



Hydrochloric Acid Facts

Significance of Hydrochloric Acid (HCl) in the United States

CAS # 7647-01-0 UN # 1050

Hydrogen chloride readily dissolves in water to form hydrochloric acid, a corrosive solution. Hydrochloric acid is most often used as a chemical intermediate to manufacture other chemicals and is used for the pickling/cleaning of metal surfaces. At room temperature it is a colorless, non-flammable gas with an unpleasant, acrid odor. Technical grades of hydrochloric acid are called muriatic acid. Muriatic acid is often yellow in color due to its impurity.

Hydrochloric Acid Releases in North Carolina

The information in this report was collected by staff in the North Carolina Hazardous Substances Emergency Events Surveillance (HSEES) Program. Hydrochloric acid releases in North Carolina have resulted in injuries, hospitalizations, and workplace evacuations (Table 1). Some examples of hydrochloric acid releases in NC include:

- *An open bottle of muriatic acid in a nursing home bathroom released vapors. Two people were treated at the hospital for eye irritation, nausea and dizziness. One hundred seven people were evacuated from the facility for 5 hours.*
- *A gallon container of hydrochloric acid broke while an employee was moving it. The employee was treated at the hospital for skin irritation and chemical burns. Thirty people were evacuated from the building for 3 hours.*
- *Several students in a middle school lab dropped and broke a two-quart container of hydrochloric acid. Three people were treated at the hospital for skin irritation. The lab was evacuated and students were allowed to return 2 hours later.*
- *Thirty-eight pounds of hydrogen chloride, along with five other chemicals, were released when a truck trailer caught fire. Twenty-three people, including members of the general public, a police officer, EMT personnel, and other responders, were treated at the hospital due to respiratory irritation. A circle radius evacuation zone was ordered. One thousand five hundred people were evacuated for 11 hours.*
- *Four gallons of muriatic acid were released in a store when a case of the acid containers fell and broke. Three employees were treated on the scene for respiratory irritation. The affected area of the building was evacuated for 3 hours.*

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Of the 55 hydrochloric acid releases or threatened releases that occurred between 1993 and 1998 in North Carolina, 36 (65.5 %) occurred in fixed facilities and 19 (34.5 %) took place in transit. Most of the fixed-facility events resulted from unintended releases from “other” areas (areas that did not fit into the standard categories), such as bathrooms, chemical labs, pool houses, etc. (N = 12, 27.9 %), storage aboveground (N = 8, 18.6 %), and transport within the fixed facility (N = 7, 16.3 %).

Efforts to identify the factors contributing to chemical releases were initiated in mid-1995. Of the 10 hydrochloric acid events for which information on factors was available, equipment failure was cited as the major contributing factor in 7 (70.0 %) incidents. The 55 events are summarized in Table 1. Table 2 lists the types of industries involved in hydrochloric acid releases. Locations of hydrochloric acid releases are shown in Map 1.

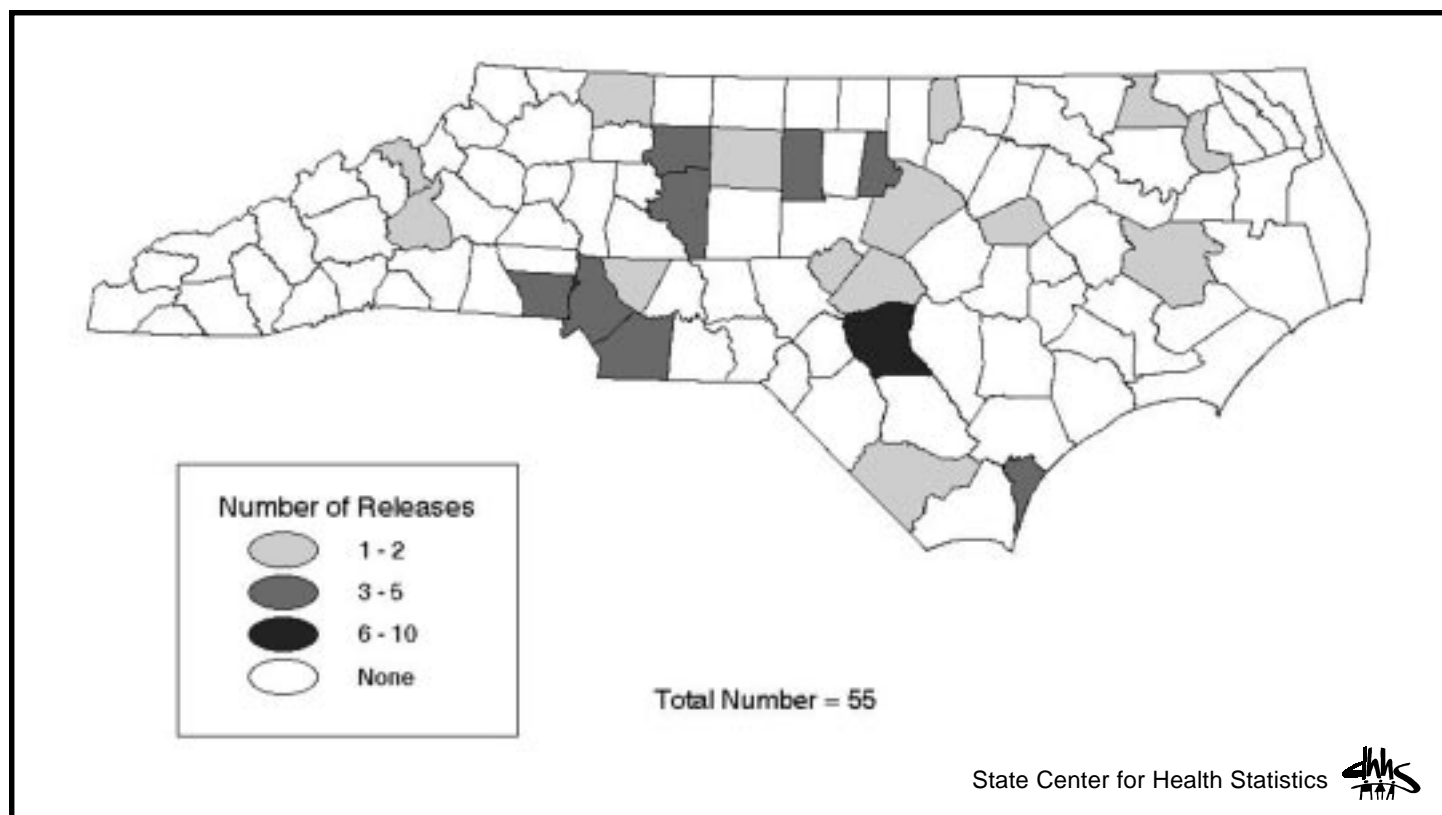
Table 1: Summary of HSEES Data on Hydrochloric Acid Releases in North Carolina, 1993-1998

Data	No.
Number of hydrochloric acid releases	
■ Actual releases	49
■ Threatened releases	6
■ Total	55
Number of events involving victims	9
Number of victims	38
Types of injuries (victims may report more than one injury)	
■ Respiratory irritation	31
■ Skin irritation	4
■ Dizziness	3
■ Gastrointestinal problems	2
■ Chemical burns	1
■ Eye irritation	1
■ Trauma	1
■ Total:	43
Range of amounts released (gallons)	1 to 21,500
Type of hydrochloric acid release (may have more than one type/event)	
■ Spill	41
■ Air release	11
■ Fire	3
■ Explosion	1
■ Other	1
Events with decontamination	7
■ No. of events with responders decontaminated	5
■ No. of events with employees decontaminated	2
Events requiring evacuation	16
Number of events following a contingency/preparedness plan	55
Type of response	
■ HAZMAT/response team’s standard operating procedure	47
■ Company’s operating procedures	3
■ Incident Specific	1
■ Other	1
■ Unknown	3
■ Total	55

Table 2: Industries Involved in Hydrochloric Acid Releases in North Carolina, 1993-1998

Type of NC Industry Releasing Hydrochloric Acid	Number of Events	Percentages
Trucking service	12	21.8
Drugs, chemicals, and allied products	12	21.8
Machinery manufacture	4	7.3
Retail gasoline service stations	4	7.3
Miscellaneous entertainment recreation services	3	5.5
Railroads	3	5.5
Schools-elementary, secondary, and universities	3	5.5
Other	14	25.5
Total	55	100.2

Map 1: Location of Hydrochloric Acid Releases across North Carolina, 1993-1998 (N = 55)



Common Routes of Hydrochloric Acid Exposure

- **Inhalation.** The most common way for hydrochloric acid to enter the body is through the respiratory system. Signs and symptoms of hydrochloric acid inhalation can include:
 - Coughing
 - Choking
 - Burning of the throat
- **Contact with the Skin.** Hydrochloric acid can irritate the skin and cause chemical burns ranging from mild to severe depending on the concentration of the hydrochloric acid solution. Concentrated vapor or solution may cause the victim to experience pain, redness of the skin, and blisters. Signs displayed by skin exposed to liquefied hydrochloric acid can include frostbite, tissue death, or severe burns with deep ulcerations.

- **Contact with the Eyes.** Hydrochloric acid, even with short-term exposure, can irritate the eyes and cause burning, swelling, tearing of the eyes, blurred vision, photophobia, sloughing of the surface cells of the eye, and may cause blindness.
- **Ingestion.** Immediate burning in the mouth and throat occur when hydrochloric acid is swallowed. Ingestion of concentrated solution can cause severe pain in the mouth, chest and abdomen, nausea and vomiting.

Acute Health Effects of Hydrochloric Acid Exposure

As the concentration of hydrochloric acid increases, the symptoms become more severe. Acute exposures to hydrochloric acid can cause immediate burning of the eyes, nose, throat and/or respiratory system. Itchy eyes, coughing and a burning nose can help to warn people of potentially hazardous exposure levels. The very young, the very old, and people with health problems are at an increased risk from the health effects of hydrochloric acid exposure.

Chronic Health Effects of Repeated Exposure to Hydrochloric Acid

Erosion of the teeth, chronic bronchial irritation with cough and/or chronic shortness of breath may occur with repeated or long-term exposure to hydrochloric acid. Skin rashes may also occur with repeated exposures of dilute concentrations of hydrochloric acid.

Proper Handling and Storage Procedures for Hydrochloric Acid

Before working with hydrochloric acid, individuals should be trained in its proper handling and storage and know how to use proper personal protective equipment.

Hydrochloric acid should be stored in a cool, dry, well-ventilated area in tightly sealed containers protected from exposure to weather, extreme temperature changes, and physical damage. Hydrochloric acid is considered a strong oxidizer and steps should be taken to separate hydrochloric acid and hydrochloric acid products from incompatible materials such as copper, brass, bronze, galvanized steel, tin, zinc, oxidizers, combustible materials, plastics, rubber and some coatings. Contact with metals causes erosion and the formation of flammable hydrogen gas. The heat generated from the exothermic reaction of metal and hydrogen chloride or hydrochloric acid could cause ignition of combustible materials.

If a fire occurs in the immediate vicinity of hydrochloric acid cylinders, remove them promptly if it can be done safely. If removal is not possible, cool cylinders by spraying with water, but never add water directly to the hydrochloric acid. Fight fire from a maximum distance and do not get water inside the containers. Do not extinguish flames as explosive re-ignition may occur. Allow the fire to burn out. If the fire cannot be brought under control, evacuate the area because of explosion hazards and toxic fumes.

Personal Protective Equipment

■ **Clothing**

Avoid skin contact with hydrochloric acid. Wear chemical-resistant clothing and protective gloves. Nitrile and neoprene gloves are best suited for prolonged contact with hydrochloric acid, but PVC and rubber gloves are also acceptable. Check with glove manufacturer for recommended use and duration guidelines.

■ **Eye Protection**

For solutions of hydrochloric acid with a pH less than or equal to 3.0, persons should wear, at a minimum, an eight-inch face shield. Splash-proof goggles are also recommended where mists of hydrochloric acid solution could contact the eyes.

■ **Respiratory Protection** (respirators)

Engineering controls should be implemented to reduce environmental concentrations to the permissible exposure level (5ppm). Respirators should be used when engineering and work practice controls are not feasible or being installed. Respiratory protection should be approved by NIOSH specifically for hydrochloric acid and used in accordance with the OSHA Respiratory Protection Standard, 29 CFR (Code of Federal Regulations) 1910.134. Under routine exposures where the ambient concentration of

hydrochloric acid exceeds 5ppm, use an air purifying, full-face respirator equipped with acid gas cartridges appropriate for hydrochloric acid. For exposures of unknown concentrations of hydrochloric acid, such as uncontrolled releases, only a pressure-demand SCBA (self-contained breathing apparatus) is appropriate. Respirator use must be limited to individuals who have been medically cleared, adequately trained, and fitted for the respirator face piece. Companies are also referred to 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals Standard.

First Aid Management

Prompt action is essential if there is a hydrochloric acid spill or leak. If a hydrochloric acid spill or leak occurs, take the following actions:

■ Breathing

If hydrogen chloride is inhaled, move the person to fresh air at once. If breathing stops, perform artificial respiration. Keep the affected person warm and resting. Seek medical attention immediately.

■ Eye Exposure

Wash eyes immediately with large amounts of water for at least 15 minutes, lifting the upper and lower lids. Seek medical attention immediately. Contacts should not be worn when working with hydrogen chloride/hydrochloric acid.

■ Skin Exposure

Skin contaminated with hydrogen chloride/hydrochloric acid should be flushed with water for at least 15 minutes. Do not rub or wash skin. If strong concentrations of gas or solution penetrate clothing, remove clothing and flush the skin with water. Seek medical attention immediately.

■ Swallowing

If hydrogen chloride solution is swallowed, and the person is conscious, give him large amounts of water or milk to dilute the hydrogen chloride solution. Do not attempt to make the exposed person vomit. Seek medical attention immediately. Refer to a material safety data sheet (MSDS); call the poison control center (1-800-848-6946), or call a physician on instructions for inducing vomiting.

Spill Management

If a hydrochloric acid spill or leak occurs, take the following actions:

- Notify trained personnel immediately, such as the company HAZMAT team or the local fire department. **Untrained persons or those without proper personal protective equipment must not enter areas with high concentrations of hydrochloric acid.**
- Evacuate and restrict people from the hazardous area of a hydrochloric acid release.
- Stop or control the source of exposure. If the exposure is from a leaking cylinder, take the cylinder outdoors or to an open area until it has completely drained, and the contents have evaporated.
- Ventilate contaminated atmospheres by opening windows to disperse the gas.
- If the exposure is from the spill of a solution, collect or confine the spilled material. If possible, reclaim the spill material, otherwise dilute and neutralize the spill and dispose in a secured landfill.
- Refer to the manufacturer's Material Safety Data Sheet (MSDS) for more information about hydrochloric acid hazards.

North Carolina HSEES Program

The North Carolina Department of Health and Human Services, Division of Public Health studies and describes the public health effects associated with releases of hazardous substances, such as hydrochloric acid, as part of the Agency for Toxic Substances and Disease Registry's Hazardous Substances Emergency Events Surveillance (HSEES) system. North Carolina is one of 16 participating states. Data are analyzed to determine trends and areas for prevention. The information is then used to develop ways to protect health and prevent or minimize hazardous substance releases.

The HSEES staff is notified about spills by several sources. The primary sources of information are the NC Division of Emergency Management, the US Coast Guard's National Response Center, and the US Department of Transportation's Hazardous Materials Information System (HMIS). To gather specific information about each spill, staff contacts local emergency management personnel, fire department personnel, emergency medical personnel, and/or industry representatives.

To plan appropriate prevention strategies, we rely on accurate and timely reporting. If you are contacted about a hazardous chemical spill, please answer the questions as precisely and truthfully as possible. The information you provide is critical to preventing future spills and reducing the risk of injury to employees, responders and the public. Contact the NC HSEES Program at 919-733-1145 or visit our web site at www.schs.state.nc.us/epi/oii/hsees.html.

Resources and Information

Occupational Safety and Health Administration (OSHA)

OSHA provides specific information about proper handling, storage, and safety and health management of hydrochloric acid. Publications can be obtained by written request or through the OSHA web page.

OSHA Publications Office
200 Constitution Avenue NW
Room N3101
Washington, DC 20210
(202) 219-8151
www.osha.gov

North Carolina OSHA
4 West Edenton St
Raleigh, NC 27601-1092
(919) 807-2860
<http://www.dol.state.nc.us/osha/osh.htm>

For specific hydrochloric acid information:
<http://www.osha-slc.gov/SLTC/healthguidelines/hydrogenchloride/recognition.html>

National Institute of Occupational Safety and Health (NIOSH)

NIOSH Publications
4676 Columbia Parkway, Mail Stop C-13
Cincinnati, OH 45226-1998
1-800-35-NIOSH (1-800-356-4674)
<http://www.cdc.gov/niosh/homepage.html>

Environmental Protection Agency (EPA)

Ariel Rios Building
1200 Pennsylvania Avenue, NW
Washington, DC 20460
202-260-2090
www.epa.gov

Region IV EPA (includes North Carolina)

Atlanta Federal Building
61 Forsyth Street, SW
Atlanta, GA 30303-3104
404-562-9900
1-800-241-1754

North Carolina Department of Health and Human Services Occupational and Environmental Epidemiology Branch

HSEES Program
1912 Mail Service Center
Raleigh, NC 27699-1912
(919) 733-3410
www.schs.state.nc.us/epi/oii/hsees.html

References

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Department of Health and Human Services • Carmen Hooker Buell, Secretary
Division of Public Health
<http://www.dhhs.state.nc.us/dph>

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Division of Public Health
Occupational & Environmental Epidemiology Branch
Hazardous Substances Emergency Events Surveillance
1912 Mail Service Center
Raleigh, NC 27699-1912