2-Chloroacetophenone

532-27-4

Hazard Summary

The main uses for 2-chloroacetophenone are in tear gas and in chemical Mace. It is a potent eye, throat, and skin irritant. Acute (short-term) inhalation exposure of humans causes burning of the eyes with lacrimation, some degree of blurred vision, possible corneal damage, irritation and burning of the nose, throat, and skin, and burning in the chest with dyspnea. Acute dermal exposure is irritating and can result in first, second, and third degree chemical burns in humans. Squamous hyperplasia of the nasal respiratory epithelium was reported in rats chronically exposed (long-term) via inhalation. EPA has not classified 2-chloroacetophenone with respect to potential carcinogenicity.

Please Note: The main source of information for this fact sheet is EPA's Integrated Risk Information System (IRIS) (4), which contains information on inhalation chronic toxicity of 2-chloroacetophenone and the RfC. Other secondary sources include the Hazardous Substances Data Bank (HSDB) (1), 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literature, and the Registry of Toxic Effects of Chemical Substances (RTECS), a database of toxic effects that are not peer reviewed.(5)

Uses

- 2-Chloroacetophenone is primarily used as a riot-control agent (tear gas) and in Chemical Mace. (1-3,7)
- It is also used as a pharmaceutical intermediate and formerly as an alcohol denaturant. (1)

Sources and Potential Exposure

- The use of tear gas and Chemical Mace to control riots and disable attackers causes direct exposure to 2-chloroacetophenone through skin contact and inhalation. (1)
- Occupational exposure may occur during its manufacture and use by inhalation and dermal contact. (1)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to 2-chloroacetophenone.

Health Hazard Information

Acute Effects:

- 2-Chloroacetophenone is a potent eye, throat, and skin irritant. Acute inhalation exposure of humans causes burning of the eyes with lacrimation; some degree of blurred vision; possible corneal damage; irritation and burning of the nose, throat, and skin; burning in the chest with dyspnea; and laryngotracheobronchitis. (1-4)
- Acute dermal exposure is irritating and can result in first, second, and third degree chemical burns in humans; these effects are exacerbated when the skin is wet. (4)
- Acute animal tests in rats, mice, rabbits, and guinea pigs have demonstrated 2-chloroacetophenone to have high acute toxicity from oral exposure. (5)

Chronic Effects (Noncancer):

- No information is available on the chronic effects of 2-chloroacetophenone in humans.
- Squamous hyperplasia of the nasal respiratory epithelium was reported in rats chronically exposed via inhalation. (3,4)
- The Reference Concentration (RfC) for 2-chloroacetophenone is 0.00003 milligrams per cubic meter (mg/m^3) based on respiratory effects 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 esimator 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, even though the study used an adequate experimental design (number of animals, exposure concentrations, controls), and the incidence and severity of the nasal lesions were exposure-related and seen in both genders of rats, there were other materials present in the exposure atmosphere, the nasal lesions may have been exacerbated by concurrent viral infection in the exposed rats, and reflex apnea may have occurred to a greater degree in mice, thereby skewing the concentration-response relationship. EPA has low to medium confidence in the database because there are no data on the toxicokinetics, reproductive, or developmental toxicity for 2-chloroacetophenone; and, consequently, low to medium confidence in the RfC. (4)
- EPA has not established a Reference Dose (RfD) for 2-chloroacetophenone. (4)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of 2-chloroacetophenone in humans or animals.

Cancer Risk:

- No information is available on the carcinogenic effects of 2-chloroacetophenone in humans.
- In a National Toxicology Program study, rats and mice were chronically exposed to 2-chloroacetophenone by inhalation. A marginal increase in fibroadenomas of the mammary gland was observed in female rats. No exposure-related increase in the incidence of tumors was observed in mice. (3)
- EPA has not classified 2-chloroacetophenone with respect to potential carcinogenicity. (4)

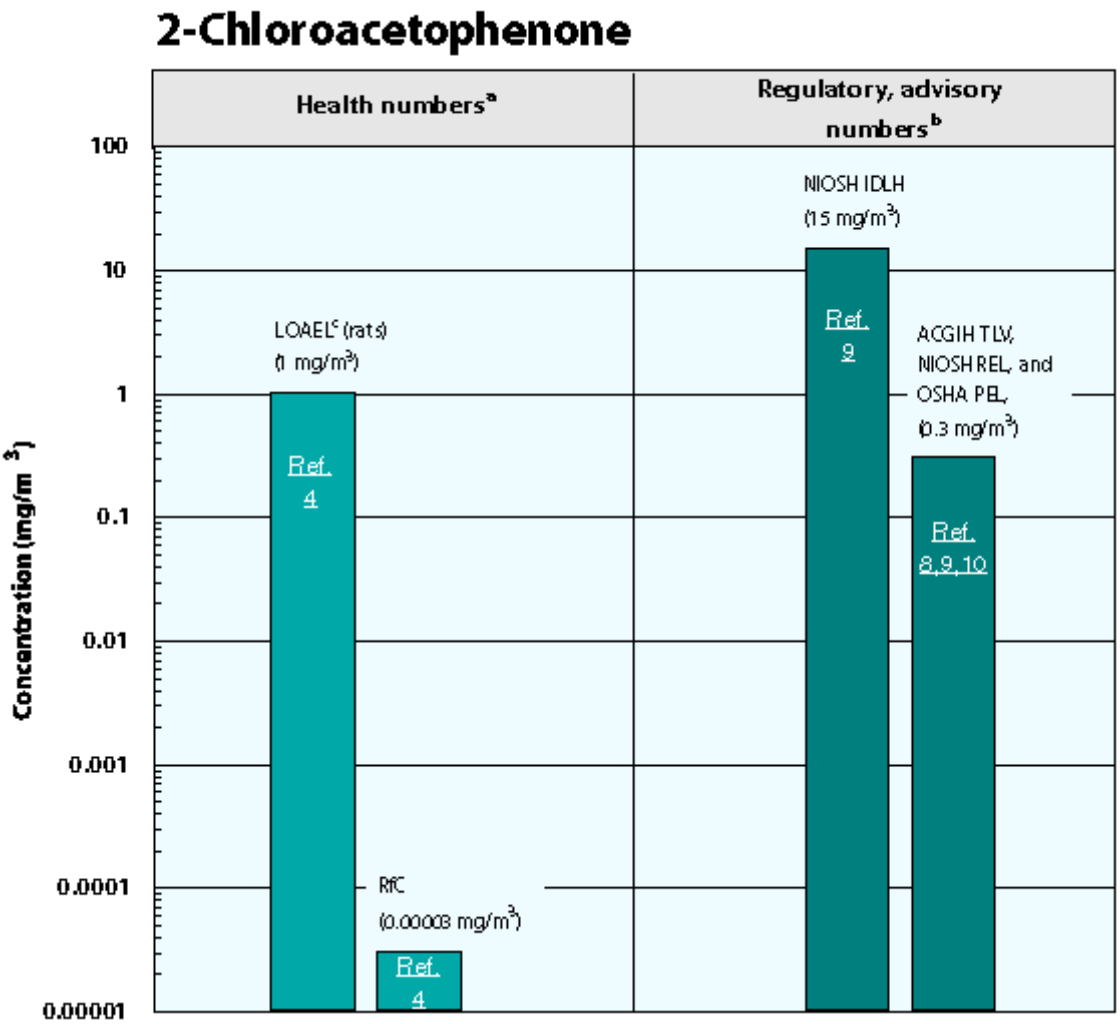
Physical Properties

- The chemical formula for 2-chloroacetophenone is C_8H_7ClO, and its molecular weight is 154.59 g/mol. (2)
- 2-Chloroacetophenone occurs as colorless to gray crystals that are practically insoluble in water. (1-3)
- In low concentrations, 2-chloroacetophenone has an odor resembling apple blossoms, with an odor threshold of 0.035 parts per million (ppm). (1,7)
- The vapor pressure for 2-chloroacetophenone is 0.0054 mm Hg at 20 °C, and its log octanol/water partition coefficient (log K_{ow}) is 2.09. (1-3)

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 2-chloroacetophenone: 1 ppm = 6.32 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.

LOAEL--Lowest-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--NIOSH'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 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. The Merck Index. An Encyclopedia of Chemicals, Drugs, and Biologicals. 11th ed. Ed. S. Budavari. Merck and Co. Inc., Rahway, NJ. 1989.
3. National Toxicology Program. Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone (CAS No. 532-27-4) in F344/N Rats and B6C3F$_1$ Mice (Inhalation Studies). TR No. 379. U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, Bethesda, MD. 1990.
4. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on 2-Chloroacetophenone. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
5. 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.
6. 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.
7. M. Sittig. Handbook of Toxic and Hazardous Chemicals and Carcinogens. 2nd ed. Noyes Publications, Park Ridge, NJ. 1985.
8. 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.
9. 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.
10. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations. 29 CFR 1910.1000. 1998.