

# Heptachlor

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## Hazard Summary

Heptachlor was used as an insecticide; however, nearly all registered uses of heptachlor have been canceled. Very limited information is available on the health effects of heptachlor in humans. Acute (short-term) inhalation exposure to heptachlor may result in nervous system effects, with oral studies showing gastrointestinal effects. Animal studies have reported effects on the liver and central nervous system from oral exposure. Chronic (long-term) inhalation and oral exposure by humans may be associated with neurological effects including irritability, salivation, and dizziness, while oral exposure may result in effects on the blood. Human studies are inconclusive regarding heptachlor and cancer. Animal oral studies have reported liver tumors. EPA has classified heptachlor as a Group B2, probable human carcinogen.

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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 Heptachlor/Heptachlor Epoxide (1). Other sources include EPA's Integrated Risk Information System (IRIS) (4), which contains information on oral chronic toxicity and the RfD, and the carcinogenic effects of heptachlor including the unit cancer risk for inhalation exposure, and the Hazardous Substances Data Bank (HSDB), a database of summaries of peer-reviewed literature. (3)

## Uses

- Heptachlor is a constituent of technical grade chlordane, approximately 10 percent by weight. (1)
- Heptachlor was used as an insecticide in the United States from 1953 to 1974. In 1974, nearly all registered uses of heptachlor were canceled. (1)
- Heptachlor was used from 1953 to 1974 as a soil and seed treatment to protect corn, small grains, and sorghum from pests. It was also used to control ants, cutworms, maggots, termites, and other pests in agriculture and in the home. (1)
- The sale of heptachlor was voluntarily canceled in 1987 by its sole U.S. manufacturer. In 1988, the sale, distribution, and shipment of existing stocks of all canceled heptachlor and chlordane products was prohibited in the United States. (1)
- The only commercial use of heptachlor products still permitted is fire ant control in power transformers. In addition, homeowner's use of existing stocks of heptachlor-containing termite control products is also allowed. (1)

## Sources and Potential Exposure

- People whose homes were treated for termites with heptachlor may be exposed to heptachlor in the indoor air for many years after treatment. (1)
- Workers who use heptachlor to kill fire ants or who manufacture the chemical may be exposed to it in the air or through the skin. (1)
- Heptachlor has been detected in food, including fish, shellfish, dairy products, meat, and poultry. (1)
- Another possible source of exposure is drinking water; heptachlor has been detected at low concentrations in drinking water wells in several states. (1,2)

## Assessing Personal Exposure

- Laboratory tests can detect heptachlor (and its breakdown product, heptachlor epoxide) in blood, fat, breast milk, and body tissues after exposure to high levels. (1)

## Health Hazard Information

### Acute Effects:

- Acute inhalation exposure to heptachlor in humans has been associated with nervous system effects in a few case studies, while gastrointestinal effects, such as nausea and vomiting, have been reported to occur following accidental ingestion of heptachlor. (1,3)
- Effects on the liver and central nervous system have been noted in animals acutely exposed to heptachlor via the oral route. (1,3)
- Heptachlor is considered to have **high to extreme** acute toxicity based on short-term oral tests in rats. (3)

### Chronic Effects (Noncancer):

- Chronic inhalation exposure to heptachlor has been associated with blood effects in humans, while oral exposure has resulted in neurological effects including irritability, salivation, dizziness, muscle tremors, and convulsions. (1)
- Animal studies have reported effects on the liver, kidney, and the immune and nervous systems from oral exposure to heptachlor. (1)
- The Reference Dose (RfD) for heptachlor is 0.0005 milligrams per kilogram body weight per day (mg/kg/d) based on liver weight increases in males rats only. 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 RfD does not imply that an adverse health effect would necessarily occur. (4)
- EPA has low confidence in the study on which the RfD is based because it is of low quality; low confidence in the database because it is incomplete; and, consequently, low confidence in the RfD. (4)
- EPA has not established a Reference Concentration (RfC) for heptachlor. (4)

### Reproductive/Developmental Effects:

- Heptachlor has been shown to cross the placenta to the developing fetus in humans. However, inadequate information is available to determine whether heptachlor may cause developmental or reproductive effects in humans. (1)
- Animal studies have reported developmental effects, including fetal resorptions, and decreased postnatal survival, as well as reproductive effects such as failure of animals to reproduce, following oral exposure to heptachlor. (1)

### Cancer Risk:

- Human studies on heptachlor exposure and cancer are inconclusive. There are several case reports describing a possible link between heptachlor exposure and leukemia and neuroblastoma; however, insufficient information is available to confirm a causal effect. Several studies on workers exposed via inhalation to heptachlor are available; however, these are limited due to confounding factors and small sample size. (1,4)
- Animal studies have reported liver tumors in mice exposed to heptachlor via ingestion. (1,4)
- EPA considers heptachlor to be a probable human carcinogen (cancer-causing agent) and has classified it as a Group B2 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  $1.3 \times 10^{-3} \text{ (}\mu\text{g}/\text{m}^3\text{)}^{-1}$ . EPA estimates that, if an individual were to continuously breathe air containing heptachlor at an average of  $0.0008 \mu\text{g}/\text{m}^3$  ( $8 \times 10^{-7}$  milligrams per cubic meter [ $\text{mg}/\text{m}^3$ ])

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 breathing air containing this chemical. Similarly, EPA estimates that breathing air containing  $0.008 \mu\text{g}/\text{m}^3$  ( $8 \times 10^{-6} \text{ mg}/\text{m}^3$ ) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing  $0.08 \mu\text{g}/\text{m}^3$  ( $8 \times 10^{-5} \text{ mg}/\text{m}^3$ ) 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)

- EPA has calculated an oral cancer slope factor of  $4.5 (\text{mg}/\text{kg}/\text{d})^{-1}$ . (4)

## Physical Properties

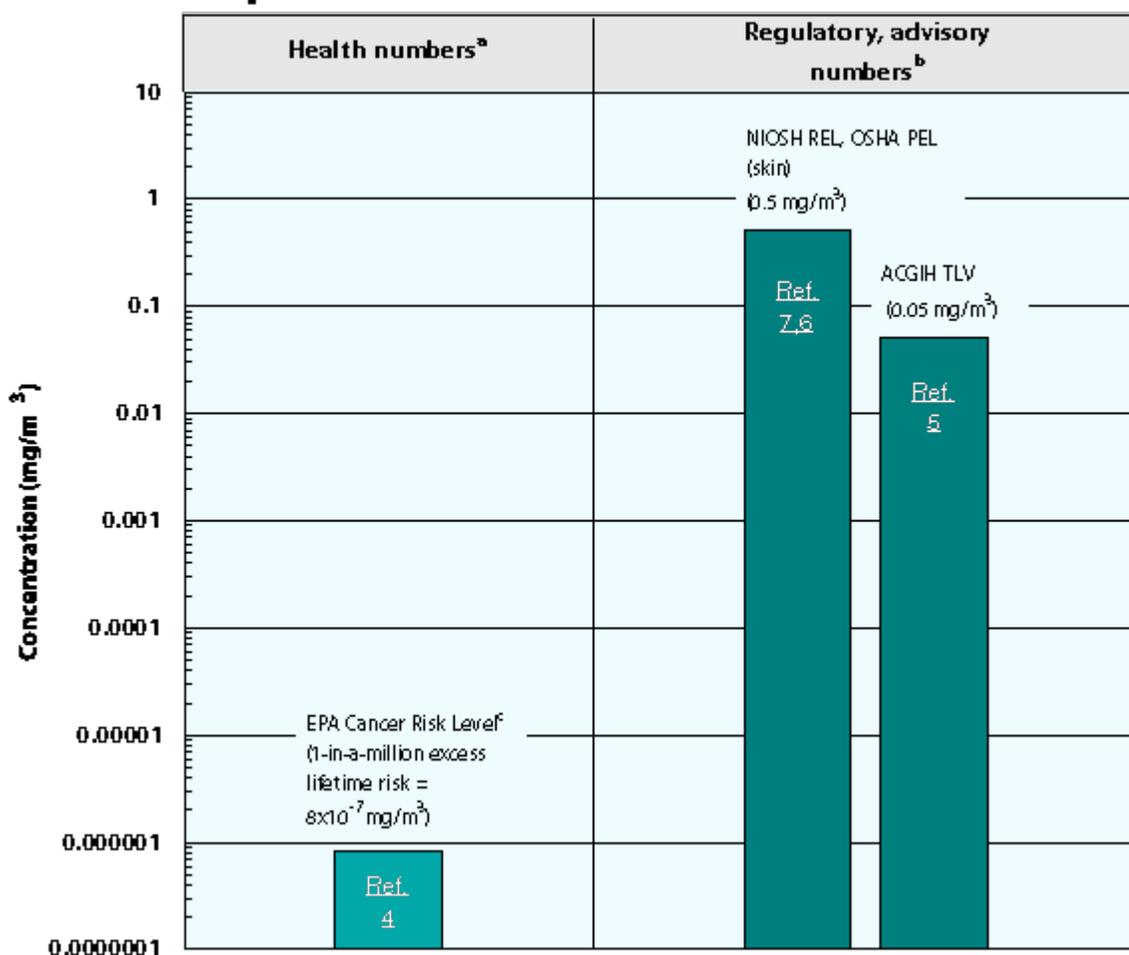
- The chemical formula for heptachlor is  $\text{C}_{10}\text{H}_5\text{Cl}_7$ , and it has a molecular weight of 373.35 g/mol. (1)
- Heptachlor is a man-made chemical; when pure, it exists as a white powder, while technical-grade heptachlor is a tan powder. (1)
- Heptachlor is not soluble in water and smells like camphor. The odor threshold for heptachlor is  $0.3 \text{ mg}/\text{m}^3$ . (1)
- The vapor pressure for heptachlor is  $3 \times 10^{-4} \text{ mm Hg}$  at  $25^\circ\text{C}$ , and it has a log octanol/water partition coefficient ( $\log K_{ow}$ ) of 5.44. (1)

### Conversion Factors:

To convert concentrations in air (at  $25^\circ\text{C}$ ) from ppm to  $\text{mg}/\text{m}^3$ :  $\text{mg}/\text{m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$ . For heptachlor:  $1 \text{ ppm} = 15.27 \text{ mg}/\text{m}^3$ . To convert concentrations in air from  $\mu\text{g}/\text{m}^3$  to  $\text{mg}/\text{m}^3$ :  $\text{mg}/\text{m}^3 = (\mu\text{g}/\text{m}^3) \times (1 \text{ mg}/1,000 \mu\text{g})$ .

### Health Data from Inhalation Exposure

# Heptachlor



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.

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.

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 work week.

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

<sup>a</sup> Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

<sup>b</sup> 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.

<sup>c</sup> These cancer risk estimates were derived from oral data and converted to provide the estimated inhalation risk.

Summary created in April 1992, updated January 2000

## References

1. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Heptachlor/Heptachlor Epoxide. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1993.

2. U.S. Environmental Protection Agency. Health Advisory for Heptachlor and Heptachlor Epoxide. Washington, DC. 1987.
3. 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.
4. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on Heptachlor. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
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.
6. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations. 29 CFR 1910.1000. 1998.
7. National Institute for Occupational Safety and Health (NIOSH). Pocket Guide to Chemical Hazards. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Cincinnati, OH. 1997.