Hexane

110-54-3

Hazard Summary

Hexane is used to extract edible oils from seeds and vegetables, as a special-use solvent, and as a cleaning agent. Acute (short-term) inhalation exposure of humans to high levels of hexane causes mild central nervous system (CNS) effects, including dizziness, giddiness, slight nausea, and headache. Chronic (long-term) exposure to hexane in air is associated with polyneuropathy in humans, with numbness in the extremities, muscular weakness, blurred vision, headache, and fatigue observed. Neurotoxic effects have also been exhibited in rats. No information is available on the carcinogenic effects of hexane in humans or animals. EPA has classified hexane as a Group D, not classifiable as to human carcinogenicity.

Please Note: The main source of information for this fact sheet is EPA's Integrated Risk Information System (IRIS) (5), which contains information on inhalation chronic toxicity of hexane and the Reference Concentration (RfC). Another secondary source used is the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Hexane. (6)

Uses

- The main use of hexane is as a solvent to extract edible oils from seed and vegetable crops (e.g., soybeans, peanuts, corn). (6)
- Commercial grades of hexane are used as solvents for glues (rubber cement, adhesives), varnishes, and inks. (3,6)
- Hexane is also used as a cleaning agent (degreaser) in the printing industry. (6)
- Hexane is used as the liquid in low temperature thermometers. (2,6,8)

Sources and Potential Exposure

- The most probable route of human exposure to hexane is by inhalation. Individuals are most likely to be exposed to hexane in the workplace. Monitoring data indicate that hexane is a widely occurring atmospheric pollutant. (1,2)

Assessing Personal Exposure

- Laboratory tests can detect a breakdown product of hexane in urine. (6)

Health Hazard Information

Acute Effects:

- Acute inhalation exposure of humans to high levels of hexane causes mild CNS depression. CNS effects include dizziness, giddiness, slight nausea, and headache in humans. (1-3)
- Acute exposure to hexane vapors may cause dermatitis and irritation of the eyes and throat in humans. (2)
- Acute animal tests in rats have demonstrated hexane to have low acute toxicity from inhalation and ingestion exposure. (4)

Chronic Effects (Noncancer):

- Chronic inhalation exposure to hexane is associated with sensorimotor polyneuropathy in humans, with numbness in the extremities, muscular weakness, blurred vision, headache, and fatigue observed. (1,2,5-7)
- Rats, chronically exposed by inhalation, have exhibited neurotoxic effects. (5,6)
- Mild inflammatory, erosive, and degenerative lesions in the olfactory and respiratory epithelium of the nasal cavity have been observed in mice chronically exposed by inhalation. Pulmonary lesions have also been observed in chronically exposed rabbits. (5,6)
- The Reference Concentration (RfC) for hexane is 0.2 milligrams per cubic meter (mg/m^3) based on neurotoxicity in humans and epithelial lesions in the nasal cavity in mice. 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. (5)
- EPA has medium confidence in the epidemiological study on which the RfC was based because the lowest-observed-adverse-effect level (LOAEL) in this study was based on neurotoxicology, and this endpoint is supported by numerous other subchronic inhalation studies in animals and by human occupational studies; medium confidence in the database because of the lack of long-term inhalation studies and appropriate reproductive studies; and, consequently, medium confidence in the RfC. (5)
- EPA has not established a Reference Dose (RfD) for hexane. (5)
- EPA has calculated a provisional RfD of 0.06 milligrams per kilogram body weight per day (mg/kg/d) based on neurological and reproductive effects in rats. The provisional RfD is a value that has had some form of Agency review but is not on IRIS. (10)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of hexane in humans.
- Testicular damage has been observed in male rats exposed to hexane via inhalation. (5)
- Teratogenic effects were not observed in the offspring of rats chronically exposed via inhalation in several studies. (3,5,8)

Cancer Risk:

- No information is available on the carcinogenic effects of hexane in humans or animals.
- EPA has classified hexane as a Group D, not classifiable as to human carcinogenicity, based on a lack of data concerning carcinogenicity in humans and animals. (3,5)

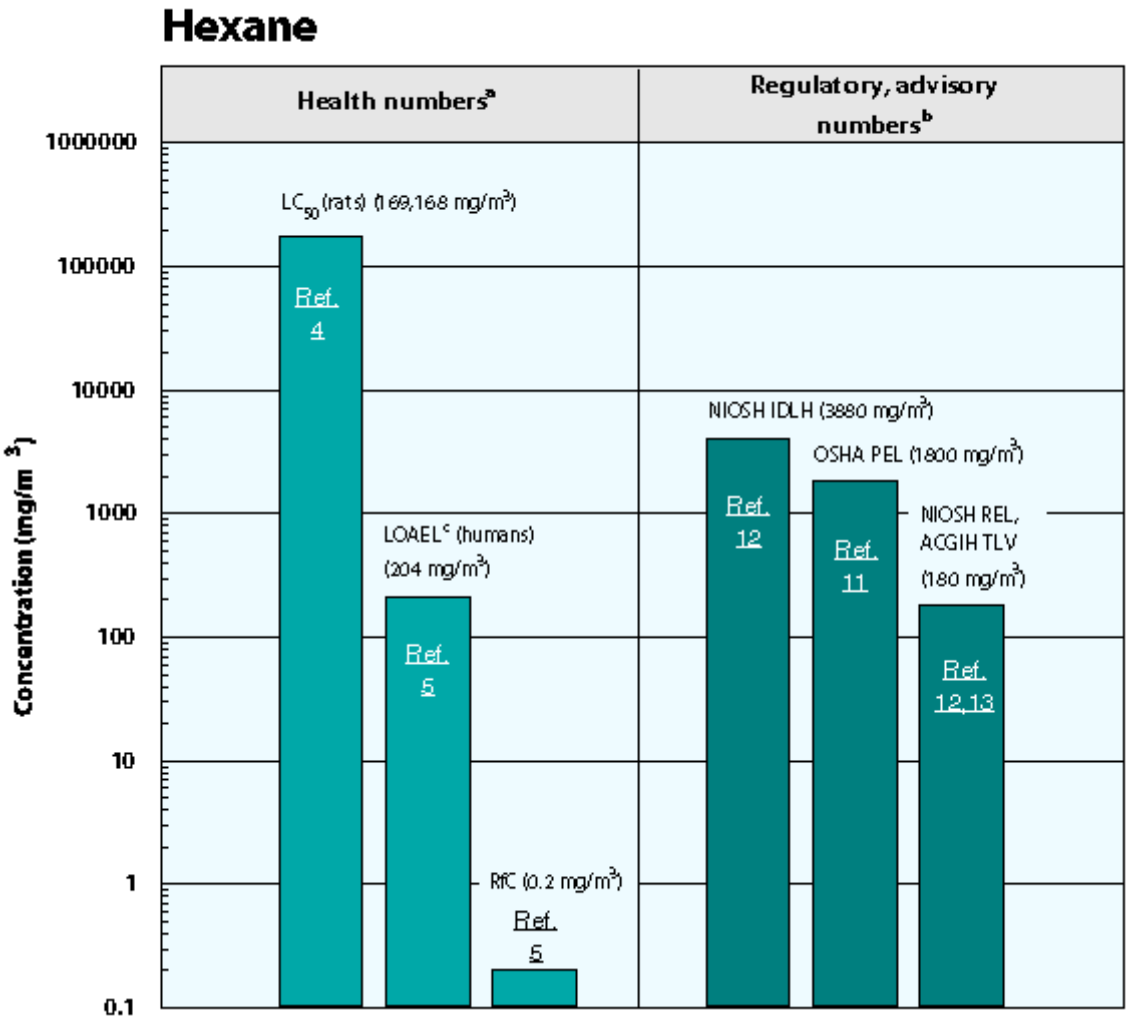
Physical Properties

- The chemical formula for hexane is C_6H_{14}, and its molecular weight is 86.17 g/mol. (8)
- Hexane is a colorless volatile liquid that is insoluble in water and highly flammable. (2,8)
- The odor threshold for hexane is 130 parts per million (ppm), with a faint peculiar odor reported. (8,9)
- The vapor pressure for hexane is 150 mm Hg at 25 °C. (3)

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 hexane: 1 ppm = 3.53 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 effect.

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.

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 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 LOAEL is from the critical study used as the basis for the EPA RfC.

Summary created in April 1992, updated January 2000

References

1. 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.
2. M. Sittig. Handbook of Toxic and Hazardous Chemicals and Carcinogens. 2nd ed. Noyes Publications, Park Ridge, NJ. 1985.
3. U.S. Environmental Protection Agency. n-Hexane Health Advisory. Office of Drinking Water, Washington, DC. 1987.
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. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on n-Hexane. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
6. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Hexane. Draft for Public Comment. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1997.
7. E.J. Calabrese and E.M. Kenyon. Air Toxics and Risk Assessment. Lewis Publishers, Chelsea, MI. 1991.
8. The Merck Index. An Encyclopedia of Chemicals, Drugs, and Biologicals. 11th ed. Ed. S. Budavari. Merck and Co. Inc., Rahway, NJ. 1989.
9. J.E. Amoore 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.
10. U.S. Environmental Protection Agency. Health Effects Assessment Summary Tables. FY 1997 Update. Solid Waste and Emergency Response, Office of Emergency and Remedial Response, Cincinnati, OH. EPA/540/R-97-036. 1997.
11. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations. 29 CFR 1910.1000. 1998.
12. 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.
13. 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.