

Sources of Exposure

General Populations

- The general population may be exposed to MTBE through inhalation of ambient air or ingestion of contaminated water.
- Dermal exposure and inhalation may also occur during bathing or washing activities if the water contains MTBE.
- Dermal exposure and inhalation may occur in populations living near industrial or hazardous waste sites.

Occupational Populations

- MTBE is no longer used as a gasoline additive in the United States; however, it is still manufactured and exported to other nations.
- Workers employed in industries that manufacture, formulate, store, or transport MTBE, and workers involved in the disposal of MTBE-containing wastes, are expected to have greater exposures than the general population.

Toxicokinetics and Biomonitoring

Toxicokinetics

- MTBE is readily absorbed following inhalation or oral exposure, and to a lesser extent following dermal exposure.
- Absorbed MTBE is initially widely distributed; the liver contains a large percentage of the initial body burden; smaller amounts are found in lungs, kidney, and testes.
- Most absorbed MTBE is rapidly metabolized; hepatic first-pass metabolism of MTBE is likely following oral exposure.
- MTBE metabolites are rapidly excreted, predominantly in the urine.

NHANES Biomonitoring

- In the 2015–2016 National Health and Nutrition Examination Survey (NHANES), geometric mean and 95th percentile concentrations were below the limit of detection.

Biomarkers/Environmental Levels

Biomarkers

- MTBE and its metabolite, *tert*-butanol, can be measured in expired air and blood after recent exposure.
- The primary urinary metabolite, 2-hydroxyisobutyric acid, can also serve as a biomarker for recent exposure. However, MTBE metabolites are not unique to MTBE.

Environmental Levels

Air

- Levels of MTBE measured at 3,146 locations across the United States (2018) were <0.8 ppbv.

Water

- In a nationwide survey of groundwater and surface water samples, MTBE was detected in 7% of the samples, with concentrations ranging from 0.016 to 0.226 µg/L.

Sediment and Soil

- There are no recent monitoring data for levels of MTBE in sediment or soil.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2021. Toxicological Profile for Methyl *tert*-Butyl Ether (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuideTM for Methyl *tert*- Butyl Ether (MTBE)



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Chemical and Physical Information

Methyl *tert*-Butyl Ether (MTBE) is a Liquid

- MTBE is a volatile organic compound (VOC). It is a colorless liquid with a terpene-like odor.
- MTBE is flammable and moderately soluble in water.
- MTBE is very soluble in some organic solvents such as alcohol and ether.
- In the 1980s, MTBE was added to gasoline as an effort to reduce air pollution. Due to increased levels in the environment (e.g., groundwater) and concerns regarding toxicity, MTBE was removed as an additive to gasoline in the United States in 2005.
- MTBE is still used as an oxygenate in many countries, and MTBE is still manufactured in large quantities in the United States and exported to other nations.
- MTBE was previously used in the United States as a pharmaceutical to dissolve gallstones in patients for which surgery was not an option. MTBE has not been approved for medical use in the United States since 2015, but is still used as a non-surgical option in other countries.

Routes of Exposure

- Inhalation – Likely route of exposure for general and occupational populations.
- Oral – Likely route of exposure for the general population through ingestion of contaminated water.
- Dermal – Possible route of exposure for general population through bathing or washing in water containing MTBE. Occupational populations are more likely to be exposed to MTBE via the dermal route.

MTBE in the Environment

- In the air, MTBE is expected to exist entirely in the vapor phase. It can be transported to the earth by wet and dry deposition.
- The atmospheric half-life is estimated to be 2.4 days.
- MTBE tends to volatilize rapidly from surface water and surface soils.
- Due to its high mobility in soil, any MTBE that is not volatilized is likely to leach into lower soil horizons and contaminate groundwater.
- MTBE is slow to degrade in water.
- MTBE is unlikely to bioconcentrate in aquatic or terrestrial organisms.

Relevance to Public Health (Health Effects)

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

Inhalation

- An acute-duration (≤ 14 days) inhalation MRL of 2 ppm was derived for MTBE.
- An intermediate-duration (15–364 days) MRL of 1 ppm was derived for MTBE.
- A chronic-duration (≥ 365 days) inhalation MRL of 1 ppm was derived for MTBE.

Oral

- No acute- or chronic-duration oral MRLs were derived for MTBE.
- An intermediate-duration (15–364 days) oral MRL of 0.6 mg/kg/day was derived for MTBE.

Health Effects

- The predominant and immediate effects of inhaling high levels of MTBE in people and animals are transient central nervous system (CNS) depression, nausea, vomiting, dizziness, hypoactivity, ataxia, and anesthesia.

Health Effects

- Patients treated with intracystic MTBE for gallstone dissolution report gastrointestinal side effects (vomiting, nausea, anorexia) and hepatic side effects.
- Oral and inhalation exposure of MTBE in animals leads to respiratory and gastrointestinal tract irritation and/or inflammation, hepatic toxicity, CNS depression, and male reproductive toxicity.
- Developmental toxicity (litter resorption, post-implantation loss, delayed ossification, cleft palate) was only observed after inhalation exposure to high concentrations of MTBE at levels that also resulted in overt parental toxicity.
- Chronic inhalation exposure of MTBE in animals resulted in an increase in hepatic tumors, while oral exposure led to testicular tumors, lymphoma, and leukemia.
- The International Agency for Research on Cancer (IARC) has determined that MTBE was not classifiable as to its carcinogenicity in humans. The Environmental Protection Agency (EPA) and The Department of Health and Human Services (HHS) have not classified the potential for MTBE to cause cancer in humans.

Children's Health

- It is not known if children are more sensitive to MTBE exposure than adults.