

Bromoform

75-25-2

Hazard Summary

Exposure to bromoform may occur from the consumption of chlorinated drinking water. The acute (short-term) effects from inhalation or ingestion of high levels of bromoform in humans and animals consist of nervous system effects such as the slowing down of brain functions, and injury to the liver and kidney. Chronic (long-term) animal studies indicate effects on the liver, kidney, and central nervous system (CNS) from oral exposure to bromoform. Human data are considered inadequate in providing evidence of cancer by exposure to bromoform, while animal data indicate that long-term oral exposure can cause liver and intestinal tumors. Bromoform has been classified as a Group B2, probable human carcinogen.

Please Note: The main sources of information for this fact sheet are the Agency for Toxic Substances and Disease Registry's (ATSDR's) [Toxicological Profile for Bromoform and Chlorodibromomethane \(1\)](#) and EPA's [Integrated Risk Information System \(IRIS\) \(4\)](#), which contains information on oral chronic toxicity and the RfD, and the carcinogenic effects of bromoform including the unit cancer risk for inhalation exposure.

Uses

- Bromoform is used as a fluid for mineral ore separation in geological tests, as a laboratory reagent, and in the electronics industry in quality assurance programs. (1)
- Bromoform was formerly used as a solvent for waxes, greases, and oils, as an ingredient in fire-resistant chemicals and in fluid gauges. (1)
- It has also been used as an intermediate in chemical synthesis, as a sedative, and as a cough suppression agent. (1)

Sources and Potential Exposure

- The principal route of human exposure to bromoform is from drinking water that has been disinfected with chlorine, bromine, or bromine compounds. (1)
- Bromoform has been detected in swimming pools that have been disinfected with bromine or bromine compounds; therefore, exposure to low levels could occur from inhalation of bromoform that has evaporated into the air or through the skin from bromoform in the water. (1)
- Exposure could also occur from inhalation of ambient air near factories or laboratories that use bromoform. Another place for exposure is near a chemical waste site where bromoform leaked into water or soil. (1)

Assessing Personal Exposure

- Limited tests exist for determining exposure to bromoform. Measurable levels of bromoform can be detected in samples of the blood, breath, or fat, but these methods are best suited for detecting recent exposures. (1)

Health Hazard Information

Acute Effects:

- Human exposure to large amounts of bromoform through inhalation and oral exposure can result in unconsciousness. (1,2)
- Animal studies, combined with limited observations in humans, indicate that the principal adverse health effects associated with short-term inhalation or oral exposure to high levels of bromoform are CNS depression, resulting in the slowing down of normal brain activities, sedation, narcosis, and sleep, and liver and kidney injury. (1,2,4)
- Tests involving acute exposure of rats have shown bromoform to have moderate toxicity from oral and inhalation exposures. (3)

Chronic Effects (Noncancer):

- The long-term effects of exposure to bromoform in humans have not been studied.
- Animal studies indicate effects on the liver, kidney, and CNS from chronic oral exposure to bromoform. (1,2)
- The Reference Dose (RfD) for bromoform is 0.02 milligrams per kilogram body weight per day (mg/kg/d) based on hepatic lesions in rats. 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. (4)
- EPA has medium confidence in the study on which the RfD is based because it utilized both sexes of two species of animals and both species showed liver lesions, but the study did not investigate clinical chemistries or perform urinalysis; medium to low confidence in the database because several studies support the choice of hepatic lesions as the critical effect for the basis of the RfD, but the chosen study is of subchronic duration and reproductive effects have not been monitored; and, consequently, medium to low confidence in the RfD. (4)
- EPA has determined that there are insufficient data to calculate a Reference Concentration (RfC) for bromoform. (4)

Reproductive/Developmental Effects:

- No studies were located regarding developmental or reproductive effects in humans. (1,2)
- Animal studies indicate that oral exposure to bromoform does not cause developmental or reproductive effects. (1,2)

Cancer Risk:

- The only available human cancer study suggested a positive correlation between levels of bromoform in drinking water and the incidence of several tumor types. However, this study was considered to be incomplete and preliminary because the study design did not permit consideration of variables such as personal habits, residential histories, and past exposures. (1,2,4)
- Animal studies have shown an increase in the incidences of liver and intestinal tumors following oral exposure to bromoform. (1,2)
- EPA considers bromoform to be a probable human carcinogen and has ranked it in EPA's Group B2. (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 $1.1 \times 10^{-6} \text{ (}\mu\text{g}/\text{m}^3\text{)}^{-1}$. EPA estimates that, if an individual were to continuously breathe air containing bromoform at an average of $0.9 \mu\text{g}/\text{m}^3$ ($9 \times 10^{-4} \text{ mg}/\text{m}^3$) over his or her entire lifetime, theoretically that person would have no more than a one-in-a-million increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that breathing air containing $9.0 \mu\text{g}/\text{m}^3$ ($9 \times 10^{-3} \text{ mg}/\text{m}^3$) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing $90.0 \mu\text{g}/\text{m}^3$ ($9 \times 10^{-2} \text{ mg}/\text{m}^3$) would result in

not greater than a one-in-ten thousand increased chance of developing cancer. For a detailed discussion of confidence in the potency estimates, please see IRIS. (4)

- These cancer risk estimates were derived from oral data and converted to provide the estimated inhalation risk. (4)
- EPA has calculated an oral cancer slope factor of $7.9 \times 10^{-3} \text{ (mg/kg/d)}^{-1}$ (4)

Physical Properties

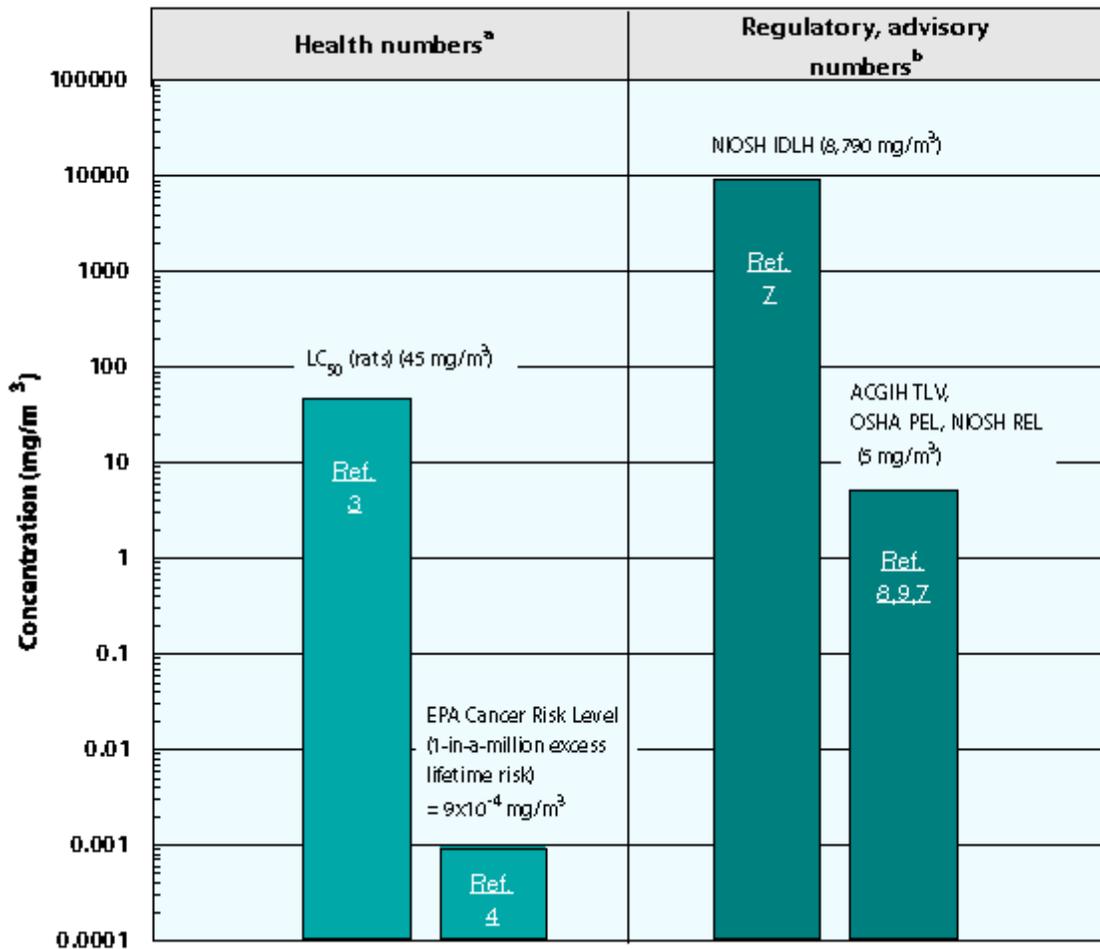
- Bromoform is a colorless to pale yellow liquid with a sweetish odor. (1,5)
 - The chemical formula for bromoform is CBr_3H and the molecular weight is 252.75 g/mol. (1,5)
 - The vapor pressure for bromoform is 5 mm Hg at 20 °C, and it has an octanol/water partition coefficient ($\log K_{ow}$) of 2.38. (1)
 - Bromoform has an odor threshold of 1.3 parts per million (ppm). (6)
 - Bromoform is slightly soluble in water and is nonflammable. (1,5)
 - Bromoform can form in drinking water as a by-product from the reaction of chlorine with dissolved organic matter and bromide ions. (1)
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Conversion Factors:

To convert concentrations in air (at 25°C) from ppm to mg/m^3 : $\text{mg/m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$. For bromoform: $1 \text{ ppm} = 10.34 \text{ mg/m}^3$. To convert concentrations in air from $\mu\text{g/m}^3$ to mg/m^3 : $\text{mg/m}^3 = (\mu\text{g/m}^3) \times (1 \text{ mg}/1,000 \mu\text{g})$.

Health Data from Inhalation Exposure

Bromoform



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.

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.

NIOSH IDLH -- National Institute of Occupational Safety and Health'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.

NIOSH REL -- NIOSH's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

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.

References

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