

Allylchloride

107-05-1

Hazard Summary

Exposure to allyl chloride primarily occurs for workers in manufacturing plants. The acute (short-term) effects of allyl chloride from inhalation exposure in humans consists of irritation of the eyes and respiratory passages. Chronic (long-term) exposure to allyl chloride in humans causes injury to the liver and kidneys and the onset of pulmonary edema (fluid in the lungs). There are no human cancer data available for allyl chloride. Limited animal studies indicate that exposure to allyl chloride by gavage (placing the chemical experimentally in the stomachs of mice) caused an increase in the incidence of forestomach tumors. EPA has classified allyl chloride as a Group C, a possible human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (5), which contains information on inhalation chronic toxicity of allyl chloride and the RfC, and the carcinogenic effects of allyl chloride, and EPA's Health and Environmental Effects Profile for Allyl Chloride (1). Other secondary sources include Hazardous Substances Data Bank (HSDB) (2), a database of summaries of peer-reviewed literature, and the Registry of Toxic Effects of Chemical Substances (RTECS), a database of toxic effects that are not peer reviewed (3).

Uses

- Almost all of the allyl chloride produced is used to make epichlorohydrin and glycerin. (1)
- Allyl chloride is also used in the synthesis of allyl compounds such as allyl alcohol, allyl amines, allyl esters, and polyesters. (1)
- Allyl chloride derivatives are found in varnish, plastics, adhesives, perfumes, pharmaceuticals, and insecticides. (1)

Sources and Potential Exposure

- Possible sources of allyl chloride emissions to the ambient air are production and processing facilities. Occupational exposure exists for people working in the production of allyl chloride, epichlorohydrin, and synthetic glycerin. (1)
- Individuals may be exposed to allyl chloride through breathing contaminated air or through skin contact. (1)

Assessing Personal Exposure

- There are tests currently available to determine personal exposure to allyl chloride through the analysis of the blood or urine. (2)

Health Hazard Information

Acute Effects:

- Acute inhalation exposure to high levels of allyl chloride in humans has resulted in irritation of the eyes and respiratory passages and unconsciousness. Intense exposure also produces conjunctivitis, reddening of eyelids, and corneal burn. (2)
- Acute animal tests in rats, mice, and guinea pigs, have shown allyl chloride to have

moderate toxicity from oral and inhalation exposure. (3)

Chronic Effects (Noncancer):

- The major effects from chronic inhalation exposure to allyl chloride in humans is liver and kidney damage, which were reversible after the cessation or minimization of exposure. (2,4)
- Allyl chloride also affects the central nervous system (CNS), causing motor and sensory neurotoxic damage, and the heart and respiratory system, causing the onset of pulmonary edema in humans. (2)
- The Reference Concentration (RfC) for allyl chloride is 0.001 milligrams per cubic meter (mg/m^3) based on functional and histological peripheral neurotoxicity 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 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 low confidence in the study on which the RfC was based because it used a small number of animals and reported detailed results for only the higher concentration with poor reporting of results for the no-observed-adverse-effect level (NOAEL) exposure; low confidence in the database because there is conflicting information on possible liver effects, no data on reproductive toxicity, and chronic animal studies are lacking; and, consequently, low confidence in the RfC. (5)
- EPA has not established a Reference Dose (RfD) for allyl chloride. (5)

Reproductive Effects/Developmental:

- Limited human data were considered inadequate in providing evidence of reproductive or developmental effects in humans exposed to allyl chloride. (1,2,4)
- One animal study involving the inhalation of allyl chloride in rabbits resulted in decreased maternal weight gain. Rats that were injected with allyl chloride had increased maternal heart, liver, spleen and kidney weights. (1,2)

Cancer Risk:

- No human cancer data were located for allyl chloride. Limited animal studies indicate that exposure to allyl chloride by gavage (placing the chemical experimentally in the stomachs of mice) caused an increase in the incidences of a rare forestomach tumor. Similar skin painting studies produced site specific tumors. (5)
- Allyl chloride is an alkylating agent and structurally related to probable human carcinogens. (2,4,5)
- EPA considers allyl chloride to be a possible human carcinogen (cancer-causing agent) and has ranked it in EPA's Group C. (5)
- EPA has not calculated an inhalation unit risk estimate for allyl chloride. (5)
- The California Environmental Protection Agency (CalEPA) has established an inhalation unit risk estimate of 6.0×10^{-6} ($\mu\text{g}/\text{m}^3$)⁻¹ and an oral cancer slope factor of 2.1×10^{-2} ($\text{mg}/\text{kg}/\text{d}$)⁻¹ for allyl chloride. (6)

Physical Properties

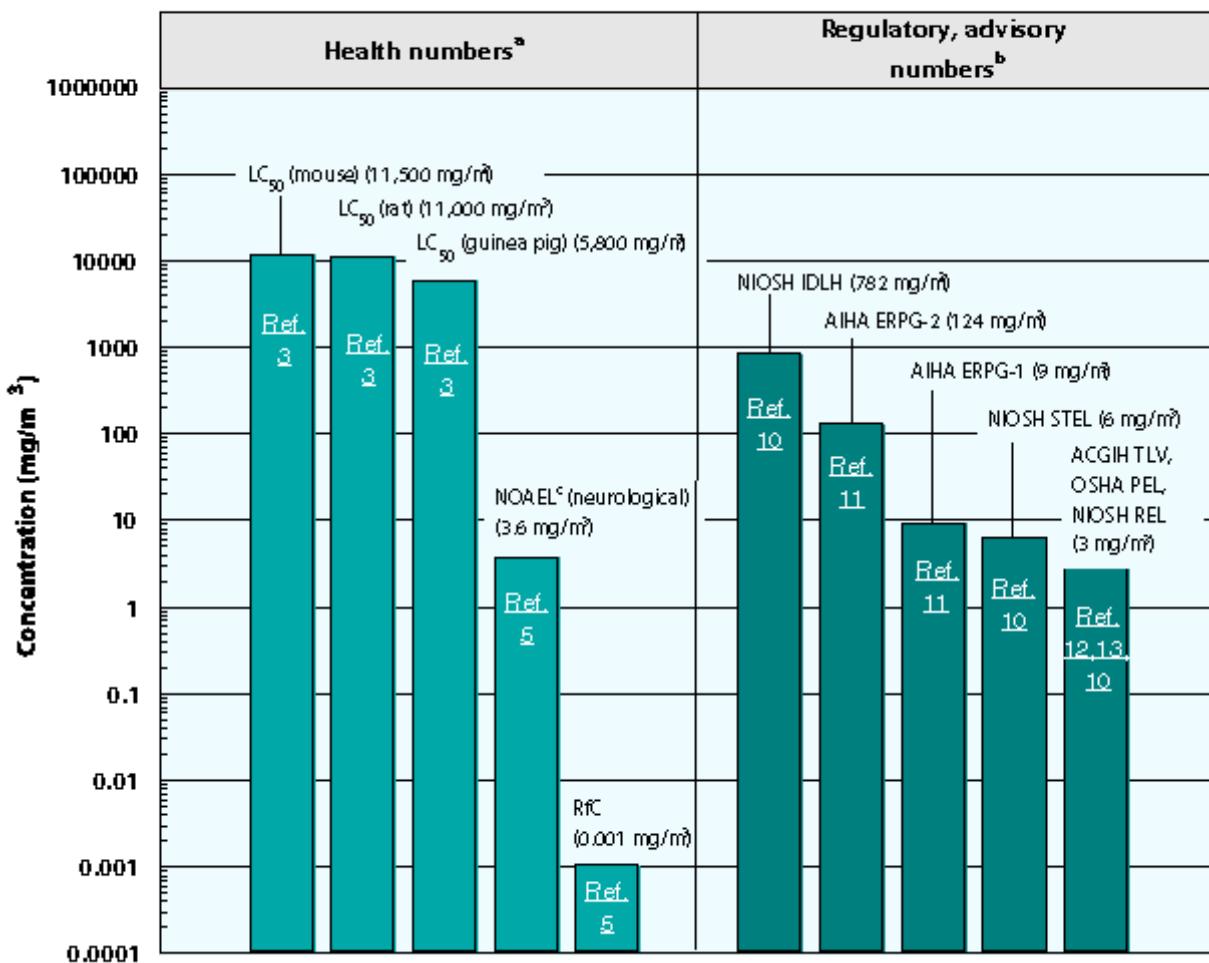
- Allyl chloride is a colorless to pale yellow liquid with a pungent, garlic-onion odor. (2,7)
- Allyl chloride has an odor threshold of 1.2 parts per million (ppm). (8)
- Allyl chloride is slightly soluble in water. (7,9)
- The chemical formula for allyl chloride is $\text{C}_3\text{H}_5\text{Cl}$, and it has a molecular weight of 76.53 g/mol. (3,7,9)
- The vapor pressure for allyl chloride is 362 mm Hg at 25 °C, and it has a log octanol/water partition coefficient ($\log K_{ow}$) of 1.45. (9)

Conversion Factors:

To convert concentrations in air (at 25°C) from ppm to mg/m³: mg/m³ = (ppm) × (molecular weight of the compound)/(24.45). For allyl chloride: 1 ppm = 3.1 mg/m³. To convert from µg/m³ to mg/m³: mg/m³ = (µg/m³) × (1 mg/1,000 µg).

Health Data from Inhalation Exposure

Allyl Chloride



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.

AIHA ERPG--American Industrial Hygiene Association's emergency response planning guidelines. ERPG 1 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor; ERPG 2 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing or developing irreversible or other serious health effects that could impair their abilities to take protective action.

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 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--NIOSH's recommended exposure limit; NIOSH recommended exposure limit for an 8- or 10-h time-weighted average exposure and/or ceiling.

NIOSH STEL -- NIOSH's short term exposure limit; NIOSH recommended exposure limit for a 15-minute period.
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, ACGIH, and AIHA numbers are advisory.

^c This NOAEL is from the critical study used as the basis for the EPA RfC.

Summary created in April 1992, updated in January 2000.

References

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