HYDROCHLORIC ACID

Hydrochloric acid is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 7647-01-0 HCl

Molecular Formula: HCl

Hydrochloric acid occurs as an aqueous solution or as hydrogen chloride gas (anhydrous hydrochloric acid). Hydrogen chloride gas is a colorless, nonflammable, corrosive gas with an irritating pungent odor. Hydrochloric acid solutions may be clear or colored yellow by traces of iron, chlorines, and organic matter (Merck, 1989). Hydrochloric acid fumes in the air and is soluble in water, alcohol, benzene, methanol, ethanol, and ether. It is incompatible with most metals, alkali, or active metals (Sittig, 1985).

Physical Properties of Hydrochloric Acid (as Hydrogen Chloride Gas)

Synonyms: hydrogen chloride; chlorohydric acid; muriatic acid; hydrochloride

Molecular Weight:	36.46
Boiling Point:	-84.9 ^{o}C
Melting Point:	-114.8 ^{o}C
Vapor Density:	1.268 (air = 1)
Vapor Pressure:	1.00 mm Hg at -150.8 ^{o}C
Conversion Factor:	1 ppm = 1.49 mg/m^3

(HSDB, 1991; Merck, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Sources of hydrochloric acid include the combustion of fuels, refuse incineration, smelting of metal scrap, thermodecomposition of gases, and pyrolysis of wire insulation materials such as polyvinyl chloride, chlorinated acrylics, and retardant treated materials. It is also produced as a by-product in dehalogenation processes (HSDB, 1991).

The primary stationary sources that have reported emissions of hydrochloric acid in California

are electric services companies, manufacturers of guided missiles, space vehicles and parts, and manufacturers of industrial inorganic chemicals (ARB, 1997b).

Hydrochloric acid (hydrogen chloride) is registered as an adjuvant. It is used to maintain pH balance in swimming pools, spas, etc. It is also registered as an antimicrobial, a bactericide, a fungicide, and a virucide. Hydrochloric acid is used as a general antimicrobial to disinfect bathrooms, kitchens and food preparation areas, and other areas in commercial and industrial buildings, in hospitals, in nursing homes, and in and around household dwellings (DPR, 1996).

The licensing and regulation of pesticides for sale and use in California are the responsibility of the Department of Pesticide Regulation (DPR). Information presented in this fact sheet regarding the permitted pesticidal uses of hydrochloric acid has been collected from pesticide labels registered for use in California and from DPR's pesticide databases. This information reflects pesticide use and permitted uses in California as of October 15, 1996. For further information regarding the pesticidal uses of this compound, please contact the Pesticide Registration Branch of DPR (DPR, 1996).

B. Emissions

The total emissions of hydrochloric acid from stationary sources in California are estimated to be at least 2.8 million pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Hydrochloric acid occurs in the gases evolved from volcanoes. It is not free in nature but is a component of the minerals halite, sylvite, and carnallite, and as a chloride ion in seawater (HSDB, 1991).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of hydrochloric acid.

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of hydrochloric acid was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

Hydrogen chloride released into the atmosphere as a gas will undergo wet and dry deposition, and will be readily incorporated into cloud, rain, and fog water. The half-life and lifetime will depend on the locality of the release and the occurrence of precipitation events (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program (AB 2588). Of the risk assessments reviewed as of December 1996, for non-cancer health effects, hydrochloric acid contributed to the total hazard index in 24 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1, and presented an individual hazard index greater than 1 in 3 of these risk assessments. Hydrochloric acid also contributed to the total hazard index in 30 of the approximately 107 risk assessments reporting a total acute hazard index greater than 1 (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to hydrochloric acid are inhalation and dermal contact.

Non-Cancer: Hydrochloric acid is highly corrosive and irritating to the eyes and respiratory tract. Acute inhalation exposure may cause coughing, hoarseness, inflammation, and ulceration of the respiratory tract, chest pain, and pulmonary edema in humans. Chronic occupational exposure to hydrochloric acid has been reported to cause gastritis, chronic bronchitis, dermatitis, and photosensitization in workers. Long-term exposure to hydrogen chloride at low levels (greater than 5 parts per million) can cause some dental erosion (U.S. EPA, 1994a).

An acute non-cancer Reference Exposure Level (REL) of 3,000 micrograms per cubic meter ($\mu g/m^3$) and a chronic REL of 7.0 $\mu g/m^3$ are listed for hydrochloric acid in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoint considered for acute toxicity is respiratory irritation. The respiratory system and skin are the endpoints related to chronic toxicity (CAPCOA, 1993). The United States Environmental Protection Agency (U.S. EPA) has established a Reference Concentration (RfC) for hydrochloric acid of 7.0 $\mu g/m^3$ based on hyperplasia of the nasal mucosa, larynx, and trachea in rats. The U.S. EPA estimates that inhalation of this concentration or less, over a lifetime, would not likely result in the occurrence of chronic non-cancer effects. The U.S. EPA has not set an oral Reference Dose (RfD) (U.S. EPA, 1994a).

No information is available on adverse 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 (U.S. EPA, 1994a).

Cancer: No information is available on the carcinogenic effects of hydrochloric acid in humans. In one study, no carcinogenic response was observed in rats exposed by inhalation. The U.S. EPA has not classified hydrochloric acid as to its human carcinogenicity (U.S. EPA, 1994a). The International Agency for Research on Cancer (IARC) has classified hydrochloric acid in Group 3: Not classifiable as to its potential human carcinogenicity (IARC, 1987a).