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### Chlorine

The Global Product Strategy (GPS) Safety Summary gives an overview of information on chemical products in the framework of the International Council of Chemicals Association (ICCA) initiative and is focused on the products' basic characteristics related to safe use. All the information for health, safety and environment for this specific product can be found in the extended Safety Data Sheet (e- SDS) provided by Hellenic Petroleum SA to its customers.

#### GENERAL INFORMATION

Chlorine is a greenish-yellow gas at room temperature. It is produced by electrolysis in the caustic soda/chlorine plant. It is hazardous to human health and is manufactured and used in closed systems. It is highly recommended that only workers with specific training should be allowed to handle this substance. If the recommendations under the section below "Risk Management Measures" are applied, the substance can be handled safely.

#### CHEMICAL IDENTITY

Name	Chlorine
Trade name	Chlorine
IUPAC Name	Chlorine
CAS Number	7782-50-5
EC Number	231-959-5
Molecular formula	Cl <sub>2</sub>

#### USES AND APPLICATIONS

Chlorine is a basic inorganic chemical with a wide variety of uses in industry. It is used in the synthesis of many other industrial and fine chemicals due to its high reactivity. It is also used in the preparation of many plastics, in metal refining, manufacture of electronic equipment and textiles. Chlorine is used for the disinfection of drinking water, and is effective against almost all bacteria, viruses and amoeba.

Elemental chlorine is not present in consumer products or provided for consumer use, but it is possible for consumers to be exposed to chlorine gas from improper use of sodium hypochlorite bleach (mixing with acids).

#### PHYSICAL AND CHEMICAL PROPERTIES

Chlorine is a gas at room temperature and pressure, though it is often transported as a liquid at higher pressures and/or lower temperatures. It is a powerful oxidant, which leads to many of its useful applications. It may explode if heated. At ambient pressure gaseous chlorine forms a liquid at -34 °C and the liquid freezes at -102 °C. The gas is heavier than air, so tends to sink.

Property	Value
Physical State	Gas
Color	Green-yellow
Odour	Characteristic
Density	3,2 g/L (0 °C, 101,325 kPa)
Boiling point	-34 <sup>0</sup> C
Melting point	-102 <sup>0</sup> C
Flash point	Not applicable
Explosive properties	No explosive properties
Self-ignition temperature	N/A
Vapor pressure	6780 hPa (20 <sup>0</sup> C)
Water solubility	7,41 g/l at 20 <sup>0</sup> C
Viscosity (kinematic)	Gas viscosity 0,0134 mPa s at 25 <sup>0</sup> C Liquid viscosity 0,346 mPa s at 25 <sup>0</sup> C
Octanol-Water partition coefficient (logKow)	Not applicable

## HEALTH EFFECTS

### Human health hazard assessment

The most relevant route of exposure is inhalation. Chlorine can be fatal if inhaled. Chlorine exposure leads only to local effects, the seriousness of which is related primarily to concentration of the gas in the air and not to the duration of exposure. Chlorine is classified as irritant for skin, eye and may cause respiratory irritation. It is not a sensitising agent, it does not have genetic effects or cause cancer and is not toxic to reproduction. The table below gives an overview of the health effects assessment results for chlorine.

Effect Assessment	Result
Acute toxicity	Acute toxicity, can be fatal if inhaled.
Irritation/corrosion	Irritant to skin and eyes, respiratory irritating and tissue damaging.
Sensitization	Negative
Toxicity after repeated exposure	No specific target organ toxicity was detected
Genotoxicity/mutagenicity	Negative
Carcinogenicity	Not considered to be a human cancer concern
Toxic for reproduction	No adverse effects on fertility and not selectively toxic to the fetus.

## ENVIRONMENTAL EFFECTS

Chlorine reacts rapidly with water to form hypochlorous acid and degrades rapidly in the environment. This substance is very toxic to aquatic organisms. However, due to the pattern of use, chlorine is not released into the natural aquatic environment, indicating that the risk to the environment is very low. Additionally, the substance is not bio accumulative and will not persist in the environment. The table below gives an overview of the environmental assessment results for chlorine.

Effect Assessment	Result
Aquatic Toxicity	Very toxic to aquatic life
Fate and behavior	Result
Biodegradation	Not applicable for inorganic substances
Bioaccumulation potential	Not bio-accumulative
PBT/vPvB conclusion	Neither considered to be PBT nor vPvB

## EXPOSURE

### Human health

**Worker:** Workers will not typically come into contact with the substance as it is manufactured and handled in industrial or professional settings in closed systems. In case of unintended exposure during maintenance, sampling, testing or other procedures, workers should follow the recommended emergency measures as described below and consult the extended Safety Data Sheet.

**Consumer:** Consumer exposure is extremely unlikely as the substance is manufactured and handled in industrial and professional settings in closed systems. Exposure is possible through the improper use of household bleach.

### Environment

Chlorine is manufactured and used under closed conditions. No aqueous or gaseous effluents are emitted directly into the environment without passing through a treatment step to remove any unreacted chlorine. In some applications, chlorine is added deliberately to drinking water supplies for disinfection and destruction of almost all harmful microorganisms. If appropriately managed, the substance can be handled at all stages of manufacture and use with a minimal impact on the aquatic environment.

## RISK MANAGEMENT MEASURES

For the detailed Risk Management Measures (RMMs) please consult the extended Safety Data Sheet of this product

### Industry use, production and formulation

Chlorine should only be handled by knowledgeable and trained personnel. Make sure that there is adequate ventilation at workplace. Do not eat, drink or smoke where chlorine is handled or stored. Use a suitable gas detection system. In cases where engineering controls cannot maintain airborne substance concentrations below exposure limits or in cases with a risk

of accidental exposure, use a complete overall protecting against chemicals and respirator.






**Consumer use**

Care must be taken to follow safety instructions found on bleach packaging.

**Environment**

Do not allow to enter sewers/surface or ground water. Consult with environmental local authorities for guidance on acceptable disposal practices.

**PERSONAL PROTECTIVE EQUIPMENT AND EMERGENCY MEASURES**

		<ul style="list-style-type: none"> <li>➤ For short term exposure: respirator with inorganic vapor cartridge</li> <li>➤ For long term exposure: full face respirator</li> </ul>
		<ul style="list-style-type: none"> <li>➤ Protective neoprene gloves and protective work clothing</li> </ul>
		<ul style="list-style-type: none"> <li>➤ Safety glasses skintight</li> </ul>
<b>First aid measures</b>		<ul style="list-style-type: none"> <li>➤ Implement emergency response procedures. Wash affected skin and eyes with plenty of water. Contaminated clothing should be removed. In case of breathing difficulties, have the casualty inhale oxygen. Call a poison center or a doctor.</li> </ul>
<b>Firefighting measures</b>		<ul style="list-style-type: none"> <li>➤ Extinguishing media: Carbon dioxide, dry chemical powder, foam.</li> <li>➤ If water is used, contain run-off.</li> </ul>
<b>Accidental release measures</b>		<ul style="list-style-type: none"> <li>➤ For containment: Cover large spillages with foam to limit vapor cloud formation. Use water sprays to dilute the concentration of gas clouds. Use valve closure systems or chlorine and chlorine dioxide horizontal packed scrubbers.</li> <li>➤ For clean up: Dam large quantities of liquid with sand or earth.</li> </ul>

**CLASSIFICATION AND LABELLING**

EU-GHS Criteria (European Regulation, CLP No1272/2008)

**Chlorine (Cl<sub>2</sub>)**

Pictograms



GHS03

GHS04

GHS06

GHS09

Signal word

Danger

Hazard class and category code

Ox.Gas1;H270,Press.Gas;H280  
Acute Tox.2;H330,Skin Irrit.2;H315; Eye Irrit.2; H319, STOT SE 3;H335

Aquatic Acute 1;H400,Aquatic Chronic 1;H410  
(M factor acute:100 and chronic :1)

Hazard statement code

H270 May cause or intensify fire; oxidiser  
H280 Contains gas under pressure; may explode if heated  
H330 Fatal if inhaled  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H335 May cause respiratory irritation  
H410 Very toxic to aquatic life with long lasting effects

Precautionary statements

*Prevention*  
P220 Keep /store away from clothing/combustible materials  
P280 Wear protective gloves/protective clothing/eye protection/face protection  
P260 Do not breathe gas/mist/vapors/spray  
P273 Avoid release to the environment

*Response*

P304+P340 If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing

*Storage*

P403+P233 Store in a well-ventilated place. Keep container tightly closed.

**BASIC TRANSPORT INFORMATION**

UN Number : 1017

**STATE AGENCY REVIEW**

- European Regulation EU-GHS No. 1272/2008, Index-No. 017-001-00-7
- European Regulation No793/93 (risk assessment)
- The substance has been registered under REACH Regulation No 1907/2008
- Under review for the European Biocidal Products Legislation for its uses as biocide
- OECD program for substances with High Production Volumes (HPV)
- International Chemical Safety Cards (ICSC)

**CONCLUSIONS**

- Chlorine is very active under specific conditions .It is acutely toxic, can be fatal if inhaled and it is very toxic to aquatic life.
- Essential uses of chlorine have been shown to be safe by minimisation of the risks of exposure of the workers, the public and the environment.
- By applying the appropriate Risk Management Measures, the chlorine concentrations to be expected at workplaces and to the general public/consumer are below recommended exposure limits.

**CONTACT INFORMATION**

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- For more information on the GPS Safety Summaries follow the link :  
<http://www.icca-chem.org/en/Home/ICCA-initiatives/global-product-strategy/>

**ABBREVIATIONS**

ICCA :International Council of Chemical Associations

GPS: Global Product Strategy

GHS: Globally Harmonized System

CLP: Classification, Labelling, Packaging

OECD: Organisation for Economic Co-operation and Development

REACH: Registration, Evaluation, Authorisation of Chemicals

PBT/vPvB: Persistent, Bio accumulative and Toxic/very Persistent and very Bio accumulative

UN: United Nations

**DISCLAIMER**

All information and recommendations provided in this GPS Safety Summary, only concern the specific product as described above, and may not apply for the same material if used in combination with any other material or in any process. They are provided in good faith as recommendations only, and are based on data which Hellenic Petroleum SA has available on the above date. They do not supersede or replace required documents by National or European Legislation. However, Hellenic Petroleum SA cannot guarantee their accuracy and validity and accepts no responsibility for any damage or loss that might arise in connection with the use of this material.