplet form, in which case lead compound volatility would have no effect on the ultimate quantity of Pb vaporized. Nevertheless, if one considers the losses to be entirely vapor, an examination of the quantities involved indicates that this increased amount of lead is likely to have little overall significance. This is because, even with TML, a large portion of the light fractions of a gasoline must have evaporated before an appreciable

fraction of the contained TML has vaporized. For example, during the vaporization of the first 10% of a gasoline, only approximately 3% of the contained TML vaporizes. This is a conservative value based on distillation conditions, in which the relative amount of lead vaporized is greater than under conditions of air evaporation.

We can estimate the quantities of Pb which would be involved in vapor losses by making use of data compiled and distributed by the Los Angeles Air Pollution Control District. According to data released in July, 1959, 5,820,000 gallons of gasoline were consumed daily in Los Angeles. The hydrocarbon losses chargeable to marketing operations were estimated at 90 tons per day, which represented 0.5% of the gasoline used. If we assume this to be entirely vapor loss, in which case differences in lead alkyl volatility would have the greatest effect, the overall lead vaporization could be estimated as follows:

a. The first 0.5% of a gasoline to vaporize would carry with it no more than 0.15% of the contained TML.

b. The 5,820,000 gallons of gasoline consumed per day would contain 33,900 lb. Pb (based on the equivalent of an average 2.8 ml TEL per gallon).

c. 0.15% of the 33,900 lb. Pb would represent a loss of only 51 lb. Pb, as compared to the simultaneous loss of 90 tons or 180,000 lb. of gasoline.

On the basis of these considerations, a change from TEL to TML could not materially affect the overall lead level of a community. The increase could, therefore, not exceed a fraction of 1%. Furthermore, since TEL and TML both are compounds which are readily decomposed by sunlight, it is unlikely that vapors of either compound could persist for long in the atmosphere.

A comparison of the physical properties of TEL and TML follows:

		TEL	TML
Formula		$(C_2H_5)_4Pb$	$(CH_3)_4Pb$
Molecular Wt.		323.45	267.35
Percent Pb		64.06	77.51
Density at 20° C		1.652	1.995
Vapor Pressure, mm Hg.	20°C	0.25	26
	60°C	4.0	155
	100°C	32	560

Very truly yours,