

Tech Notes

Lead in Gasoline

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In November of 2013 I gave a seminar of fuel additives and made a statement that gasoline in the 20's, 30's, and 40's. 50's, 60's and early 70's had lead added to it from the oil companies. That statement was meant with resistances and some people said that lead was not in the gasoline during the Model A time period. I offer the following information for your study. This was printed from Wikipedia which is an on line encyclopedia.

<http://en.wikipedia.org>

History

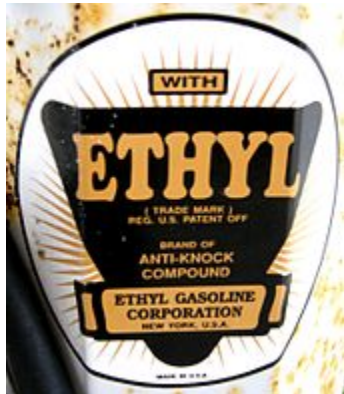
The first automotive combustion engines, so-called Otto engines, were developed in the last quarter of the 19th century in Germany. The fuel was a relatively volatile hydrocarbon obtained from coal gas. With a boiling point near 85 °C (octanes boil about 40 °C higher), it was well suited for early carburetors (evaporators). The development of a "spray nozzle" carburetor enabled the use of less volatile fuels. Further improvements in engine efficiency were attempted at higher compression ratios, but early attempts were blocked by knocking (premature explosion of fuel). In the 1920s, antiknock compounds were introduced by Migley and Boyd, specifically tetraethyl lead (TEL). This innovation started a cycle of improvements in fuel efficiency that coincided with the large-scale development of oil refining to provide more products in the boiling range of gasoline's. In the 1950s oil refineries started to focus on high octane fuels, and then detergents were added to gasoline to clean the jets and carburetors. The 1970s witnessed greater attention to the environmental consequences of burning gasoline. These considerations led to the phasing out of TEL and its replacement by other antiknock compounds. Subsequently, low-sulfur gasoline was introduced, in part to preserve the catalysts in modern exhaust systems.

Tetraethyl lead

Main article: Tetraethyl lead

Gasoline, when used in high-compression internal combustion engines, tends to auto ignite (*detonate*) causing damaging "engine knocking" (also called "pinging" or "pinking") noise. To address this problem, tetraethyl lead (TEL) was widely adopted as an additive for gasoline in the 1920s. With the discovery of the extent of environmental and health damage caused by the lead, however, and the incompatibility of lead with catalytic converters, leaded gasoline was phased out beginning in 1973. By 1995, leaded fuel accounted for only 0.6% of total gasoline sales and less than 2000 short tons (1814 t) of lead per year. From 1 January 1996, the U.S. Clean Air Act banned the sale of leaded fuel for use in on-road vehicles. The use of TEL also necessitated other additives, such as dibromoethane.

Formulation of ethyl fluid



Sign on an antique gasoline pump advertising tetraethyl lead by the Ethyl Corporation

TEL was supplied for mixing with raw gasoline in the form of **ethyl fluid** which was TEL blended with the lead scavengers 1,2-dibromoethane and 1,2-dichloroethane. Ethyl fluid also contained a reddish dye to distinguish treated from untreated gasoline and discourage the use of leaded gasoline for other purposes such as cleaning.

Ethyl fluid was added to gasoline at a ratio of 1:1260, usually at the refinery. Because of the widespread use and toxic nature of ethyl fluid, the Ethyl Corporation developed an expertise in its safe handling. In the 1920s before safety procedures were yet developed, 17 workers for the Ethyl Corporation, DuPont, and Standard Oil died from the effects of exposure to lead.

The formula for ethyl fluid is:

- Tetraethyl lead 61.45%
- 1,2-Dibromoethane 17.85%
- 1,2-Dichloroethane 18.80%
- Inerts & dye 1.90%

Dibromoethane and dichloroethane act in a synergistic manner, where a particular mixing ratio provides the best lead scavenging ability.

In the U.S. in 1972, the United States Environmental Protection Agency launched an initiative to phase out leaded gasoline based on a regulation under the authority of the Clean Air Act Extension of 1970. Ethyl Corp's response was to sue the EPA. Although the EPA's regulation was initially dismissed the EPA won the case on appeal, so the TEL phase out began in 1976 and was completed by 1986. A 1994 study indicated that the concentration of lead in the blood of the U.S. population had dropped 78% from 1976 to 1991.