

Hexachlorocyclopentadiene

77-47-4

Hazard Summary

Hexachlorocyclopentadiene is an intermediate in the manufacture of some pesticides.

Hexachlorocyclopentadiene is very toxic following acute (short-term) oral and inhalation exposures. The chemical is a severe eye, skin, and pulmonary irritant in humans, with effects including tearing of the eyes, sneezing, salivation, blistering, burns, and cough from acute exposures. Limited information is available on chronic (long-term), reproductive, developmental, and cancer effects of hexachlorocyclopentadiene in humans. Animal studies have seen effects on the lung, liver, kidney, and blood. EPA has classified hexachlorocyclopentadiene as a Group D, not classifiable as to human carcinogenicity.

Please Note: The main source of information for this fact sheet is EPA's Health Assessment Document for Hexachlorocyclopentadiene. ⁽¹⁾ Other secondary sources include EPA's Integrated Risk Information System (IRIS) ⁽¹⁾, which contains information on oral chronic toxicity and the Reference Dose (RfD), and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Hexachlorocyclopentadiene. ⁽¹⁾

Uses

- Hexachlorocyclopentadiene is the key intermediate in the manufacture of some pesticides, including heptachlor, chlordane, aldrin, dieldrin, and endrin. (5,6)
- Hexachlorocyclopentadiene is also used in the manufacture of flame retardants and some resins and dyes. (1,8)

Sources and Potential Exposure

- Workers involved in the manufacture of hexachlorocyclopentadiene and during the manufacture of products containing the chemical would have the highest exposure to hexachlorocyclopentadiene. (1,9)
- Hexachlorocyclopentadiene has been detected at low levels in ambient air. The sources of the chemical in air appear to be releases from manufacturing processes or incineration and landfilling of wastes containing hexachlorocyclopentadiene. (1)

Assessing Personal Exposure

- Laboratory tests can detect hexachlorocyclopentadiene in blood or urine. (1,9)

Health Hazard Information

Acute Effects:

- Hexachlorocyclopentadiene is very toxic to humans. (2)
- Hexachlorocyclopentadiene is a severe eye, skin, and pulmonary irritant in humans. Inhalation of the chemical causes tearing, sneezing, and salivation, and skin contact can cause blisters and burns. (1,3)
- The major target organ for acute hexachlorocyclopentadiene toxicity is the lung, with cough, chest pains, and difficulty in breathing reported in humans. Nervousness, headaches, and abdominal cramps are other symptoms reported from hexachlorocyclopentadiene toxicity. (1,3)
- Tests involving acute exposure of rats have shown hexachlorocyclopentadiene to have **extreme** toxicity by

inhalation exposure, moderate toxicity by oral exposure, and high to extreme toxicity by dermal exposure.(3,4)

Chronic Effects (Noncancer):

- Epidemiologic studies on workers have not shown any significant differences in mortality between workers exposed to hexachlorocyclopentadiene and those in the general population. However, these studies are limited by short follow-up periods, lack of data on cigarette smoking, and other factors. (1,2)
- Chronic exposure to hexachlorocyclopentadiene, via inhalation, has been studied in animals, with effects noted in the lung, liver, kidney, and blood. (1,3,9)
- EPA has established a Reference Concentration (RfC) of 0.0002 milligrams per cubic meter (mg/m^3) for hexachlorocyclopentadiene, based on respiratory effects in rats. (2)
- The Reference Dose (RfD) for hexachlorocyclopentadiene is 0.006 milligrams per kilogram body weight per day ($\text{mg}/\text{kg}/\text{d}$) based on stomach lesions in rats.
- The RfC and RfD are not direct estimators of risk but rather reference points to gauge the potential effects. At exposures increasingly above these levels, the potential for adverse health effects increases. Lifetime exposure above the RfC or RfD does not imply that an adverse health effect would necessarily occur. (2)

Reproductive/Developmental Effects:

- No information is available regarding the reproductive or developmental effects of hexachlorocyclopentadiene in humans. (1,3,9)
- Animal studies have not reported birth defects from exposure to hexachlorocyclopentadiene by gavage (placing the chemical experimentally in the stomach), and no information is available regarding reproductive or developmental effects from inhalation exposure. (1-3)

Cancer Risk:

- As discussed above in the chronic effects section, epidemiologic studies have not demonstrated any differences in mortality between hexachlorocyclopentadiene-exposed workers and the general population. The observed mortality included deaths from cancer, as well as from other diseases. (1,2)
- The National Toxicology Program (NTP) completed a 2-year inhalation study and concluded that there was no evidence of carcinogenic activity in rats and mice. (5)
- EPA has classified hexachlorocyclopentadiene as a Group D; not classifiable as to human carcinogenicity. (2)

Physical Properties

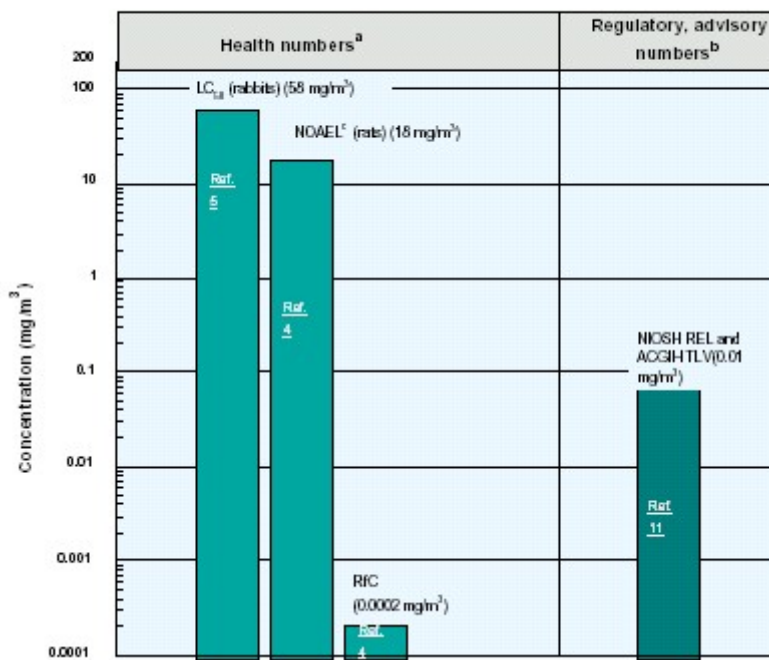
- Hexachlorocyclopentadiene is a pale-yellow liquid with a characteristic pungent, musty odor; the odor threshold is 0.03 parts per million (ppm). (1,7,8)
- The chemical formula for hexachlorocyclopentadiene is C_5Cl_6 , and it has a molecular weight of 272.29 g/mol. (1,8)
- The vapor pressure for hexachlorocyclopentadiene is 0.08 mm Hg at 25 °C, and the log octanol/water partition coefficient ($\log K_{ow}$) is 5.04. (1,8)

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 hexachlorocyclopentadiene: 1 ppm = 11.1 mg/m^3 .

Health Data from Inhalation Exposure

Hexachlorocyclopentadiene



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 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.

NIOSH and ACGIH numbers are advisory.

^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. U.S. Environmental Protection Agency. Health Assessment Document for Hexachlorocyclopentadiene. EPA/600/8-84/001F. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Office of Research and Development, Cincinnati, OH. 1984
2. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on Hexachlorocyclopentadiene. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
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. 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.
5. National Toxicology Program (NTP). Toxicology and Carcinogenesis Studies of Hexachlorocyclopentadiene (CAS No. 77-47-4) in F344/N Rats and B6C3F1 Mice (Inhalation Studies). TR-437. 1994.
6. U.S. Environmental Protection Agency. Health Effects Assessment Summary Tables. FY1997

Update. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Office of Research and Development, Cincinnati, OH. 1997.

7. J.E. Amore and E. Hautala. Odor as an aid to chemical safety: Odor thresholds compared with threshold limit values and volatilities for 214 industrial chemicals in air and water dilution. *Journal of Applied Toxicology*, 3(6):272–290. 1983.
8. U.S. Environmental Protection Agency. Health and Environmental Effects Document for Chlorinated Cyclopentadienes. ECAO–CIN–G029. Office of Solid Waste and Emergency Response, Washington, DC. 1988.
9. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Hexachlorocyclopentadiene. Draft for Public Comment. Public Health Service, U.S. Department of Health and Human Services. Atlanta, GA. 1997.
10. 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.
11. 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.