

Hydrochloric Acid (Hydrogen Chloride)

7647-01-0

Hazard Summary—Created in April 1992; Revised in January 2000

Hydrochloric acid has many uses. It is used in the production of chlorides, fertilizers, and dyes, in electroplating, and in the photographic, textile, and rubber industries. Hydrochloric acid is corrosive to the eyes, skin, and mucous membranes. Acute (short-term) inhalation exposure may cause eye, nose, and respiratory tract irritation and inflammation and pulmonary edema in humans. Acute oral exposure may cause corrosion of the mucous membranes, esophagus, and stomach and dermal contact may produce severe burns, ulceration, and scarring in humans. Chronic (long-term) occupational exposure to hydrochloric acid has been reported to cause gastritis, chronic bronchitis, dermatitis, and photosensitization in workers. Prolonged exposure to low concentrations may also cause dental discoloration and erosion. EPA has not classified hydrochloric acid for 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 hydrochloric acid and the Reference Concentration (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literature, and the Registry of Toxic Effects of Chemical Substances (RTECS) (5), a database of toxic effects that are not peer reviewed.

Uses

- Hydrochloric acid is used in the production of chlorides, for refining ore in the production of tin and tantalum, for pickling and cleaning of metal products, in electroplating, in removing scale from boilers, for the neutralization of basic systems, as a laboratory reagent, as a catalyst and solvent in organic syntheses, in the manufacture of fertilizers and dyes, for hydrolyzing starch and proteins in the preparation of various food products, and in the photographic, textile, and rubber industries. (1-4,6)

Sources and Potential Exposure

- Occupational exposure to hydrochloric acid may occur via inhalation or dermal contact during its production and use. (1,2)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to hydrochloric acid.

Health Hazard Information

Acute Effects:

- Hydrochloric acid is corrosive to the eyes, skin, and mucous membranes. Acute inhalation exposure may cause coughing, hoarseness, inflammation and ulceration of the respiratory tract, chest pain, and pulmonary edema in humans. (1-4)
- Acute oral exposure may cause corrosion of the mucous membranes, esophagus, and stomach, with nausea, vomiting, and diarrhea reported in humans. Dermal contact may produce severe burns, ulceration,

and scarring. (1–4)

- Pulmonary irritation, lesions of the upper respiratory tract, and laryngeal and pulmonary edema have been reported in rodents acutely exposed by inhalation. (1,4)
- Acute animal tests in rats, mice, and rabbits, have demonstrated hydrochloric acid to have moderate to high acute toxicity from inhalation and moderate acute toxicity from oral exposure. (3)

Chronic Effects (Noncancer):

- Chronic occupational exposure to hydrochloric acid has been reported to cause gastritis, chronic bronchitis, dermatitis, and photosensitization in workers. Prolonged exposure to low concentrations may also cause dental discoloration and erosion. (1–3,6)
- Chronic inhalation exposure caused hyperplasia of the nasal mucosa, larynx, and trachea and lesions in the nasal cavity in rats. (4,6)
- The Reference Concentration (RfC) for hydrochloric acid is 0.02 milligrams per cubic meter (mg/m^3) based on hyperplasia of the nasal mucosa, larynx, and trachea 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 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. (4)
- EPA has low confidence in the study on which the RfC was based since it used only one dose and had limited toxicological measurements; low confidence in the database because the database does not provide any additional chronic or reproductive studies; and, consequently, low confidence in the RfC. (4)
- EPA has not established a Reference Dose (RfD) for hydrochloric acid. (4)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of hydrochloric acid in humans.
- In rats exposed to hydrochloric acid by inhalation, severe dyspnea, cyanosis, and altered estrus cycles have been reported in dams, and increased fetal mortality and decreased fetal weight have been reported in the offspring. (4,6)

Cancer Risk:

- No information is available on the carcinogenic effects of hydrochloric acid in humans.
- In one study, no carcinogenic response was observed in rats exposed via inhalation. (1)
- EPA has not classified hydrochloric acid with respect to potential carcinogenicity. (4)

Physical Properties

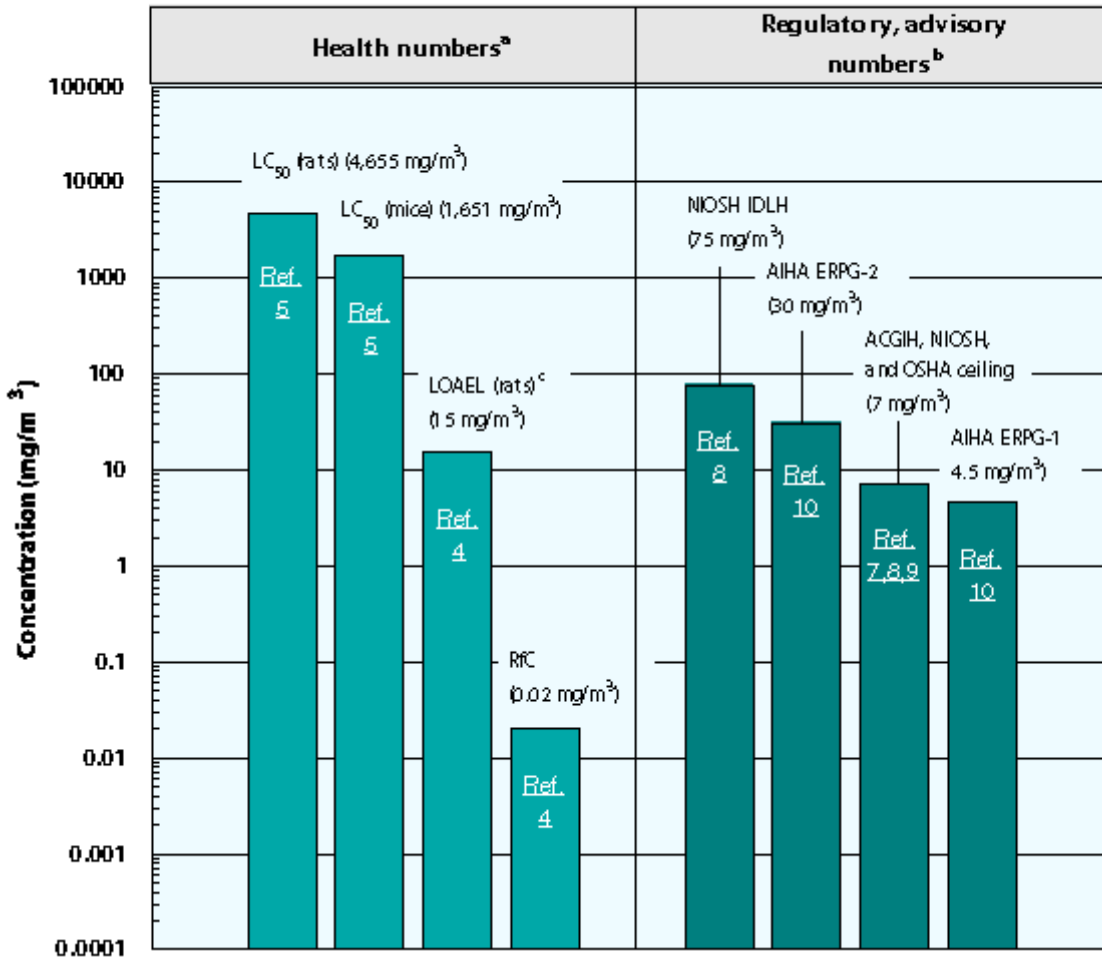
- Hydrogen chloride is a common synonym for hydrochloric acid. (4)
- The chemical formula for hydrochloric acid is HCl, and its molecular weight is 36.47 g/mol. (1,3)
- Hydrochloric acid occurs as a colorless, nonflammable aqueous solution or gas. (1,3,4)
- Hydrochloric acid has an irritating, pungent odor, with an odor threshold of about $7 \text{ mg}/\text{m}^3$. (1)

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 hydrochloric acid: $1 \text{ ppm} = 1.49 \text{ mg}/\text{m}^3$.

Health Data from Inhalation Exposure

Hydrochloric Acid



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.

ACGIH TLV ceiling--American Conference of Governmental and Industrial Hygienists' threshold limit value ceiling; the concentration of a substance that should not be exceeded during any part of the working exposure.

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.

LOAEL--Lowest-observed-adverse-effect level.

NIOSH REL ceiling--National Institute of Occupational Safety and Health's recommended exposure limit ceiling; the concentration that should not be exceeded at any time.

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 ceiling value--Occupational Safety and Health Administration's permissible exposure limit ceiling value; the concentration of a substance that should not be exceeded at any time.

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

Summary created in April 1992, updated January 2000

References

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