[redacted]

For the first time in 30 years, a new antiknock agent is being used in place of tetrae
The Standard Oil Company of California has recen
it is now using tetramethyl lead, known under th
in its gasolines.

Several years ago, scientists at the C
Corporation, Standard Oil Company of California'
sidiary, discovered that TML does a better job a
agent than TEL in modern gasolines used in high
It's estimated that the substitution of TML for
line will produce an improvement in the operatio
automatic transmission car by a noticeable increase in road octane number. Considerably greater improvements result when such gasolines are used in certain "stick shift" cars.

The successful use of Methyl climaxes a major research project conducted for over 10 years at Cal Research. During this time, Cal Research acquired new knowledge of the preflame reactions of hydrocarbons that cause engine knock and the mechanism by which antidetonants suppress knock. They carried on shock tube studies designed to measure thermal stabilities of the antiknock compounds.

Over the years, the proportion of aromatic hydrocarbons in gasoline has increased and has affected combustion reactions. High compression engines subject gasoline to much higher temperatures and pressures than occurred in older style engines. These changes in fuel composition and operating conditions make new Methyl more effective than TEL.

After determining that TML was more effective than TEL, particularly in road ratings, the practicality of using this additive had to be established. It was soon determined that TML could be manufactured economically. Extensive tests also proved that there were no harmful effects of TML on engine life.

Exhaustive tests demonstrated to the Surgeon General of the United States that no public health problem would be introduced from the replacement of TEL with TML. To provide this information Cal Research requested the cooperation of both the Ethyl and Du Pont

Corporations. Dr. R. A. Kehoe, Director of the Kettering Laboratory, Department of Preventive Medicine and Industrial Health, University of Cincinnati Medical School, world authority on lead toxicology, was retained as a consultant in this work. Initially the safety of using TML in gasoline was questioned because its vapor pressure is somewhat higher than that of TEL. Toxicity tests were arranged in a garage in which over 500 fueling operations were conducted per day. The particular garage was chosen because the concentration of gasoline vapors and exhaust fumes was considerably higher than average.

Lead contents of the garage atmosphere and of the urine and blood of the garage attendants were carefully monitored over a three-month period. Two test gasolines, one containing 3 ml of TEL per gallon, followed by the other containing TML at the same lead concentration, were supplied for the test period. No increase of the lead contents of either the urine or the blood resulted from the replacement of TEL with TML. These findings established that TML was indeed as safe as TEL.

When large-scale performance testing of gasolines containing TML and millions of miles of passenger car service were accumulated, Cal Research made the recommendation to the Standard Oil Company of California that TML be used in its gasolines. Standard Oil Company of California is the first to use Methyl antiknock compound commercially.

New plants have been constructed to supply Standard's needs. The entire current national production of TML is being used exclusively by Standard Oil Company of California until such time as additional production becomes available.

Initially, TML will cost refiners more than TEL. However, in the long run, this differential is expected to decrease.

This development is important to the refiner and consumer alike from the standpoint of the cost of alternative methods of increasing octane numbers of gasolines. Substitution of Methyl for TEL will raise the road octane number of the average premium gasoline at least one number. Nationwide TML can provide a saving over other methods of octane improvement of at least $30,000,000 per year, assuming that all premium gasolines are upgraded one road octane number by switching to Methyl antiknock compound. With economics such as these, Cal Research predicts that eventually Methyl will replace a large portion or all of the tetraethyl lead used today by other refiners.

FIRST NEW ANTIKNOCK AGENT IN 38 YEARS DEVELOPED FOR MOTOR GASOLINES

A new antiknock agent, tetramethyl lead, known by the trademark "Methyl", has been introduced in Standard Oil Company of California motor gasolines. Methyl is the first antiknock agent other than tetraethyl lead to be used on a commercial scale in motor gasolines in 38 years.

Known as a chemical compound for years, tetramethyl lead's potential was not recognized until it was applied to modern fuels. Several years ago, California Research Corporation, research subsidiary of Standard Oil Company of California, discovered in the course of their antiknock additive research that tetramethyl lead is superior to tetraethyl lead in high octane, high aromatic content fuels. The high compression ratio cars of today have higher cycle temperatures than the older cars, and tetraethyl lead breaks down too early in the cycle to give maximum effectiveness. The advantage of TML over TEL is pronounced in catalytically reformed stocks which are the heart of most modern high octane gasolines.

The decision to use TML commercially was based on extensive and road test vehicles. Thousands of hours of laboratory and performance testing and several million miles of field testing in passenger car service were required by Standard's management before approving TML in their gasolines.

Methyl Increases Octane Rating

The direct replacement of TEL by Methyl on an equivalent lead concentration basis raises the road octane quality of high octane premium gasolines from one to two octane numbers in most cars. An example of the gains in road octane numbers which may be obtained with Methyl are shown in the accompanying chart. These data are the improvements obtained in ten late model cars of a Cal Research road test fleet. The six test fuels were commercial production gasolines in the 98 to 102 F-1 octane range and varied from 20% to 45% in aromatic content. Road octane gain with Methyl over TEL varies among cars, but Standard has found Methyl always more effective than TEL in their commercial production premium fuels.

Engine Durability Does Not Change When TEL Is Replaced with Methyl

Although there is no apparent reason to suspect that Methyl would affect durability differently than TEL, this was well checked before commercialization. Engine tests included octane requirement increase (laboratory and fleet), piston varnish, oil ring plugging, fuel system condition, fuel pump life and intake system deposits. Laboratory tests covered storage stability, rust tests and the various gum tests. Methyl performed as well or better than TEL in all of these tests.

No Health Problems Introduced When Methyl Replaces TEL

It was also established that the substitution of TML for TEL in gasoline introduced no public health hazards. Old work on toxicity of lead compounds had shown that tetramethyl was one of the least toxic of all organic lead compounds. This prior data and other tests show that gasolines containing TML were safe for use in automobiles. Testing was a joint program involving the Standard Oil Company of California; Dr. R. A. Kehoe, Director of the Kettering Laboratory of Applied Physiology of the University of Cincinnati Medical School; and the lead suppliers, Ethyl Corporation and E. I. du Pont de Nemours and Company. The site chosen for the test program was a taxi fleet fueling station in a garage to obtain above-average gasoline vapor exposure. Lead in the garage atmosphere and in the urine and blood of 15 garage attendants was monitored for several months while using gasoline containing first three ml/gallon of TEL followed by an equivalent concentration of lead from TML. On the basis of these studies, Dr. Kehoe concluded that there was no indication of increased lead absorption by humans and therefore no hygienic reason why TML should not be used commercially. In this the U.S. Surgeon General concurred.

Methyl Will Initially Cost More Than TEL

Although it is predicted that on a contained lead basis Methyl will ultimately cost little more than TEL, it will initially cost the refiner more. Even at its current price, Methyl provides octane improvement in modern fuels considerably below processing costs for the same improvement in road octanes.

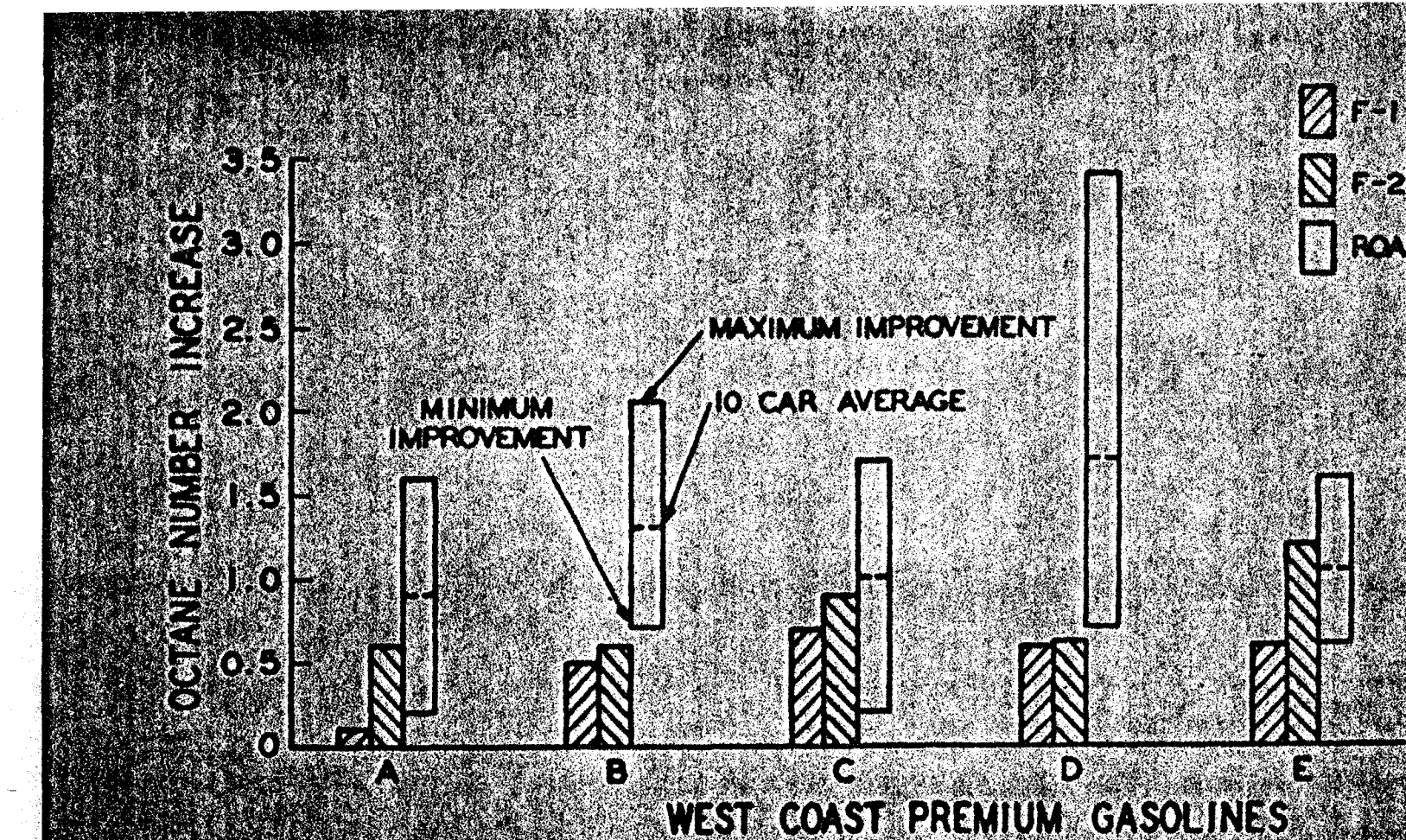
Recent press releases show that other companies are becoming aware of the virtues of tetramethyl lead. Because of the

early discovery by California Research Corporation and the prompt follow-up directed to commercialization, the Standard Oil Company of California is able to supply its customers with gasolines containing TML well ahead of others. New plants to manufacture Methyl have been constructed to supply Standard's needs. Their output will be used exclusively in Standard's gasolines until such time as additional production becomes available.

Attach.-Chart

WEST COAST PREMIUM GASOLINES

THIS FIGURE SHOWS INCREMENTAL INCREASE IN F-1 AND F-2 LABORATORY ENGINE OCTA
REPLACING TEL BY TML IN THE SAME SIX GASOLINES. THE RELATIONSHIP BETWEEN F.
OCTANE IMPROVEMENT SHOWN ARE TYPICAL FOR A MAJORITY OF GASOLINES TESTED BY C



THIS FIGURE SHOWS INCREMENTAL INCREASE IN F-1 AND F-2 LABORATORY ENGINE OCT
REPLACING TEL BY TML IN THE SAME SIX GASOLINES. THE RELATIONSHIP BETWEEN F
OCTANE IMPROVEMENT SHOWN ARE TYPICAL FOR A MAJORITY OF GASOLINES TESTED BY