

**Hydrogen Chloride (HCl)**  
**CAS 7647-01-0; UN 1050 (anhydrous), UN 1789 (solution),**  
**UN 2186 (refrigerated liquefied gas)**

Synonyms for an aqueous solution of hydrogen chloride include chlorohydric acid, hydrochloric acid, and muriatic acid.

- **Persons exposed only to hydrogen chloride gas do not pose significant risks of secondary contamination. Persons whose clothing or skin is contaminated with hydrochloric acid can cause secondary contamination by direct contact or through off-gassing vapor.**
- **Hydrogen chloride is a colorless, corrosive, nonflammable gas that fumes in air. It has a characteristic pungent odor. It is heavier than air and may accumulate in low-lying areas.**
- **Hydrogen chloride is not absorbed through the skin, but when hydrogen chloride gas comes in contact with moisture, it forms hydrochloric acid, which is corrosive and can cause irritation and burns.**

### **Description**

At room temperature, hydrogen chloride is a colorless to slightly yellow gas with a pungent odor. On exposure to air, the gas forms dense white vapors due to condensation with atmospheric moisture. The vapor is corrosive, and air concentrations above 5 ppm can cause irritation.

Hydrogen chloride is available commercially as an anhydrous gas or as aqueous solutions (hydrochloric acid). Commercial concentrated hydrochloric acid contains 36% to 38% hydrogen chloride in water. Aqueous solutions generally are colorless but may be yellow due to traces of iron, chlorine, and organic impurities.

### **Routes of Exposure**

#### *Inhalation*

Inhalation is an important route of exposure to hydrogen chloride. Its odor and highly irritating properties generally provide adequate warning for acute, high-level exposures. However, only 50% of exposed persons can perceive hydrogen chloride's odor at the OSHA permissible exposure limit (5 ppm), and **odor may not provide adequate warning in the workplace**. Hydrogen chloride vapor is heavier than air and may cause asphyxiation in enclosed, poorly ventilated, or low-lying areas.

Children exposed to the same levels of hydrogen chloride as adults may receive larger dose because they have greater lung surface area:body weight ratios and increased minute volumes:weight ratios. In addition, they may be exposed to higher levels than adults in the same location because of their short stature and the higher levels of hydrogen chloride found nearer to the ground.

*Skin/Eye Contact*

Hydrogen chloride is not absorbed through the skin. Direct contact with aqueous solutions of hydrogen chloride or with concentrated vapor can cause severe chemical burns.

Children are more vulnerable to toxicants affecting the skin because of their relatively larger surface area:body weight ratio.

*Ingestion*

Ingestion of concentrated hydrochloric acid can cause severe corrosive injury to the lips, mouth, throat, esophagus, and stomach.

**Sources/Uses**

Hydrogen chloride is produced commercially by any of the following reactions: heated hydrogen gas with calcium chloride, sulfuric acid with sodium chloride, sodium chloride with sulfur dioxide and steam, and hydrogen burned in chlorine. Hydrogen chloride can be formed during the combustion of many plastics. Hydrochloric acid (muriatic acid) is a component of commercial chemicals used to clean and disinfect swimming pools.

Hydrogen chloride is used for cleaning, pickling, and electroplating metals; in refining mineral ores; in petroleum well extraction; in leather tanning; and in the refining of fats, soaps, and edible oils. It is also used in producing polymers and plastics, rubber, fertilizers, dyes, dyestuffs, and pigments.

**Standards and Guidelines**

OSHA PEL (permissible exposure limit) = 5 ppm (ceiling)

NIOSH IDLH (immediately dangerous to life or health) = 50 ppm

AIHA ERPG-2 (emergency response planning guideline) (maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action) = 20 ppm

**Physical Properties**

*Description:* Colorless-to-slightly yellow gas

*Warning properties:* Sharp, choking odor. Air odor threshold is 0.77 ppm, but only 50% of distracted exposed persons can perceive hydrogen chloride's odor at 5 ppm.

*Molecular weight:* 36.5 daltons

*Boiling point* (760 mm Hg): = -121 °F (-85 °C)

*Freezing point:* -174 °F (-114 °C)

*Vapor pressure:* 30,780 mm Hg at 68 °F (20 °C)

*Gas density:* 1.3 (air = 1)

*Water solubility:* 67% at 68 °F (20 °C)

*Flammability:* Not flammable

### **Incompatibilities**

Hydrogen chloride is highly corrosive to most metals. It also reacts with hydroxides, amines, and alkalies.



## Health Effects

- **Concentrated hydrogen chloride can be corrosive to the skin, eyes, nose, mucous membranes, and respiratory and gastrointestinal tracts.**
- **Inhalation of hydrogen chloride can lead to pulmonary edema. Ingestion can cause severe injury to the mouth, throat, esophagus, and stomach.**
- **Other effects of exposure include shock, circulatory collapse metabolic acidosis, and respiratory depression.**

### Acute Exposure

Hydrogen chloride is a strong mineral acid; its corrosive and irritant properties are the primary concern in both acute and chronic exposures.

Children do not always respond to chemicals in the same way that adults do. Different protocols for managing their care may be needed.

### *Respiratory*

Hydrogen chloride gas is intensely irritating to the mucous membranes of the nose, throat, and respiratory tract. Brief exposure to 35 ppm causes throat irritation, and levels of 50 to 100 ppm are barely tolerable for 1 hour. The greatest impact is on the upper respiratory tract; exposure to high concentrations can rapidly lead to swelling and spasm of the throat and suffocation.

Most seriously exposed persons have immediate onset of rapid breathing, blue coloring of the skin, and narrowing of the bronchioles. Patients who have massive exposures may develop an accumulation of fluid in the lungs.

Exposure to hydrogen chloride can lead to Reactive Airway Dysfunction Syndrome (RADS), a chemically- or irritant-induced type of asthma.

Children may be more vulnerable to corrosive agents than adults because of the relatively smaller diameter of their airways. Children may also be more vulnerable to gas exposure because of increased minute ventilation per kg and failure to evacuate an area promptly when exposed.

### *Metabolic*

A rare and unusual complication of ingestion of high levels of hydrogen chloride is an increase in the concentration of chloride ions in the blood, causing an acid-base imbalance.

Because of their higher metabolic rates, children may be more vulnerable to toxicants interfering with basic metabolism.

*Dermal*

Deep burns of the skin and mucous membranes are caused by contact with concentrated hydrochloric acid or hydrogen chloride gas; disfiguring scars may result. Contact with less concentrated acid or with vapor or mist can cause redness of the skin and mild inflammation.

Because of their relatively larger surface area:body weight ratio, children are more vulnerable to toxicants affecting the skin.

*Ocular*

Exposure of the eyes to concentrated hydrogen chloride vapor or hydrochloric acid can cause corneal cell death, cataracts, and glaucoma. Exposure to dilute solutions can cause stinging pain and injuries such as ulcers of the eye surface.

*Gastrointestinal*

Ingesting concentrated hydrochloric acid can cause pain, difficulty swallowing, nausea, and vomiting.

Ingestion of concentrated hydrochloric acid can also cause severe corrosive injury to the mouth, throat esophagus, and stomach, with bleeding, perforation, scarring, or stricture formation as potential sequelae.

*Hepatic*

Liver damage and ischemia may be observed.

*Renal*

Renal failure and nephritis may occur.

*Cardiovascular*

Ingestion of concentrated hydrochloric acid or massive skin exposure to either hydrochloric acid or hydrogen chloride gas may cause low blood pressure as a result of gastrointestinal bleeding or fluid displacement. After acute exposure, pulmonary function generally returns to baseline in 7 to 14 days.

*Potential Sequelae*

Although complete recovery is usual, symptoms and prolonged pulmonary deficits can persist. Patients may develop Reactive Airways Dysfunction Syndrome (RADS).

Patients who have ingested hydrochloric acid may experience scarring of the esophagus or stomach, which can cause narrowing, difficulty swallowing, or gastric outlet obstruction.

**Chronic Exposure**

Chronic or prolonged exposure to hydrogen chloride gas (above the OSHA PEL) or to mist has been associated with changes in pulmonary function, chronic inflammation of the bronchi, nasal ulceration, and symptoms resembling acute viral infection of the upper respiratory tract as well as inflammation of the skin, discoloration and erosion of dental enamel, and inflammation of the eye membrane. Chlorosis may occur with prolonged exposure.

*Carcinogenicity*

Hydrogen chloride has not been classified for carcinogenic effects.

*Reproductive and  
Developmental Effects*

Some reproductive hazards of hydrogen chloride to humans are unknown. Few studies have been directed at reproductive effects in experimental animals exposed to hydrogen chloride. No data were located pertaining to maternal transfer of hydrogen chloride through the placenta or in breast milk. Hydrogen chloride is not included in *Reproductive and Developmental Toxicants*, a 1991 report published by the U.S. General Accounting Office (GAO) that lists 30 chemicals of concern because of widely acknowledged reproductive and developmental consequences.

Fetotoxicity, developmental abnormalities, and possible resistance to hydrogen chloride by inhalation during pregnancy have been noted. No data about possible male reproductive effects is available.





## Prehospital Management

- **Victims exposed only to hydrogen chloride gas and whose skin and clothing appear dry do not pose risks of secondary contamination to rescuers. However, victims exposed to hydrochloric acid or hydrogen chloride whose clothing or skin is moist or wet can secondarily contaminate response personnel by direct contact or through off-gassing vapor.**
- **High concentrations of hydrogen chloride can cause corrosive injury to all exposed body tissues. When inhaled, it can result in upper respiratory tract irritation, leading to laryngeal edema, laryngeal spasm, and asphyxia. Concentrated hydrochloric acid causes similar corrosive injury to the skin and, if ingested, can cause severe corrosive injury to the mouth, throat, esophagus, and stomach.**
- **There is no antidote for hydrogen chloride poisoning. Treatment consists of support of respiratory and cardiovascular functions.**

### Hot Zone

Rescuers should be trained and appropriately attired before entering the Hot Zone. If the proper equipment is not available, or if rescuers have not been trained in its use, assistance should be obtained from a local or regional HAZMAT team or other properly equipped response organization.

### Rescuer Protection

Hydrogen chloride gas is a severe respiratory-tract and skin irritant that forms a strong acid (hydrochloric acid) on contact with water.

*Respiratory Protection:* Positive-pressure, self-contained breathing apparatus (SCBA) is recommended in response situations that involve exposure to potentially unsafe levels of hydrogen chloride.

*Skin Protection:* Chemical-protective clothing is recommended because hydrogen chloride can cause skin irritation and burns.

### ABC Reminders

Quickly access for a patent airway, ensure adequate respiration and pulse. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible.

### Victim Removal

If victims can walk, lead them out of the Hot Zone to the Decontamination Zone. Victims who are unable to walk may be removed on backboards or gurneys; if these are not available, carefully carry or drag victims to safety.

Consider appropriate management of chemically contaminated children, such as measures to reduce separation anxiety if a child is separated from a parent or other adult.

## **Decontamination Zone**

Victims exposed only to hydrogen chloride gas who have no skin or eye irritation do not need decontamination; they may be transferred immediately to the Support Zone. All others require decontamination as described below.

### *Rescuer Protection*

If exposure levels are determined to be safe, decontamination may be conducted by personnel wearing a lower level of protection than that worn in the Hot Zone (described above).

### *ABC Reminders*

Quickly access for a patent airway, ensure adequate respiration and pulse. Stabilize the cervical spine with a collar and a backboard if trauma is suspected. Administer supplemental oxygen as required. Assist ventilation with a bag-valve-mask device if necessary.

### *Basic Decontamination*

Victims who are able may assist with their own decontamination. Remove contaminated clothing while flushing exposed skin and hair with water for 3 to 5 minutes, wash thoroughly with soap and water. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate. Double-bag contaminated clothing and personal belongings.

Flush exposed or irritated eyes with tepid plain water or saline for 15 minutes. Eye irrigation should be carried out simultaneously with other basic care and transport. Remove contact lenses if easily removable without additional trauma to the eye.

In cases of ingestion, **do not induce emesis. Do not administer activated charcoal or attempt to neutralize stomach contents.** Victims who are conscious and able to swallow should be given 4 to 8 ounces of water or milk. (Children's dose is 2 to 4 ounces.)

Consider appropriate management of chemically contaminated children, such as measures to reduce separation anxiety if a child is separated from a parent or other adult. If possible, seek assistance from a child separation expert.

### *Transfer to Support Zone*

As soon as basic decontamination is complete, move the victim to the Support Zone.

**Support Zone**

Be certain that victims have been decontaminated properly (see *Decontamination Zone* above). Victims who have undergone decontamination or who have been exposed only to gas and who have no symptoms of skin or eye irritation pose no serious risk of secondary contamination. In such cases, Support Zone personnel require no specialized protective gear.

*ABC Reminders*

Quickly access for a patent airway. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible. Ensure adequate respiration and pulse. Administer supplemental oxygen as required and establish intravenous access if necessary. Place on a cardiac monitor.

*Additional Decontamination*

Continue irrigating exposed skin and eyes, as appropriate.

In cases of ingestion, **do not induce emesis. Do not administer activated charcoal or attempt to neutralize stomach contents.** Adult victims who are conscious and able to swallow should be given 4 to 8 ounces of water or milk, if it has not been given previously, to flush residual acid from the esophagus and to dilute stomach contents. Children should receive half of the adult dose.

*Advanced Treatment*

In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, perform cricothyroidotomy if equipped and trained to do so.

Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly). Sympathomimetic bronchodilators generally will reverse bronchospasm in patients exposed to hydrogen chloride.

Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water, repeat every 20 minutes as needed, cautioning for myocardial variability.

Patients who are comatose, hypotensive, or are having seizures or cardiac arrhythmias should be treated according to advanced life support (ALS) protocols.

*Transport to Medical Facility*

Only decontaminated patients or patients not requiring decontamination should be transported to a medical facility. “Body bags” are not recommended.

Report to the base station and the receiving medical facility the condition of the patient, treatment given, and estimated time of arrival at the medical facility.

If hydrochloric acid has been ingested, prepare the ambulance in case the victim vomits toxic material. Have ready several towels and open plastic bags to quickly clean up and isolate vomitus.

**Multi-Casualty Triage**

Consult with the base station physician or the regional poison control center for advice regarding triage of multiple victims.

Patients with evidence of significant exposure such as skin or eye irritation, pain, or breathing difficulties should be transported to a medical facility for evaluation. Others may be discharged from the scene after their names, addresses, and telephone numbers are recorded. Those discharged should be advised to seek medical care promptly if symptoms develop (see *Patient Information Sheet* below).

## Emergency Department Management

- **Patients exposed only to hydrogen chloride gas whose clothing and skin are dry do not pose a risk of secondary contamination. Hospital personnel can be secondarily contaminated by patients exposed to hydrochloric acid either by direct skin contact or through inhalation of vapor off-gassing from heavily soaked clothing or skin. Patients do not pose contamination risks after contaminated clothing is removed and the skin is washed.**
- **High concentrations of hydrogen chloride causes corrosive injury to all exposed body tissues. When inhaled, it can result in upper respiratory tract irritation, leading to laryngeal edema, laryngeal spasm, and asphyxia. Concentrated hydrochloric acid causes similar corrosive injuries to exposed tissues and, if ingested, can cause severe corrosive injury to the mouth, throat, esophagus, and stomach.**
- **There is no antidote for hydrogen chloride poisoning. Treatment consists of support of respiratory and cardiovascular functions.**

### Decontamination Area

Previously decontaminated patients and patients exposed only to hydrogen chloride gas who have no skin or eye irritation may be transferred immediately to the Critical Care Area. Others require decontamination as described below.

Hospital personnel should don rubber gloves, rubber aprons, and eye protection before treating patients who are wet with hydrochloric acid.

Be aware that use of protective equipment by the provider may cause fear in children, resulting in decreased compliance with further management efforts.

Because of their relatively larger surface area:body weight ratio, children are more vulnerable to toxicants affecting the skin. Also, emergency room personnel should examine children's mouths because of the frequency of hand-to-mouth activity among children.

### *ABC Reminders*

Evaluate and support airway, breathing, and circulation. Children may be more vulnerable to corrosive agents than adults because of the smaller diameter of their airways. In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, surgically create an airway.

Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in

situations of multiple chemical exposures may pose additional risks. Consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly). Hydrogen chloride poisoning is not known to pose additional risk during the use of bronchial or cardiac sensitizing agents. Sympathomimetic bronchodilators generally will reverse bronchospasm in patients exposed to hydrogen chloride.

Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water, repeat every 20 minutes as needed, cautioning for myocardial variability.

Patients who are comatose, hypotensive, or having seizures or cardiac arrhythmias should be treated in the conventional manner.

#### *Basic Decontamination*

Patients who are able may assist with their own decontamination. Remove and double-bag contaminated clothing and personal belongings.

Flush exposed skin and hair with water for 3 to 5 minutes (preferably under a shower). Wash thoroughly with soap and water, rinse thoroughly with water. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Flush exposed eyes with plain water or saline for at least 15 minutes. Remove contact lenses if easily removable without additional trauma to the eye. Continue irrigation while transporting the patient to the Critical Care Area.

In cases of ingestion, **do not induce emesis. Do not administer activated charcoal or attempt to neutralize stomach contents.** If it has not been given previously, administer 4 to 8 ounces of water or milk to adults to flush residual acid from the esophagus and to dilute stomach contents. (Children's dose is 2 to 4 ounces.)

#### **Critical Care Area**

Be certain that appropriate decontamination has been carried out (see *Decontamination Area* above).

*ABC Reminders*

Evaluate and support airway, breathing, and circulation as in *ABC Reminders* above. Children may be more vulnerable to corrosive agents than adults because of the relatively smaller diameter of their airways. Establish intravenous access in seriously ill patients if this has not been done previously. Continuously monitor cardiac rhythm.

Patients who are comatose, hypotensive, or have seizures or cardiac arrhythmias should be treated in the conventional manner.

*Inhalation Exposure*

Administer supplemental oxygen by mask to patients who have respiratory symptoms. Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly). Sympathomimetic bronchodilators generally will reverse bronchospasm in patients exposed to hydrogen chloride.

Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water, repeat every 20 minutes as needed, cautioning for myocardial variability.

Observe patients for at least 24 hours, repeating appropriate tests and chest examinations as needed. Follow-up as clinically indicated.

Some authorities recommend treatment with high doses of corticosteroids for patients who have high-dose exposures, but the value of this treatment is questionable and unsupported by clinical studies.

*Skin Exposure*

If the skin was in contact with concentrated hydrochloric acid or hydrogen chloride gas or mists, chemical burns may occur, treat as thermal burns.

Because of their relatively larger surface area:body weight ratio, children are more vulnerable to toxicants affecting the skin.

<i>Eye Exposure</i>	Continue irrigating for at least 15 minutes or until the pH of the conjunctival fluid has returned to normal. Test visual acuity. Examine eyes for corneal damage and treat appropriately. Immediately consult an ophthalmologist for patients who have corneal injuries.
<i>Ingestion Exposure</i>	<p><b>Do not induce emesis. Do not administer activated charcoal or attempt to neutralize stomach contents.</b> Immediate dilution with 4 to 8 ounces of water or milk may be beneficial (pediatric dose 2 to 4 ounces) for alert patients who can swallow.</p> <p>Consider endoscopy to evaluate the extent of gastrointestinal tract injury. Extreme throat swelling may require endotracheal intubation or cricothyroidotomy. Gastric lavage is useful in certain circumstances to remove caustic material and prepare for endoscopic examination. Consider gastric lavage with a small nasogastric tube if: (1) a large dose has been ingested; (2) the patient's condition is evaluated within 30 minutes; (3) the patient has oral lesions or persistent esophageal discomfort; and (4) the lavage can be administered within 1 hour of ingestion. Care must be taken when placing the gastric tube because blind gastric-tube placement may further injure the chemically damaged esophagus or stomach.</p> <p>Because children do not ingest large amounts of corrosive materials, and because of the risk of perforation from NG intubation, lavage is discouraged in children unless performed under endoscopic guidance.</p> <p>Toxic vomitus or gastric washings should be isolated (e.g., by attaching the lavage tube to isolated wall suction or another closed container).</p> <p>The use of corticosteroids to prevent acid-induced strictures is questionable and unsupported by clinical studies.</p>
<i>Antidotes and Other Treatments</i>	There is no antidote for hydrogen chloride poisoning.
<i>Laboratory Tests</i>	The diagnosis of acute hydrogen chloride toxicity is primarily clinical, based on symptoms of the corrosive action of the gas or acid. Routine laboratory studies for all exposed patients include CBC, glucose, and electrolyte determinations. Monitor acid-base status in patients who have ingested hydrochloric acid. If respiratory-tract irritation is present, monitor with chest radiography and pulse oximetry (or ABG measurements).



**Disposition and  
Follow-up**

There is no biologic test specific for systemically absorbed hydrogen chloride.

Patients who develop serious signs or symptoms of hydrogen chloride exposure should be hospitalized and observed closely for 4 to 6 hours or until asymptomatic.

*Delayed Effects*

Delayed effects are unlikely in patients who have minor symptoms that resolve quickly. However, symptoms can be delayed for 1 to 2 days.

*Patient Release*

Patients who have had minor exposure and who are asymptomatic 4 to 6 hours after exposure may be discharged and advised to seek medical care promptly if symptoms develop (see the *Hydrogen Chloride—Patient Information Sheet* below).

*Follow-up*

Obtain the name of the patient's primary care physician so that the hospital can send a copy of the ED visit to the patient's doctor.

Patients who have inhaled significant amounts of hydrogen chloride should be monitored with pulmonary function tests. Patients should also be monitored for the development of Reactive Airway Dysfunction Syndrome (RADS), a chemically- or irritant-induced type of asthma. About 2 to 4 weeks after an ingestion, consider follow-up esophagoscopy and an upper gastrointestinal tract series to evaluate secondary scarring or stricture formation.

Patients who have skin or corneal injury should be re-examined within 24 hours.

**Reporting**

If a work-related incident has occurred, you may be legally required to file a report; contact your state or local health department.

Other persons may still be at risk in the setting where this incident occurred. If the incident occurred in the workplace, discussing it with company personnel may prevent future incidents. If a public health risk exists, notify your state or local health department or other responsible public agency. When appropriate, inform patients that they may request an evaluation of their workplace from OSHA or NIOSH. See Appendices III and IV for a list of agencies that may be of assistance.



## **Hydrogen Chloride Patient Information Sheet**

This handout provides information and follow-up instructions for persons who have been exposed to hydrogen chloride gas or hydrochloric acid solution.

### **What are hydrogen chloride and hydrochloric acid?**

Hydrogen chloride is a colorless to slightly yellow gas with a sharp, irritating odor. It forms a dense white vapor when it comes in contact with air. When hydrogen chloride dissolves in water, it forms hydrochloric acid also known as muriatic acid. Both hydrogen chloride and hydrochloric acid are corrosive and may cause burns on contact. Hydrogen chloride is not flammable.

### **What immediate health effects can be caused by exposure to these chemicals?**

Hydrogen chloride gas can irritate the lungs, causing a cough and shortness of breath. Breathing high levels of the gas or vapor can lead to a build-up of fluid in the lungs, which may cause death. Because hydrochloric acid is corrosive, it can cause eye damage, even blindness, if splashed in the eyes. Skin contact can cause severe burns. Ingestion of concentrated hydrochloric acid can cause severe injury to the mouth, throat, esophagus and stomach. Generally, the more serious the exposure, the more severe the symptoms.

### **Can hydrogen chloride or hydrochloric acid overexposure be treated?**

There is no antidote for poisoning due to these substances, but their effects can be treated and most exposed persons get well. People who have had serious exposures may need to be hospitalized.

### **Are any future health effects likely to occur?**

A single, small exposure from which a person recovers quickly is not likely to cause delayed or long-term effects. Patients who breathe a large amount of hydrogen chloride may develop permanent lung injury. If hydrochloric acid was swallowed, a patient may permanently have trouble swallowing.

### **What tests can be done if a person has been exposed to hydrogen chloride?**

Specific tests for the presence of hydrogen chloride in blood or urine generally are not useful to the doctor. If a severe exposure has occurred, blood and urine analyses and other tests may show whether the lungs or stomach has been injured. Testing is not needed in every case.

### **Where can more information about hydrogen chloride and hydrochloric acid be found?**

More information about hydrogen chloride and hydrochloric acid can be obtained from your regional poison control center; your state, county, or local health department; the Agency for Toxic Substances and Disease Registry (ATSDR); your doctor; or a clinic in your area that specializes in occupational and environmental health. If the exposure happened at work, you may wish to discuss it with your employer, the Occupational Safety and Health Administration (OSHA), or the National Institute for Occupational Safety and Health (NIOSH). Ask the person who gave you this form for help in locating these telephone numbers.

## Follow-up Instructions

Keep this page and take it with you to your next appointment. Follow *only* the instructions checked below.

- ☐ Call your doctor or the Emergency Department if you develop any unusual signs or symptoms within the next 24 hours, especially:
- coughing or wheezing
  - difficulty breathing, shortness of breath, or chest pain
  - stomach pain or vomiting
  - increased pain or a discharge from exposed eyes
  - increased redness or pain or a pus-like discharge in the area of a skin burn
- ☐ No follow-up appointment is necessary unless you develop any of the symptoms listed above.
- ☐ Call for an appointment with Dr. \_\_\_\_\_ in the practice of \_\_\_\_\_.
- When you call for your appointment, please say that you were treated in the Emergency Department at \_\_\_\_\_ Hospital by \_\_\_\_\_ and were advised to be seen again in \_\_\_\_\_ days.
- ☐ Return to the Emergency Department/ \_\_\_\_\_ Clinic on (date) \_\_\_\_\_ at \_\_\_\_\_ AM/PM for a follow-up examination.
- ☐ Do not perform vigorous physical activities for 1 to 2 days.
- ☐ You may resume everyday activities including driving and operating machinery.
- ☐ Do not return to work for \_\_\_\_\_ days.
- ☐ You may return to work on a limited basis. See instructions below.
- ☐ Avoid exposure to cigarette smoke for 72 hours; smoke may worsen the condition of your lungs.
- ☐ Avoid drinking alcoholic beverages for at least 24 hours; alcohol may worsen injury to your stomach or have other effects.
- ☐ Avoid taking the following medications: \_\_\_\_\_
- ☐ You may continue taking the following medication(s) that your doctor(s) prescribed for you: \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- ☐ Other instructions: \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- Provide the Emergency Department with the name and the number of your primary care physician so that the ED can send him or her a record of your emergency department visit.
  - You or your physician can get more information on the chemical by contacting: \_\_\_\_\_ or \_\_\_\_\_, or by checking out the following Internet Web sites: \_\_\_\_\_; \_\_\_\_\_.

Signature of patient \_\_\_\_\_ Date \_\_\_\_\_

Signature of physician \_\_\_\_\_ Date \_\_\_\_\_