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Methyl Tertiary Butyl Ether (MTBE)

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Gasoline

Note: EPA no longer updates this information, but it may be useful as a reference or resource.

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MTBE in Fuels

2013 status update

In 2005, Congress passed the Energy Policy Act that removed the oxygenate requirement for reformulated gasoline (RFG). At the same time, Congress also instituted a renewable fuel standard. In response, refiners made a wholesale switch removing MTBE and blending fuel with ethanol. According to EPA's RFG Survey Data, MTBE has not been used in significant quantities in RFG areas since 2005. A similar decrease in MTBE use has also been observed in conventional gasoline areas.

What is MTBE?

MTBE (methyl tertiary-butyl ether) is a chemical compound that is manufactured by the chemical reaction of methanol and isobutylene. MTBE is produced in very large quantities (over 200,000 barrels per day in the U.S. in 1999) and is almost exclusively used as a fuel additive in motor gasoline. It is one of a group of chemicals commonly known as "oxygenates" because they raise the oxygen content of gasoline. At room temperature, MTBE is a volatile, flammable and colorless liquid that dissolves rather easily in water.

Why was it used?

MTBE had been used in U.S. gasoline at low levels since 1979 to replace lead as an octane enhancer (helps prevent the engine from "knocking"). Between 1992 and 2005, MTBE had been used at higher concentrations in some gasoline to fulfill the oxygenate requirements set by Congress in the 1990 Clean Air Act Amendments. (A few cities, such as Denver, used oxygenates (MTBE) at higher concentrations during the wintertime in the late 1980's.)

Oxygen helps gasoline burn more completely, reducing harmful tailpipe emissions from motor vehicles. In one respect, the oxygen dilutes or displaces gasoline components such as aromatics (e.g., benzene) and sulfur. In another, oxygen optimizes the oxidation during combustion. Most refiners have chosen to use MTBE over other oxygenates primarily for its blending characteristics and for economic reasons.

What are the oxygenate requirements of the Clean Air Act?

The Clean Air Act Amendments of 1990 (CAA) required the use of oxygenated gasoline in areas with unhealthy levels of air pollution. The CAA did not specifically require MTBE. Refiners could choose to use other oxygenates, such as ethanol. The two oxygenated gasoline programs were:

Winter Oxyfuel Program: Originally implemented in 1992, the CAA requires oxygenated fuel (gasoline containing 2.7 percent oxygen by weight) during the cold

months [in cities \(PDF\)](#) (4 pp, 2.09MB, EPA-420-B-03-003, October 2001) that have elevated levels of carbon monoxide. Ethanol is now the only oxygenate used in this program.

Year-round Reformulated Gasoline Program: Since 1995, the CAA requires reformulated gasoline (RFG) year-round [in cities](#) with the worst ground-level ozone (smog). Between 1995 and May 2006, RFG required the use of oxygen in gasoline (minimum of 2 percent oxygen by weight). Refiners chose MTBE as the main oxygenate in RFG in cities outside of the Midwest primarily for economic reasons and its blending characteristics. Unlike ethanol, MTBE can be shipped through existing pipelines, and its volatility is lower, making it easier to meet the emission standards.

To address its unique air pollution problems, California has adopted similar, but more stringent requirements for its gasoline ([California RFG](#)). [EXIT Disclaimer](#)

What are the [air quality benefits \(PDF\)](#) (4 pp, 131K, EPA420-F-99-040, November 1999) of using reformulated gasoline (RFG) that contains oxygenates?

RFG has been helping improve the air for millions of Americans since 1995. The use of RFG compared to conventional gasoline has resulted in annual reductions of smog-forming pollutants (volatile organic compounds and nitrogen oxides) and toxics (such as benzene). With the [second phase \(PDF\)](#) (2 pp, 127K, EPA420-F-99-042, November 1999) of RFG program, which began January 2000, EPA estimates that smog-forming pollutants are being reduced annually by at least 105 thousand tons, and toxics by at least 24 thousand tons. Refiners are required to reduce the emissions of volatile organic compounds, toxics, and nitrogen oxides by 27, 22, and 7 percent, respectively, compared to the conventional gasoline they produced in 1990.
