HYDROGEN CHLORIDE **FACTS**

TEXAS Department of State Health Services

Hazardous Substances Emergency Events Surveillance (HSEES) System

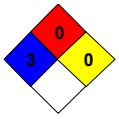
Synonyms: Anhydrous hydrogen chloride, Hydrochloric acid, anhydrous HCl, Muriatic acid

CAS Number: 7647-01-0

DOT Numbers: UN1050 (anhydrous)
UN 2186 (refrigerated liquid)

RTECS Number: MW4025000

Hazard rating	NFPA
HEALTH	3 = Extreme danger
FLAMMABILITY	0 = Minimal
REACTIVITY	0 = Stable
CORROSIVE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE	



Characteristics:

- Colorless to slightly yellow compressed liquefied gas.
- Pungent odor, heavier than air.
- When exposed to air, it forms dense white corrosive vapors.
- Reacts with water and in solution is a strong acid.
- Containers may explode in a fire.
- Contact from liquefied compressed gas may cause frostbite to skin and eyes.
- Incompatibilities and reactivities: Alkalis, amines, brass, copper, or zinc. It reacts violently with bases and is corrosive. It reacts violently with oxidants, forming the TOXIC gas CHLORINE. In the presence of water and metals, it forms HYDROGEN, a FLAMMABLE/EXPLOSIVE gas.

Uses and Potential Exposures:

- Used in the production of other chemicals, fertilizers, and dyes.
- Used in cleaning, pickling, or electroplating metals, ore refining, food processing, leather tanning, and in the rubber and textile industries.
- Used to keep swimming pool water at the proper pH balance.
- It is naturally occurring during volcanic eruptions and can form when many plastics burn.
- Soldering materials may contain hydrogen chloride and exposure can occur during soldering.

Exposure Routes:

- Inhalation
- Ingestion (solution)
- Skin and/or eye contact

AVOID ALL CONTACT!

Hydrogen chloride exposure levels and associated health impact in acute (< 15 minutes) exposure situations:

Concentration	Health Effects
0.25 - 10 ppm	Readily detectable odor. Eye, nose, and throat irritation, corrosive, burning sensation. Liquid exposure to skin or eyes will cause frostbite, serious skin burns, corrosion, pain, and blurred vision or blindness. Ingestion will cause nausea, vomiting, intense thirst. Symptoms may be delayed. Chronic exposure to low levels may result in tooth enamel corrosion, coughing, shortness of breath, bronchitis. It may cause respiratory cancers. It may affect the liver and kidneys.
> 10 ppm ($15\ mg/m^3$)	Corrosive skin burns, sneezing, laryngitis, hoarseness, chest pain, feeling of suffocation.
50 ppm	**Immediately dangerous to life and health (IDLH)**
> 50 ppm	Pulmonary edema, laryngeal spasm. Ingestion will cause esophageal burns, gastric perforation, peritonitis. Note: The symptoms often do not manifest until a few hours have passed and physical exertion will aggravate this condition. Rest and medical observation are essential.

Recommended and permissible occupational exposure limits for hydrogen chloride:

Concentration	Recommendations
None	*Threshold Limit Value – Time Weighted Average (TLV-TWA®)** the time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect.
2 ppm	*Threshold Limit Value - Short-Term Exposure Limit (TLV-STEL®)** is defined as a 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the 8-hour TWA is within the TLV-TWA. Exposures above the TLV-TWA up to the TLV-STEL should not be longer than 15 minutes and should not occur more than four times per day. There should be at least 60 minutes between successive exposures.
5 ppm (7 mg/m^3)	*Permissible Exposure Limit (PEL)*† The permissible airborne contaminant concentration weighted over an 8-hour work day, as determined from breathing-zone air samples, over which the employee may not be exposed.

*American Conference of Governmental Industrial Hygienists (ACGIH) guidelines
†Occupational Safety and Health Administration (OSHA) guidelines

Personal Protective Equipment (PPE) Guidelines:
Note: Workplace controls are better than PPE.

Clothing

- Wear acid-resistant gloves and clothing. Safety equipment made from Neoprene, Polyvinyl Chloride and Nitrile Butyl Rubber are recommended.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- Structural firefighter protective clothing provides limited protection in fire situations, ONLY; not effective in spill situations.

Eye Protection

- When working with fumes, gases, or vapors, wear non-vented, impact resistant goggles and face shield.
- When working with liquids, wear indirect-vent, impact and splash resistant goggles and face shield.
- Avoid wearing contact lenses when working with this substance.

Respiratory Protection

NIOSH respirator recommendations

Concentration (ppm)	Recommendations	AFP
Emergency or planned entry into unknown concentrations (50 ppm) IDLH	►Self-contained breathing apparatus with full facepiece and is operated in a pressure-demand or other positive-pressure mode.	10,000
Escape	►Air-purifying, full-facepiece respirator (gas mask) with chin-style, front- or back-mounted acid gas canister. ►Escape-type, self-contained breathing apparatus.	50
Up to 50 ppm	►Air-purifying, full-facepiece respirator (gas mask) with chin-style, front- or back-mounted hydrogen chloride canister. ►Self-contained breathing apparatus with a full facepiece.	50
Up to 25 ppm	►Air-purifying respirator with cartridge(s) providing protection against hydrogen chloride.	25
Up to 10 ppm	►Any chemical cartridge/canister providing protection against hydrogen chloride. ►supplied-air respirator providing protection against hydrogen chloride.	10

Hydrogen Chloride Handling and Storage:

- Avoid contact with combustible and reducing substances, strong oxidants, strong bases, or metals.
- Store in a cool, dry, well-ventilated areas.

Disposal Methods:

1. Ventilation.
2. Remove gas with a fine water spray. Use complete protective clothing, including self-contained breathing apparatus.

Spills and Emergencies:

- ✓ Evacuate endangered area 160 to 330 feet in all directions. If there is a fire/explosion threat, consider an evacuation in all directions within ½ mile.
- ✓ Stay up wind. Ventilate area. Hydrogen chloride is heavier than air. Keep out of low lying areas or confined spaces. Use a fine water spray to remove gas.
- ✓ Stop the leak. If the source is a leaking cylinder, turn the leaking cylinder with the leak up to prevent the escape of gas in a liquid state. Remove the cylinder to a safe place in open air and repair the leak or allow the cylinder to empty.
- ✓ Cover spills with dry lime, sand, or soda ash, and place in covered containers for proper hazardous materials disposal.
- ✓ After clean-up is complete, wash the area.

Emergency First Aid Measures:

Eye Contact

1. Immediately flush eyes with large amounts of water. Continue for at least 30 minutes, lifting upper and lower eye lids.
2. Seek medical attention immediately.

Skin Contact

1. Quickly remove and isolate contaminated clothing.
2. Immediately wash skin with large amounts of water for at least 20 minutes, followed by washing with soap and water.
3. Seek medical attention immediately.

Respiratory

1. Remove the victim from the site of the release to fresh air.
2. If breathing has stopped, begin rescue breathing using universal precautions, and CPR if heart activity has stopped.
3. Transfer the victim promptly to a medical facility.
4. Observation is recommended for up to 48 hours, as fluid in the lungs (pulmonary edema) may be delayed.

Fire Extinguishing and Explosion Hazard:

- ✓ In case of fire, use Carbon Dioxide (except for Cyanides), dry chemical, dry sand, or alcohol-resistant foam, water spray or fog.
- ✓ To prevent explosion or corrosion of the cylinder, do NOT spray straight streams of water on or into a leaking cylinder; use a water spray or fog.
- ✓ Fight the fire from the maximum distance or use unmanned hose holders or monitor nozzles.
- ✓ Dike the fire control water for later disposal; do not scatter the material. Isolate the area for ½ mile in all directions.
- ✓ Hydrogen chloride reacts with many metals in the presence of water, forming HYDROGEN, a FLAMMABLE/EXPLOSIVE gas.
- ✓ Mixing Hydrogen chloride with oxidants will form CHLORINE, a TOXIC gas.

TxHSEES Facts

The Texas Department of State Health Services (DSHS) has participated in this surveillance system since 1993. HSEES collects and analyzes information about releases of hazardous substances (excluding petroleum) that need to be cleaned up or neutralized as well as threatened releases that result in a public health action such as an evacuation. The goal of HSEES is to reduce the morbidity (injury) and mortality (death) that result from hazardous substance events.

From 1993 to 2002, TxHSEES investigated 23,139 events meeting the HSEES case definition. Due to the large number of spills and air releases in Texas, TxHSEES requires that the spill or release must be greater than one gallon or greater than 10 pounds, unless the CERCLA reportable quantity is one pound.

HSEES categorizes chemicals into 16 substance categories. The substance category, acids, ranked as the fourth most frequent category (1,497, 6%).

Hydrochloric acid releases accounted for 20% of the acid releases and included hydrochloric acid and muriatic acid. Hydrochloric acid was involved in 306 actual or threatened events: 211 fixed-facility events and 95 transportation events (Table 1). A total of 106 people were injured during 29 events involving hydrochloric acid releases (Table 1).

Table 1. Summary of hydrochloric acid events reported to TxHSEES

	Fixed Facility No. %	Transportation No. %	Total
Events	211 (69%)	95 (31%)	306
Evacuations	29 (91%)	3 (9%)	32
Shelter-in-place	3 (75%)	1 (25%)	4
People receiving emergency decontaminations	75 (91%)	7 (9%)	82
Events with victims	19 (66%)	10 (34%)	29
Victims	88 (83%)	18 (17%)	106

More than 7,294 people were evacuated in 32 hydrochloric acid events. The number of people evacuated ranged from 2 to 5,000, with a median number of 16 people evacuated. The length of evacuation ranged from 1 to 24 hours, with a median number of 2 hours.

The industries most frequently associated with hydrochloric acid releases were transportation (90, 29%) and chemical manufacturing (87, 28%) (Table 2). Nine percent of all hydrochloric acid release events injured people. The transportation industry accounted for 35% of the events involving victims and injured 21 people; however, chemical manufacturing was associated with the largest number of injured persons (23, 21%).

Table 2. Frequency of events, events with victims, and victims by selected industries

Industry Category	Events No. (%)	Events with victims No. (%)	Victims No. (%)
Transportation	90 (29%)	10 (35%)	21 (19%)
Chemical Mfg.	87 (28%)	7 (24%)	23 (21%)
Mining/Oil & Gas Extraction	20 (7%)	1 (3%)	1 (1%)
Wholesale	21 (7%)	4 (14%)	4 (4%)
Durable and Nondurable Goods Mfg	20 (7%)	2 (7%)	3 (3%)
Petroleum Refining	11 (4%)	1 (3%)	1 (1%)
All other	46 (15%)	3 (10%)	52 (50%)
Unknown	11 (4%)	1 (3%)	1 (1%)
Total*	306 (101%)	29 (99%)	106 (100%)

* Percentages may not add to 100% due to rounding.

The chemical manufacturing industry had the largest number of evacuations (6, 19% of all evacuations), followed by durable and nondurable goods manufacturing (5, 16%). Eighty-two people received emergency decontamination in 17 events.

The majority of injured persons were members of the general public (64, 60%) and their most frequent injuries were respiratory irritation, trauma, and skin irritation. For the 38 injured employees, trauma, followed by respiratory irritation, were the most frequently reported injuries. The 4 responders most frequently reported respiratory irritation, chemical burns, and heat stress. Three deaths occurred in events associated with hydrochloric acid releases. Most people were treated on the scene or at a hospital and released.

Case Study 1

Highlights: 9 victims, an evacuation, and closed highways

A chemical tanker jackknifed and overturned on a freeway ramp; the guard rail penetrated the trailer, releasing 5,000 gallons of hydrochloric acid at the intersection of two major highways. This occurred in a densely populated metropolitan area. Traffic was grid locked for hours. More than 120 firefighters, police, and paramedics enforced an evacuation that lasted 24 hours. More than 5,000 people were evacuated, including 4,371 students from 8 public schools and one day care facility, a community college, a Salvation Army shelter, and local stores. People living in senior citizen homes were told to shelter-in-place.

The driver was taken to the hospital and treated for chemical burns. The hospital emergency staff wore protective suits and masks as they removed the driver's clothing and showered him. Two firefighters, one police officer, and five members of the general public were taken to local hospitals, treated for symptoms of respiratory irritation, and were released. There was an unconfirmed report of 32 people being treated at the scene for eye and respiratory symptoms. This event prompted the city council to discuss the development of a hazardous materials route plan for the city.

Case Study 2

Highlights: 26 victims

Twenty-six people, mostly children, were injured during their first week of summer vacation when a

pipe began spewing hydrochloric acid into a municipal swimming pool. Four children were admitted to the hospital, and 22 others were transported to the hospital, treated, and released. Injuries included difficulty breathing, nausea, vomiting, and a burning sensation in their eyes, noses, and throats. The city parks director stated that two weeks before the release, a contractor had converted the pool's water treatment system from a gas chlorine system to a system which mixed liquid chlorine, hydrochloric acid, and water.

For more information about TxHSEES, call 512-458-7220.

This fact sheet does not replace the material safety data sheet (MSDS) required for a hazardous chemical under the Occupational Health and Safety Act of 1970 (29 U.S.C. 651 ET SEQ.) and regulations promulgated under this Act.

Information for this fact sheet was obtained from the TxHSEES program, the Environmental Protection Agency (EPA); the Agency for Toxic Substances and Disease Registry (ATSDR) TOXFAQS; the Handbook of Toxic and Hazardous Chemicals and Carcinogens, Third Edition; ACGIH, Threshold Limit Values and Biological Exposure Indices, 2004; Federal OSHA Regulations: 29 CFR 1910.1000, 29 CFR 1910.111; National Institute of Occupational Safety and Health, NIOSH Pocket Guide to Chemical Hazards, 2003; NIOSH International Chemical Safety Cards; Department of Transportation Gydebook (hazmat.dot.gov/gydebook); Department of Transportation hazmat.dot.gov/erg2000/g124.pdf); and National Library of Medicine's TOXNET Hazardous Substances Databank (toxnet.nlm.nih.gov).

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