

Methyl Ethyl Ketone (2-Butanone)

78-93-3

Hazard Summary

Methyl ethyl ketone is used as a solvent. Acute (short-term) inhalation exposure to methyl ethyl ketone in humans results in irritation to the eyes, nose, and throat. Limited information is available on the chronic (long-term) effects of methyl ethyl ketone in humans. Chronic inhalation studies in animals have reported slight neurological, liver, kidney, and respiratory effects. No information is available on the developmental, reproductive, or carcinogenic effects of methyl ethyl ketone in humans. Developmental effects, including decreased fetal weight and fetal malformations, have been reported in mice and rats exposed to methyl ethyl ketone via inhalation and ingestion. EPA has classified methyl ethyl ketone as a Group D, not classifiable as to human carcinogenicity.

Please Note: The main sources of information for this fact sheet are EPA's Health Effects Assessment for Methyl Ethyl Ketone (1) and EPA's Integrated Risk Information System (IRIS) (6), which contains information on inhalation chronic toxicity of methyl ethyl ketone and the RfC and oral chronic toxicity and the RfD.

Uses

- The primary use of methyl ethyl ketone is as a solvent in processes involving gums, resins, cellulose acetate, and cellulose nitrate. (1)
- Methyl ethyl ketone is also used in the synthetic rubber industry, in the production of paraffin wax, and in household products such as lacquer and varnishes, paint remover, and glues. (1)

Sources and Potential Exposure

- Methyl ethyl ketone has been detected in both indoor and outdoor air. Methyl ethyl ketone can be produced in outdoor air by the photooxidation of certain air pollutants, such as butane and other hydrocarbons. (1)
- Methyl ethyl ketone has been found in drinking water and surface water at a number of sites. (2)
- Exposure to methyl ethyl ketone could also occur at the workplace and through exposure to household products containing the chemical. (1)

Assessing Personal Exposure

- Levels of methyl ethyl ketone in the urine can be measured to determine exposure to the chemical. (1)

Health Hazard Information

Acute Effects:

- Acute exposure of humans to high concentrations of methyl ethyl ketone produces irritation to the eyes, nose, and throat. (1,4)
- Other effects reported from acute inhalation exposure in humans include central nervous system depression, headache, and nausea. (1,4)
- Dermatitis has been reported in humans following dermal exposure to methyl ethyl ketone. (1)

- Tests involving acute exposure of rabbits has shown methyl ethyl ketone to have **high** acute toxicity from dermal exposure, while acute oral exposure of rats and mice has shown the chemical to have **moderate** toxicity from ingestion. (5)
- Acute inhalation tests in rats indicate **low** toxicity from methyl ethyl ketone exposure via inhalation. (5)

Chronic Effects (Noncancer):

- Limited information is available on the chronic effects of methyl ethyl ketone in humans from inhalation exposure. One study reported nerve damage in individuals who sniffed a glue thinner containing methyl ethyl ketone and other chemicals. (1)
- Slight neurological, liver, kidney, and respiratory effects have been reported in chronic inhalation studies of methyl ethyl ketone in animals. (1)
- The Reference Concentration (**RfC**) for methyl ethyl ketone is 1 milligram per cubic meter (mg/m^3) based on decreased fetal birth weight in mice. The **RfC** is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the **RfC**, the potential for adverse health effects increases. Lifetime exposure above the **RfC** does not imply that an adverse health effect would necessarily occur. (6)³
- EPA has medium confidence in the principal study on which the **RfC** is based because it is well designed and tested several exposure concentrations and several endpoints of toxicity although there are insufficient data presented for possible respiratory effects; low confidence in the database because there are no multigenerational studies and only one subchronic study and portal-of-entry effects are not adequately addressed; and, consequently, confidence in the **RfC** is low. (6)
- The Reference Dose (**RfD**) for methyl ethyl ketone is 0.6 milligrams per kilogram body weight per day ($\text{mg}/\text{kg}/\text{d}$) based on decreased fetal birth weight in rats. (6)
- EPA has low confidence in the study on which the **RfD** is based because lowering the high-dose group from 3.0 to 2.0% confounded determination of the critical effect; low confidence in the database because of the lack of oral data for MEK itself, the absence of data in a second species, and the lack of long-term metabolism data; and, consequently, low confidence in the **RfD**. (6)

Reproductive/Developmental Effects:

- No information on the reproductive or developmental effects of methyl ethyl ketone in humans was located.
- An inhalation study in mice exposed to methyl ethyl ketone reported decreased fetal weight and fetal malformations. Developmental effects have also been reported in rats following oral and inhalation exposures. (4,7)

Cancer Risk:

- No information on the carcinogenicity of methyl ethyl ketone in humans was located.
- No studies were available on the carcinogenicity of methyl ethyl ketone by the oral or inhalation routes. In a dermal carcinogenicity study, skin tumors were not reported from methyl ethyl ketone exposure. (1,6)
- EPA has classified methyl ethyl ketone as a Group D, not classifiable as to human carcinogenicity, based on a lack of data concerning carcinogenicity in humans and animals. (6)

Physical Properties

- Methyl ethyl ketone is a colorless volatile liquid that is soluble in water. (2)
- The odor threshold for methyl ethyl ketone is 5.4 parts per million (ppm), with an acetone-like odor reported. (3)
- The chemical formula for methyl ethyl ketone is $\text{C}_4\text{H}_8\text{O}$ and the molecular weight is 72.10 g/mol. (7,9)
- The vapor pressure for methyl ethyl ketone is 95.1 mm Hg at 25 °C, and it has a log octanol/water partition coefficient ($\log K_{ow}$) of 0.261. (9)

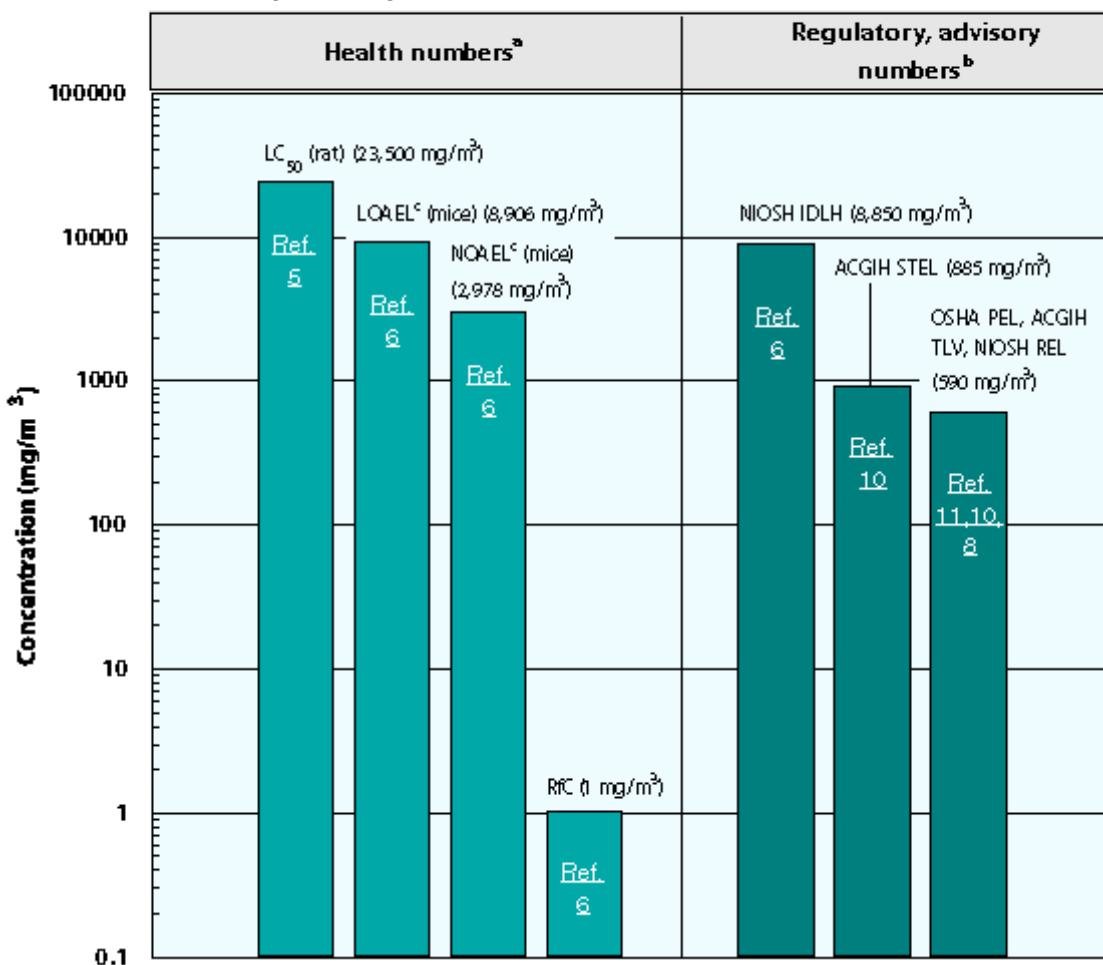
- Methyl ethyl ketone is also referred to as 2-butanone. (6)

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m³: mg/m³ = (ppm) × (molecular weight of the compound)/(24.45). For methyl ethyl ketone: 1 ppm = 2.95 mg/m³.

Health Data from Inhalation Exposure

Methyl Ethyl Ketone



ACGIH STEL --American Conference of Governmental and Industrial Hygienists' short-term exposure limit: 15-min time-weighted-average exposure that should not be exceeded at any time during a workday even if the 8-h time-weighted-average is within the threshold limit value.

ACGIH TLV --ACGIH's threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

LC₅₀ (Lethal Concentration₅₀) --A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

LOAEL --Lowest-observed-adverse-effect level.

NIOSH REL --National Institute of Occupational Safety and Health's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

NIOSH IDLH -- NIOSH's immediately dangerous to life or health concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.

NOAEL --No-observed-adverse-effect level.

OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

^a Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

^b Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

^c The LOAEL and NOAEL are from the critical study used as the basis for the EPA RfC.

References

Summary created in April 1992, Updated January 2000

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