This product safety summary is intended to provide a general overview of the chemical substance in the context of ICCA global product strategy. It is not intended to provide emergency response, medical or treatment information, nor to provide an overview of all safety and health information. This summary is not intended to replace the Safety Data Sheet. For detailed guidance on the use or regulatory status of this substance, please consult the Safety Data Sheet.

A. CHEMICAL PRODUCT IDENTIFICATION:

Product Name	Chlorine
Synonyms	Chlorine
IUPAC Name	Chlorine
CAS NO	7782-50-5
E C No	231-959-5
Molecular Formula	Cl_2

B. 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 metal refining, manufacture of electronic equipment and textiles. Chlorine is used in the disinfection of drinking water, and is effective against almost all bacteria, viruses and amoeba.
- ✓ The substance chlorine is not present in consumer products or provided for consumer use.

C. PHYSICAL / CHEMICAL PROPERTIES:

Properties	Value
Physical state and appearance	Greenish yellow gas
Odor	Characteristic ‘chlorine’ odor
Molecular Weigh	70.90 g/mol
Color:	Green – yellow
Boiling Point	-34°C / -29.20°F at 1013 hPa
Melting Point / Range	-101°C/ 149.8°F at 1013 hPa

Flash Point	Not applicable
Specific Gravity	3212 g/cm^3 at 0°c
Critical Temperature	-
Relative Density	3212 g/cm^3 at 0°c
Vapor Pressure	678 kPa at 20°C
Vapor Density	Not applicable
Volatility	No information available
Odor Threshold	No information available
Partition Coefficient	-0.85 at 20°C
Water Solubility	7.41 g/l at 20°C
Explosive/oxidising properties	No information available

D. HEALTH EFFECTS:

Effect Assessment	Value
Acute Toxicity **Oral / inhalation / dermal**	ORAL LD50: 1100 mg/kg DERMAL LD50: >2000 mg/kg INHALATION LC50: 1.462 mg/L
Irritation / corrosion **Skin / eye/ respiratory tract**	Chlorine (as chlorine bleach) may be considered as comparable to hypochlorous acid and/or hypochlorite for which experimental results are: ✓ Irritating to skin. ✓ Risk of serious damage to eyes. (In case of direct contact with liquid or exposure to vapours, serious lesions with possible after-effects if not washed immediately) ✓ Irritating to respiratory system.
Sensitisation	Not classified.
Toxicity after repeated exposure	Not classified.

Oral / inhalation / dermal	
Genotoxicity / Mutagenicity	Not classified.
Carcinogenicity	Not classified as human Carcinogen.
Toxicity for reproduction	Not classified.

E. ENVIRONMENTAL EFFECTS:

- ✓ Chlorine reacts rapidly with water to form hypochlorous acid. This species 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. In some applications, chlorine is added deliberately to drinking water supplies for disinfection and destruction of almost all harmful microorganisms. It can be used also in wastewater treatment plants to control sludge bulking. The substance is not bio-accumulative, is rapidly degraded and will not persist in the environment.

Effect Assessment	Value
Aquatic Toxicity	Toxicity to Fish LC50: 0.06 mg/L Toxicity to aquatic Invertebrate EC50: 0.141 mg/L Toxicity to Algae ErC50: <0.05 mg/L Based on available information, According to GHS product is classified for Aquatic Toxicity.

Fate and behaviour	Value
Biodegradation	As a non-organic compound, chlorine is not biodegradable.
Bio-accumulation	Chlorine does not bio-accumulate or bio-concentrate, because of its water solubility and high reactivity.
PBT/vPvB conclusion	The substance is not PBT/ VPvB.

F. EXPOSURE :

- ✓ May be harmful if absorbed through the skin, cause burns, the material is extremely destructive to the tissue of the mucous membranes and is harmful if inhaled and may be harmful if swallowed.

Human health	
Consumers	Consumer exposure to the substance in itself is unlikely as the substance is manufactured and handled in industrial and professional settings in closed systems. However, chlorine is sometimes used in the treatment of swimming pools or in other water disinfection. The chlorine reacts with water to give hypochlorous acid (known as

	chlorine bleach). Exposure to the gas is possible if household chlorine bleach is mixed with acid, and therefore chlorine bleach (also sodium hypochlorite) should never be mixed with acids.
Workers	Sodium hydroxide is manufactured in a closed process, which minimizes the employee exposure potential. Workers who might accidentally come into contact with the undiluted substance should follow the safety measures recommended in the extended safety datasheet. The substance has been assessed as safe for professional and industrial use, when the provisions laid down in the extended safety data sheet are followed carefully (Chapter 8 and exposure scenario).

Environment
The manufacture of chlorine takes place in closed systems, as are the uses identified (apart from biocidal uses). No aqueous or gaseous effluents are emitted directly into the environment without passing through a treatment step, typically site water treatment for aqueous effluents and scrubbing gas effluents with sodium hydroxide to remove any unreacted chlorine. Any substance released is rapidly destroyed upon contact with organic material. It should be noted that there is also low levels of chlorine gas released from natural processes, such as chlorine reduction on coastlines. Based on the risk assessment, the use of chlorine is safe under conditions recommended in the extended safety data sheet (Chapter 8 and exposure scenario).

G. RISK MANAGEMENT MEASURES

Effect	Value
Eyes	Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Get immediate medical attention.
Skin protection	Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. Seek immediate medical attention. Wash contaminated clothing before reuse.
Ingestion	Ingestion is not considered a potential route of exposure.
Inhalation	Remove victim to uncontaminated area wearing self-contained breathing apparatus. Keep victim warm and rested. Apply artificial respiration if breathing stopped. Seek immediate medical attention.

H. PERSONAL PROTECTIVE EQUIPMENT AND EMERGENCY MEASURES

Effect		Value
Engineering controls		Ensure exposure is below occupational exposure limits (where available). Provide adequate general and local exhaust ventilation. Systems under pressure should be regularly checked for leakages. Consider the use of a work permit system e.g., for maintenance activities. Alarm detectors should be used when toxic gases may be released.
Special risks , Specific hazards		Oxidizer. May ignite or explode on contact with combustible materials. Containers may rupture or explode if exposed to heat.
Personnel Protective equipment	Eye/Face protection	Wear protective goggles for all industrial operations. If risk of splashing, chemical proof goggles/face shield.
	Skin protection	Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
	Hand protection	Protective gloves - chemical resistant Recommended materials: Neoprene Non-recommended materials: PVC, polyethylene
	Respiratory protection	In case of emissions, face mask with type B cartridge- Self-contained breathing apparatus in medium confinement/insufficient oxygen/in case of large uncontrolled emissions/in all circumstances when mask and cartridge do not give adequate protection. Use only respiratory protection that confirms to international/ national standards.

I. ACCIDENTAL RELEASE MEASURES

- ✓ Use proper personal protective equipment (pl refer MSDS)
- ✓ Person Precautions: Follow the protective measures given in the fire fighting and exposure controls/personal protection sections. Evacuate or shelter people depending upon the gravity of the situation (consult an expert/or respect a radius of 500 m).Advice people to take refuge in upper floors and closed rooms and wait for instructions. If safe to do so, without over exposing anyone, try to stop the leak. Approach from upwind.
- ✓ Environmental Precautions:Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant

authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

- ✓ Spill cleanup measures: Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Disperse gas & vapors with water spray. Avoid spraying the leak source. Isolate the area. Cover the spreading liquid with foam in order to slow down the evaporation.

J. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	Use extinguishing media appropriate for surrounding fire.

K. 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 CLP (EC) 1272/2008, implementation of the GHS in the European Union.

Classification H280 H270 H331 H315 H319 H335 H400	 Gases under pressure: compressed gas Oxidizing gas: Category 1 Acute toxicity: Category 3 Skin corrosion/irritation: Category 2 Eye damage/irritation: Category 2 STOT – Single exposure: category 3 Aquatic acute: Category 1
Pictogram	
Signal Word	Danger
Hazard statements H270 H280 H315 H319 H335 H400	 May cause or intensify fire; oxidizer Contains gas under pressure; may explode if heated Causes skin irritation Causes eye irritation May cause respiratory irritation Toxic to aquatic life

Precautionary statements	
P220	Keep/Store away from clothing, combustibles
P244	Keep reduction valves free from grease and oil
P260	Do not breathe gas
P264	Wash face, hands and skin thoroughly after handling.
P261	Avoid breathing dust/fume/gas/mist/vapour/spray
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment
P280	Wear protective gloves, protective clothing, eye protection, face protection
P370+P376	In case of fire: stop leak if safe and easy to do
P370+P352	IF ON SKIN: Wash with soap and plenty of water
P332+P313	If skin irritation occurs: Get medical advice/attention.
P362+P364	Take off contaminated clothing and wash it before reuse.
P321	Specific treatment (see … on this label)
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312	Specific treatment (see… on this label)
P305+P351+P338+P315	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical advice / attention
P337+P313	If eye irritation persists: Get medical advice/attention.
P391	Collect spillage
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P410+P403	Protect from sunlight. Store in a well-ventilated place.
P405	
P501	Store locked up.

L. BASIC TRANSPORT INFORMATION

DOT / TDG/ IATA/ IMDG/IMO

UN No.	UN1017
Proper shipping Name	Chlorine
Technical name	Chlorine
Hazard Class	2.3(5.1,8)
Packaging Group	Not applicable
Environmental Hazard	Yes

M. REGULATORY INFORMATION

✓ **International Inventories**

TSCA	Complies
EINECS/ ELINCS	Complies
DSL/NDSL	Complies
PICCS	Complies
ENCS	Complies
IECSC	Complies
AICS	Complies
KECL	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
AICS - Australian Inventory of Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances

N. CONCLUSIONS

- ✓ Chlorine is used in metal refining, manufacture of electronic equipment and textiles. Chlorine is used in the disinfection of drinking water, and is effective against almost all bacteria, viruses and amoeba.
- ✓ Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

- ✓ By applying the appropriate Risk Management measures the concentrations to be expected at workplaces and to the general public are below recommended exposure limits

O. CONTACT INFORMATION

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P. DISCLAIMER

- ✓ The above information and recommendations provided in 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 any process. They are in good faith as recommendations only and based on data which is available globally. GFL (Gujarat Fluorochemicals Ltd) not imply any guarantee concerning the accuracy and validity and accepts no responsibility for any damage or loss that might arise in connection with then use of this material.
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