MATERIAL SAFETY DATA SHEET HYDROCHLORIC ACID

1: Chemical Product Identification

Trade Name	Hydrochloric acid
Chemical Family	Inorganic Acid
Chemical Name	Hydrochloric Acid
SYNONYMS	Aqueous hydrogen chloride, chlorohydric acid, Hydrogen chloride Muriatic acid Spirits of salt
Chemical Formula	HCl
Chemical Abstracts No.	7647-01-0
EINECS No.	231-595-7
NIOSH No.	MW 4025000
HAZCHEM CODE	2R
UN No.	1789

2: Hazards Identification

Classification of the substance or mixture

GHS US classification

Skin corrosion/irritation	Category 1B H314 Causes severe skin burns and eye damage
Serious eye damage/eye irritation	Category 1 H318 Causes serious eye damage

GHS Label elements, including precautionary statements

GHS US labeling

Hazard pictograms (GHS US) :



Signal word (GHS US) :	Danger
Hazard statements (GHS US) :	H314 - Causes severe skin burns and eye damage

Precautionary statements (GHS US) : P260 - Do not breathe mist, vapors, spray.

P264 - Wash exposed skin thoroughly after handling.

P280 - Wear protective gloves, eye protection, protective clothing, 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.

P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.

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.

P363 - Wash contaminated clothing before reuse.

P405 - Store locked up.

P501 - Dispose of contents/container to comply with local, state and federal regulations

Main Hazards	Threshold limit values (TLVs) / American Conference of Governmental Industrial Hygienists (ACGIH) / 2002*

Ceiling Exposure Limit (TLV-C): 5 ppm (7.5 mg/m3)

(*Notice of intended change: The reduction of the TLV-C to 2 ppm, 3mg/m3)

Chemical Hazards	Hydrochloric acid may react explosively with potassium permanganate or sodium and contact of fuminghydrochloric acid with tetraselenium tetranitride is also explosive. Passing hydrogen chloride into alcoholic hydrogen cyanide in .
preparation	of alkyliminoformate chlorides proceeds explosively, and other hazard-free methods are available (4*). An extremely exothermic decomposition reaction may occur with 1,1- difluoroethylene particularly at high vessel loadings.

Rubidium acetylide ignites in contact with hydrochloric acid, and caesium acetylide ignites in contact with gaseous hydrogen chloride or concentrated hydrochloric acid. Hydrogen chloride also ignites in contact with fluorine, and concentrated aqueous solutions produce flame. Aluminium-titanium alloys ignite or incandesce on heating in hydrogen chloride. Hexalithium disilicide incandesces in concentrated hydrochloric acid, and silanes (which ignite) are evolved with the dilute acid.

Filling a glass drying tap on a hydrochloric acid storage tank with silica gel instead of calcium sulphate resulted in fracturing of the tap, and the accidental addition of concentrated hydrochloric acid to a tank of sulphuric acid caused the tank to burst violently. The safe dehydration of hydrochloric acid which releases a lot of gas avoids the possibility of layer formation in an unstirred flask.

Biological Hazards	Hydrochloric acid and high concentrations of the gas are highly corrosive to the skin and mucous membranes.

Considerable variation in species sensitivity to hydrochloric acid exists. The health effects of occupational exposure have reviewed.

Health Effects

Eyes	Low concentrations of vapour or mist (10-35 ppm) can be immediately irritating, causing redness. Concentrated vapour, mist or splashed liquid can cause severe irritation, burns and permanent blindness.
Skin	Hydrochloric acid liquid can cause skin burns and may produce keloid and retractile scarring. Facial burns may result in serious and disfiguring scars. Frequent contact with the dilute acid may cause dermatitis. And photosensitisation may result from industrial contact.
Ingestion	Hydrochloric acid solutions can cause corrosive burns to mouth, throat, oesophagus, and stomach. Symptoms may include difficulty in swallowing, intense thirst, nausea, vomiting, diarrhoea and in severe cases, collapse, and death. Small amounts of acid which enter the lungs during ingestion or vomiting (aspiration) can cause serious lung injury and death.
Inhalation	The major effects of acute exposure to hydrogen chloride are usually limited to the upper respiratory tract and are severe enough to lead to prompt withdrawal. Exposure to the gas causes cough, burning of the throat and choking feeling, inflammation and ulceration of the nose, throat, and larynx. Exposure to higher concentrations, as may occur if a worker is prevented from escaping, may cause laryngeal spasm, and oedema of the lungs and vocal cords.

Prolonged or repeated exposure may cause dental discolouration and erosion. Pulmonary function changes in naive but not chronically exposed workers suggests acclimatisation occurs. Gastritis and chronic bronchitis have also been reported in exposed workers.

In humans, exposure to 50 - 100 ppm for 1 hour is barely tolerable, 35 ppm for a short while causes throat irritation, and 10 ppm was tolerable, although immediate irritation has been reported at

concentrations over 5 ppm. Bleeding nose and gums, ulceration of nasal and oral mucosa, and painful shaving due to tender facial skin was reported in workers exposed to mists from heated metal pickling solutions.

In animal studies reported effects of exposure to high concentration of hydrogen chloride include damage to the lungs and blood vessels, lung collapse, and lesions of the liver and other organs, coughing, wheezing, frothing, slowing of movement, increased respiratory rate, and death due to respiratory tract effects. Repeated exposure to low concentrations of the gas (34 ppm) had no immediate toxic effects and produced no morphological changes. Exposure to 100 ppm, 6 hours/day for 50 days caused slight unrest and irritation of the nose and eyes in several species, while repeated exposure at higher concentrations caused weight loss. Lesions in the nasal cavity of mice has also been reported.

Inhalation of weak hydrochloric acid into the bronchi of rabbits caused inflammatory processes like those occurring in "flu or due to chemical weapons. Differing responses to irritant gases such as hydrogen chloride between rodents and nonhuman primates suggest that the former may be an inadequate model for evaluating the toxicity of irritant gases to humans.

Additional Medical Information

Carcinogenicity	No carcinogenic response was noted in inhalation experiments with rats. Mortality rate from lung cancer was found to be significantly alleviated in workers exposed to sulphuric and hydrochloric acid mists during steel pickling operations.
Mutagenicity	No information is available concerning the mutagenicity of hydrochloric acid.
Teratogenicity and Embryotoxicity	No human information is available. Insufficient information is available to evaluate an animal report.

Reproductive Hazards No information is available concerning the reproductive hazards of hydrochloric acid

3. Composition and Information on Ingredients

Composition:

Name	CAS #	Percent	EINECS/ELINCS
Water	7732-18-5	62–68	231-791-2
Hydrogen chloride	7647-01-0	27–38	231-595-7

Hazardous Components	Hydrochloric acid (HCl) is commercially available as a solution of up to 38% hydrogen chloride (m/m) dissolved in water.
EEC Classification [C;Xi]	Corrosive; Irritant.
Risk Phrases	R34: Causes burns

R36/37/38: Irritating to eyes and respiratory system and skin

Safety Phrases	S1/2: Keep locked up and out of reach of children.

S26: In case of contact with eyes, rinse with plenty of water, seek medical advice.

S28: After contact with skin, wash immediately with plenty of water.

S45: In case of accident or if you feel unwell, seek medical advice immediately, show label where possible.

EU Comments:	Concentration greater than or equal to 25%: Corrosive. Causes burns. Irritating to the respiratory system. [C; R34-37].

Concentration less than 25% and greater than or equal to 10%: Irritant. Irritating to eyes, and respiratory system and skin. [Xi, R36/37/38].

The product label must indicate the percentage concentration of the solution.

4: First Aid Measures

Eye	Immediately flush the contaminated eye(s) with gently flowing water for at least 30 minutes, holding the eyelid(s) open. Neutral saline solution may be used as soon as it is available. DO NOT INTERRUPT FLUSHING. If necessary, keep emergency vehicle waiting. Take care not to rinse contaminated water into the non-affected eye. If irritation persists, repeat flushing. Transport victim to hospital as soon as possible.
Skin	Remove contaminated clothing immediately, drench the contaminated area with running water for at least 30 minutes. Do not interrupt flushing. If necessary, keep emergency vehicle waiting. Transport victim to hospital as soon as possible. Completely decontaminate clothing, shoes and leather goods before re-use or discard.
Ingested	Never give anything by mouth if victim is rapidly losing consciousness or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 240 to 300 ml of water. If milk is available, it may be administered AFTER the water has been given. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Repeat administration of water. Transport victim to hospital as soon as possible.
Inhaled	Take proper precautions to ensure your own safety before attempting rescue, e.g., wear appropriate protective equipment, use the "buddy" system. Remove source of contamination or move victim to fresh air. If unconscious, do not give anything to drink, give artificial ventilation and chest compression or place in the recovery position as necessary. If conscious make the casualty lie or sit down quietly, give medical oxygen if available. Lung congestion may occur - a conscious casualty with breathing difficulties should be placed in a sitting position. Immediately transport victim to an emergency medical facility. Symptoms may be delayed up to 48 hours after exposure.

FIRST AID COMMENTS Consult a physician and/or the nearest Poison Control Centre for all exposures except minor instances of inhalation or skin contact. All first aid procedures should be periodically reviewed by a physician familiar with the material and its conditions of use in the workplace.

5: Fire and Explosion Data

Extinguishing Media Hydrochloric acid is not combustible. Use extinguishing agents compatible with acid and appropriate for the burning material. Use water spray to cool containers involved in a fire to prevent rupture. Use water spray or fog to reduce or direct vapours. Do not direct water spray at source of leak.

Special Hazards Contact with common metals produces hydrogen gas which may form explosive mixtures in air.

Protective Clothing Gas-tight chemical safety goggles or face shield. Impervious gloves, coveralls, boots, and/or other resistant protective clothing to prevent all possible skin contact. Neoprene, Viton, and butyl rubber are suitable materials for protective clothing. An impervious acid-resistant full- body encapsulating suit and respiratory protection may be required. See section 8.

6: Accidental Release Measures

Personal Precautions Restrict access to area until completion of clean-up. Ensure clean-up is conducted by fully trained personnel only.

Wear adequate personal protective equipment: Gas-tight chemical safety goggles or face shield. Impervious gloves, coveralls, boots, and/or other resistant protective clothing to prevent all possible skin contact. Neoprene, Viton and butyl rubber are suitable materials for protective clothing. An impervious acid-resistant full- body encapsulating suit and respiratory protection may be required. See section 8.

Ventilate area.

Environmental Precautions Keep now neutralised material out of sewers, storm drains, surface waters and soil. Notify government occupational health and safety and environmental authorities.

Clean-Up Methods

Small spills

Contain and soak up spill with absorbent material which does not react with spilled chemical. Put material in suitable, covered, labelled containers. Neutralise spill area with lime or soda ash and flush area with water. Do not get water inside containers. Contaminated absorbent material may pose the same hazards as the spilled product.

Large spills Avoid contact with spilled material. Keep upwind and out of low areas. Avoid inhaling vapour. Prevent material from entering sewers, waterways, or confined spaces. Stop or reduce leak if it can be done without risk. Recover spilled HCl if feasible. Contain spill with earth, sand, or absorbent material which does not react with spilled material. Collect material in suitable, covered, labelled containers. Dispose of contaminated product and materials used in cleaning in a manner approved for this chemical. After removal, neutralise spill area with lime or soda ash and flush spill area with water to an approved sewer.

Water fog or spray may be necessary to knock down vapours.

Contact fire and emergency services and supplier for additional advice.

7: Handling and Storage

Precautions: Keep locked up. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fibreboard drum using a strong polyethylene inner package.

Storage:	Keep container tightly closed. Keep container in a cool, well-ventilated area.

8: Exposure Controls/Personal Protection

Engineering Controls: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill: Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Respiratory protection not required in normal conditions

Personal protective equipment symbol(s):



Other information Do not eat, drink or smoke during use

Exposure Limits: CEIL: 5 (ppm) from OSHA (PEL) [United States]

CEIL: 7 (mg/m3) from OSHA (PEL) [United States]

CEIL: 5 from NIOSH

CEIL: 7 (mg/m3) from NIOSH

TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)]

TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)] Consult local authorities for acceptable exposure limits.

9: Physical and Chemical Properties

Physical state and appearance	Liquid.
Odour:	Pungent. Irritating (Strong.)
Taste	Not available.
Molecular Weight:	Not applicable.
Colour	Colourless to light yellow.
pH (1% soln/water):	Acidic.
Boiling Point:	108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C@ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)
Melting Point:	-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)
Critical Temperature:	Not available.
Specific Gravity:	1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions)1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)
Vapor Pressure:	16 kPa (@ 20°C) average
Vapor Density:	1.267 (Air = 1)
Volatility:	Not available.
Odour Threshold:	0.25 to 10 ppm
Water/Oil Dist. Coeff.:	Not available.
Iconicity (in Water):	Not available.
Dispersion Properties:	See solubility in water, diethyl ether.
Solubility:	Soluble in cold water, hot water, diethyl ether.

10: Stability and Reactivity Data

Stability:	The product is stable.
Instability Temperature:	Not available.
Conditions of Instability:	Incompatible materials, water
Incompatibility with various substances:	Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.
Corrosivity:	Extremely corrosive in presence of aluminium, of copper, of stainless steel (304), of stainless steel (316).

Non-corrosive in presence of glass.

Special Remarks on Reactivity: Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulphate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalis (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper, and alloys (e.g., brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid (increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothermic reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the following can cause explosion or ignition on contact.

Special Remarks on Corrosivity: Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinum, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze.

Polymerization: Will not occur.

11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals: Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans: CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans: Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals: Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] – Route: Inhalation; Dose: 1300ppm/30M LCL [Rabbit] – Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans: May cause adverse reproductive effects (toxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: Corrosive. Causes severe skin irritation and burns.

Eyes: Corrosive. Causes severe eye irritation/conjunctivitis, burns, corneal necrosis.

Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and laryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract enema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nonspatial perforation glottal closure, occur, particularly if exposure is prolonged. May affect the liver.

Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric haemorrhage, and infection. Can also cause nausea, vomiting (with “coffee ground” emesis), diarrhoea, thirst, difficulty swallowing, salivation,

chills, fever, uneasiness, shock, strictures, and stenosis (oesophageal, gastric, pyloric). May affect behaviour (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnoea, bronchitis. Chemical pneumonitis and pulmonary enema

12: Ecological Information

Ecotoxicity:	Not available.
BOD5 and COD:	Not available.

Products of Biodegradation: Possibly hazardous short-term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

13: Disposal Considerations

Waste Disposal: Waste must be disposed of in accordance with federal, state and local environmental control regulations.

14: Transport Information

DOT Classification:	Class 8: Corrosive material
Identification:	Hydrochloric acid, solution UNNA: 1789 PG: II
Special Provisions for Transport:	Not available.

15: Other Regulatory Information

Other Regulations:

OSHA:	Hazardous of Hazard Communication Standard (29 CFR

1910.1200).

EINECS:	This product is on the European Inventory of Existing Commercial Chemical Substances.
Protective Equipment:	Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

16: Other Information

References:	Not Available
Other Special Considerations:	Not Available

EXCLUSION OF LIABILITY All information and instructions provided in this Material Safety Data Sheet in respect of the substance is given solely in terms of the provisions of the Occupational Health and Safety Act No 85 of 1993 and Regulations (“the Act”), is based on scientific and technical knowledge as at the date indicated on this MS Material Safety Data Sheet and is presented in good faith to be correct.

The information and instructions provided in this MSDS apply only to the substance in its present form and not to any formulation or mix, in which event it is the sole responsibility of the user of the substance as formulated and/or mixed to investigate and establish any danger which may arise out of its use, wherever such user may be situated.

It is the sole responsibility of the person in receipt of this Material Safety Data Sheet wherever such recipient may be situated, to ensure that the information provided is communicated to and

understood by any person who may come in contact with the substance in any place and in any manner whatsoever. If such recipient produces formulations or mixes using the substance, then it is such recipient's sole responsibility to comply with the provisions of the Act in respect of the provision of the necessary Material Safety Data Sheet, or to comply with any other applicable legislation.