

4,4'-Methylenebis(2-Chloroaniline) (MBOCA)

101-14-4

Hazard Summary

4,4'-Methylenebis(2-chloroaniline), which is also called MBOCA, is used as a curing agent for liquid polyurethane elastomers. In the only available acute (short-term) study of MBOCA in humans, an accidental exposure to MBOCA resulted in gastrointestinal distress, transitory kidney damage, and burning face and eyes in one worker. No information is available on the chronic (long-term), reproductive, or developmental effects of MBOCA in humans. Animal studies have reported effects on the lung, liver, and kidney from chronic oral exposure to MBOCA. Animal studies have reported that MBOCA produces tumors of the liver, lung, urinary bladder, and mammary glands from oral exposure. EPA has classified MBOCA as a Group B2, probable human carcinogen.

Please Note: The main source of information for this fact sheet is the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for 4,4'-Methylenebis(2-chloroaniline). (1)

Uses

- MBOCA is used as a curing agent for liquid polyurethane elastomers. These elastomers have been used to produce shoe soles; rolls for postage stamp machines; cutting bars in plywood manufacturing; rolls and belt drives in cameras, computers, and reproducing equipment; and pulleys for escalators and elevators. (1)

Sources and Potential Exposure

- Occupational exposure to MBOCA may occur for those workers in factories that manufacture MBOCA or use it to produce plastic products. (1)
- The general population is unlikely to be exposed to MBOCA unless they live in an area known to be contaminated with the chemical. (1)

Assessing Personal Exposure

- There is a test that can measure MBOCA in the urine. However, this test will only detect recent exposures to the chemical. (1)

Health Hazard Information

Acute Effects:

- In one case, an accidental acute exposure of a worker to MBOCA, symptoms of gastrointestinal distress, transitory kidney damage, and burning face and eyes were reported. (1,2)
- Tests involving acute exposure of rats, mice, and guinea pigs have shown MBOCA to have moderate to high acute toxicity from oral exposure. (3)

Chronic Effects (Noncancer):

- No information is available on the chronic effects of MBOCA in humans.

- Animal studies have reported effects on the lung, liver, and kidney from chronic oral exposure to MBOCA. (1)
- EPA has not established a Reference Concentration (RfC) for MBOCA.
- EPA has calculated a provisional Reference Dose (RfD) of 0.0007 milligrams per kilogram body weight per day (mg/kg/d) for MBOCA based on liver and kidney effects in dogs. The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral 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 RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. The provisional RfD is a value that has had some form of Agency review, but is not on the IRIS system. (5)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of MBOCA in humans or animals.

Cancer Risk:

- In one epidemiologic study of 200 workers exposed to MBOCA, 3 men were diagnosed with bladder cancer. However, there were no controls in this study and no information on the exposure concentrations. (1)
- Animal studies have reported that MBOCA produces tumors of the liver, lung, urinary bladder, and mammary gland from oral exposure. (1,2,4)
- MBOCA has a chemical structure similar to benzidine, a known human bladder carcinogen, and to a potent animal carcinogen, 3,3'-dichlorobenzidine. (1)
- EPA has classified MBOCA as a Group B2, probable human carcinogen. (4)
- EPA uses mathematical models, based on animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA calculated an inhalation unit risk estimate of $3.7 \times 10^{-5} (\mu\text{g}/\text{m}^3)^{-1}$. (4)

Physical Properties

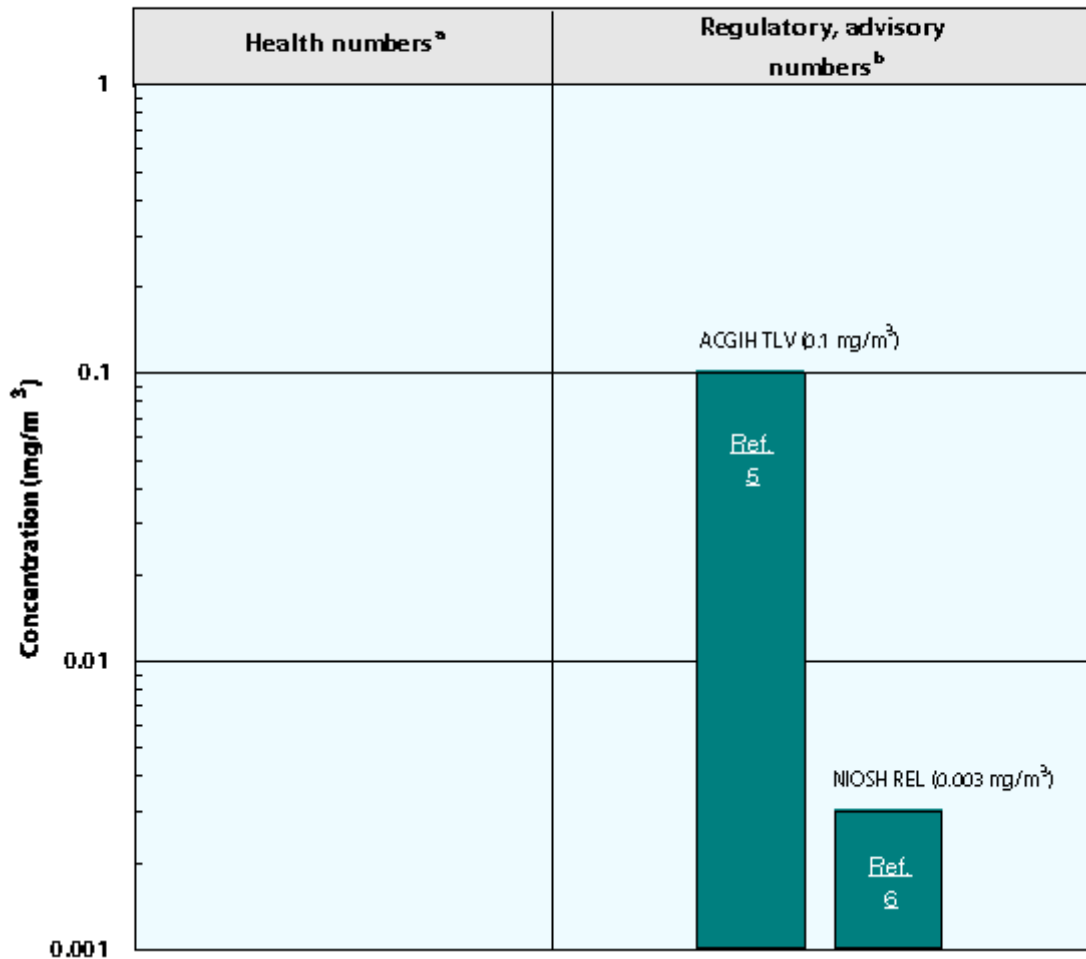
- Pure MBOCA is a colorless solid, but technical-grade MBOCA is yellow, tan, or brown pellets. (1)
- MBOCA is nearly odorless; the odor threshold is not available. (1)
- The chemical formula for MBOCA is $\text{C}_{13}\text{H}_{12}\text{Cl}_2\text{N}_2$, and the molecular weight is 267 g/mol. (1)
- The vapor pressure for MBOCA is 1×10^{-5} mm Hg at 25 °C, and it has a log octanol/water partition coefficient ($\log K_{ow}$) of 3.94. (1)

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m^3 : $\text{mg}/\text{m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$. For MBOCA: $1 \text{ ppm} = 10.9 \text{ mg}/\text{m}^3$. To convert concentrations in air from $\mu\text{g}/\text{m}^3$ to mg/m^3 : $\text{mg}/\text{m}^3 = (\mu\text{g}/\text{m}^3) \times (1 \text{ mg}/1,000 \mu\text{g})$.

Health Data from Inhalation Exposure

MBOCA



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

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.

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. NIOSH and ACGIH numbers are advisory.

Summary created in April 1992, updated January 2000

References

1. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for 4,4'-Methylenebis (2-Chloroaniline) (MBOCA). Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1994.
2. U.S. Department of Health and Human Services. Hazardous Substances Data Bank (HSDB, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
3. U.S. Department of Health and Human Services. Registry of Toxic Effects of Chemical Substances (RTECS, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
4. U.S. Environmental Protection Agency. Health Effects Assessment Summary Tables. FY 1997 Update.

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5. American Conference of Governmental Industrial Hygienists (ACGIH). 1999 TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents. Biological Exposure Indices. Cincinnati, OH. 1999.
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