OEHHA

Hydrogen Chloride

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

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Recognizing "HCl"

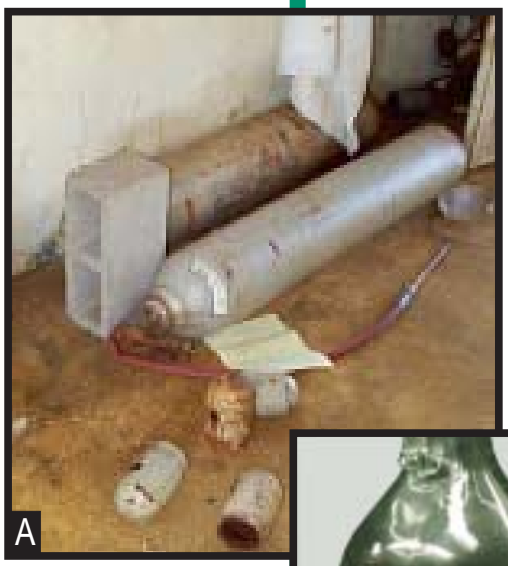
Appearance: Anhydrous hydrogen chloride (HCl) gas is colorless to slightly yellow at room temperature. When exposed to air, HCl gas condenses with moisture in the air to produce dense, white, and corrosive hydrochloric acid vapors. **Hydrochloric acid** is a colorless or slightly yellow fuming, aqueous liquid formed by dissolving HCl gas in water. Yellowing is caused by trace amounts of iron, chlorine, or organic matter impurities.

Odor: Pungent. Immediately irritating at 5 ppm (7.5 mg/m^3).

Odor Threshold: 0.26 ppm (0.4 mg/m^3).

Odor Safety Class: C (less than 50% of distracted individuals perceive warning of threshold limit).

Vapor Density: 1.3 (air =1.0). Hydrogen chloride gas is heavier than air and may accumulate close to the ground or in depressions.



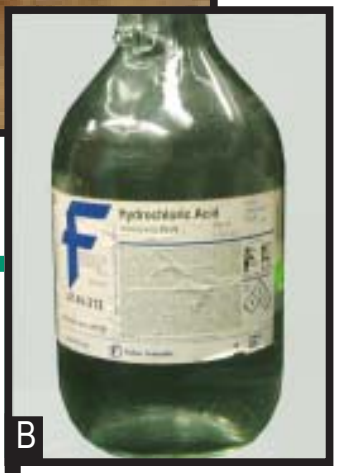


Figure 1: Anhydrous hydrogen chloride gas is stored as a liquid in pressurized containers **[A]**. Aqueous solutions of hydrogen chloride are called hydrochloric acid or muriatic acid **[B]** and are found in commercial chemical or swimming pool supply houses. *Photos: Courtesy of CA Department of Justice.*

Containers & Packaging

Anhydrous HCl is a gas at room temperature but becomes liquid when put under pressure. Anhydrous (e.g. without water) HCl gas is typically stored and transported as a liquid in pressurized tanks (Figure 1, A). Aqueous solutions of hydrogen chloride are called hydrochloric or muriatic acid (Figure 1, B). Hydrochloric acid is used as an ingredient in toilet bowl cleaners. HCl solutions can also be purchased at pool supply and hardware stores as an acidifier, cleaner, and disinfectant.

Role in Drug Synthesis

HCl is used to produce the solid hydrochloride salt of methamphetamine. Both aqueous and gaseous forms can be used, but HCl gas is more effective.

Health Hazards

General: HCl is severely corrosive and irritating to all body tissues. Prolonged exposure may cause permanent effects.

Inhalation Exposure: HCl gas causes burning and irritation of the nose and throat, coughing, choking, sneezing, breathing difficulty, chest pain, and headache. Inhalation of anhydrous HCl gas can be fatal if exposure to concentrations of 0.1% in air occur even for a few minutes. Exposure to high concentrations of liquid or gaseous HCl can result in constriction of the airways, swelling, fluid build up and tissue death in the lungs, rapid breathing and pulse, shock, decreased blood pressure, tooth discoloration, gum and nosebleeds. HCl vapor is heavier than air. Asphyxiation might occur in confined, un-ventilated areas.

Skin (Dermal) Exposure: Direct contact with fumes or liquid can cause corrosive burns. Irritation, pain, inflammation, and ulceration can result. Frostbite may occur with exposure to anhydrous HCl as it is released from tanks.

Eye Contact: Fumes can cause extreme irritation. Contact with liquid HCl can result in pain, swelling, corneal erosion, tissue death, and may cause permanent eye damage.

Ingestion: HCl ingestion can cause pain, irritation, nausea, vomiting, thirst, difficulty swallowing, salivation, corrosive burns, ulceration, and perforation of the gastrointestinal tract, which can be fatal. Other effects include chills, fever, and kidney inflammation.

Special Concerns for Children: Children may inhale larger doses of HCl due to their greater lung size to body weight ratio and increased inhalation rates. Short stature may also be a risk since vapors may concentrate near the ground.

Clandestine Labs/ "Meth": Hydrogen Chloride

Environmental Concerns

Air: HCl gas is subject to wet deposition (washout by rainfall). HCl gas readily combines with water in the air to form HCl acid.

Soil: Anhydrous HCl gas readily combines with soil moisture to form HCl acid. HCl acid, an aqueous solution, can infiltrate soil and dissolve minerals, especially carbonates. This process typically results in neutralization of the HCl acid. However, if large amounts of HCl acid are spilled, infiltration and downward migration through the soil column may occur.

Ground Water: HCl acid can readily move through soil spaces where it may come in contact with, and may acidify, ground water. If significantly neutralized by organic and mineral components in the soil, or if diluted with sufficient amounts of water, ground water contamination can be minimized.

Surface Water: HCl dissociates almost completely in water to form acidic hydronium ions. Acified water can be neutralized with agricultural lime (CaO), crushed limestone ($CaCO_3$), or sodium bicarbonate ($NaHCO_3$).

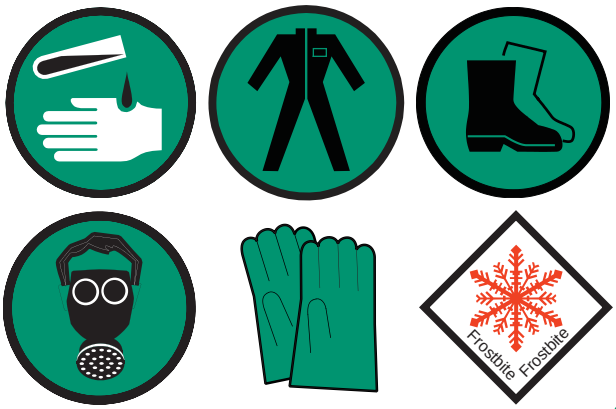
Indoors: Long-term contamination of indoor surfaces by anhydrous HCl is not likley a concern since it is a gas at room temperature and will typically dissipate. Care should be taken not to inhale HCl gas or vapors from HCl acid. If spilled on indoor surfaces, HCl acid can be neutralized by the addition of common bases, such as sodium bicarbonate. Spills should be addressed as recommended for hazardous materials cleanup of aqueous acids.

Exposure Limits

Occupational Exposure Limits (NIOSH & ACGIH)
Ceiling Limit: 2 ppm
8-Hr Time Weighted Average (TWA): not established
Immediately Dangerous (IDLH): 50 ppm (75 mg/m^3)

Preliminary Remediation Goals (PRGs)(U.S. EPA, Reg. 9):
Air: 14 ppb (21 $\mu g/m^3$). Soil & Water: not established

Handling & Safety



First Aid

Inhalation Exposure: Remove affected person to fresh air. Monitor for respiratory distress. Administer oxygen and assist ventilation as requried. Seek medical attention immediately. Severe respiratory tract irritation can progress to pulmonary edema, the onset of which may be delayed up to 24 to 72 hours after exposure.

Contact with Clothing or Skin (Dermal Exposure): Remove contaminated clothing. Flush exposed areas with water for at least 5 minutes. Thoroughly wash with soap and water when possible. Seek medical attention if needed.

Contact with Eyes: Flush exposed eyes with water or saline solution for at least 15 minutes. Remove contact lenses if possible. Seek immediate medical attention.

Ingestion (Oral) Exposure: Do not induce vomiting, do not give activated charcoal, and do not attempt to neutralize. Give 4-8 oz. of water or milk. Seek medical attention.

Chemical Hazards

Reactivity: HCl acid is highly corrosive and reacts with nearly all metals. It reacts with oxidizers releasing chlorine gas. When mixed with water, it releases large amounts of heat.

Flammability: HCl is not flammable, but in contact with strong bases (e.g., ammonium hydroxide or sodium hydroxide), an explosive reaction can occur. Flammable hydrogen gas can be produced when HCl contacts metals. Containers holding HCl gas or hydrochloric acid may explode when heated and corrosive HCl fumes may result. Water used to control a fire may become corrosive or toxic due to HCl acid contamination.

Chemical Incompatibilities: HCl is incompatible with alkalis, amines, copper, copper alloys, hydroxides, zinc, sulfuric acid, and organic materials.

More Information

Office of Environmental Health Hazard Assessment (OEHHA)
www.OEHHA.CA.Gov

Department of Toxic Substances Control (DTSC)
www.DTSC.CA.Gov

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