

Dichlorvos

62-73-7

Hazard Summary

Dichlorvos is an insecticide used on crops, animals, and in pest-strips. Acute (short-term) and chronic (long-term) exposures of humans to dichlorvos results in the inhibition of an enzyme, acetylcholinesterase, with neurotoxic effects including perspiration, vomiting, diarrhea, drowsiness, fatigue, headache, and at high concentrations, convulsions, and coma. No information is available on the reproductive, developmental, or carcinogenic effects of dichlorvos on humans. A study by the National Toxicology Program (NTP) reported an increased incidence of tumors of the pancreas, mammary glands, and forestomach in animals. EPA has classified dichlorvos 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 dichlorvos and the Reference Concentration (RfC), oral chronic toxicity and the Reference Dose (RfD), and the carcinogenic effects of dichlorvos including the unit cancer risk for oral exposure; and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Dichlorvos. (7)

Uses

- Dichlorvos is used as an agricultural insecticide on crops, stored products, and animals. It is also used as an insecticide for slow release on pest-strips for pest control in homes. Dichlorvos is used as an anthelmintic (worming agent) for dogs, swine, and horses, as a boticide (agent that kills fly larvae) for horses, and in flea collars for dogs. (4,7)
- In 1995, EPA proposed cancellation of dichlorvos for all home uses, and for many commercial and industrial uses. (7)
- The EPA requires cautionary warning labels on products containing dichlorvos. (7)

Sources and Potential Exposure

- Individuals involved in the manufacture, formulation, and application of dichlorvos in agricultural, household, and public health uses are most likely to be exposed to this insecticide. (1,7)
- Individuals may be exposed to dichlorvos from indoor air in buildings where it is used in pest strips or sprays for insect control. (2,7)
- Small amounts of residues of dichlorvos have been detected in food. (3,7)

Assessing Personal Exposure

- Tests are available that measure the activity of two enzymes, serum cholinesterase and erythrocyte acetylcholinesterase, that are affected by dichlorvos. (1)

Health Hazard Information

Acute Effects:

- Dichlorvos exerts its toxic effects in humans and animals by inhibiting the enzyme, acetylcholinesterase. Effects from acute exposure include perspiration, nausea, vomiting, diarrhea, drowsiness, fatigue,

headache, and at very high concentrations, convulsions, and coma. (2,3,7)

- Tests involving acute exposure of rats, mice, and rabbits have demonstrated dichlorvos to have high to extreme acute toxicity from oral or dermal exposure and extreme acute toxicity from inhalation. (5)

Chronic Effects (Noncancer):

- Acetylcholinesterase inhibition may also occur in humans from chronic exposure to dichlorvos. (3,7)
- Symptoms in animals orally exposed to dichlorvos include ataxia, salivation, dyspnea, tremors, and diarrhea. (4,7)
- The Reference Concentration (RfC) for dichlorvos is 0.0005 milligrams per cubic meter (mg/m^3) based on decreased brain cholinesterase activity in rats. 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. (4)
- EPA has medium confidence in the study on which the RfC was based because the principal study was well-conducted for its time; medium confidence in the database because it is relatively complete but an inhalation-based assessment of its multigeneration reproductive toxicity was not found; and consequently the confidence in the RfC is medium. (4)
- The Reference Dose (RfD) for dichlorvos is 0.0005 milligrams per kilogram body weight per day ($\text{mg}/\text{kg}/\text{d}$) based on plasma and red blood cell cholinesterase inhibition in male and female dogs and brain cholinesterase inhibition in male dogs. (4)
- EPA has medium to high confidence in the study on which the RfD was based because, although the principal study is of good quality, there was a change in the dosing regime; medium confidence in the database because it lacks a rabbit developmental toxicity study and adequate studies to fully address chronic and reproductive toxicity in the rat; and, consequently, medium confidence in the RfD. (4)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of dichlorvos in humans.
- In one study, birth defects in fetuses were observed in rats exposed to dichlorvos by injection; however, in several other animal studies, birth defects were not observed. (2,3,7)
- Sperm abnormalities were observed in mice injected with dichlorvos. (7)

Cancer Risk:

- No information is available on the carcinogenic effects of dichlorvos in humans.
- In a gavage study by the NTP, there was an increased incidence of tumors of the pancreas and leukemia in male rats, tumors of the pancreas and mammary gland in female rats, and tumors of the forestomach in both sexes of mice. (8)
- Dichlorvos was not found to be carcinogenic in an animal study by the National Cancer Institute (NCI) in which the compound was administered in the diet. (9)
- EPA has classified dichlorvos as a Group B2, probable human carcinogen. (4)
- EPA uses mathematical models, based on human and animal studies, to estimate the probability of a person developing cancer from drinking water containing a specified concentration of a chemical. EPA calculated an oral cancer slope factor of $0.29 (\text{mg}/\text{kg}/\text{d})^{-1}$ and an oral unit risk estimate of $8.3 \times 10^{-6} (\mu\text{g}/\text{L})^{-1}$. EPA estimates that, if an individual were to continuously drink water containing dichlorvos at an average of $0.1 \mu\text{g}/\text{L}$ ($1 \times 10^{-4} \text{ mg}/\text{L}$) over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of drinking water containing this chemical. Similarly, EPA estimates that drinking water containing $1.0 \mu\text{g}/\text{L}$ ($1 \times 10^{-3} \text{ mg}/\text{L}$) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and water containing $10.0 \mu\text{g}/\text{L}$ ($1 \times 10^{-2} \text{ mg}/\text{L}$) 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)

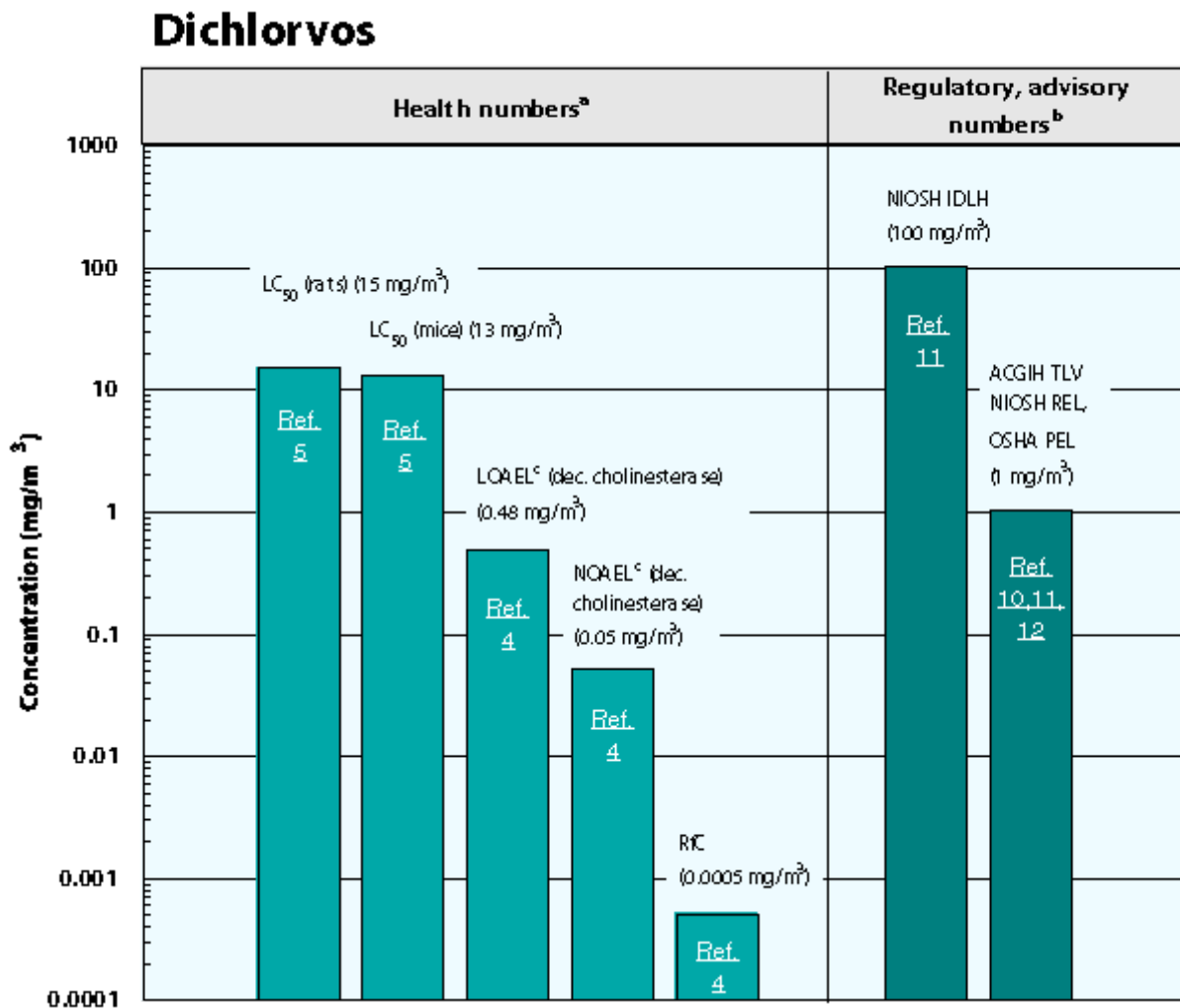
Physical Properties

- The chemical formula for dichlorvos is $C_4H_7Cl_2O_4P$, and its molecular weight is 220.98 g/mol. (3,7)
- Dichlorvos occurs as an oily colorless to amber liquid that is slightly soluble in water. (1,3,4)
- Dichlorvos has an aromatic chemical odor; the odor threshold has not been established. (1,4)
- The vapor pressure for dichlorvos is 0.012 mm Hg at 20 °C. (3,6)
- The log octanol/water partition coefficient for dichlorvos is 1.16. (7)

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m^3 : $mg/m^3 = (ppm) \times (\text{molecular weight of the compound}) / (24.45)$. For dichlorvos: 1 ppm = 9.04 mg/m^3 .

Health Data from Inhalation Exposure



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.

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

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

NIOSH IDLH --National Institute of Occupational Safety and Health's immediately dangerous to life or health limit; 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 --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.

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 NOAEL and LOAEL are from the critical study used as the basis for the RfC.

Summary created in April 1992, updated January 2000

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