1 Identification

GHS Product Identifier

Hydrochloric Acid 30-32%

Other means of identification

CAS:	7647-01-0
EC:	231-595-7
RTECS:	MW4025000
ICSC:	0163
Synonyms:	Hydrochloride, Muriatic Acid
Proper Shipping Name:	HYDROCHLORIC ACID, concentration >15% hydrochloric acid HYDROCHLORIC ACID, concentration >5% <15% hydrochloric acid
Chemical Formula:	HCl
Molecular Weight:	36.458 g/mol

HYDROCHLORIC ACID, SOLUTION is a colorless watery liquid with a sharp, irritating odor. Consists of hydrogen chloride, a gas, dissolved in water. Sinks and mixes with water. Produces irritating vapor. Clear, colourless or slightly yellowish, corrosive liquid having a pungent odour.

Recommended use of the chemical and restriction on use

Hydrochloric acid is used in the production of chlorides, for refining ore in the production of tin and tantalum, for pickling and cleaning of metal products, in electroplating, in removing scale from boilers, for the neutralization of basic systems, as a laboratory reagent, as a catalyst and solvent in organic syntheses, in the manufacture of fertilizers and dyes, for hydrolyzing starch and proteins in the preparation of various food products, and in the photographic, textile, and rubber industries. Industrial Water Treatment. Not for food, drug or household use.

Supplier's details

AQUATRADE WATER TREATMENT CHEMICALS (PTY) LTD

4A Spanner Road
Spartan, Kempton Park
Gauteng, South Africa
1619
www.aquatradesa.co.za
admin@aquatradesa.co.za

PO Box 357
Isando
Gauteng, South Africa
1600

Tel: +27 11 394 0752

Emergency phone number

+27 82 921 0643 (Available Mon - Fri, GMT 5:00 to 20:00)

2 Hazard(s) identification

Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008
Metal Corrosion (Category 1), H290
Acute Toxicity (Inhalation) (Category 3), H331
Skin Corrosion/Irritation (Category 1B), H314
Serious Eye Damage/Irritation (Category 1), H318
Specific Target Organ Toxicity - Respiratory (Category3), H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

GHS label elements

Danger

May be corrosive to metals

Causes severe skin burns and eye damage

Causes serious eye damage

Toxic if inhaled

May cause respiratory irritation

Keep only in original container.

Do not breathe dust/fume/gas/mist/vapours/spray.

Wash thoroughly after handling.

Use only outdoors or in a well-ventilated area.

Wear protective gloves/protective clothing/eye protection/face protection.

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

IF ON SKIN (or hair): Remove/Take off Immediately all contaminated clothing. Rinse SKIN with water/shower.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Immediately call a POISON CENTER or doctor/physician.

Store in a well-ventilated place. Keep container tightly closed.

Store locked up.

Dispose of contents and container in accordance with local, regional, national, international regulations.

Other hazards which do not result in classification

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Gas concentrations of 50 to 100 ppm are tolerable for 1 hour. Concentrations of 1,000 to 2,000 ppm are dangerous, even for brief exposures. More severe exposures will result in serious respiratory distress and prolonged exposures will result in death. Mists of hydrochloric acid are considered less harmful than anhydrous hydrochloric acid, because droplets have no dehydrating action. Individuals with respiratory problems and digestive diseases may be adversely affected by low level exposures to the gas or mist.

3 Composition/information on ingredients

Description	CAS Number	EINECS Number	%	Note
Hydrochloric Acid 30% - 35%	7647-01-0	231-595-7	30 - 35	Metal Corrosion (Cat.1), Acute Toxicity (Oral) (Cat. 4), Acute Toxicity (Dermal) (Cat. 5), Acute Toxicity (Inhalation) (Cat. 2), Skin Corrosion/Irritation (Cat. 1A), Serious Eye Damage (Cat. 1)

4 First-aid measures

Description of necessary first-aid measures

Inhalation Exposure:

1. Move victims to fresh air. Emergency personnel should avoid self-exposure to hydrogen chloride.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
4. RUSH to a health care facility. *(EPA, 1998)*

If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible. *(NIOSH, 2016)*

Fresh air, rest. Half-upright position. Artificial respiration may be needed. Refer immediately for medical attention. *from ILO-ICSC*

Remove person to fresh air; keep him warm and quiet and get medical attention immediately; start artificial respiration if breathing stops. INGESTION: have person drink water or milk; **DO NOT** induce vomiting. EYES: immediately flush with plenty of water for at least 15 min. and get medical attention; continue flushing for another 15 min. if physician does not arrive promptly. SKIN: immediately flush skin while removing contaminated clothing; get medical attention promptly; use soap and wash area for at least 15 min. *(USCG, 1999)*

Dermal/Eye Exposure:
1. Remove victims from exposure. Emergency personnel should avoid self- exposure to hydrogen chloride.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
3. Remove contaminated clothing as soon as possible.
4. If eye exposure has occurred, eyes must be flushed with lukewarm water for at least 15 minutes.
5. Wash exposed skin areas THOROUGHLY with soap and water.
6. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
7. RUSH to a health care facility. *(EPA, 1998)*

Eye:
If this chemical in solution contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical. If eye tissue is frozen, seek medical attention immediately. If tissue is not frozen, immediately and thoroughly flush the eyes with large amounts of water for at least 15 minutes, occasionally lifting the lower and upper eyelids. If irritation, pain, swelling, lacrimation, or photo phobia persist, get medical attention as soon as possible.
Skin:
If this chemical in solution contacts the skin and frostbite has not occurred, immediately flush the contaminated skin with water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. Get medical attention promptly. If frostbite has occurred, seek medical attention immediately; do NOT rub the affected areas or flush with water. In order to prevent further tissue damage, **DO NOT** attempt to remove frozen clothing from frostbitten areas. (*NIOSH, 2016)*

Wear protective gloves when administering first aid. First rinse with plenty of water for at least 15 minutes, then remove contaminated clothes and rinse again. Refer immediately for medical attention. *from ILO-ICSC*
Rinse with plenty of water for several minutes (remove contact lenses if easily possible). Refer immediately for medical attention. *from ILO-ICSC*

Ingestion Exposure:
1. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
2. **DO NOT** induce vomiting or attempt to neutralize!
3. Rinse mouth with large amounts of water. Victims should not attempt to swallow this water.
4. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
5. Activated charcoal is of no value.
6. Give the victims water or milk: children up to 1 year old, 125 mL (4 oz or 1/2 cup); children 1 to 12 years old, 200 mL (6 oz or 3/4 cup); adults, 250 mL (8 oz or 1 cup). Water or milk should be given only if victims are conscious and alert.
7. RUSH to a health care facility. *(EPA, 1998)*

Swallow:
If this chemical in solution has been swallowed, get medical attention immediately. *(NIOSH, 2016)*

Most important symptoms/effects, acute and delayed

Warning:
Hydrogen chloride is extremely corrosive. Caution is advised. Signs and Symptoms of Acute Hydrogen Chloride Exposure:

Signs and symptoms of acute ingestion of hydrogen chloride may be severe and include salivation, intense thirst, difficulty in swallowing, chills, pain, and shock. Oral, esophageal, and stomach burns are common. Vomitus generally has a coffee-ground appearance. The potential for circulatory collapse is high following ingestion of hydrogen chloride. Acute inhalation exposure of hydrogen chloride may result in sneezing, hoarseness, choking, laryngitis, and respiratory tract irritation. Bleeding of nose and gums, ulceration of the nasal and oral mucosa, bronchitis, pneumonia, dyspnea (shortness of breath), chest pain, and pulmonary edema may also occur. If the eyes have come in contact with hydrogen chloride, irritation, pain, swelling, corneal erosion, and blindness may result. Dermal exposure may result in dermatitis (red, inflamed skin), severe burns, and pain. Emergency Life-Support Procedures: Acute exposure to hydrogen chloride may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree of contamination. Air-purifying or supplied-air respiratory equipment should also be worn, as necessary. Rescue vehicles should carry supplies such as plastic sheeting and disposable plastic bags to assist in preventing spread of contamination.

Indication of immediate medical attention and special treatment needed, if necessary

Prehospital:

Consult with the base station physician or the regional poison control centre 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

ATSDR; Medical Management Guidelines for Hydrogen Chloride (HCl) CAS 7647-01-0; UN 1050 (anhydrous), UN 1789 (solution). UN 2186 (refrigerated liquefied gas). Available from, as of July 31, 2007: http://www.atsdr.cdc.gov/MHMI/mmg173.html - from HSDB

ABC Reminders for treating victims in the Hot Zone: Quickly access for a patent airway, ensure adequate respiration and pulse. ... 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. ... ABC Reminders for treating victims removed to the Decontamination Zone: 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. ABC Reminders for treating victims transferred to Support Zone: ... 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.

ATSDR; Medical Management Guidelines for Hydrogen Chloride (HCl) CAS 7647-01-0; UN 1050 (anhydrous), UN 1789 (solution). UN 2186 (refrigerated liquefied gas). Available from, as of July 31, 2007: http://www.atsdr.cdc.gov/MHMI/mmg173.html - from HSDB

Immediate first aid:

Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device, or pocket mask, as trained. Perform CPR as necessary. Immediately flush contaminated eyes with gently flowing water. Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 172-3- from HSDB

Basic treatment:

Establish a patent airway (oropharyngeal or nasopharyngeal airway, if needed). Suction if necessary. Watch for signs of respiratory insufficiency and assist respirations if needed. Administer oxygen by non-rebreather mask at 10 to 15 L/min. Monitor for pulmonary oedema and treat if necessary ... . Monitor for shock and treat if necessary.... For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with 0.9% saline (NS) during transport.... Do not use emetics. Activated charcoal is not effective. For ingestion, rinse mouth and administer 5 mL/kg up to 200 mL of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool ... . Do not attempt to neutralize because of exothermic reaction. Cover skin burns with dry, sterile dressings after decontamination ... . /Inorganic acids and related compounds/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 173 - from HSDB

Advanced treatment:
Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious, has severe pulmonary oedema, or is in severe respiratory distress. Early intubation, at the first sign of upper airway obstruction, may be necessary. Positive-pressure ventilation techniques with a bag valve mask device may be beneficial. Consider drug therapy for pulmonary oedema ... . Consider administering a beta agonist such as albuterol for severe bronchospasm ... . Monitor cardiac rhythm and treat arrhythmias as necessary ... . Start IV administration of D5W /SRP: "To keep open", minimal flow rate/. Use 0.9% saline (NS) or lactated Ringer's (LR) if signs of hypovolemia are present. For hypotension with signs of hypovolemia, administer fluid cautiously. Consider vasopressors if patient is hypotensive with a normal fluid volume. Watch for signs of fluid overload ... . Use proparacaine hydrochloride to assist eye irrigation ... . /Inorganic acids and related compounds/
Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 173 - from HSDB

CRITICAL CARE AREA:
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. ... 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.
ATSDR; Medical Management Guidelines for Hydrogen Chloride (HCl) CAS 7647-01-0; UN 1050 (anhydrous), UN 1789 (solution). UN 2186 (refrigerated liquefied gas). Available from, as of July 31, 2007: http://www.atsdr.cdc.gov/MHMI/mmg173.html - from HSDB

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.
ATSDR; Medical Management Guidelines for Hydrogen Chloride (HCl) CAS 7647-01-0; UN 1050 (anhydrous), UN 1789 (solution). UN 2186 (refrigerated liquefied gas). Available from, as of July 31, 2007: http://www.atsdr.cdc.gov/MHMI/mmg173.html - from HSDB
Eye Exposure 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.
ATSDR; Medical Management Guidelines for Hydrogen Chloride (HCl) CAS 7647-01-0; UN 1050 (anhydrous), UN 1789 (solution). UN 2186 (refrigerated liquefied gas). Available from, as of July 31, 2007: http://www.atsdr.cdc.gov/MHMI/mmg173.html - from HSDB

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.
ATSDR; Medical Management Guidelines for Hydrogen Chloride (HCl) CAS 7647-01-0; UN 1050 (anhydrous), UN 1789 (solution). UN 2186 (refrigerated liquefied gas). Available from, as of July 31, 2007: http://www.atsdr.cdc.gov/MHMI/mmg173.html - from HSDB

Ingestion Exposure:
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. 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. Toxic vomitus or gastric washings should be isolated (e.g., by attaching the lavage tube to isolated wall suction or another closed container). The use of corticosteroids to prevent acid-induced strictures is questionable and unsupported by clinical studies.
ATSDR; Medical Management Guidelines for Hydrogen Chloride (HCl) CAS 7647-01-0; UN 1050 (anhydrous), UN 1789 (solution). UN 2186 (refrigerated liquefied gas). Available from, as of July 31, 2007: http://www.atsdr.cdc.gov/MHMI/mmg173.html - from HSDB

Emergency and supportive measures.
Medical Surveillance
The following medical procedures should be made available to each employee who is exposed to hydrogen chloride at potentially hazardous levels: 1. Initial medical examination: A complete history and physical examination: the purpose is to detect existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the respiratory system, skin, and eyes should be stressed. 14" x 17" chest roentgenogram: Hydrogen chloride causes lung damage. Surveillance of the lungs is indicated. FVC and FEV (1 sec): Hydrogen chloride is a respiratory irritant. Persons with impaired pulmonary function may be at increased risk from exposure. Periodic surveillance is indicated. 2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis, except that an X-ray is necessary only when indicated by the results of pulmonary function testing or by signs and symptoms of respiratory disease.
Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) Publication No. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981., p. 1 - from HSDB

5 Fire-fighting measures

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Specific hazards arising from the chemical

Non-combustible, but contact with metals may produce highly flammable hydrogen gas.

Special protective actions for fire-fighters

Wear self-contained breathing apparatus and full protective clothing. Neutralize with chemically basic substances such as soda ash or slaked lime. Normal fire fighting procedures may be used. Do not get water inside containers. Move containers from fire area. Keep containers that are exposed to the fire cool with water that is sprayed from the side until well after the fire is out. (EPA, 1998)
from CAMEO Chemicals

If material involved in fire:
Extinguish fire using agent suitable for type of surrounding fire. (Material itself does not burn or burns with difficulty). Use water in flooding quantities as fog. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible.
Association of American Railroads; Bureau of Explosives. Emergency Handling of Hazardous Materials in Surface Transportation. Association of American Railroads, Pueblo, CO. 2005, p. 475 - from HSDB

Excerpt from ERG Guide 157 [Substances - Toxic and/or Corrosive (Non-Combustible / Water-Sensitive)]:
Note: Some foams will react with the material and release corrosive/toxic gases.
SMALL FIRE: CO2 (except for Cyanides), dry chemical, dry sand, alcohol-resistant foam.
LARGE FIRE: Water spray, fog or alcohol-resistant foam. Move containers from fire area if you can do it without risk. Use water spray or fog; do not use straight streams. Dike fire-control water for later disposal; do not scatter the material.
FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. (ERG, 2016)
from CAMEO Chemicals

6 Accidental release measures

Personal precautions, protective equipment and emergency procedures

Evacuate danger area! Consult an expert!

Personal protection: gas-tight chemical protection suit including self-contained breathing apparatus. Ventilation. Remove gas with fine water spray.
from ILO-ICSC

Excerpt from ERG Guide 157 [Substances - Toxic and/or Corrosive (Non-Combustible / Water-Sensitive)]:
As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.
SPILL: Increase, in the downwind direction, as necessary, the isolation distance shown above.
FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2016)
from CAMEO Chemicals

Environmental precautions

Environmental considerations -- land spill: Dig a pit, pond, lagoon, holding area to contain liquid or solid material. /SRP: If time permits, pits, ponds, lagoons, soak holes, or holding areas should be sealed with an impermeable flexible membrane liner./ Dike surface flow using soil, sand bags, foamed polyurethan or foamed concrete. Absorb bulk liquid with fly ash or cement powder. Neutralize with agricultural lime (CaO), crushed limestone ($CaCO_3$) or sodium bicarbonate ($NaHCO_3$). Water spill: Neutralize with agricultural lime (CaO), crushed limestone ($CaCO_3$) or sodium bicarbonate ($NaHCO_3$). Air spill: Apply water spray or mist to knock down vapors. Vapor knockdown water is corrosive or toxic and should be diked for containment.

Association of American Railroads; Bureau of Explosives. Emergency Handling of Hazardous Materials in Surface Transportation. Association of American Railroads, Pueblo, CO. 2005, p. 475 - from HSDB

Methods and materials for containment and cleaning up

Prevent further leakage or spillage if safe to do so. **DO NOT** let product enter drains.; Methods and materials for containment and cleaning up: Clean up promptly by sweeping or vacuum.

Spills in Water: Sodium bicarbonate is recommended as an in situ neutralizing agent.
Environment Canada; Tech Info for Problem Spills: Hydrochloric acid (Draft) p.109 (1981) - from HSDB

During scrubbing (an air pollution control method), water is used for removing hydrochloric acid.
Kirk-Othmer Encyclopedia of Chemical Technology. 3rd ed., Volumes 1-26. New York, NY: John Wiley and Sons, 1978-1984., p. 1(78) 655 - from HSDB

The following absorbent materials have been tested and recommended for vapor suppression and/or containment of 26% and 35% hydrochloric acid solutions: a mixture of (75%) anionic polyacrylamide (R1779) and (25%) nonionic polyacrylamide (Versicol W25), individually use the anionic polyacrylamide or nonionic polyacrylamide, and Cellosize WP3H (hydroxyethyl cellulose).
Environment Canada; Tech Info for Problem Spills: Hydrochloric acid (Draft) p.108 (1981) - from HSDB

Approach release from upwind. Stop or control the leak, if this can be done without undue risk. Use water fog or spray to knock down and absorb vapors. Releases may require isolation or evacuation. Control runoff and isolate discharged material for proper disposal.
National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 49-86 - from HSDB

7 Handling and storage

Precautions for safe handling

Excerpt from ERG Guide 157 [Substances - Toxic and/or Corrosive (Non-Combustible / Water-Sensitive)]:
ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. **DO NOT** touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. A vapor-suppressing foam may be used to reduce vapors. **DO NOT** GET WATER INSIDE CONTAINERS. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material. Prevent entry into waterways, sewers, basements or confined areas.
SMALL SPILL: Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain. Use clean, non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal. (ERG, 2016)

- *from CAMEO Chemicals*

Conditions for safe storage, including any incompatibilities

Safe Storage

Cool. Fireproof if in building. Separated from food and feedstuffs and incompatible materials. See Chemical Dangers. Keep in a well-ventilated room.
from ILO-ICSC

Storage Conditions

Store in cool, dry, well-ventilated location. Separate from oxidizing materials, organic materials, and alkalies.
National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 49-87 - from HSDB

The acid should not be stored in the vicinity of flammable or oxidizing substances, eg nitric acid or chlorates, or near metals and metal hydrides that may be attacked by the acid ... Electrical equipment should be flameproof and protected against corrosive action.
International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 1085 - from HSDB

Storage areas should be well ventilated and have a cement floor and shelter from direct sunlight and heat should be provided. *International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 1085 - from HSDB*

8 Exposure controls/personal protection

Control parameters

REL	C 5 ppm (7 mg/m^3)	*from The National Institute for Occupational Safety and Health (NIOSH)*
PEL	C 5 ppm (7 mg/m^3)	*from The National Institute for Occupational Safety and Health (NIOSH)*
PEL-C	5 ppm (7 mg/m^3)	*from OSHA Occupational Chemical DB*
REL-C	5 ppm (7 mg/m^3)	*from OSHA Occupational Chemical DB*
IDLH	50 ppm (NIOSH, 2016)	*from CAMEO Chemicals*
	50 ppm	*from OSHA Occupational Chemical DB*
	50 ppm	*from The National Institute for Occupational Safety and Health (NIOSH)*

Threshold Limit Values
Ceiling Limit: 2 ppm.
American Conference of Governmental Industrial Hygienists. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. ACGIH, Cincinnati, OH 2014, p. 35 - from HSDB
A4; Not classifiable as a human carcinogen.
American Conference of Governmental Industrial Hygienists. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. ACGIH, Cincinnati, OH 2014, p. 35 - from HSDB
2 ppm as STEL; A4 (not classifiable as a human carcinogen).
from ILO-ICSC
3.0 mg/m^3, 2 ppm; peak limitation category: I(2); pregnancy risk group: C.
from ILO-ICSC

Other Occupational Permissible Levels
AEGLs

Exposure Time	AEGL 1 (Discomfort)	AEGL 2 (Impaired Escape)	AEGL 3 (Life Threatening/Death)
10 minutes	1.8	100	620
30 minutes	1.8	43	210
1 hour	1.8	22	100
4 hours	1.8	11	26
8 hours	1.8	11	26

U.S. EPA; Acute Exposure Guideline Levels (AEGLs) - Results for Hydrogen Chloride. Available from, as of August 5, 2009:http://www.epa.gov/oppt/aegl/pubs/chemlist.htm - from HSDB

Emergency Response Planning Guidelines (ERPG):
ERPG(1) 3 ppm (no more than mild, transient effects) for up to 1 hr exposure. Odor should be detectable near ERPG-1.

ERPG(2) 20 ppm (without serious, adverse effects) for up to 1 hr exposure.
ERPG(3) 150 ppm (not life threatening) up to 1 hr exposure.
2014 Emergency Response Planning Guidelines (ERPG) & Workplace Exposure Level (WEEL). American Industrial Hygiene Association, Falls Church, VA 2014, p. 26 - from HSDB

Australia: peak limitation 5 ppm (1990).
Federal Republic of Germany: 5 ppm, short-term level 10 ppm, 5 min, 8 times per shift, Pregnancy group C, no reason to fear a risk of damage to the developing embryo or fetus when MAK or BAT values are adhered to (1991).
Sweden: ceiling value 5 ppm (1989); United Kingdom: 10-min STEL 5 ppm (1991).
American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I, II, III. Cincinnati, OH: ACGIH, 1991., p. 774 - from HSDB

Appropriate engineering controls

Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection.
NIOSH. NIOSH Pocket Guide to Chemical Hazards. Department of Health & Human Services, Centers for Disease Control & Prevention. National Institute for Occupational Safety & Health. DHHS (NIOSH) Publication No. 2010-168 (2010). Available from:http://www.cdc.gov/niosh/npg - from HSDB

Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities should provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.]
NIOSH. NIOSH Pocket Guide to Chemical Hazards. Department of Health & Human Services, Centers for Disease Control & Prevention. National Institute for Occupational Safety & Health. DHHS (NIOSH) Publication No. 2010-168 (2010). Available from:http://www.cdc.gov/niosh/npg - from HSDB

Quick drench facilities and/or eyewash fountains should be provided within the immediate work area for emergency use where there is any possibility of exposure to liquids that are extremely cold or rapidly evaporating.
NIOSH. NIOSH Pocket Guide to Chemical Hazards. Department of Health & Human Services, Centers for Disease Control & Prevention. National Institute for Occupational Safety & Health. DHHS (NIOSH) Publication No. 2010-168 (2010). Available from:http://www.cdc.gov/niosh/npg - from HSDB

Individual protection measures

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors. Recommendations below is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye/face protection:
Tightly fitting safety goggles. Faceshield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166 (EU).

Skin protection:
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Vendor recommendations concerning the protective qualities of materials are as follow:
1 Neoprene, nitrile, chlorinated polyethylene, and polyvinyl alcohol received A (highest) or B (good) ratings from three or more venders.
2 Natural rubber and nitrile/polyvinyl chloride received A (highest) or B (good) ratings from less than three vendors, B (good) and C (fair) ratings, with B's predominating, from several vendors.
3 Neoprene/styrene-butadiene rubber and polyurethane received B (good) and C (fair) ratings, with C's

predominating, from several vendors, C (fair) or D (poor) ratings from less than three vendors.
ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.65 (1983) - from HSDB

Breakthrough times of chlorinated polyethylene are greater than one hour reported by (normally) two or more testers. There are some data suggesting breakthrough times of polycarbonate to be approximately an hour or more.
ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.65 (1983) - from HSDB

Breakthrough times of natural rubber, neoprene, nitrile, and polyvinyl chloride are greater than one hour reported by (normally) two or more testers. Breakthrough times of natural rubber and neoprene are greater than one hour reported by (normally) two or more testers. There are some data suggesting the breakthrough times of nitrile, polyvinyl chloride, Viton, and Saranex to be approximately an hour or more.
ACGIH; Guidelines Select of Chem Protect Clothing Volume #1 Field Guide p.65 (1983) - from HSDB

Body Protection:
Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace. Workers should wear acid resistant protective clothing, incl hoods, eye & face protection, acid resistant hand & arm protection, & foot & leg protection.

Respiratory protection:
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).
International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 1085- from HSDB

For entry into a situation where the spilled material and its characteristics are unknown a totally encapsulated chemical suit should be worn. *Environment Canada; Tech Info for Problem Spills: Hydrochloric acid (Draft) p.110 (1981) - from HSDB*

Respirator Recommendations
NIOSH/OSHA
Up to 50 ppm:
(APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern.
(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern*.
(APF = 10) Any supplied-air respirator*.
(APF = 50) Any self-contained breathing apparatus with a full facepiece.
Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister Any appropriate escape-type, self-contained breathing apparatus.
NIOSH. NIOSH Pocket Guide to Chemical Hazards. Department of Health & Human Services, Centers for Disease Control & Prevention. National Institute for Occupational Safety & Health. DHHS (NIOSH) Publication No. 2010-168 (2010). Available from:http://www.cdc.gov/niosh/npg - from HSDB

9 Physical and chemical properties

Physical and chemical properties

Appearance (physical state, colour etc):	Clear, colourless to pale yellow liquid
Odour:	Pungent odour
Odour threshold:	No test data available
pH:	<2
Melting/Freezing Point:	-27 - -63°C

Initial boiling point and boiling range:	98 - 91°C
Flash point:	No test data available
Evaporation rate:	No test data available
Flammability (solid, gas):	Not flammable
Upper/lower flammability or explosive limits	Not flammable or explosive
Vapour pressure:	14 mmHg @ 20°C H_2O
Vapour density:	0.7 H_2O
Relative density:	1.14 - 1.18
Solubility(ies):	Miscible in all proportions
Partition coefficient: n-octanol/water:	No test data available
Auto-ignition temperature:	No test data available
Decomposition temperature:	No test data available

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10 Stability and reactivity

Reactivity

Air and Water Reactions

Fumes strongly in moist air, generating corrosive hydrochloric acid vapors. Soluble in water with evolution of heat.

from CAMEO Chemicals

Fumes in air as vapors boil away. Very soluble in water to give hydrochloric acid. Rapid mixing with water generates heat that drives off considerable gaseous hydrogen chloride.

from CAMEO Chemicals

An aqueous solution. Dilution may generate heat. Fumes in air.

from CAMEO Chemicals

Reactive Group

Acids, Strong Non-oxidizing

from CAMEO Chemicals

Acids, Strong Non-oxidizing

Water and Aqueous Solutions

from CAMEO Chemicals.

Reactivity Alerts

Known Catalytic Activity

Water-Reactive

from CAMEO Chemicals

Known Catalytic Activity

from CAMEO Chemicals

Pistoia Alliance CSL Reactivity Alerts

Pistoia Alliance CSL Reactivity Alerts: 1 of 1 (Pistoia Alliance CSL Reaction Information)

CSL No	CSL00043
Reactants/Reagents	FORMALDEHYDE; PARAFORMALDEHYDE; HCl gas; HYDROCHLORIC ACID
Reaction Class	Chlorination
Function Group	ALDEHYDE
GHS Category	Harmful,Toxic
Warning Message	Generation of bis(chloromethyl) ether (potent carcinogen)
Source Reference	User-Reported
CSL Status	Approved
Modified Date	5/31/2018

from Pistoia Alliance Chemical Safety Library

Reactivity Profile

HYDROCHLORIC ACID is an aqueous solution of hydrogen chloride, an acidic gas. Reacts exothermically with organic bases (amines, amides) and inorganic bases (oxides and hydroxides of metals). Reacts exothermically with carbonates (including limestone and building materials containing limestone) and hydrogen carbonates to generate carbon dioxide. Reacts with sulfides, carbides, borides, and phosphides to generate toxic or flammable gases. Reacts with many metals (including aluminum, zinc, calcium, magnesium, iron, tin and all of the alkali metals) to generate flammable hydrogen gas. Reacts violently with acetic anhydride, 2-aminoethanol, ammonium hydroxide, calcium phosphide, chlorosulfonic acid, 1,1-difluoroethylene, ethylenediamine, ethyleneimine, oleum, perchloric acid, b-propiolactone, propylene oxide, silver perchlorate/carbon tetrachloride mixture, sodium hydroxide, uranium(IV) phosphide, vinyl acetate, calcium carbide, rubidium carbide, cesium acetylide, rubidium acetylide, magnesium boride, mercury(II) sulfate [Lewis]. Mixtures with concentrated sulfuric acid can evolve toxic hydrogen chloride gas at a dangerous rate. Undergoes a very energetic reaction with calcium phosphide [Mellor 8:841(1946-1947)].

from CAMEO Chemicals

Chemical stability

Stable under recommended storage conditions. Hydrochloric acid has high thermal stability.

Possibility of hazardous reactions

The aqueous solution is a strong acid. Corrosive fumes emitted on contact with air. Reacts violently with bases, oxidizers forming toxic chlorine gas. Reacts, often violently, with acetic anhydride, active metals, aliphatic amines, alkanolamines, alkylene oxides, aromatic amines, amides, 2-aminoethanol, ammonia, ammonium hydroxide, calcium phosphide, chlorosulfonic acid, ethylene diamine, ethyleneimine, epichlorohydrin, isocyanates, metal acetylides, oleum, organic anhydrides, perchloric acid, 3-propiolactone, uranium phosphide, sulfuric acid, vinyl acetate, vinylidene fluoride. Highly corrosive to most metals, forming flammable hydrogen gas. Attacks some plastics, rubber, and coatings.

Hydrochloric acid and hydrogen chloride react violently with many metals, with the generation of highly flammable hydrogen gas, which may explode. Reaction with oxidizers such as permanganates, chlorates, chlorites, and hypochlorites may produce chlorine or bromine gas.

Conditions to avoid

Direct sunlight and extreme temperatures above 49°C or below 10°C.

Incompatible materials

The aqueous solution is a strong acid. Corrosive fumes emitted on contact with air. Reacts violently with bases, oxidizers forming toxic chlorine gas. Reacts, often violently, with acetic anhydride, active metals, aliphatic amines, alkanolamines, alkylene oxides, aromatic amines, amides, 2-aminoethanol, ammonia, ammonium hydroxide, calcium phosphide, chlorosulfonic acid, ethylene diamine, ethyleneimine, epichlorohydrin, isocyanates, metal acetylides, oleum, organic anhydrides, perchloric acid, 3-propiolactone, uranium phosphide, sulfuric acid, vinyl acetate, vinylidene fluoride. Highly corrosive to most metals, forming flammable hydrogen gas. Attacks some plastics, rubber, and coatings.

Pohanish, R.P. (ed). Sittig's Handbook of Toxic and Hazardous Chemical Carcinogens 6th Edition Volume 1: A-K,Volume 2: L-Z. William Andrew, Waltham, MA 2012, p. 1465 - from HSDB

Hydrochloric acid and hydrogen chloride react violently with many metals, with the generation of highly flammable hydrogen gas, which may explode. Reaction with oxidizers such as permanganates, chlorates, chlorites, and hypochlorites may produce chlorine or bromine gas.

National Research Council. Prudent Practices in the Laboratory. Handling and Disposal of Chemicals. Washington, DC: National Academy Press, 1995., p. 333 -from HSDB

Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-111 - from HSDB

Magnesium boride, when treated with concentrated hydrochloric acid produces spontaneously flammable gas.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-113 - from HSDB

Rubidium acetylene carbide burns with slightly warm hydrochloric acid or with molten sulfur. Rubidium carbide ignites in contact with hydrochloric acid unless acid is dilute.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-167 - from HSDB

Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-205 - from HSDB

Calcium phosphide and hydrochloric acid undergo very energetic reaction.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-43 - from HSDB

Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent at 125 deg C.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-118 - from HSDB

The reaction of silver perchlorate with carbon tetrachloride in the presence of small amount of hydrochloric acid produces trichloromethyl perchlorate, which detonates at 40 deg C.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-172 - from HSDB

Aqueous hydrochloric acid solutions react with most metals, forming flammable hydrogen gas.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 49-86 - from HSDB

Hydroxides, amines, alkalis, copper, brass, zinc [Note: Hydrochloric acid is highly corrosive to most metals].

NIOSH. NIOSH Pocket Guide to Chemical Hazards. Department of Health & Human Services, Centers for Disease Control & Prevention. National Institute for Occupational Safety & Health. DHHS (NIOSH) Publication No. 2010-168 (2010). Available from:http://www.cdc.gov/niosh/npg -from HSDB

With sulfuric acid: Accidental addition of 6,500 liters of concentrated hydrochloric acid to a bulk sulfuric acid storage tank released sufficient hydrogen chloride by dehydration to cause the tank to explode violently. Complete dehydration of hydrochloric acid solution releases some 250 volumes of gas.

Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 949 - from HSDB

Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-48 - from HSDB

Sodium explodes on contact with hydrochloric acid.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-174 - from HSDB

Sodium reacts very vigorously with gaseous hydrogen chloride.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-174 - from HSDB

Magnesium boride, when treated with concentrated hydrochloric acid, produces a spontaneously flammable gas.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-113 - from HSDB

Mixing hydrochloric acid and 28% ammonia in a closed container caused the temperature and pressure to increase.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-95 - from HSDB

Mixing 36% hydrochloric acid and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.

National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-

96 - from HSDB

The hydronium compound /with perchloric acid/ decomposes spontaneously with violence.
National Fire Protection Association; Fire Protection Guide to Hazardous Materials. 14TH Edition, Quincy, MA 2010, p. 491-95 - from HSDB

Hydroxides, amines, alkalis, copper, brass, zinc [Note: Hydrochloric acid is highly corrosive to most metals.]
from The National Institute for Occupational Safety and Health (NIOSH)

Hazardous decomposition products

Thermal decomposition may release toxic fumes of Chloride.

11 Toxicological information

Toxicological (health) effects

Serious local effects by all routes of exposure. The substance can be absorbed into the body by inhalation.
from ILO-ICSC

Exposure by inhalation, ingestion (solution), skin and/or eye contact
from The National Institute for Occupational Safety and Health (NIOSH)

Acute Effects

- Hydrochloric acid is corrosive to the eyes, skin, and mucous membranes. Acute inhalation exposure may cause coughing, hoarseness, inflammation and ulceration of the respiratory tract, chest pain, and pulmonary edema in humans. (-)
- Acute oral exposure may cause corrosion of the mucous membranes, esophagus, and stomach, with nausea, vomiting, and diarrhea reported in humans. Dermal contact may produce severe burns, ulceration, and scarring. (-)
- Pulmonary irritation, lesions of the upper respiratory tract, and laryngeal and pulmonary edema have been reported in rodents acutely exposed by inhalation.
- Acute animal tests in rats, mice, and rabbits, have demonstrated hydrochloric acid to have moderate to high acute toxicity from inhalation and moderate acute toxicity from oral exposure.
  from EPA Air Toxics

Chronic Effects

- Chronic occupational exposure to hydrochloric acid has been reported to cause gastritis, chronic bronchitis, dermatitis, and photosensitization in workers. Prolonged exposure to low concentrations may also cause dental discoloration and erosion. (-,)
- Chronic inhalation exposure caused hyperplasia of the nasal mucosa, larynx, and trachea and lesions in the nasal cavity in rats.
- The Reference Concentration (RfC) for hydrochloric acid is 0.02 milligrams per cubic meter (mg/m^3) based on hyperplasia of the nasal mucosa, larynx, and trachea in rats. The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfC, the potential for adverse health effects increases. Lifetime exposure above the RfC does not imply that an adverse health effect would necessarily occur.
- EPA has low confidence in the study on which the RfC was based since it used only one dose and had limited toxicological measurements; low confidence in the database because the database does not provide any additional chronic or reproductive studies; and, consequently, low confidence in the RfC.
- EPA has not established a Reference Dose (RfD) for hydrochloric acid.
  from EPA Air Toxics

Cancer Risk

- No information is available on the carcinogenic effects of hydrochloric acid in humans.
- In one study, no carcinogenic response was observed in rats exposed via inhalation.
- EPA has not classified hydrochloric acid with respect to potential carcinogenicity.
  from EPA Air Toxics

Reproductive and Developmental Effects

- No information is available on the reproductive or developmental effects of hydrochloric acid in humans.
- In rats exposed to hydrochloric acid by inhalation, severe dyspnea, cyanosis, and altered estrus cycles have been reported in dams, and increased fetal mortality and decreased fetal weight have been reported in the offspring.
  from EPA Air Toxics

Information on the likely routes of exposure

Occupational exposure to hydrochloric acid may occur via inhalation or dermal contact during its production and use.
from EPA Air Toxics

According to the 2012 TSCA Inventory Update Reporting data, 109 reporting facilities estimate the number of persons reasonably likely to be exposed in the manufacturing, processing, or use of hydrogen chloride in the United States may be as low as <10 workers and as high as 9999 workers per plant; the data may be greatly underestimated due to confidential business information (CBI) or unknown values(1).
*[(1) US EPA; Chemical Data Reporting (CDR). Non-confidential 2012 Chemical Data Reporting information on chemical production and use in the United States. Available from, as of Feb 27, 2015: http://www.epa.gov/cdr/pubs/guidance/cdr_factsheets.html] **PEER REVIEWED***

NIOSH (NOES Survey 1981-1983) has statistically estimated that 1,238,572 workers (388,130 of these were female) were potentially exposed to hydrochloric acid in the US(1). Occupational exposure to hydrogen chloride or hydrochloric acid may occur through inhalation and dermal contact with these compounds at workplaces where hydrogen chloride or hydrochloric acid is produced or used(SRC). Hydrogen chloride is produced mainly as a co-product in hydrocarbon chlorination and dehydrochlorination processes, which are closed system processes; under normal operating conditions the likelihood of workers being exposed to hydrogen chloride is low. Process sampling, maintenance, and breakdowns may result in limited short-term exposure to hydrogen chloride(2). Use data indicate that the general population may be exposed to hydrogen chloride or hydrochloric acid via inhalation and dermal contact with consumer products containing these compounds(SRC).
*[(1) NIOSH; NOES. National Occupational Exposure Survey conducted from 1981-1983. Estimated numbers of employees potentially exposed to specific agents by 2-digit standard industrial classification (SIC). Available from, as of Feb 26, 2015: http://www.cdc.gov/noes/ (2) WHO; Environ Health Criteria 21: Chlorine and Hydrogen chloride. International Programme on Chemical Safety. Available from, as of Feb 25, 2015: http://www.inchem.org/documents/ehc/ehc/ehc21.htm] **PEER REVIEWED***

Symptoms related to the physical, chemical and toxicological characteristics

Symptoms
irritation nose, throat, larynx; cough, choking; dermatitis; solution: eye, skin burns; liquid: frostbite; In Animals: laryngeal spasm; pulmonary edema.
from The National Institute for Occupational Safety and Health (NIOSH)

Inhalation Symptoms
Cough. Sore throat. Burning sensation. Shortness of breath. Laboured breathing.
from ILO-ICSC

Skin Symptoms
Redness. Pain. Serious skin burns. ON CONTACT WITH LIQUID: FROSTBITE.
from ILO-ICSC
Burns on the face may produce serious and disfiguring scars. Digestive diseases are frequent and are characterized by dental molecular necrosis in which the teeth lose their shine, turn yellow, become soft, pointed, and then break off.
International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 1085 - from HSDB
Corrosive burns may result from the inhalation of acid fumes and from skin contact with or the ingestion of strong acid. Symptoms after ingestion or skin contact include immediate pain and ulceration of all membranes and tissues which come in contact with the acid. Ingestion may be assoc with nausea, vomiting and intense thirst; corrosion of the stomach may lead within a few hours or a few days to gastric perforation and peritonitis. Late esophageal, gastric and pyloric strictures and stenoses should be anticipated. Contact of conc acid with the eye can cause extensive necrosis of the conjunctiva and corneal epithelium, resulting in perforation or opaque scarring. Chemical pneumonitis can be expected after respiratory exposure to acid vapors or after tracheobronchial aspiration of ingested acid. Death may occur due to complications such as circulatory shock, asphyxia due to glottic or laryngeal edema, perforation of the stomach with peritonitis, gastric hemorrhage, infection or anition due to stricture formation.

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 826 - from HSDB

Eye Symptoms

Redness. Pain. Blurred vision. Severe burns. ON CONTACT WITH LIQUID: FROSTBITE.
from ILO-ICSC

Ingestion Symptoms

Corrosion of mucous membranes of mouth, throat, and esophagus, with immediate pain and dysphagia. The necrotic areas are at first grayish white but soon acquire a blackish discoloration and sometimes a shrunken or wrinkled texture; the process is described as a "coagulation necrosis." 2) Epigastric pain, which may be associated with nausea and the vomiting of mucoid and "coffee-ground" material. At times, gastric hemorrhage may be intense, and the vomitus then contains fresh blood. Profound thirst /SRP: may be present/. 3) Ulceration of all membranes and tissues with which the acid comes in contact.
Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984., p. II-102 - from HSDB
Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine. Circulatory shock is often the immediate cause of death. 5) Asphyxial death due to glottic edema. 6) Late esophageal, gastric and pyloric strictures and stenoses, which may require major surgical repair, should be anticipated. Signs of obstruction commonly appear within a few weeks but may be delayed for months and even years. Permanent scars may also appear in the cornea, skin and oropharynx. 7) Uncorrected circulatory collapse of several hours' duration may lead to renal failure and ischemic lesions in the liver and heart.
Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984., p. II-102 - from HSDB

Target Organs

Eyes, skin, respiratory system
from The National Institute for Occupational Safety and Health (NIOSH)

Sensitisation:

Not sensitising on skin.

Carcinogen:

Evaluation: There is inadequate evidence for the carcinogenicity in humans of hydrochloric acid. There is inadequate evidence for the carcinogenicity in experimental animals of hydrochloric acid. Overall evaluation: Hydrochloric acid is not classifiable as to its carcinogenicity to humans (Group 3).

IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work). Available at:http://monographs.iarc.fr/ENG/Classification/index.php , p. 54 206 (1992) - from HSDB

A4; Not classifiable as a human carcinogen.

American Conference of Governmental Industrial Hygienists. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. ACGIH, Cincinnati, OH 2014, p. 35 - from HSDB

IARC-3, TLV-A4

from OSHA Occupational Chemical DB

Delayed and immediate effects and also chronic effects from short and long term exposure

Effects of Short Term Exposure

Rapid evaporation of the liquid may cause frostbite. The substance is corrosive to the eyes, skin and respiratory tract. Inhalation of this gas may cause asthma-like reactions (RADS). Exposure could cause asphyxiation due to swelling in the throat. Inhalation of high concentrations may cause lung oedema, but only after initial corrosive effects on the eyes and the upper respiratory tract have become manifest. Inhalation of high concentrations may cause pneumonitis. See Notes.
from ILO-ICSC

Effects of Long Term Exposure

Repeated or prolonged inhalation may cause effects on the teeth. This may result in tooth erosion. The substance may have effects on the upper respiratory tract and lungs. This may result in chronic inflammation of the respiratory tract and

reduced lung function . Mists of this strong inorganic acid are carcinogenic to humans. See Notes.
from ILO-ICSC

Numerical measures of toxicity (such as acute toxicity estimates)

LC_{50} Rat inhalation 3124 ppm/1 hr
Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 1980 - from HSDB
LC_{50} Mouse inhalation 1108 ppm/1 hr
Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 1980 - from HSDB
LD_{50} Mouse ip 1449 mg/kg
Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 1980 - from HSDB
LD_{50} Rabbit oral 900 mg/kg
Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 1980 - from HSDB
LD_{50} Rat oral 238-277 mg/kg
Organization for Economic Cooperation and Development; Screening Information Data Set for Hydrogen Chloride, CAS # 7647-01-0, p. 15 (2002). Available from, as of July 7, 2007: http://www.chem.unep.ch/irptc/sids/OECDSIDS/sidspub.html - from HSDB
LC_{50} Rat inhalation 5.7 mg/L/30 min
Organisation for Economic Cooperation and Development; Screening Information Data Set for Hydrogen Chloride, CAS # 7647-01-0, p. 15 (2002). Available from, as of July 7, 2007: http://www.chem.unep.ch/irptc/sids/OECDSIDS/sidspub.html - from HSDB
LC_{50} Rat inhalation 23.7 mg/L/ 5 min
Organisation for Economic Cooperation and Development; Screening Information Data Set for Hydrogen Chloride, CAS # 7647-01-0, p. 15 (2002). Available from, as of July 7, 2007: http://www.chem.unep.ch/irptc/sids/OECDSIDS/sidspub.html - from HSDB
LD_{50} Rat female oral 7.8 mL/kg/ 3.3% HCl in water
European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.101 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB
LC_{50} Mouse inhalation 68725 ppm for 5 min
European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.107 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB
LC_{50} Mouse inhalation 1108 ppm for 1 hr
European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.101 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB
LD_{50} Mouse dermal 1449 mg/kg
European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.118 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB
LC_{50} Guinea pig inhalation 4.3 mg/L for 15 min
European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.113 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB
LC_{50} Guinea pig inhalation 2.0 mg/L for 30 min
European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.113 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB

Toxicity Summary
IDENTIFICATION AND USE:
Hydrogen chloride is a colorless gas with pungent, irritating odor. it is used as tuberculocide, disinfectant (bactericide/germicide/purifier, limited, general or broad-spectrum, hospital or medical), sanitizer, virucide, fungicide/fungistat, and microbicide/microbiostat (slime-forming bacteria). It is also used in the manufacture of pharmaceutical hydrochlorides, vinyl chloride from acetylene, alkyl chlorides from olefins, and arsenious chlorides from arsenious oxide. In the chlorination of rubber. In organic reactions involving isomerization, polymerization, and alkylation. For making chlorine where economical. Hydrochloric acid has been identified as being used in hydraulic fracturing as a pH adjuster.

HUMAN EXPOSURE AND TOXICITY:
Hydrogen chloride will rapidly dissociate and its effects are thought to be a result of pH change (local deposition of H+)

rather than effects of hydrogen chloride/hydrochloric acid. Hydrogen chloride is corrosive to the skin and severe effects can be expected from exposure to the eyes. No skin sensitization has been reported. The irritation of hydrogen chloride to mucous is so severe that workers evacuate from the work place shortly after detecting its odor. In humans, no association between hydrogen chloride exposure and tumor incidence was observed. In one of eight asthmatic volunteers exposed to an aerosol of unbuffered hydrochloric acid at pH 2 for 3 min during tidal breathing, airway resistance was increased by 50%. Short term exposures have been reported to induce transitory obstruction in the respiratory tract, which diminishes with repeated exposure, suggesting adaption. Acclimatized workers can work undisturbed with a hydrogen chloride level of 15 mg/cu m (10 ppm). Exposure to hydrochloric acid can produce burns on the skin and mucous membranes, the severity of which is related to the concentration of the solution. Subsequently, ulceration may occur, followed by keloid and retractile scarring. Contact with the eyes may produce reduced vision or blindness. Frequent contact with aqueous solutions of hydrochloric acid may lead to dermatitis. Dental decay, with changes in tooth structure, yellowing, softening and breaking of teeth, and related digestive diseases are frequent after exposures to hydrochloric acid.

ANIMAL STUDIES:
For repeated dose toxicity, local irritation effects were observed in the groups of 10 ppm and above in a 90-day inhalation study. For genetic toxicity, a negative result has been shown in the Ames test. A positive result, which is considered to be an artifact due to the low pH, has been obtained in a chromosome aberration test using Hamster ovary cells. For carcinogenicity, no pre-neoplastic or neoplastic nasal lesions were observed in a 128-week inhalation study with male rats at 10 ppm hydrogen chloride gas. No evidence of treatment related carcinogenicity was observed either in other animal studies performed by inhalation, oral or dermal administration. Hydrogen chloride is not expected to have developmental toxicity. In addition, no effects on the gonads were observed in a good 90- day inhalation study up to 50 ppm.

ECOTOXICITY STUDIES:
The hazard of hydrochloric acid for the environment is caused by the proton (pH effect). For this reason the effect of hydrochloric acid on the organisms depends on the buffer capacity of the aquatic ecosystem. Also the variation in acute toxicity for aquatic organisms can be explained for a significant extent by the variation in buffer capacity of the test medium. For example, LC_{50} values of acute fish toxicity tests varied from 4.92 to 282 mg/L
from HSDB

Interactive effects

Helicobacter pylori is the major causative factor of ulcer but the use of ibuprofen and other non-steroidal anti-inflammatory drugs have also been implicated in development of ulcer. The purpose of the present study was to determine the anti-ulcer effect of glucosamine. The protective effect of glucosamine on ibuprofen-induced peptic ulcer in male albino rats was studied with respect to changes in the volume of gastric juice, acid output, pepsin activity, activities of membrane bound ATPases, protein content, glycoprotein components and histopathology. Oral administration of ibuprofen caused significant increase in the number of lesions in the gastric mucosa, increases in the volume of gastric juice and acidity, and decreased activity of pepsin. The levels of protein content and glycoprotein components (hexose, hexosamine and sialic acid) and ATPase activities were also observed. Oral pretreatment with glucosamine resulted in significant reduction in the number of lesions in the gastric mucosa and decreases in the volume of gastric juice and acidity. The pepsin activity was also maintained at near normalcy. Prior oral administration of glucosamine significantly prevented the ibuprofen-induced depletion of protein and glycoprotein components and maintained the activities of membrane bound ATPases as compared to untreated ulcer induced group of rats. The anti-ulcerogenic activity of glucosamine might be ascribable to its ability to neutralize the hydrochloric acid secreted into the stomach and to its capability to strengthen the mucosal barrier by increasing mucosal glycoprotein synthesis and to its free radical scavenging property. Histopathological investigations of the mucosal tissue also support the anti-ulcerogenic effect of glucosamine.
Abstract: PubMed Santhosh S et al; J Gastroenterol Hepatol 22 (6): 949-53 (2007) - from HSDB

The mechanism by which nonsteroidal anti-inflammatory drugs (NSAIDs) suppress gastric mucosal blood flow is not fully understood, although the depletion of mucosal prostaglandin E2 has been proposed as one possible explanation. We investigated the role of gastric acid on gastric mucosal blood flow in NSAID-treated rats. A rat stomach was mounted in an ex vivo chamber, and gastric mucosal blood flow was measured sequentially in a 5 cu mm area of the gastric corpus using a scanning laser Doppler perfusion image system. Results showed that diclofenac (5 mg/kg s.c.) and indomethacin (10 mg/kg s.c.) did not affect gastric mucosal blood flow, although both strongly decreased mucosal prostaglandin E2 when saline was instilled into the gastric chamber. On replacement of the saline in the chamber with 100 mM hydrochloric acid, these drugs caused a decrease in gastric mucosal blood flow levels within 30 min. The specific cyclooxygenase (COX)-2 inhibitors celecoxib (50 mg/kg s.c.) and rofecoxib (25 mg/kg s.c.) did not affect mucosal prostaglandin E2 level, nor did they decrease gastric mucosal blood flow, even when hydrochloric acid was added to the chamber. Furthermore, measurement of vasoconstrictive factors present in the mucosa showed that endothelin-1 levels increased after administration of diclofenac s.c. in the presence of intragastric hydrochloric acid. This indicates that the presence of mucosal hydrochloric

acid plays an important role in the NSAID-induced decrease in gastric mucosal blood flow, while the COX-1-derived basal prostaglandin E2, which is unlikely to control gastric mucosal blood flow itself, protects microcirculatory systems from mucosal hydrochloric acid.
Abstract: PubMed Funatsu T et al; Eur J Pharmacol 554 (1): 53-9 (2007) - from HSDB

A large quantity of white gas containing titanium dioxide and hydrogen chloride was generated unexpectedly during an experiment in a chemical laboratory. Fourteen students and staff complained of nausea, dyspnea, or respiratory irritation immediately after inhaling the gas. On arrival at Saint Luke's International Hospital, more than half of the patients presented with low-grade fever. Symptoms spontaneously resolved soon after admission, although the low-grade fever persisted until the following morning. Low-grade fever after inhalation exposure is not explicable byhydrogen chloride inhalation and therefore appeared to be caused by titanium dioxide inhalation, manifesting as metal fume fever. Titanium dioxide is thought to have no remarkable human toxicity and is considered to be safe clinically. To our knowledge, this is the first report of titanium dioxide inhalation as the potential cause of metal fume fever in humans. Correlations between the degree of fever and quantity and concentration of inhaled titanium dioxide remain to be determined.
Abstract: PubMed Otani N et al; Am J Emerg Med 26 (5): 608-11 (2008) - from HSDB

In one of eight asthmatic volunteers exposed to an aerosol of unbuffered hydrochloric acid at pH 2 for 3 min during tidal breathing, airway resistance was increased by 50%. Bronchoconstriction was increased in all eight subjects after inhalation of a mixture of hydrochloric acid and glycine at pH 2.
IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work). Available at:http://monographs.iarc.fr/ENG/Classification/index.php , p. V54 201 (1992) - from HSDB

Hydrochloric acid, carbon monoxide, and unsaturated carbon cmpd interactions account for the extreme toxicity of gases from polyvinyl chloride and other chloride containing polymers.
Einbrodt HJ, Prajsnar D; Wiss Umwelt ISS (2): 97-105 (1983) - from HSDB

Where specific chemical data are not available

None known.

Mixtures

No data available.

Mixture versus ingredient information

No data available.

Other information

None.

12 Ecological information

Toxicity

LC50 Rat inhalation 3124 ppm/1 hr
Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 1980 - from HSDB
LC50 Mouse inhalation 1108 ppm/1 hr
Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 1980 - from HSDB
LD50 Mouse ip 1449 mg/kg
Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 1980 - from HSDB
LD50 Rabbit oral 900 mg/kg
Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 1980 - from HSDB
LD50 Rat oral 238-277 mg/kg
Organization for Economic Cooperation and Development; Screening Information Data Set for Hydrogen Chloride, CAS # 7647-01-0, p. 15 (2002). Available from, as of July 7, 2007: http://www.chem.unep.ch/irptc/sids/OECDSIDS/sidspub.html - from HSDB
LC50 Rat inhalation 5.7 mg/L/30 min

Organisation for Economic Cooperation and Development; Screening Information Data Set for Hydrogen Chloride, CAS # 7647-01-0, p. 15 (2002). Available from, as of July 7, 2007: http://www.chem.unep.ch/irptc/sids/OECDSIDS/sidspub.html - from HSDB

LC50 Rat inhalation 23.7 mg/L/ 5 min

Organisation for Economic Cooperation and Development; Screening Information Data Set for Hydrogen Chloride, CAS # 7647-01-0, p. 15 (2002). Available from, as of July 7, 2007: http://www.chem.unep.ch/irptc/sids/OECDSIDS/sidspub.html - from HSDB

LD50 Rat female oral 7.8 mL/kg/ 3.3% HCl in water

European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.101 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB

LC50 Mouse inhalation 68725 ppm for 5 min

European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.107 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB

LC50 Mouse inhalation 1108 ppm for 1 hr

European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.101 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB

LD50 Mouse dermal 1449 mg/kg

European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.118 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB

LC50 Guinea pig inhalation 4.3 mg/L for 15 min

European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.113 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB

LC50 Guinea pig inhalation 2.0 mg/L for 30 min

European Chemicals Bureau; IUCLID Dataset, Hydrogen Chloride (CAS # 7647-01-0) p.113 (2000 CD-ROM edition). Available from, as of July 9, 2007: http://esis.jrc.ec.europa.eu/ - from HSDB

Persistence and degradability

Environmental Fate

TERRESTRIAL FATE:

If released to soil, hydrogen chloride will evaporate from dry soil surfaces and dissociate into chloride and hydronium ions in moist soil(1).

(1) ATSDR; ToxFAQs for Hydrogen Chloride, April 2002. Available from, as of Mar 5, 2015:http://www.atsdr.cdc.gov/toxfaqs/index.asp - from HSDB

AQUATIC FATE:

If released to water, hydrogen chloride dissociates readily in water to chloride and hydronium ions(1). The dissociation results in a decrease of the pH of the water(1). Volatilization from water surfaces is not expected(2) based upon a Henry's Law constant of 4.90X10-10 atm-cu m/mole(3). Hydrogen chloride does not build up in aquatic organisms(4).

(1) ATSDR; ToxFAQs for Hydrogen Chloride, April 2002. Available from, as of Mar 5, 2015:http://www.atsdr.cdc.gov/toxfaqs/index.asp (2) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 15-1 to 15-29 (1990) (3) Brimblecombe P, Clegg SL; J Atmos Chem 8: 95 (1989) (4) Hisham MW, Bommaraju TV; Hydrogen Chloride. Kirk-Othmer Encyclopedia of Chemical Technology. (1999-2015). New York, NY: John Wiley & Sons. Online Posting Date: 28 Apr 2014 - from HSDB

ATMOSPHERIC FATE:

Anhydrous hydrogen chloride released into the air will be in the vapor form. Once released to the environment it will react with atmospheric moisture and standing water to form hydrochloric acid(1). Hydrogen chloride is removed from air by wet deposition as chloride salts with an atmospheric lifetime of 1-5 days(2).

(1) Hisham MW, Bommaraju TV; Hydrogen Chloride. Kirk-Othmer Encyclopedia of Chemical Technology. (1999-2015). New York, NY: John Wiley & Sons. Online Posting Date: 28 Apr 2014 (2) Kao AS; J Air Waste Manage Assoc 44: 683-96 (1994) - from HSDB

Abiotic Degredation

Hydrogen chloride is removed from air by wet deposition as chloride salts with an atmospheric lifetime of 1-5 days(1). Hydrogen chloride dissociates readily in water to chloride and hydronium ions, decreasing the pH of the water(2).

(1) Kao AS; J Air Waste Manage Assoc 44: 683-96 (1994) (2) ATSDR; ToxFAQs for Hydrogen Chloride, April 2002. Available from, as of Mar 5, 2015: http://www.atsdr.cdc.gov/toxfaqs/index.asp - from HSDB

Bioconcentration

Hydrogen chloride dissociates readily in water to chloride and hydronium ions(1). Therefore, hydrogen chloride does not accumulate in the aquatic organisms(1,2).

(1) ATSDR; ToxFAQs for Hydrogen Chloride, April 2002. Available from, as of Mar 5, 2015:http://www.atsdr.cdc.gov/toxfaqs/index.asp (2) Hisham MW, Bommaraju TV; Hydrogen Chloride. Kirk-Othmer Encyclopedia of Chemical Technology. (1999-2015). New York, NY: John Wiley & Sons. Online Posting Date: 28 Apr 2014 - from HSDB

Effluents Concentrations

Hydrogen chloride was estimated to be present at a concentration of 88 ppm in smokestack emissions from a coal-burning industrial power plant near Dayton, Ohio(1). Hydrogen chloride, as a pharmaceutical component, was not detected in influent or effluent samples to a sewage treatment plant in southern England sampled in June 2004(2).

(1) Gross KC et al; Environ Sci Technol 44: 9390-7 (2010) (2) Jones OAH et al; Environ Pollut 145: 738-44 (2007) - from HSDB

Animal Concentrations

Hydrochloric acid is found in the digestive tract of most mammals(1).

(1) Hisham MW, Bommaraju TV; Hydrogen Chloride. Kirk-Othmer Encyclopedia of Chemical Technology. (1999-2015). New York, NY: John Wiley & Sons. Online Posting Date: 28 Apr 2014 - from HSDB

Other Environmental Concentrations

Hydrochloric acid is found in the gases evolved from volcanoes, particularly those located in Mexico and South America. Hydrogen chloride was detected in the atmosphere of the planet Venus. The dissociation of hydrogen chloride is considered the source of chlorine detected in the spectra of distant stars(1).

(1) ATSDR; ToxFAQs for Hydrogen Chloride, April 2002. Available from, as of Mar 5, 2015:http://www.atsdr.cdc.gov/toxfaqs/index.asp - from HSDB

Bioaccumulative potential

Hydrogen chloride dissociates readily in water to chloride and hydronium ions(1). Therefore, hydrogen chloride does not accumulate in the aquatic organisms(1,2).

(1) ATSDR; ToxFAQs for Hydrogen Chloride, April 2002. Available from, as of Mar 5, 2015:http://www.atsdr.cdc.gov/toxfaqs/index.asp (2) Hisham MW, Bommaraju TV; Hydrogen Chloride. Kirk-Othmer Encyclopedia of Chemical Technology. (1999-2015). New York, NY: John Wiley & Sons. Online Posting Date: 28 Apr 2014 - from HSD

Mobility in soil

Soil Adsorption/Mobility

Hydrogen chloride dissociates into chloride and hydronium ions in moist soil(1).

(1) ATSDR; ToxFAQs for Hydrogen Chloride, April 2002. Available from, as of Mar 5, 2015:http://www.atsdr.cdc.gov/toxfaqs/index.asp - from HSDB

Volatilization from Water/Soil

The Henry's Law constant for hydrogen chloride is 2.04X10+6 mol/L atm (4.90X10-10 cu m atm/mol)(1). This Henry's Law constant indicates that hydrogen chloride is expected to be essentially nonvolatile from water and moist soil surfaces(2). Hydrogen chloride will evaporate from dry soil surfaces(3).

(1) Brimblecombe P, Clegg SL; J Atmos Chem 8: 95 (1989) (2) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 15-1 to 15-29 (1990) (3) ATSDR; ToxFAQs for Hydrogen Chloride, April 2002. Available from, as of Mar 5, 2015: http://www.atsdr.cdc.gov/toxfaqs/index.asp - from HSDB

Water Concentrations

SEAWATER: Hydrogen chloride was identified as one of the chemicals contributing to the chemical stress of coastal waters in the Gulf of Mexico(1).

(1) Klaine SJ, Mayer FL; pp. 446-509 in Pesticide residues in coastal tropical ecosystems. Distribution, fate and effects. New York, NY: Taylor & Francis (2003)- from HSDB

Other adverse effects

Environmental Protection:

This product is toxic to fish and aquatic organisms. Do not discharge effluent containing this product into bodies of water unless in accordance with international, national and/or provincial law.

13 Disposal considerations

Disposal methods

Ecology - waste materials:

This product is toxic to fish and aquatic organisms. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries oceans or other waters unless in accordance with the requirements of the National Pollutant Discharge Elimination System (NPDES) permit and the permitting authorith has been notified in writing prior to discharge.

Generators of waste (equal to or greater than 100 kg/mo) containing this contaminant, EPA hazardous waste number D002, must conform with USEPA regulations in storage, transportation, treatment and disposal of waste.
40 CFR 240-280, 300-306, 702-799 (USEPA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of April 2, 2015: http://www.ecfr.gov - from HSDB

Product: Contact a licensed professional waste disposal service to dispose of this material. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging: Dispose of as unused product.

Neutralization: Neutralize with limestone ($CaCO_3$), soda ash ($Na2CO_3$) or slaked lime ($Ca(OH)_2$). Flushing to sewer with high dilution depends on allowable neutral salt concn in effluent water. Consider use of waste acid to neutralize alkaline wastes.
United Nations. Treatment and Disposal Methods for Waste Chemicals (IRPTC File). Data Profile Series No. 5. Geneva, Switzerland: United Nations Environmental Programme, Dec. 1985., p. 190 - from HSDB

14 Transport information

UN Number

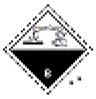
UN1789 Class: 8 PG: II Exempt: 50 F: 20

UN Proper Shipping Name

HYDROCHLORIC ACID, concentration >15% hydrochloric acid HYDROCHLORIC ACID, concentration >5% <15% hydrochloric acid

Transport hazard class(es)

8



Packing group, if applicable

II

Environmental hazards

Do not discharge effluent containing this product into bodies of water unless in accordance with international, national and/or provincial law.

Special precautions for user

DO NOT load with Classes 1 and 2.3.
Can load with Class 8 bases if possible to seperate by 1 metre.
Cyanides, Class 6.1 **must not** be transported with acid.
May be loaded together with classes 2.1, 2.2, 5, 6.1 and 6.2 if kept 1 metre apart.
Goods of different classes **must** be segregated by an air space of at least 100mm or by an approved segregation device or non-dangerous goods.

P, B, L and O provisions as per SANS 10231:2006
None.

DOT Emergency Guidelines
GUIDE 157 SUBSTANCES - TOXIC and/or CORROSIVE (Non-Combustible/Water-Sensitive)
Fire or Explosion:
Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. For UN1796, UN1826, UN2031 at high concentrations and for UN2032, these may act as oxidizers, also consult GUIDE 140. Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.). Substance may react with water (some violently), releasing corrosive and/or toxic gases and runoff. Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated or if contaminated with water.

U.S. Department of Transportation. 2012 Emergency Response Guidebook. Washington, D.C. 2012- from HSDB

Health:
TOXIC; inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns or death. Reaction with water or moist air may release toxic, corrosive or flammable gases. Reaction with water may generate much heat that will increase the concentration of fumes in the air. Fire will produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution. *U.S. Department of Transportation. 2012 Emergency Response Guidebook. Washington, D.C. 2012 - from HSDB*

Public Safety:
CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover. As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate enclosed areas.
U.S. Department of Transportation. 2012 Emergency Response Guidebook. Washington, D.C. 2012 - from HSDB

Protective Clothing:
Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection. Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.
U.S. Department of Transportation. 2012 Emergency Response Guidebook. Washington, D.C. 2012 - from HSDB

Evacuation:
Spill: See Table 1 - Initial Isolation and Protective Action Distances for highlighted materials. For non-highlighted materials, increase, in the downwind direction, as necessary, the isolation distance shown under "PUBLIC SAFETY". Fire: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.
U.S. Department of Transportation. 2012 Emergency Response Guidebook. Washington, D.C. 2012 - from HSDB

Fire:
Note: Some foams will react with the material and release corrosive/toxic gases. Small Fire: CO2 (except for Cyanides), dry chemical, dry sand, alcohol-resistant foam. Large Fire: Water spray, fog or alcohol-resistant foam. Move containers from fire area if you can do it without risk. Use water spray or fog; do not use straight streams. Dike fire-control water for later disposal; do not scatter the material. Fire involving Tanks or Car/Trailer Loads: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire.
U.S. Department of Transportation. 2012 Emergency Response Guidebook. Washington, D.C. 2012 - from HSDB

Spill or Leak:
ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. A vapor suppressing foam may be used to reduce vapors. DO NOT GET WATER INSIDE CONTAINERS. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material. Prevent entry into waterways, sewers, basements or confined areas. Small Spill: Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain. Use clean non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.
U.S. Department of Transportation. 2012 Emergency Response Guidebook. Washington, D.C. 2012 - from HSDB

First Aid:
Move victim to fresh air. Call 911 or emergency medical service. Give artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. In case of contact with Hydrofluoric acid(UN1790),flush skin and eyes with water for5 minutes; then, for skin exposuresrub on a calcium/gel combination; for eyes flush with a water/calcium solution if available, otherwise continue with water for 15 minutes. For minor skin contact, avoid spreading material on unaffected

skin. Keep victim warm and quiet. Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
U.S. Department of Transportation. 2012 Emergency Response Guidebook. Washington, D.C. 2012 - from HSDB

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable.

15 Regulatory information

Safety, health and environmental regulations specific for the product in question

SA NATIONAL LEGISLATION
Hazardous Substances Act 15 of 1973 and Regulations.
Occupational Health and Safety Act 85 of 1993 and Regulations.

SA NATIONAL STANDARDS
SANS 10228 : 2006 : Identification and Classification of Dangerous Goods for Transport by Road and Rail.
SANS 10231 : 2018 : Transport of dangerous goods - Operational requirements for road vehicles.
SANS 10234 : 2008 : Globally Harmonized System of classification and labelling of chemicals (GHS).
SANS 11014 : 2010 : Safety Data Sheets for chemical Products.

REACH Regulation (EC) No 1907/2006
This product contains only components that have been either pre-registered, registered, are exempt from registration, are regarded as registered or are not subject to registration according to Regulation (EC) No. 1907/2006 (REACH)., The aforementioned indications of the REACH registration status are provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. It is the buyer´s/user´s responsibility to ensure that his/her understanding of the regulatory status of this product is correct.

Seveso III: Directive 2012/18/EU
Listed in Regulation: Not applicable

USA Regulations
Clean Water Act Requirements
Hydrochloric acid is designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance. This designation includes any isomers and hydrates, as well as any solutions and mixtures containing this substance.
40 CFR 116.4; U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of February 4, 2015: http://www.ecfr.gov - from HSDB

CERCLA Reportable Quantities
Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 5000 lb or 2270 kg. The toll free number of the NRC is (800) 424-8802. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV. D.3.b).
40 CFR 302.4 (USEPA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of February 4, 2015: http://www.ecfr.gov - from HSDB

RCRA Requirements
D002; A solid waste containing hydrochloric acid may become characterized as a hazardous waste when subjected to testing for corrosivity as stipulated in 40 CFR 261.21, and if so characterized, must be managed as a hazardous waste.
40 CFR 261.22 (USEPA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of February 4, 2015: http://www.ecfr.gov - from HSDB

FIFRA Requirements
Residues of hydrochloric acid are exempted from the requirement of a tolerance when used as a solvent, neutralizer in accordance with good agricultural practice as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest.
40 CFR 180.910 (USEPA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of February 4, 2015: http://www.ecfr.gov - from HSDB

Based on the reviews of the generic data for the active ingredients mineral acids /including hydrochloric acid/, the Agency has sufficient information on the health effects of mineral acids and on its potential for causing adverse effects in fish and wildlife and the environment. Therefore, the Agency concludes that products, labeled and used as specified in this Reregistration Eligibility Decision, containing mineral acids for all uses except for the use of sulfuric acid on potato vines, are eligible for reregistration.
USEPA/Office of Prevention, Pesticides and Toxic Substances; Reregistration Eligibility Decision Document for Mineral Acids p.22 EPA 738-F-93-025 (December 1993). Available from, as of February 24, 2015:http://www.epa.gov/pesticides/reregistration/status.htm - from HSDB

As the federal pesticide law FIFRA directs, EPA is conducting a comprehensive review of older pesticides to consider their health and environmental effects and make decisions about their continued use. Under this pesticide reregistration program, EPA examines newer health and safety data for pesticide active ingredients initially registered before November 1, 1984, and determines whether the use of the pesticide does not pose unreasonable risk in accordance to newer safety standards, such as those described in the Food Quality Protection Act of 1996. Pesticides for which EPA had not issued Registration Standards prior to the effective date of FIFRA '88 were divided into three lists based upon their potential for human exposure and other factors, with List B containing pesticides of greater concern than those on List C, and with List C containing pesticides of greater concern than those on List D. Hydrogen chloride is found on List D. Case No: 4064; Pesticide type: fungicide, herbicide, antimicrobial; Case Status: RED Approved 02/94; OPP has made a decision that some/all uses of the pesticide are eligible for reregistration, as reflected in a Reregistration Eligibility Decision (RED) document .; Active ingredient (AI): hydrogen chloride; AI Status: OPP has completed a Reregistration Eligibility Decision (RED) document for the case/AI.
United States Environmental Protection Agency/ Prevention, Pesticides and Toxic Substances; Status of Pesticides in Registration, Reregistration, and Special Review. (1998) EPA 738-R-98-002, p. 324 - from HSDB

FDA Requirements
Hydrochloric acid used as a buffer and neutralizing agent in animal drugs, feeds, and related products is generally recognized as safe when used in accordance with good manufacturing or feeding practice.
21 CFR 582.1057 (USFDA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of February 4, 2015: http://www.ecfr.gov - from HSDB

This substance is generally recognized as safe when used as a buffer and neutralizing agent in accordance with good manufacturing practice.
21 CFR 182.1057 (USFDA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of February 4, 2015: http://www.ecfr.gov - from HSDB

Drug products containing certain active ingredients offered over-the-counter (OTC) for certain uses. A number of active ingredients have been present in OTC drug products for various uses, as described below. However, based on evidence currently available, there are inadequate data to establish general recognition of the safety and effectiveness of these ingredients for the specified uses: hydrochloric acid is included in digestive aid drug products.
21 CFR 310.545 (a)(8) (USFDA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of February 4, 2015: http://www.ecfr.gov - from HSDB

Chemical safety assessment:
Not assessed.

16 Other information

Other information

Full text of H & P-Statements referred to under sections 2
Hazard statements

H290	May be corrosive to metals.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H331	Toxic if inhaled.
H335	May cause respiratory irritation.

Precautionary statements

P234	Keep only in original container.

P260	Do not breathe mist/vapours/spray.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	IF ON SKIN (or hair): Remove/Take off Immediately all contaminated clothing. Rinse SKIN with water/shower.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/physician.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents and container in accordance with local, regional, national, international regulations.

Abbreviations and Acronyms:

CAS	Chemical Abstract Service
EC$_{50}$	Exposure Concentration
EC(EINECS)	European Inventory of Existing Commercial Chemicals
ILO-ICSC	International Chemical Safety Cards
HSDB	Toxicology database that focuses on the toxicology of potentially hazardous chemicals
LD$_{50}$	Lethal dose required to kill 50% of the population
LC$_{50}$	Lethal concentration required to kill 50% of the population
NIOSH	National Institute of Occupational Safety and Health
PNEC	Predicted No-Effect Concentration
RTECS	Registry of Toxic Effects of Chemical Substances
STEL	Short Term Exposure Limits
TWA	Time Weighted Average

Labelling REGULATION (EC) No 1272/2008

Signal Word

Danger

Pictograms

GHS05	Corrosive Hazard
GHS07	Health Hazard
GHS08	Serious Health Hazard

Training advice

Provide adequate information, instruction and training for operators.

Compiled by R. van Rooyen, SHEQ and E. Le Sar, Director

MANUFACTURER/SUPPLIER DISCLAIMER:

IMPORTANT: This information is given without a warranty or guarantee. No suggestions for use are intended or shall be construed as a recommendation to infringe any existing patents or violate any national or local laws. Safe handling and use is the responsibility of the customer. Read the label before using this product. This information is true and accurate to the best of our knowledge.

Revision History

Revision:	Date:	Change:
1.0	2018/04/19	Preparation of the safety data sheet according to Regulation (EC) No 1907/2006 of the European Parliament and of the Council
2.0	2018/05/05	Revised all sections. Updated ingredient SDS
3.0	2018/11/28	Revised all sections. Updated with ECHA/Pubchem website information