

GPS Safety Summary

Substance Name:

Hydrogen chloride

1. General Statement

Hydrogen chloride gas is a strong acid which is widely used in industry.

2. Chemical Identity

Names: Hydrogen chloride (gas); Hydrochloric acid (solutions)
Brand name: none
Chemical names (IUPAC): Hydrogen chloride (gas); Hydrochloric acid (solutions)
CAS number: 7647-01-0
EC number: 231-595-7
Molecular formula: HCl
Structure:

Gas:	HCl
Solution:	H⁺ Cl⁻

3. Use and applications

Hydrogen chloride is an acid gas used in pharmaceutical industry, fine chemistry and large scale substance manufacturing (including petroleum products). It is also used in the formulation of preparations and/or re-packaging (excluding alloys), and for electronics applications.

4. Physical / Chemical properties

Hydrogen chloride is an inorganic strong acid gas which is extremely water-soluble, leading to the solution known as hydrochloric acid. Upon contact with humidity the gas forms a white fume, which corrodes metals and then forms hydrogen (flammable and explosive gas). Hydrogen chloride has the following physicochemical properties:

Property	Value
Physical state	Gas at 20°C and 1013 hPa
Form	Liquefied gas (under pressure) Solution in water
Colour	Colourless (gas, diluted solutions) Yellow to green (concentrated solutions)
Odour	Irritating (gas, solution)
Molecular weight	36.5 g/mol
Density	1.49 kg/m ³ at 25°C (gas, calculated) 1.17 kg/L (solution at 35%)

Vapour pressure	4.62 MPa at 25°C (gas)
Freezing / boiling points	Not applicable / -85°C at 1013 hPa
Flash point	Not applicable (gas, solution)
Flammability	Non-flammable (gas, solution)
Self-ignition temperature	Not applicable (gas, solution)
Explosive / oxidizing properties	Not expected based on structure
Water solubility	725 g/L at 20°C
Dissociation constant (pK _a)	Strong acid: total dissociation in water
Octanol-water partition coefficient (Log K _{ow})	Not applicable (inorganic)

5. Health Effects

The substance, both as a gas and as an aqueous solution, is a strong acid and is therefore strongly corrosive to human tissues. However, hydrochloric acid exists naturally as a major component of gastric acid, maintaining a pH of 1-2 in the stomach.

Effect Assessment	Result
Acute Toxicity Oral / inhalation / dermal	Toxic by inhalation (gas). Risk of pulmonary edema (gas, solution). Risk of burns to the mouth, esophagus and stomach.
Irritation / corrosion Skin / eye / respiratory tract	Severely irritating to respiratory tract (gas, solution). Corrosive to skin and eye (gas, solution).
Sensitisation	Inhalation: no data. Dermal: not sensitizing (solution).
Toxicity after repeated exposure Oral / inhalation / dermal	Studies of prolonged inhalation in animals mainly showed local effects related to corrosion/irritation (gas). Dermal and oral: not relevant for a gas.
Genotoxicity / Mutagenicity	Not expected to cause genetic effects based on available <i>in vitro</i> test data where the pH was properly controlled.
Carcinogenicity	No carcinogenic effects were noted in rats exposed by inhalation for their lifetime (gas).
Reproductive / Developmental Toxicity	Not expected to cause reproductive/developmental effects.

6. Environmental Effects

In contact with water, Hydrogen chloride immediately dissociates and decreases the pH value. HCl is very toxic to algae and aquatic invertebrates and harmful to fish, however, due to its rapid dissociation and the buffer capacity of the environment, this substance is not classified.

If emitted, the gas will quickly partition to the atmosphere where it will photodegrade into chloride free radical in a few weeks, while the solution will stay in water and partly volatilise to the atmosphere. Neither will partition significantly to soil or sediment, and they are not expected to bioaccumulate in the food chain as ions H⁺/Cl⁻ are naturally present in living organisms.

Effect Assessment	Result
Aquatic Toxicity	Acute: very toxic Chronic: no data

Fate and behaviour	Result
Degradation/Persistence	Non persistent: dissociates in all media except air.
Bioaccumulation potential	Not expected to bioaccumulate
PBT / vPvB conclusion	Not considered to be PBT* or vPvB**

*: Persistent, Bioaccumulative and Toxic (PBT)

** : very Persistent and very Bioaccumulative (vPvB)

7. Exposure

7.1 Human health

Consumers:

Consumers may use Hydrochloric acid solutions (maximum concentration: 20%) for private households. Exposure is limited by the warning effect of the well-known local corrosive/irritant properties: gloves are worn and inhalation is limited.

Indirect exposure via the environment is not relevant: hydrochloric acid consists in ions H⁺ and Cl⁻ which are commonly present in the environment, animals and humans.

Workers:

Hydrogen chloride and its solutions are industrially manufactured and used mainly in closed systems in a continuous or batch process, minimizing the occupational exposure potential. Workers may be exposed during cleaning, maintenance, transfer (notably for formulation), sampling and analysis.

Some professional uses involve specific use processes such as roller application, spraying, treatment of articles, hand-mixing, etc. These processes involve higher exposure but workers are specifically trained and risks are controlled by adequate collective and individual risk management measures.

Procedures, controls, collective and personal risk management measures are in place, which limit the occupational exposure during the manufacture and use of the substance. Workers who might accidentally come into contact with the gas or the solutions should follow the safety measures recommended in the relevant Extended Safety Data Sheet.

Based on the risk assessment, the risk is controlled when activities are carried out under conditions recommended in the Extended Safety Data Sheet (see Chap. 8 and Exposure Scenarios).

7.2 Environment

Hydrogen chloride and its solutions are industrially manufactured and used mainly in closed systems in a continuous or batch process, minimizing release to the environment. Procedures, controls and risk management measures are in place, which limit the environmental exposure.

Professional uses such as activities related to cleaning may involve a higher environmental release fraction, but due to lower tonnages and wide-spread use, local releases are low.

The main expected release compartment is the atmosphere for the gas, and water (with partial volatilisation to the atmosphere) for the solutions. In the aquatic environment, the solution immediately dissociates into ions H⁺ and Cl⁻ which are normal environmental constituents. The relevant exposure determinant is more the effect on pH than the exposure to these ions. pH is buffered in environmental media. In the atmosphere, the gas photodegrades in a few weeks.

Based on the risk assessment, the risk is controlled when activities are carried out under conditions recommended in the Extended Safety Data Sheet (see Chap. 8 and Exposure

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Scenarios).

8. Risk Management recommendations

Human health measures		
Organizational	Collect the latest available Safety Data Sheet. Implement good basic standards of occupational hygiene. Ensure operatives are well informed of the hazards and trained to minimise exposures. Handle and store according to the indications of the Safety Data Sheet.	
Engineering controls	Use material of high integrity for loading and unloading (gas and concentrated solutions). Gas under pressure: avoid exposure of recipient to heat and sunlight. Provide appropriate local exhaust ventilation at points of emission. Ensure that eye- and handwash stations and safety showers are close to workstation locations.	
Protection	Eye/Face protection:	Safety goggles (with sideshields for solutions)
	Skin protection:	Anti-acid protective suit, safety boots
	Hand protection:	Neoprene gloves (gas) or PVC gloves (solutions) tested to EN374
	Respiratory protection:	Gas or solution with important or long exposure: self-contained breathing apparatus. Solutions with low and short exposure: complete mask (A2B2 filter).
Environment protective measures		
Do not release in the environment. Monitor environmental pH in case of release.		

9. Regulatory Information / Classification and Labelling

9.1 Regulatory Information

This substance has notably been registered and assessed under:




- EU Regulation EC 1907/2006 (REACH),
- US EPA IRIS (Integrated Risk Information System),
- OECD SIDS (Screening Information Data Set) program.

9.2 Classification and labelling



Under GHS, substances are classified according to their physical, health, and environmental hazards. The hazards are communicated via specific labels and the eSDS. GHS attempts to standardize hazard communication so that the intended audience (workers, consumers, transport workers and emergency responders) can better understand the hazards of the chemicals in use. Substances registered for REACH are classified according to CLP (EC) 1272/2008, implementation of the GHS in the European Union.

For the particular case of Hydrogen chloride, classification and labelling depend on physical form (gas or solution) and concentration (for solutions) as detailed below:



▪ **Gas:**

Classification	
<ul style="list-style-type: none"> – Gases under pressure: Category Pressure gas – Acute toxicity – Inhalation: Category 3. – Skin corrosion: Category 1A. – Serious eye damage: Category 1. 	
Signal word	
Danger	
Pictograms	
– GHS04: Gas cylinder	
– GHS06: Skull and crossbones	
– GHS05: Corrosion	
Hazard statements	
<ul style="list-style-type: none"> – H280: Contains gas under pressure; may explode if heated. – H331: Toxic if inhaled. – H314: Causes severe skin burns and eye damage. 	


▪ **Solution at $\geq 25\%$:**

Classification	
<ul style="list-style-type: none"> – Corrosion to metals: Category 1 – Skin corrosion: Category 1B. – Serious eye damage: Category 1. – Specific target organ toxicity - single exposure (inhalation): Category 3; May cause respiratory irritation. 	
Signal word	
Danger	
Pictograms	
– GHS05: Corrosion	
– GHS07: Exclamation mark	
Hazard statements	
<ul style="list-style-type: none"> – H290: May be corrosive to metals. – H314: Causes severe skin burns and eye damage. – H335: May cause respiratory irritation. 	

▪ **Solution at ≥ 10 – $< 25\%$:**

Classification	
<ul style="list-style-type: none"> – Corrosion to metals: Category 1 – Skin irritation: Category 2. – Eye irritation: Category 2. – Specific target organ toxicity - single exposure (inhalation): Category 3; May cause respiratory irritation. 	
Signal word	
Attention	
Pictograms	
– GHS05: Corrosion	
– GHS07: Exclamation mark	
Hazard statements	
<ul style="list-style-type: none"> – H290: May be corrosive to metals. – H315: Causes skin irritation. – H319: Causes serious eye irritation. – H335: May cause respiratory irritation. 	

▪ **Solution at ≥ 0.1 – $< 10\%$:**

Classification	
Corrosion to metals: Category 1	
Signal word	
Attention	
Pictogram	
GHS05: Corrosion	
Hazard statement	
H290: May be corrosive to metals.	

10. Contact Information within Company

For further information on this substance or product safety summary in general, please contact:

- **ICCA portal where the GPS Safety Summary is posted:**
<http://www.icca-chem.org/en/Home/ICCA-initiatives/global-product-strategy/>

11. Date of Issues / Revision

- Date of issue: 2013/01/30
- Date of revision:

12. Disclaimer

The information contained in this paper is intended as advice only and whilst the information is provided in utmost good faith and has been based on the best information currently available, is to be relied upon at the user's own risk.

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