The ToxGuide™ is developed to be used as a pocket guide. Tear off at perforation and fold along lines.

Sources of Exposure

General Populations

- Members of the general population may be exposed to chlorine if they mix an acid with a solution containing sodium hypochlorite. Examples include mixing toilet bowl cleaners containing hydrochloric, phosphoric, or oxalic acid with bleach. If enough acid is added to lower the pH of the hypochlorite solution to below 4, chlorine gas will be released.
- Individuals may also be exposed to chlorine if swimming pool chemicals are accidentally mixed with acids or too much sodium hypochlorite is added to the water over a short period of time.
- Individuals living near a chlorine tank spill or rupture may be exposed to higher levels of chlorine.

Occupational Populations

- Workers at facilities that produce, transport, or use chlorine may be exposed to low concentrations of chlorine gas.
- Workers may also be exposed to high chlorine concentrations if an accidental release occurs at a facility.

Toxicokinetics and Normal Human Levels

Toxicokinetics

- Irrespective of the mode of breathing, nasal or oral, and respiratory flow rate, >95% of the inspired chlorine was absorbed in the upper airways and <5% was delivered to the lower airways.
- No relevant data were located regarding oral or dermal absorption of aqueous chlorine.
- Because aqueous chlorine is a potent oxidant, the distribution, metabolism, and excretion of chlorine is determined by the product of the reactions of chlorine and biomolecules.

Normal Human Levels

- Greater than 95% of the chlorine that is inhaled (over a 1–5 ppm range) reacts in the upper respiratory tract (and eventually joins the chloride pool in the body). Thus, analysis of human biological materials such as blood, urine, and body tissue for chlorine is not considered relevant.

Biomarkers/Environmental Levels

Biomarkers

- There are no biomarkers that can be used to quantify exposure to chlorine gas or aqueous chlorine.

Environmental Levels

Air

- Levels of chlorine in ambient air have not been located.

Sediment and Soil

- Levels of chlorine in sediment and soil have not been located.

Water

- Levels of chlorine monitored in water are not available. Because aqueous chlorine is not a predominant species at environmental pH, chlorine is not expected to be detected in the aquatic environment.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Chlorine (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™ for Chlorine

Cl_2

CAS# 7782-50-5

September 2007

U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov

Contact Information:
Division of Toxicology
and Environmental Medicine
Applied Toxicology Branch

1600 Clifton Road NE, F-32
Atlanta, GA 30333
1-800-CDCINFO
1-800-432-4636
www.atsdr.cdc.gov/toxpro2.html

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Chemical and Physical Information

Chlorine is a gas

- Chlorine is a heavier-than-air, greenish-yellow gas with a pungent, irritating odor. The odor threshold for chlorine is 0.002 ppm in air and 0.31 ppm in water.
- Chlorine is a nonflammable gas; however, it is a very strong oxidizing agent, reacting explosively or forming explosive compounds or mixtures with many common chemicals.
- Chlorine reacts directly with nearly all of the elements to form chlorides.
- Chlorine hydrolyzes rapidly and almost completely in water to form hypochlorous acid and hypochlorite.
- Chlorine is stored and transported as a liquid in pressurized containers.
- The major uses of chlorine include the manufacturing of vinyl chloride to make polyvinyl chloride (PVC) plastics, the manufacturing of other organic and inorganic compounds, water treatment and pulp and paper bleaching. Chlorine has been used in the food industry as a bleaching agent for flour.

Routes of Exposure

- Inhalation – Predominant route of exposure for general population and workers.
- Oral – Not a relevant route of exposure.
- Dermal – Minor route of exposure.

Chlorine in the Environment

- Chlorine may be released into the environment through the process of water chlorination and during accidents such as a chlorine gas leak from an industrial facility or a chlorine tank spill or rupture.
- Since chlorine gas is so reactive, it is not expected to remain in the environment very long after it is released. Chlorine immediately reacts with both organic and inorganic materials that it comes into contact with.
- Free chlorine in drinking water is defined as the sum of dissolved chlorine gas, hypochlorous acid, and hypochlorite anion.

Relevance to Public Health (Health Effects)

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

Inhalation

- An MRL of 0.07 ppm has been derived for acute-duration inhalation exposure (≤14 days).
- An MRL of 0.002 ppm has been derived for intermediate-duration inhalation exposure (15-364 days).
- An MRL of 0.00005 ppm has been derived for chronic-duration inhalation exposure (≥1 year).

Oral

- No acute-, intermediate-, or chronic-duration oral MRLs were derived for chlorine.

Health Effects

- The principal targets of exposure to chlorine gas are the respiratory airways and the eyes.
- The toxicity of chlorine appears to be dependent on the duration of exposure and exposure concentration, and the moisture content of the surface contacted by the gas (i.e., the respiratory epithelium).
- DHHS, IARC, and EPA have not classified chlorine gas as to its human carcinogenicity.

Children's Health

- There is some suggestive evidence that children may be more sensitive to the respiratory effects of chlorine than adults.