1,2-Dibromo-3-Chloropropane (DBCP)

96-12-8

Hazard Summary

1,2-Dibromo-3-chloropropane (DBCP) was used in the past as a soil fumigant and nematocide on crops; it is no longer used except as an intermediate in chemical synthesis. Acute (short-term) exposure to DBCP in humans results in moderate depression of the central nervous system (CNS) and pulmonary congestion from inhalation, and gastrointestinal distress and pulmonary edema from oral exposure. Chronic (long-term) exposure to DBCP in humans causes male reproductive effects, such as decreased sperm counts. Testicular effects and decreased sperm counts were observed in animals chronically exposed to DBCP by inhalation. Available human data on DBCP and cancer are inadequate. High incidences of tumors of the nasal tract, tongue, adrenal cortex, and lungs of rodents were reported in a National Toxicology Program (NTP) inhalation study. EPA has classified DBCP as a Group B2, probable human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (4), which contains information on inhalation chronic toxicity of DBCP, and the Reference Concentration (RfC) and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for 1,2-Dibromo-3-Chloropropane. (2)

Uses

- Until 1977, DBCP was used as a soil fumigant and nematocide on over 40 different crops in the United States. From 1977 to 1979, EPA suspended registration for all DBCP-containing products except for use on pineapples in Hawaii. In 1985, EPA issued an intent to cancel all registrations for DBCP, including use on pineapples. Subsequently, the use of existing stocks of DBCP was prohibited. (2)
- DBCP is used as an intermediate in the synthesis of organic chemicals. (1,2)

Sources and Potential Exposure

- Human exposure to DBCP could result from the the ingestion of contaminated drinking water and food. (2)
- In the past, release of DBCP to the environment occurred primarily from its fumigant and nematocide uses; because of the cancellation of all DBCP uses, environmental exposure is expected to decline with time. (1,2)

Assessing Personal Exposure

- DBCP can be measured in exhaled air, blood, and biological tissues. Samples must be collected shortly after exposure, because DBCP is rapidly eliminated from the body. (2)

Health Hazard Information

Acute Effects:

- Acute exposure to DBCP produces moderate depression of the CNS and pulmonary congestion after exposure by inhalation, and gastrointestinal distress and pulmonary edema after oral exposure in humans. (1,2)

- In rats acutely exposed to DBCP by inhalation, pulmonary and ocular irritation, and kidney, liver, spleen, and CNS effects have been observed. (2)
- Dermal exposure to DBCP may irritate the skin and eyes in humans and animals. (2,3,4)
- Tests involving acute exposure of rats, mice, rabbits, and guinea pigs have demonstrated DBCP to have high acute toxicity from inhalation, oral, and dermal exposure. (5)

Chronic Effects (Noncancer):

- No information is available on the chronic effects of DBCP in humans. (2)
- Chronic exposure to DBCP by inhalation has been reported to affect the nasal cavity, spleen, adrenal gland, kidneys, stomach, and liver in rats and mice. (4)
- The Reference Concentration (RfC) for DBCP is 0.0002 milligrams per cubic meter (mg/m^3) based on testicular effects in rabbits. 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 esimator 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. (4)
- EPA has medium confidence in the study on which the RfC was based due to the lack of reporting respiratory effects; medium confidence in the database because although chronic studies in two different species exist, the available reproductive studies were limited and there is uncertainty about occurrence of respiratory tract effects relative to testicular effects; and, consequently, medium confidence in the RfC. (4)
- EPA has not established a Reference Dose (RfD) for DBCP. (4)
- ATSDR has established an intermediate oral minimal risk level (MRL) of 0.002 milligrams per kilogram body weight per day (mg/kg/d) based on reproductive effects in rabbits. The MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. (2)

Reproductive/Developmental Effects:

- Chronic exposure to DBCP causes male reproductive effects. Decreased sperm counts have been observed in men occupationally exposed to DBCP; birth defects, prematurity, mortality, or spontaneous abortions were not associated with paternal exposure to DBCP. (2,4)
- Testicular effects and decreased sperm count were observed in animals chronically exposed to DBCP by inhalation. (4)
- Birth defects were not observed in rats exposed to DBCP by gavage (experimentally placing the chemical in their stomachs). (2,4)

Cancer Risk:

- Human data are inadequate on DBCP and cancer. The available studies involve multiple chemicals and do not control for confounding factors. (1,2,4)
- A study by the NTP reported tumors of the respiratory tract and tongue in male and female rats, tumors of the adrenal cortex in female rats, and tumors of the nasal cavity and lung in male and female mice when exposed to DBCP by inhalation. (8)
- A study by the National Cancer Institute (NCI) reported tumors of the forestomach in rats and mice and and mammary gland tumors in female rats exposed to DBCP by gavage. (9)
- EPA has classified DBCP as a Group B2, probable human carcinogen. (10)
- EPA has calculated an oral cancer slope factor of 1.4 $(mg/kg/d)^{-1}$ and an inhalation unit risk factor of 6.9 x 10^{-7} $(\mu g/m^3)^{-1}$. (10)

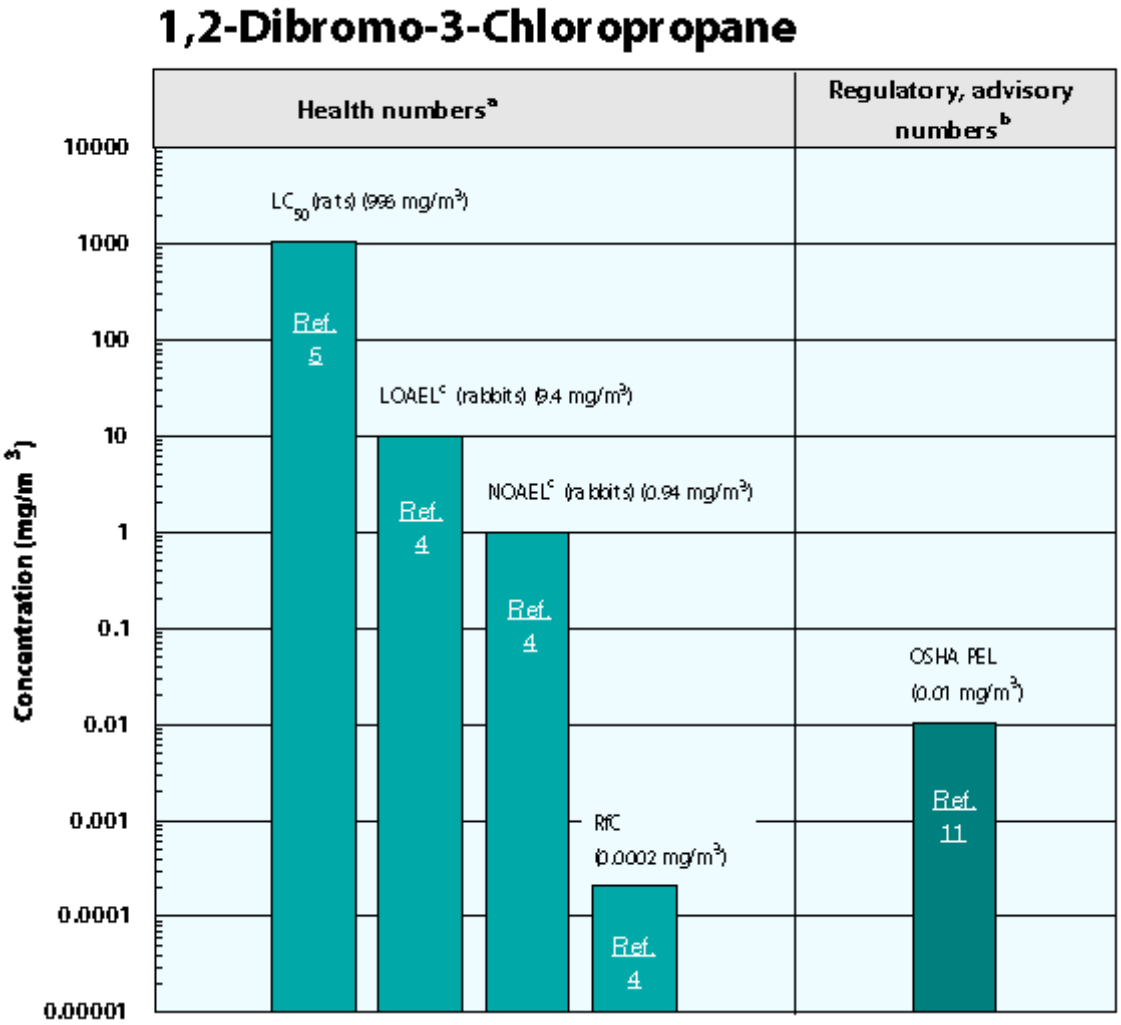
Physical Properties

- The chemical formula for DBCP is $C_3H_5Br_2Cl$, and the molecular weight is 236.36 g/mol. (2,3,7,8)

- DBCP occurs as a colorless liquid when pure, and commercial grades as a dark-amber to dark-brown liquid that is slightly soluble in water. (2,3,6)
- DBCP has a pungent odor with an odor threshold of 0.3 mg/m^3. (1,2)
- The vapor pressure for DBCP is 0.8 mm Hg at 21 °C, and its log octanol/water partition coefficient (log K_{ow}) is 2.43. (6)

Conversion Factors:
To convert concentrations in air (at 25 °C) from ppm to mg/m^3: mg/m^3 = (ppm) × (molecular weight of the compound)/(24.45). For 1,2-dibromo-3-chloropropane: 1 ppm = 9.7 mg/m^3.

Health Data from Inhalation Exposure



LC_{50} (Lethal Concentration $_{50}$)--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.
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.
[c] The LOAEL and NOAEL are from the critical study used as the basis for the EPA RfC.

Summary created in April 1992, updated January 2000

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