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MTBE in Fuels

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 is it used?

MTBE has been used in U.S. gasoline at low levels since 1979 to replace lead as an octane enhancer (helps prevent the engine from "knocking"). Since 1992, MTBE has 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) require the use of oxygenated gasoline in areas with unhealthy levels of air pollution. The CAA does not specifically require MTBE. Refiners may choose to use other oxygenates, such as ethanol. The two oxygenated gasoline programs are:

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, 132K, October 2001) that have elevated levels of carbon monoxide. Ethanol is the primary 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). RFG is oxygenated gasoline (minimum of 2 percent oxygen by weight) that is specially blended to have fewer polluting compounds than conventional gasoline. At this time, about 30 percent of this country's gasoline is reformulated gasoline, of

which about 87 percent (PDF) (6 pp, 30K) contains MTBE. Refiners have chosen 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 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.

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Additional Information

You can access additional documents on MTBE in gasoline and its air quality benefits from the Office of Transportation and Air Quality Web site.

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