

Company : Esso Research & Engineering Co.
Executive Offices

March 16, 1959

Location : Linden, New Jersey

Date : February 27, 1959

Report by : M. A. Remondino

Present : Dr. R. E. Eckardt, Dir. Medical Res. Div. - Esso R & E
Dr. Bennison, Asst. Dir. Medical Res. Div. "
Dr. J. G. McNab, Deputy to W. J. Sweeney "
Dr. N. V. Hakala, Dir. Prod. Res. Div. "
Mr. T. M. Korn, Group Leader, Prod. Res. Div. "
Mr. W. C. Asbury, V. P., Patents, Contracts, Licensing "

Dr. R. A. Kehoe - Ethyl Corporation
Mr. R. K. Scales "
Mr. M. A. Remondino "

Subject: Mixed Lead Alkyls

On July 20, 1956, Esso Research and Engineering Company and Ethyl Corporation entered into a secrecy agreement concerning discussions and exchange of information incident to the discovery by Esso Research and its affiliates of important difficulties in the road performance of leaded fuels of certain compositions used in some foreign cars. The depreciation in some cars is quite serious, and tests showed that the problem can be reduced to a considerable extent by using organic lead compounds more volatile than TEL. Results from their tests on lighter lead compounds have been furnished to Ethyl Corporation.

On February 17, Dr. McNab of Esso Research called and asked that we bring them up-to-date on any new developments on the subject of more volatile lead alkyl compounds.

At the start of the meeting, Esso R & E and Ethyl agreed that the discussion covered at this meeting falls within the terms of the secrecy agreement.

Dr. J. G. McNab then stated that they would be interested in being brought up-to-date on the subject of alkyl lead compounds lighter than tetraethyl. He said Esso R & E are interested in anything we might be doing along this line because of the benefits they found from using mixed alkyls and tetramethyllead in the solution of the foreign car problem. He further stated that the benefits from TML were far greater than from the mixed alkyls which they tested.

R. K. Scales summed up briefly some of the work going on at our Baton Rouge Research Laboratories on process development and manufacturing safety for lighter lead alkyls. He mentioned that interest expressed by others was partly responsible for the additional work being done, and that the discussions with others were likewise under secrecy agreements. Mr. Scales mentioned that one of the most important factors in the use of lighter lead alkyls in gasoline was the hygienic aspects, so for this meeting we had Dr. Kehoe available to discuss any developments along this line since his last communications with Dr. Eckardt.

Dr. Kehoe began his discussion by briefly summarizing our more than 30 years experience in the over-all handling of tetraethyllead (manufacture, transportation and blending in gasoline). He emphasized that the handling of lead either in the manufacture or in gasoline causes little concern when the material is in the hands of either the lead manufacturers or the petroleum industry. This is because the two industries require close adherence to the special precautions developed years ago. The precautionary measures by the petroleum industry to guard against other hazards of handling gasoline have contributed greatly to the safety of having TEL in gasoline.

Dr. Kehoe cited some cases he thought were representative of the worse possible conditions of handling leaded gasoline, which occurred in some unusual circumstances during the war. He went on to describe can-filling operations, particularly in Egypt, in which cases of lead poisoning were found (he mentioned forty cases, fifteen of which were fatal.). He further stated that in this instance an experiment designed to produce lead poisoning probably could not have been designed better than the actual case. Many of the people involved in this particular operation became intoxicated from gasoline vapors and would have to leave the completely enclosed building to recover.

Dr. Kehoe stated that in more than 30 years of our experience there has been no case of lead poisoning from handling leaded gasoline in the normal fashion. It was his opinion that a person can bathe in leaded gasoline without measurable lead absorption. He stated that the skin absorption of lead is negligible at a concentration one part of lead in 800 of gasoline.

It was Dr. Kehoe's opinion that as of now tetramethyllead cannot be used instead of tetraethyllead. In the absence of actual data, he said TML might be safe enough to offset the additional volatility on the basis that TML decomposes slower in the body and therefore, it can be more readily excreted. Apparently, the organic form is more readily excreted than the inorganic form, and the inorganic form is far more dangerous to the body tissues.

Dr. Kehoe then covered the data he had from experiments on the various ways of taking lead into the body. The following tabulations contain some of the data he offered.

1. Inhalation (These data are indications)

Experiments on rabbits, exposure 1 hour.

Concentration expressed as mg Pb/liter air

<u>Compound</u>	<u>Lethal Dose</u> in	<u>Non-Lethal Dose</u>
TEL	.2 mg (lethal with/72 hr.)	
TML	4.5	2.3
Me ₃ Et	2.0	
Et ₃ Me	± 4.0 (questionable)	
Me ₂ Et ₂	No data	
E Mixture	± 4.0	

2. Oral - Experiments on Rabbits

Concentration Expressed as mg/kilo of body Weight

<u>Compound</u>	<u>Lethal Dose</u>	<u>Non-Lethal Dose</u>
TEL	40	20
TML	20	10
Me ₃ Et	15	10
Me ₂ Et ₂	10	7
Et ₃ Me	20	15
E Mixture	25	20

3. Skin Absorption. Experiments on Rabbits, 3 hr. exposure.

Neat Compounds

TEL .75 ml/kilo body wt. is lethal
TML 7 gr/kilo body wt. is not lethal

TEL at conc. of .5 ml/kilo body wt. of Guinea Pig is lethal
Neat TML applied to skin will not produce fatality

Dr. Kehoe stated that so far as lead is concerned acute toxicity is relatively unimportant. The important thing is the accumulation of small amounts on a day to day basis.

In response to a question by Dr. Eckardt, Dr. Kehoe stated that the symptomatology is indistinguishable between humans, rabbits and other subjects of their experiments. The subject of lead poisoning goes into a psychiatric state - humans appear terrified - and can be setoff into this state rather easily. Survivors appear to recover completely with no brain damage. This is based on observations by Dr. Kehoe.

Dr. Eckardt stated they had no trouble (hygienic) when gasolines contained benzene in years gone by, but based on present knowledge of the toxicity of benzene it would be considered a dangerous component of gasoline.

Dr. Hakala asked what would be the evaporation characteristics of tetramethyllead if the volatility of the fuel is varied over a substantial range. We have no data on this.

In response to question by Dr. Eckardt, Dr. Kehoe stated that the expenditure by Ethyl Corporation on the medical aspects of use of tetraethyllead is approximately \$100,000 per year.

In answer to a question concerning the effect of tetraethyllead and other lead sources on air pollution, Dr. Kehoe stated that in the Los Angeles - Pasadena area, under the worse conditions of inversion, the concentration of lead-in-air is about 5 to 7 micrograms per cubic meter.

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In response to their question, R. K. Scales gave them a rundown on our new price estimates for the mixed alkyls, and tetramethyllead. They were also interested in our target so far as timing for commercial availability was concerned. Mr. Scales answered by saying that our plans include the possibility of commercial quantities becoming available January 1, 1960 if necessary.

The Esso people thought it might be a good idea for them to take another look at the mixed alkyls for domestic as well as overseas use.

Dr. Eckhardt stated that he had heard rumors there is a possibility that the lead limitation of 3 cc per gallon might be raised to 4 cc in the future. Dr. Kehoe answered by saying we had taken the proposal to the Surgeon General, and it is presently under consideration by the Surgeon General and his staff.

Some discussion was had on the laboratory and road performance of the mixed alkyls and tetramethyllead, and also on the evaporation characteristics of these compounds. After the discussion of this phase, copies of the following were left with Dr. Hakala.

"Evaporation of Lead Alkyls" H. J. Gibson, Jan. 15, 1959

"Evaporation of Lead Alkyls in Gasoline" H. A. Beatty
October 9, 1958

A writeup "Laboratory Antiknock Evaluation of TML, MA-250, MA-500, MA-750 and TEL In Finished Gasolines" Refinery Technology.

Several tables showing the Laboratory Octane Number and the Road Performance in a Cadillac and a high compression Pontiac. Included in these data were curves showing octane-temperature profiles of several fuels used in the road rating programs.

Dr. Hakala and Mark Korn said they would advise us if they have need for samples of the mixed alkyls.

M. A. Remondino
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MAR:ss

cc: Mr. H. J. Gibson
Mr. D. M. Guy
Dr. R. A. Kehoe ✓
Dr. G. F. Kirby
Mr. M. D. McDorman
Mr. R. K. Scales
Mr. M. A. Remondino Files
Mr. H. E. Hesselberg