



MALAY-SINO CHEMICAL INDUSTRIES SDN BHD (16055-T)

SAFETY DATA SHEET

SODIUM HYPOCHLORITE 5 – 16% (NaOCl)

SECTION 1: IDENTIFICATION OF THE HAZARDOUS CHEMICAL AND OF THE SUPPLIER

CAS NO

7681 – 52 – 9

PRODUCT NAME

SODIUM HYPOCHLORITE

PROPER SHIPPING NAME

HYPOCHLORITE SOLUTION

PRODUCT USE

Disinfectant, bleaching agent, source of available chlorine, deodorizer

MANUFACTURER

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PRINCIPAL SUPPLIER

TAIKO MARKETING SDN. BHD.

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SECTION 2 – HAZARD IDENTIFICATION

ICOP Classification

Skin Corr. 1B	Skin corrosion or irritation category 1B
Eye Dam. 1	Serious eye damage or eye irritation category 1
Aquatic Acute 1	Hazardous to the aquatic environment – acute hazard category 1



EMERGENCY OVERVIEW

Signal Word : DANGER

**DETERMINED BY USING ICOP CRITERIA
HAZARD STATEMENT**

Revision No.: 03
Revision Date: 31st December 2020
Preparation Date: 1st March 2015



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H-314	Causes severe skin burns and eye damage.
H-318	Causes serious eye damage.
H-400	Very toxic to aquatic life.

PRECAUTIONARY STATEMENTS

Prevention

Code	Phrase
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash hand thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response

Code	Phrase
P301+P330+P+331	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 victim to fresh air and keep at rest in a position 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.
P321	Specific treatment.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.

Storage

Code	Phrase
P405	Store locked up.

Disposal

Code	Phrase
P501	Dispose of contents/container to designated and secure place/area only.

SECTION 3: COMPOSITION AND INFORMATION OF THE INGREDIENTS OF THE HAZARDOUS CHEMICAL



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NAME	CAS RN	%
Sodium hypochlorite	7681-52-9	5.4 – 13.2
Sodium hydroxide	1310-73-2	0.1 – 0.5
Sodium chloride	7647-14-5	4 - 12
Water	7732-18-5	Remaining

SECTION 4: FIRST-AID MEASURES

SWALLOWED

- For advice, contact a Poisons Information Centre or a doctor at once.
- Urgent hospital treatment is likely to be needed.
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Transport to hospital or doctor without delay.

EYE

If this product comes in contact with the eyes:

- Immediately hold eyelids apart and flush the eye continuously with running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

If skin or hair contact occurs:

- Immediately flush body and clothes with large amounts of water, using safety shower if available.
- Quickly remove all contaminated clothing, including footwear.



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- Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre.
- Transport to hospital or doctor without delay.

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital or doctor without delay.
- Inhalation of vapours or aerosols (mists, fumes) may cause lung oedema.
- Corrosive substances may cause lung damage (e.g. lung oedema, fluid in the lungs).
- As this reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested.
- Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered.
This must definitely be left to a doctor or person authorized by him/her.

NOTES TO PHYSICIAN

- Excellent warning properties force rapid escape of personnel from chlorine vapour thus most inhalations are mild to moderate. If escape is not possible, exposure to high concentrations for a very short time can result in dyspnea, haemophysis and cyanosis with later complications being tracheobroncho-pneumonitis and pulmonary oedema. Oxygen, intermittent positive pressure breathing apparatus and aerosolised bronchodilators are of therapeutic value where chlorine inhalation has been light to moderate. Severe inhalation should result in hospitalisation and treatment for a respiratory emergency.
- Any chlorine inhalation in an individual with compromised pulmonary function (COPD) should be regarded as a severe inhalation and a respiratory emergency. [CCINFO, Dow 1988]
- Effects from exposure to chlorine gas include pulmonary oedema which may be delayed. Observation in hospital for 48 hours is recommended
- Diagnosed asthmatics and those people suffering from certain types of chronic bronchitis should receive medical approval before being employed in occupations involving chlorine exposure.



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- If burn is present, treat as any thermal burn, after decontamination for corrosives:

BASIC TREATMENT

- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-re breather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for pulmonary oedema .
- Monitor and treat, where necessary, for shock.
- Anticipate seizures.
- Where eyes have been exposed, flush immediately with water and continue to irrigate with normal saline during transport to hospital.
- DO NOT use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.
- Skin burns should be covered with dry, sterile bandages, following decontamination.
- DO NOT attempt neutralisations as exothermic reaction may occur.

ADVANCED TREATMENT

- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use. •Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolaemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary oedema.
- Hypotension with signs of hypovolaemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.



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EMERGENCY TREATMENT

- Laboratory analysis of complete blood count, serum electrolytes, BUN, creatinine, glucose, urinalysis, baseline for serum aminotransferases (ALT and AST), calcium, phosphorus and magnesium, may assist in establishing a treatment regime.
- Positive end-expiratory pressure (PEEP)-assisted ventilation may be required for acute parenchymal injury or adult respiratory distress syndrome.
- Consider endoscopy to evaluate oral injury. Consult a toxicologist as necessary.
- BRONSTEIN, A.C. and CURRANCE, P.L. EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994. For acute or repeated exposures to hypochlorite solutions:
 - Release of small amounts of hypochlorous acid and acid gases from the stomach following ingestion, is usually too low to cause damage but may be irritating to mucous membranes. Buffering with antacid may be helpful if discomfort is evident.
 - Evaluate as potential caustic exposure.
 - Decontaminate skin and eyes with copious saline irrigation. Check exposed eyes for corneal abrasions with fluorescein staining.
 - Emesis or lavage and catharsis may be indicated for mild caustic exposure.
 - Chlorine exposures require evaluation of acid/base and respiratory status.
 - Inhalation of vapours or mists may result in pulmonary oedema. ELLENHORN and BARCELOUX: Medical Toxicology.
- Depending on the degree of exposure, periodic medical examination is indicated. The symptoms of lung oedema often do not manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation is therefore essential. Immediate administration of an appropriate spray, by a doctor or a person authorised by him/her should be considered.

SECTION 5: FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA

- Water spray or fog.
- Foam.



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- Dry chemical powder.
- Carbon dioxide.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Use fire fighting procedures suitable for surrounding area.
- Do not approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

FIRE / EXPLOSION HAZARD

- Non combustible.
- Not considered to be a significant fire risk.
- Decomposition may produce toxic fumes of: hydrogen chloride.
- May emit corrosive fumes.

FIRE INCOMPATIBILITY

- None known.

SECTION 6: ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material.
- Check regularly for spills and leaks.
- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact with the substance, by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable, labelled container for waste disposal.



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MAJOR SPILLS

- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation (or protect in place).
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labelled containers for recycling.
- Neutralise/decontaminate residue (see Section 13 for specific agent).
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

FOOTNOTES

1. **PROTECTIVE ACTION ZONE** is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the down wind protective action distance.
2. **PROTECTIVE ACTIONS** should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/ or incurring serious or irreversible health effects.
3. **INITIAL ISOLATION ZONE** is determined as an area, including upwind of the incident, within which a high probability of localized wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.
4. **SMALL SPILLS** involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered “small spills”.



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5. LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a “one-tonne” compressed gas cylinder.
6. Guide 154 is taken from the US DOT emergency response guide book.
7. IERG information is derived from CANUTEC – Transport Canada.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7: HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- DO NOT allow clothing wet with material to stay in contact with skin.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Avoid contact with moisture.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately. Launder contaminated clothing before re-use.
- Use good occupational work practice.
- Observe manufacturer's storage and handling recommendations contained within this SDS.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

SUITABLE CONTAINER

- Liquid inorganic hypochlorites shall not to be transported in unlined metal drums. Inner packagings shall be fitted with vented closures and plastics drums and carboys shall have vented closures or be performance tested to a minimum of 250 kPa. All non-vented packagings shall be filled so that the ullage is at least 10% at 21-25 deg.C. Vented packagings may be filled to an ullage not less than 5% at 21-25 deg.C, provided that this ullage does not result in leakage from, nor distortion of, the packaging.



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- Lined metal can, lined metal pail/ can.
- Plastic pail.
- Polyliner drum.
- Packing as recommended by manufacturer.
- Check all containers are clearly labelled and free from leaks.
- For low viscosity materials
 - Drums and jerricans must be of the non-removable head type.
 - Where a can is to be used as an inner package, the can must have a screwed enclosure.
- For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):
 - Removable head packaging;
 - Cans with friction closures and;
 - Low pressure tubes and cartridges may be used.

Where combination packages are used, and the inner packages are of glass, porcelain or stoneware, there must be sufficient inert cushioning material in contact with inner and outer packages unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.

STORAGE INCOMPATIBILITY

- Contact with acids produces toxic fumes.
- Presence of rust (iron oxide) or other metal oxides catalyses decomposition of inorganic hypochlorites.
- Contact with water can cause heating and decomposition giving off chlorine and oxygen gases. Solid hypochlorites in contact with water or moisture may generate sufficient heat to ignite combustible materials. Thermal decomposition can be sustained in the absence of oxygen.
- Contact with acids produces toxic fumes of chlorine.
- Bottles of strong sodium hypochlorite solution (10-14% available chlorine) burst in storage due to failure of the cap designed to vent oxygen slowly during storage. A hot summer may have exacerbated the situation. Vent caps should be checked regularly (using full personal protection) and hypochlorites should not be stored in direct sunlight or at temperatures exceeding 18 deg. C.
- Anhydrous solid hypochlorite may decompose violently on heating or if subject to friction.
- Inorganic hypochlorites reacts violently with many incompatible materials including fuels, oils, wood, paper, etc. which become readily ignitable. Avoid contact with peroxides



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glycerine, lubricating oil, combustibles, amines, solvents, charcoal, metal oxides and salts, copper, mercaptan, sulfur, organic sulfides, turpentine.

- Contact of hypochlorites with nitromethane, alcohols, glycerol, phenol or diethylene glycol monomethyl ether results in ignition.
- Ammonia or primary aliphatic or aromatic amines may react with hypochlorites to form N-mono- or di-chloramines which are explosively unstable (but less so than nitrogen trichloride). Contact in drains between effluents containing ammonium salts and hypochlorites and acid lead to the formation of nitrogen trichloride which decomposed explosively. Whilst cleaning a brewery tank, reaction between an acidified ammonium sulfate cleaning preparation and sodium hypochlorite, lead nitrogen chloride formation and violent explosion
- Interaction of ethyleneimine (aziridine) with hypochlorites gives an explosive N-chloro compound.
- Interaction of metal hypochlorites with nitrogenous materials may lead to the formation of nitrogen trichloride with explosive decomposition.
- Metal oxides catalyse the oxygen decomposition of the hypochlorite.
- Heating with carbon under confinement can result in explosion. Explosive interaction has occurred with carbonised food residues. After an attempt to clean these using bleach, and after heating, sodium chlorate appears to have been formed with consequent violent explosion.
- Removal of formic acid from industrial waste streams with sodium hypochlorite solutions produced explosion at 55 deg. C.
- Explosions following reaction with methanol are attributed to formation of methyl hypochlorite.
- When finely divided materials such as sugar, wood dust and paper are contaminated with hypochlorite solution they burn more readily when dry.
- Calcium hypochlorite with over 60% "active" chlorine ignites on contact with lubricating oils, damp sulfur, organic thiols or sulfides.
- Incompatible with sanitising bowl cleaners containing bisulfites. Contact with acids produces toxic fumes of chlorine.

STORAGE REQUIREMENTS

- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.



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- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storage and handling recommendations contained within this SDS.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X



X



+



X



+

+: May be stored together

O: May be stored together with specific preventions

X: Must not be stored together

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	STEL ppm
Use and Standard Of Exposure Of Chemical Hazardous To Health (OSHA Act 1994) Permissible Exposure Limits of Toxic Substances	Sodium Hypochlorite 5 - 15% (Sodium hydroxide)	2

The following materials had no OELs on our records

- Sodium hypochlorite CAS: 7681 – 52 – 9 CAS: 10022 – 70 – 5
- Sodium chloride CAS: 7647 – 14 - 5
- Water: CAS: 7732 – 18 - 5

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m ³)	Revised IDLH Value (ppm)
Sodium hydroxide 1823	10	

MATERIAL DATA

SODIUM HYPOCHLORITE 5 - 15%:



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SODIUM HYPOCHLORITE:

- For chlorine:
 - Odour Threshold Value: 0.08 ppm (detection) – olfactory fatigue may develop
 - NOTE: Detector tubes for chlorine, measuring in excess of 0.2 ppm, are commercially available. Long-term measurements (8 hrs) may be conducted to detect concentrations exceeding 0.13 ppm.
 - Smell is not a good indicator of severity of exposure in the range 0.5 to 2 ppm. In this range subjects found exposure unpleasant with itching and burning of the throat reported and occasionally an urge to cough.
 - Significant differences in the responses of males and females were also recorded with females often reporting headache and drowsiness.
 - Exposure at 1 ppm chlorine for 8 hours produced significant changes in pulmonary function and increased subjective irritation. Similar 8 hour exposures at 0.5 ppm produced no significant pulmonary function changes and less severe subjective irritation. Exposures for 2 hours at 2 ppm chlorine produced no significant changes in pulmonary irritation.
 - An 8 hour exposure at 1.5 ppm produced increased mucous secretion from the nose and increased mucous in the hypopharynx. Exposure at or below the TLV-TWA and STEL is thought to protect the worker against annoying symptoms in nose, throat and conjunctiva and declines in pulmonary function.
 - Odour Safety Factor (OSF)
 - OSF=1.6 (CHLORINE).

SODIUM HYPOCHLORITE:

- Available chlorine, as chlorine
- TLV TWA: 0.5 ppm, 1.5 mg/m³: STEL: 1 ppm, 2.9 mg/m³
- ES Peak: 1 ppm, 3 mg/m³
- CEL TWA: 2 mg/m³ (compare WEEL TWA)
- The odour threshold is likely to be similar to that of chlorine, 0.3 ppm.
- Acute, subchronic, and chronic toxicity studies have shown no significant treatment related effects. High concentrations may produce moderate to severe eye irritation, but not permanent injury. High doses also appear to be embryotoxic. Since nearly all sodium hypochlorite is handled as aqueous solution, airborne exposure is likely to be as an aerosol, or mist. Sodium hypochlorite dissociates in water to form free hypochlorous acid in equilibrium. The toxic effects are likely to be similar to those of chlorine or sodium hydroxide.



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SODIUM HYDROXIDE:

- For sodium hydroxide:
The TLV-C is recommended based on concentrations that produce noticeable but not excessive, ocular and upper respiratory tract irritation.

SODIUM CHLORIDE:

- It is the goal of the ACGIH (and other Agencies) to recommend TLVs (or their equivalent) for all substances for which there is evidence of health effects at airborne concentrations encountered in the workplace.
- At this time no TLV has been established, even though this material may produce adverse health effects (as evidenced in animal experiments or clinical experience). Airborne concentrations must be maintained as low as is practically possible and occupational exposure must be kept to a minimum.

NOTE: The ACGIH occupational exposure standard for Particles Not Otherwise Specified (P.N.O.S) does NOT apply.

- Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no-observable-effect-levels (NOEL) are used to determine these limits where human results are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five-category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.
- OSHA (USA) concluded that exposure to sensory irritants can:
 - cause inflammation
 - cause increased susceptibility to other irritants and infectious agents
 - lead to permanent injury or dysfunction



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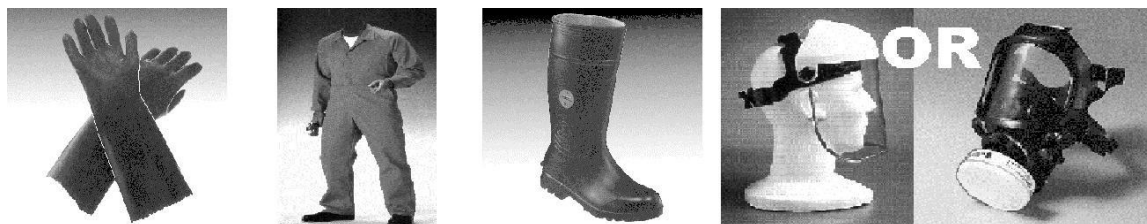
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- permit greater absorption of hazardous substances and
- acclimate the worker to the irritant warning properties of these substances thus increasing the risk of overexposure.

WATER:

- No exposure limits set by NOHSC or ACGIH.

PERSONAL PROTECTION



EYE

- Chemical goggles.
- Full face shield may be required for supplementary but never for primary protection of eyes.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent].

HANDS / FEET

- Wear chemical protective gloves, e.g., PVC.
- Wear safety footwear or safety gumboots, e.g. Rubber.
- When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.



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NOTE:

- The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
- Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed. The selection of the suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
- The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
- Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:
 - frequency and duration of contact,
 - chemical resistance of glove material,
 - glove thickness and
 - dexterity
- Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).
- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
- Contaminated gloves should be replaced.
- Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.

OTHER

- Overalls
- PVC Apron
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.



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GLOVE SELECTION INDEX

- Glove selection is based on a modified presentation of the: "Forsberg Clothing Performance Index" . The effect(s) of the following substance(s) are taken into account in the computer- generated selection: sodium hypochlorite, sodium chloride.
- Protective Material

NATURAL RUBBER	A
NATURAL + NEOPRENE	A
NITRILE	A

A: Best Selection

B: Satisfactory; may degrade after 4 hours continuous immersion

C: Poor to Dangerous Choice for other than short term immersion

NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

RESPIRATOR

- Type B-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)
- Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Required minimum protection factor	Maximum gas/vapour concentration present in air p.p.m. (by volume)	Half-face Respirator	Full-Face Respirator
up to 10	1000	b – AUS/ Class1 p	-
up to 50	1000	-	b – AUS/ Class1 p
up to 50	5000	Airline*	-
up to 100	5000	-	b – 2 p
up to 100	10000	-	b – 3 p



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100+

Airline**

* - Continuous Flow ** - Continuous-flow or positive pressure demand

A (All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide (HCN), B3 = Acid gas or hydrogen cyanide (HCN), E = Sulfur dioxide (SO₂), G = Agricultural chemicals, K = Ammonia (NH₃), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds (below 65 degC).

ENGINEERING CONTROLS

- Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
- The basic types of engineering controls are:
 - Process controls which involve changing the way a job activity or process is done to reduce the risk.
 - Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.
 - Employers may need to use multiple types of controls to prevent employee overexposure.
- General exhaust is adequate under normal operating conditions. Local exhaust ventilation may be required in special circumstances. If risk of overexposure exists, wear approved respirator. Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection. Provide adequate ventilation in warehouses and enclosed storage areas.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Clear, greenish-yellow solution with strong chlorine odour; mixes with water.

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PHYSICAL PROPERTIES

Liquid.

Mixes with water.

Corrosive.

Contact with acids liberates toxic gas.

State	Liquid	Molecular Weight	Not applicable
Melting Range (°C)	- 15 approx (12% trade)	Viscosity	Not available
Boiling Range (°C)	Non Available	Solubility in water (g/L)	Miscible
Flash Point (°C)	Non Available	pH (1% Solution)	Not available
Decomposition Temp (°C)	Not Available	pH (as supplied)	<12
Autoignition Temp (°C)	Not Available	Vapour Pressure (kPa)	Not available
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	1.2 @ 25C
Lower Explosive Limit (%)	Not Available	Relative Vapour Density (air=1)	Not available
Volatile Component (%vol)	Not Available	Evaporation Rate	Not available

SECTION 10: STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

For incompatible materials - refer to Section 7 - Handling and Storage.

SECTION 11: TOXICOLOGICAL INFORMATION

Health hazard summary table:

Acute toxicity	Not applicable
Skin corrosion/irritation	Skin Corr. 1B

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Serious eye damage/irritation	Eye Dam.1
Respiratory or skin sensitization	Not applicable
Germ cell mutagenicity	Not applicable
Carcinogenicity	Not applicable
Reproductive toxicity	Not applicable
STOT- single exposure	Not applicable
STOT- repeated exposure	Not applicable
Aspiration hazard	Not applicable

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

- The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion.
- Accidental ingestion of the material may be damaging to the health of the individual.
- Ingestion of hypochlorites may cause burning in the mouth and throat, abdominal cramps, nausea, vomiting, diarrhoea, pain and inflammation of the mouth and stomach, fall of blood pressure, shock, confusion, and delirium. Severe poisonings may lead to convulsion, coma and death. Ingestion irritates the mouth, throat and stomach. The hypochlorous acid liberated in the stomach can cause wall perforation, toxemia, haemorrhage and death.
- Necrosis and haemorrhage of the upper digestive tract, oedema and pulmonary emphysema were found on autopsy after suicidal ingestion, and methaemoglobinaemia was also reported in another fatal case.
- The material can produce severe chemical burns within the oral cavity and gastrointestinal tract following ingestion.

EYE

- The material can produce chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating.
- When applied to the eye(s) of animals, the material produces severe ocular lesions which are present twenty-four hours or more after instillation.
- Hypochlorite in pool water at concentrations of 1 ppm chlorine or less is non irritating to eyes if the pH is higher than 7.2 (slightly alkaline). At lower pH, a sensation of stinging, smarting of eyes with transient reddening may occur but generally no injury.
- Eye contact with a 5% hypochlorite solution may produce a temporary burning discomfort



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and slight irritation of the corneal epithelium with no injury.

- The material can produce severe chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating.

SKIN

- The material can produce chemical burns following direct contact with the skin.
- Open cuts, abraded or irritated skin should not be exposed to this material.
- Contact may cause severe itchiness, skin lesions and mild eczema.
- A 5.25% solution of sodium hypochlorite applied to intact human skin for 4 hours and observed at 4, 24 and 48 hours resulted in exudation and slight sloughing of the skin on 4 of 7 subjects.
- Two patients were reported with chronic allergic dermatitis of the hand related to sensitisation to sodium hypochlorite as the active component of laundry bleach.
- Entry into the blood-stream through, for example, cuts, abrasions, puncture wounds or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
- Skin contact will result in rapid drying, bleaching, leading to chemical burns on prolonged contact.
- The material can produce severe chemical burns following direct contact with the skin.

INHALED

- The material is not thought to produce adverse health effects following inhalation (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.
- Chlorine vapour is extremely irritating to the upper respiratory tract and lungs.
- Symptoms of exposure to chlorine include coughing, choking, breathing difficulty, chest pain, headache, vomiting, pulmonary oedema. Inhalation may cause lung congestion, bronchitis and loss of consciousness.
- Effects may be delayed. Delayed effects of exposure to chlorine vapour can include shortness of breath, violent headaches, pulmonary oedema and pneumonia.
- Earlier reports suggested that concentrations around 5 ppm chlorine caused respiratory complaints, corrosion of the teeth, inflammation of the mucous membranes of the nose and



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increased susceptibility to tuberculosis in chronically-exposed workers. Recent studies have not confirmed these findings. Concentrations too low to effect the lower respiratory tract may however irritate the eyes, nose and throat.

- Amongst 29 volunteers exposed at 0.5, 1 or 2 ppm chlorine for 4 to 8 hours the following responses were recorded: itching or burning of the nose, itching or burning of the throat, production of tears, urge to cough, runny nose, nausea, headache, general discomfort, dizziness, drowsiness and shortness of breath.

CHRONIC HEALTH EFFECTS

- Repeated or prolonged exposure to corrosives may result in the erosion of teeth, inflammatory and ulcerative changes in the mouth and necrosis (rarely) of the jaw. Bronchial irritation, with cough, and frequent attacks of bronchial pneumonia may ensue. Gastrointestinal disturbances may also occur. Chronic exposures may result in dermatitis and/or conjunctivitis.
- On the basis, primarily, of animal experiments, concern has been expressed by at least one classification body that the material may produce carcinogenic or mutagenic effects; in respect of the available information, however, there presently exists inadequate data for making a satisfactory assessment.
- Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.
- There exists limited evidence that shows that skin contact with the material is capable either of inducing a sensitisation reaction in a significant number of individuals, and/or of producing positive response in experimental animals.
- Reduced respiratory capacity may result from chronic low level exposure to chlorine gas. Chronic poisoning may result in coughing, severe chest pains, sore throat and haemoptysis (bloody sputum). Moderate to severe exposures over 3 years produced decreased lung capacity in a number of workers.
- Delayed effects can include shortness of breath, violent headaches, pulmonary oedema and pneumonia. Amongst chloralkali workers exposed to mean concentrations of 0.15 ppm for an average of 10.9 years a generalised pattern of fatigue (exposures of 0.5 ppm and above) and a modest increased incidence of anxiety and dizziness were recorded. Leukocytosis and a lower haematocrit showed some relation to exposure.

TOXICITY AND IRRITATION

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- Unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

SODIUM CHLORIDE:

SODIUM HYPOCHLORITE:

- The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
- Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

SODIUM HYPOCHLORITE 5 – 15%

- Most of the data for toxicity of hypochlorites by the oral route are from studies performed with sodium hypochlorite or chlorine gas. In biological systems, characterised by pH values in the range of 6-8, the most abundant active chemical species is (hypochlorous acid) HOCl, in equilibrium with hypochlorite anion (ClO⁻). Such available chlorine is readily absorbed via the oral route and distributed into plasma, bone marrow, testis, skin, kidney and lung. Only about 50% is excreted mainly with the urine followed by excretion with faeces. HOCl is not enzymatically metabolised.
- Acute toxicity: The acute oral LD50 of calcium hypochlorite was 790 mg/kg in male rats. Inhalation exposures to concentrations of greater than about 500 ppm (10 min or more) may be fatal for rats. Based on human experience and control studies in volunteers, it can be



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concluded that the acute NOAEL for humans was considered to be 0.5 ppm (1.5 mg/m³).

- Hypochlorite salts are extremely corrosive and can cause severe damage to the eyes and skin. Calcium hypochlorite is reported to be corrosive to the skin and has severe effects that can be expected from exposure to the eyes, which is ascribable to the alkalinity of calcium cation (pH=12.0 at 1 % as free available chlorine (FAC*)). Moderate to severe lesions in the respiratory tract were reported after exposure to chlorine that may emerge in case of accidental misuse of hypochlorite salts. Exposure to chlorine at 9 ppm (27 mg/m³) for 6 h/day during 1, 3 and 5 days was reported to cause epithelial necrosis, cellular exfoliation, erosion, ulceration and squamous metaplasia in the nasal passage of rats and mice. For either of Ca or Na salt, reliable skin sensitisation studies are not available and case reports are available but no reliable case report could be found showing a sensitization potential in humans.
- Repeat dose toxicity: In a 13-week study, male and female F-344 rats (10/sex/group) received sodium hypochlorite (NaClO) in drinking water at level of 0.025, 0.05, 0.1, 0.2, or 0.4 %. A weight gain was significantly decreased in male rats at 0.2 and 0.4 % and in females at 0.4 %. These effects were dose related and obviously correlated with reduced water consumption. No histopathological changes attributable to the treatment were found. But an increase of AAT in the blood gave evidence of the adverse effects on the liver. Based on significant body-weight reduction at the top dose, a subchronic NOAEL of 59.5 mg/kg bw/day as free available chlorine (FAC*) (at 0.1% NaClO level in the drinking water) can be calculated for male rats. For female rats a subchronic NOAEL of 215.7 mg/kg bw/day as FAC (at 0.2 % NaClO level in the drinking water) can be calculated. A NOAEL of 950 ppm available chlorine (59.5 mg/kg bw/day) can be derived from a 13-week rat study with sodium hypochlorite in drinking water.
- In a life-time guideline NTP-study, 70 male and female F344 rats and B6C3F1 mice were administered chlorine via drinking water at dose levels of 0, 70, 140 and 275 mg (equivalent to FAC)/L in buffered water. These concentrations were equivalent to 0, 4.8, 7.5 and 13.9 mg/kg bw/day for male rats and 0, 3.8, 6.9 and 13.2/kg bw/day for female rats. Mean body weights of male and female rats were similar among treated and control groups at both 14-week and 66-week interim evaluations. Those of male mice were significantly lower at week 66. Dose-related decrease in water consumption was observed throughout the study in both species and sexes. Food consumption was comparable among chlorine-treated and control groups. There were no clinical findings, alterations in haematological parameters and biologically significant differences in relative organ weights attributable to the treatment at 14/15-week and 66-week interim evaluations. Survival rate in chlorine-treated groups of rats and mice were similar to those of the controls after two groups. There was no evidence for non-neoplastic lesions to be associated with the consumption of chlorinated drinking water [NTP, 1992]. Based on these findings, a NOAEL (chronic) can be calculated to be



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approximately 14 mg available chlorine /kg bw/day for rats and 22.5 mg available chlorine /kg bw/day for mice.

- Reproductive toxicity: No reproductive toxic effects were shown up to 5 mg/kg (highest dose tested) of sodium salt (equivalent to 4.8 mg/kg of calcium salt) in a one generation oral study in rats. No evidence of adverse developmental effects were reported in animals. Moreover, epidemiological studies in humans did not show any evidence of toxic effects on reproduction and development.
- Genotoxicity: There are data from in vitro studies to suggest that solutions of chlorine/hypochlorite have some mutagenic potential, but it can be concluded that they are not mutagenic in vivo.
- No carcinogenicity was observed in mice or rats exposed by inhalation to chlorine and orally to sodium hypochlorite, except some equivocal results were reported for female rats by oral route. For human carcinogenicity, no causal relationship between hypochlorite exposure and tumour incidence was observed. The observation is applicable to calcium hypochlorite.
- A number of fibrosarcomas and squamous cell carcinomas were observed in mice treated dermally with repeated subcarcinogenic doses of 4-nitroquinoline-1-oxide, followed by dermal treatment with sodium hypochlorite.
- Hypochlorite salts are classified by IARC as Group 3: NOT classifiable as to its carcinogenicity to humans. Evidence of carcinogenicity may be inadequate or limited in animal testing.

SODIUM HYPOCHLORITE:

TOXICITY

Oral (mouse) LD50:5800 mg/kg
Oral (woman) TDLo:1000 mg/kg
Oral (rat) LD50:8910 mg/kg
as sodium hypochlorite pentahydrate

IRRITATION

Eye (rabbit): 10 mg – Moderate
Skin (rabbit): 500 mg/24h – Moderate
Eye (rabbit): 100 mg – Moderate

SODIUM HYDROXIDE:

TOXICITY

IRRITATION

Skin (rabbit): 500 mg/24h - SEVERE
Eye (rabbit): 0.05 mg/24h - SEVERE
Skin (rabbit): 1 mg/24h - SEVERE
Eye (rabbit): 1 mg/30s rinsed – SEVERE

- The material may produce severe irritation to the eye causing pronounced inflammation.



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- Repeated or prolonged exposure to irritants may produce conjunctivitis.
- The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) thickening of the epidermis.
- Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis. Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

SODIUM HYDROXIDE:

TOXICITY

Oral (rat) LD50:3000 mg/kg
Oral (human) TDLo:12357 mg/kg/23d
Intravenous (mouse) LD50:645 mg/kg
Oral (human) TDLo:12357 mg/kg
Subcutaneous (rat) LD:3500 mg/kg
Intraperitoneal (mouse) LD50:2602 mg/kg
Intravenous (rabbit) LD:1100 mg/kg
Subcutaneous (guinea pig) LD:2160 mg/kg
Intravenous (guinea pig) LD:300 mg/kg
Intraperitoneal (rat) LD50:2600 mg/kg

IRRITATION

Skin (rabbit): 500 mg/24h – Mild
Eye (rabbit): 10 mg – Moderate
Eye (rabbit): 100 mg/24h – Moderate

- The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.
- Oral (Lowest Toxic Dose) Human: None 8.2 mg/kg

WATER

- No significant acute toxicological data identified in literature search.

CARCINOGEN

Sodium hypochlorite	International Agency For Research on Cancer (IARC) – Agents Reviewed by the IARC Monographs	Group	3
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SECTION 12: ECOLOGICAL INFORMATION

SODIUM HYDROXIDE:

SODIUM CHLORIDE: SODIUM HYPOCHLORITE:

- DO NOT discharge into sewer or waterways.

SODIUM HYDROXIDE: SODIUM HYPOCHLORITE:

- Prevent, by any means available, spillage from entering drains or water courses.

SODIUM HYPOCHLORITE:

- Marine Pollutant:
 - Yes: Very toxic to aquatic organisms
- DO NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
- Wastes resulting from use of the product must be disposed of on site or at approved waste sites. For chlorine:

Environmental fate:

- Atmospheric chlorine produced as a result of such process as disinfection forms hydrochloric (HCl) or hypochlorous (HOCl) acid in the atmosphere, either through reactions with hydroxy radicals or other trace species such as hydrocarbons. These acids are believed to be removed from the atmosphere primarily through precipitation washout (i.e. wet deposition as chlorine is scrubbed out by rain in the subcloud layer) or dry deposition as gaseous chlorine contacts and reacts with the earth's surface.
- Water chlorination, resulting from municipal and industrial wastewater treatment and cooling water disinfection, initially introduces chlorine into the water as chlorine gas, hypochlorite ion (OCl⁻), or its salt. These forms of chlorine are termed free residual chlorines (FRC). Chlorine in aqueous systems volatilises or quickly decays to residual forms such as hypochlorous acid, chloramine and chlorinated organics. Aquatic chemistry is determined by aquatic factors including pH, ammonium ion (which combines with chlorine to produce chloramine) and certain other reducing agents. Inorganic reducing agents in estuarine waters include sulfur, iron and manganese. Other organic compounds in water also contribute to chlorine decay rate. The reactions of chlorine or hypochlorites in water produce a number of



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by-products many of which have been implicated as genotoxic or tumourigenic.

- Chlorine, added to drinking water as chlorine gas (Cl₂) or hypochlorite salts (e.g., NaOCl), effectively inactivates bacteria in 20 minutes at concentrations of 0.03 to 0.06 mg/l at pH range of 7.0 to 8.5 and temperature range of 4 deg.C to 22 deg.C.
- Chlorine disinfectants in wastewater react with organic matters, giving rise to organic chlorine compounds such as AOX (halogenated organic compounds absorbable on activated carbon), which are toxic for aquatic organisms and are persistent environmental contaminants.
- Chlorine hydrolyses very rapidly in water (rate constants range from 1.5 x 10⁻⁴ at deg. C to 4.0 x 10⁻⁴ at 25 deg.C; half-life in natural waters, 0.005 seconds. In fresh and wastewaters at pH >6, complete hydrolysis occurs with the formation of hypochlorous acid (HOCl) and chloride ion (Cl⁻). The hypochlorous acid ionizes to hydrogen ion (H⁺) and hypochlorite ion (OCl⁻). At pH values >5, OCl⁻ predominates; at pH values <5, HOCl predominates. Free chlorine (Cl₂, HOCl, and OCl⁻) reacts rapidly with inorganics such as bromide and more slowly with organic material present in natural waters. These reactions yield chloride, oxidised organics, chloroorganics (including trihalomethanes), oxygen, nitrogen, chlorate, bromate and bromoorganics.
- Chlorines ultimate aqueous fate is chloride.
- Vapourisation of molecular chlorine (Cl₂) from water to the atmosphere may be significant at low pH values and high concentrations (e.g., pH 2 and 3500 mg/l chlorine), but is insignificant at neutral pH and low concentrations.
- Vegetation acts as an important sink for chlorine air pollution. Plant exposure to elevated levels of chlorine can cause plant injury; however chlorine tends to be rapidly converted to other less toxic forms.
- Atmospheric: When chlorine, hypochlorous acid or hydrogen chloride mixes in the atmosphere with water vapour, dilute solutions of strong mineral acids are formed that fall to earth as acid rain, snow, and fog, or acidified dry particles.
- Chlorine may react with soil components to form chlorides; depending on their water solubility, these chlorides are easily washed out from the soil.
- Bioaccumulation/ bioconcentration: There is no potential for the bioaccumulation or bioconcentration of chlorine.

Ecotoxicity:

Fish LC50 (96 h): 0.015 – 13.5 mg/l

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- Chlorine has high acute toxicity to aquatic organisms; many toxicity values are less than or equal to 1 mg/l.
- Twenty-four-hour LC50 values range from 0.076 to 0.16 mg/l for *Daphnia magna* (water flea) and from 0.005 to 0.1 mg/l for *Daphnia pulex* (cladocern); 48-hour LC50 values range from 5.3 to 12.8 mg/l for *Nitocra spinipes* (snail); and 96-hour LC50 values range from 0.13 to 0.29 mg/L for *Oncorhynchus mykiss* (rainbow trout), from 0.1 to 0.18 mg/l for *Salvelinus fontinalis* (brook trout), and from 0.71-0.82 mg/l for *Lepomis cyanellus* (green sunfish)
- Papillomas of the oral cavity in fish have been associated with exposure to chlorinated water supplies.
- Chlorine is phytotoxic but is also essential to plant growth; crops need around 2 kg or more of chlorine per acre. Acute toxicity to plants is characterized by defoliation with no leaf symptoms and, in higher plant forms, by spotting of the leaves (at 1.5 mg/m³) and marginal and interveinal injury (at 150-300 mg/m³)
- Data from experimental studies indicate that injury to animals occurs only in the presence of high concentrations of chlorine, either in drinking water or the ambient atmosphere. http://www.epa.gov/chemfact/s_chlori.txt
- U.S. ENVIRONMENTAL PROTECTION AGENCY August 1994. for hypochlorites:

Environmental fate:

- NOTE: Hypochlorite ion is predominant at alkaline pH values, while Cl₂ is mainly present at pH below 4. Therefore the concentration of chlorine in an aqueous solution is generally expressed as free available chlorine (FAC) which is the sum of Cl₂ + HOCl + ClO⁻, regardless whether these species stem from dissolved gaseous chlorine or from dissolved sodium/calcium hypochlorite
- Hypochlorite anion dissolved in water is brought to equilibrium between active chlorine species like chlorine (Cl₂), hypochlorous acid (HOCl) or hypochlorite ClO⁻. The relative amounts of the components are dependent on ionic strength and pH. At the pH in the natural environment (6-8), HOCl or ClO⁻ is dominating (HClO: pK_a = 7.53). A diluted aqueous solution of HOCl will decompose very slowly in the dark, but more rapidly in the presence of light, particularly rapidly in full sun light, by producing hydrogen chloride and oxygen. Some chlorine and chloric acid (HClO₃) may also develop. The physico-chemical properties indicate that chlorine released into the environment as HClO or Cl₂ is distributed into water and air. Consequently, the effects that may manifest in the natural environment are considered common to those assessed for the other source of hypochlorite.
- In the natural water, in the presence of organic or inorganic compounds, the free available chlorine immediately reacts forming various chlorinated and/or oxidized by-products e.g. chloramines or chloromethanes. They are mainly distributed to the hydrosphere, but are also



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able to transfer to some extent to the atmosphere depending on their intrinsic properties. A potential for bioaccumulation or bioconcentration of active chlorine species can be disregarded, because of their water solubility and their high reactivity.

- In fresh water, the hypochlorites break down rapidly into non-toxic compounds when exposed to sunlight. In seawater, chlorine levels decline rapidly; however, hypobromite (which is acutely toxic to aquatic organisms) is formed. Sodium and calcium hypochlorite are low in toxicity to avian wildlife, but they are highly toxic to freshwater fish and invertebrates.
- Hypochlorite is a highly reactive chemical which, during and after its use in household scenarios, undergoes a variety of reactions. The major one is the oxidation of inorganic and organic species.
- A minor reaction, which consumes about 1.5% of the chlorine atoms from hypochlorite, is chlorination, which leads to formation of organohalogen by-products that are often measured by the group parameter, AOX. Hypochlorite itself is rapidly broken down during use, in the sewer, and if any does reach sewage treatment it will further degrade (half-life of around 0.6 minutes). Predictions have indicated that its concentration will fall to below 1.E-32 ug/l by the end of the sewer, partially due to its reaction with ammonia in the sewer which leads to a subsequent increase in chloramine.
- The organohalogen by-products formed from the use of hypochlorite are currently receiving much attention. However, the levels of AOX produced are low (for example, 37 ug/l from bleach use compared to a sewage background level of 106 ug/l), and the organohalogens produced from domestic use of hypochlorite are not believed to have an adverse effect on the environment. Available data indicate that no dioxins are produced, and that the identified AOXs are typically small molecules with a low degree of chlorination and for which ecotoxicological properties are known or can be predicted. Where drinking water is disinfected by chlorination, the levels of organohalogens in sewage effluent arising from bleach use will be comparable with, and sometimes only a fraction of, those arising from the tap-water. After secondary sewage treatment, the levels entering receiving waters will be of the same order of magnitude as background levels typically present in rivers, though the total flux in rivers from natural sources will be much greater.
- The majority of the measured AOX is unidentified, but thought to consist of high molecular weight components formed from fats, proteins and humic acids which are too large to bioaccumulate.
- In addition, studies on the whole AOX mixture in laundry waste-water indicated that the level of AOX present did not effect growth or reproduction of Ceriodaphnia, and that around



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70% is removed in activated sludge.

Ecotoxicity:

- The level of chloramine reaching surface water is estimated to be below 5.E-10 ug/l. Both these concentrations are orders of magnitude below the lowest acute EC50s determined for sodium hypochlorite (EC50 to invertebrates = 5 ug/l) and monochloramine (EC50 to invertebrates = 16 ug/l).
- Valid freshwater short-term toxicity data are available only for invertebrates: the LC50 for *Ceriodaphnia dubia* is 5 ug FAC/l (FAC=Free available chlorine). Adequate standard acute tests in fish are not available, but from many reliable studies performed under intermittent exposure conditions a 96h LC50 of 60 ug TRC/L and a 168 h LC50 of 330 ug TRC/L can be derived (TRC = total residual chlorine = the sum of combined and free residual available chlorine). Due to the intermittent regime (three 45 minutes pulses per day) a 96h LC50 << 60 ug TRC/l can be expected for fish in a standard test. Most lowest result for algae is reported for *Thalassiosira pseudonana* with a IC50 of 75 ug/L (20 deg C).
- Regarding long-term toxicity to freshwater organisms, the lowest NOEC was 5 ug/L (*Ictalurus punctatus*, 133 d, growth). In microcosm and field studies the most sensitive parameter was the density of zooplankton with a NOEC of 1.5 ug TRC/L, and zooplankton is more sensitive to chlorine than algae.
- For salt water, valid short-term toxicity data are available for mollusks and for fish (*Oncorhynchus kisutch* 96 h LC50 = 32 ug TRO/L) (TRO = Total Residual Oxidant) showing comparable sensitivity. For long term toxicity the molluscs are more sensitive than fish showing a 15 d NOEC of 6.2 ug TRO/L. It is impossible to delineate representative toxicity indicator figures because of the unique feature of the chemical to be tested in standard methods. However, the accumulated scientific information covering a wide range of species, temperature,application regime or field studies can be used for the hazard assessment.
- The material is classified as an ecotoxin* because the Fish LC50 (96 hours) is less than or equal to 0.1 mg/l * Classification of Substances as Ecotoxic (Dangerous to the Environment)
- Appendix 8, Table 1 Compiler's Guide for the Preparation of International Chemical Safety Cards: 1993 Commission of the European Communities.

SODIUM HYDROXIDE:

- Metal-containing inorganic substances generally have negligible vapour pressure and are not expected to partition to air. Once released to surface waters and moist soils their fate depends on solubility and dissociation in water. Environmental processes (such as oxidation and the



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presence of acids or bases) may transform insoluble metals to more soluble ionic forms. Microbiological processes may also transform insoluble metals to more soluble forms. Such ionic species may bind to dissolved ligands or sorb to solid particles in aquatic or aqueous media. A significant proportion of dissolved/ sorbed metals will end up in sediments through the settling of suspended particles. The remaining metal ions can then be taken up by aquatic organisms.

- When released to dry soil most metals will exhibit limited mobility and remain in the upper layer; some will leach locally into ground water and/ or surface water ecosystems when soaked by rain or melt ice. Environmental processes may also be important in changing solubilities.
- Even though many metals show few toxic effects at physiological pHs, transformation may introduce new or magnified effects.
- A metal ion is considered infinitely persistent because it cannot degrade further.
- The current state of science does not allow for an unambiguous interpretation of various measures of bioaccumulation.
- The counter-ion may also create health and environmental concerns once isolated from the metal. Under normal physiological conditions the counter-ion may be essentially insoluble and may not be bioavailable. Environmental processes may enhance bioavailability.

Ecotoxicity:

Fish LC50 (96h): 43mg/l

SODIUM CHLORIDE:

- Although inorganic chloride ions are not normally considered toxic they can exist in effluents at acutely toxic levels (chloride >3000 mg/l). The resulting salinity can exceed the tolerances of most freshwater organisms.
- Inorganic chlorine eventually finds its way into the aqueous compartment and as such is bioavailable. Incidental exposure to inorganic chloride may occur in occupational settings where chemicals management policies are improperly applied. The toxicity of chloride salts depends on the counter-ion (cation) present; that of chloride itself is unknown. Chloride toxicity has not been observed in humans except in the special case of impaired sodium chloride metabolism, e.g. in congestive heart failure. Healthy individuals can tolerate the intake of large quantities of chloride provided that there is a concomitant intake of fresh water.
- Although excessive intake of drinking-water containing sodium chloride at concentrations



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above 2.5 g/litre has been reported to produce hypertension, this effect is believed to be related to the sodium ion concentration.

- Chloride concentrations in excess of about 250 mg/litre can give rise to detectable taste in water, but the threshold depends upon the associated cations. Consumers can, however, become accustomed to concentrations in excess of 250 mg/litre. No health-based guideline value is proposed for chloride in drinking-water.
- In humans, 88% of chloride is extracellular and contributes to the osmotic activity of body fluids. The electrolyte balance in the body is maintained by adjusting total dietary intake and by excretion via the kidneys and gastrointestinal tract. Chloride is almost completely absorbed in normal individuals, mostly from the proximal half of the small intestine. Normal fluid loss amounts to about 1.5-2 liters/day, together with about 4 g of chloride per day. Most (90 - 95%) is excreted in the urine, with minor amounts in faeces (4-8%) and sweat (2%).
- Chloride increases the electrical conductivity of water and thus increases its corrosivity. In metal pipes, chloride reacts with metal ions to form soluble salts thus increasing levels of metals in drinking-water. In lead pipes, a protective oxide layer is built up, but chloride enhances galvanic corrosion. It can also increase the rate of pitting corrosion of metal pipes.

TLM 96 > 1000 ppm

Ecotoxicity

Ingredient	Persistence: Water/ Soil	Persistence: Air	Bioaccumulation	Mobility
Sodium hypochlorite	No Data Available	No Data Available	LOW	HIGH
Sodium hydroxide	LOW	No Data Available	LOW	HIGH
Sodium chloride	LOW	No Data Available	LOW	HIGH

SECTION 13: DISPOSAL INFORMATION

- Containers may still present a chemical hazard/ danger when empty.
- Return to supplier for reuse/ recycling if possible.
Otherwise:
- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent



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- re-use, and bury at an authorised landfill.
- Where possible retain label warnings and MSDS and observe all notices pertaining to the product. Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
 - A Hierarchy of Controls seems to be common - the user should investigate:
 - Reduction
 - Reuse
 - Recycling
 - Disposal (if all else fails)
 - This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.
 - DO NOT allow wash water from cleaning or process equipment to enter drains.
 - It may be necessary to collect all wash water for treatment before disposal.
 - In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
 - Where in doubt contact the responsible authority.
 - Recycle wherever possible.
 - Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
 - Treat and neutralise at an approved treatment plant. Treatment should involve: Neutralisation with soda-ash or soda-lime followed by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material).
 - Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

SECTION 14: TRANSPORTATION INFORMATION



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SODIUM HYPOCHLORITE 5 – 16% (NaOCl)



Labels Required: CORROSIVE

Land Transport UNDG:

Class or division: 8

UN No: 1791

Shipping Name: HYPOCHLORITE SOLUTION

Subsidiary risk: None

UN packing group: III

Air Transport IATA:

ICAO/ IATA Class: 8

UN/ ID Number: 1791

Special provisions: A3A803

ICAO/ IATA Subrisk: None

Packing Group: III

Shipping Name: HYPOCHLORITE SOLUTION

Maritime Transport IMDG:

IMDG Class: 8

UN Number: 1791

EMS Number: F – A, S – B

Limited Quantities: 5 L

Shipping Name: HYPOCHLORITE SOLUTION

IMDG Subrisk: None

Packing Group: III

Special Provisions: None

SECTION 15: REGULATORY INFORMATION

REGULATIONS

Occupational Safety & Health (Classification, Labeling, and Safety Data Sheet of Hazardous Chemical) Regulation 2013.

The Industry Code of Practice on Chemical Classification and Hazard Communication 2013 (ICOP CCHC).

Revision No.: 03

Revision Date: 31st December 2020

Preparation Date: 1st March 2015



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The Industry Code of Practice on Chemical Classification and Hazard Communication 2014 (Amendment) 2019) Part 1.

Occupational Safety & Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulation 2000.

Environmental Quality Act 1974.

Regulations for ingredients

Sodium hypochlorite 10% (CAS: 7681-52-9,10022-70-5) is found on the following regulatory lists;

"GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD List of High Production Volume (HPV) Chemicals", "WHO Guidelines for Drinking-water Quality - Guideline values for chemicals that are of health significance in drinking-water".

Sodium hydroxide (CAS: 1310-73-2, 12200-64-5) is found on the following regulatory lists;

"ASEAN Cosmetic Directive Annex III Part 1 List of substances which cosmetic products must not contain except subject to restrictions and conditions laid down", "CODEX General Standard for Food Additives (GSFA) - Additives Permitted for Use in Food in General, Unless Otherwise Specified, in Accordance with GMP", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "International Council of Chemical Associations (ICCA) - High Production Volume List", "International Fragrance Association (IFRA) Survey: Transparency List", "OECD List of High Production Volume (HPV) Chemicals", "Singapore Environmental Protection and Management (Hazardous Substances) Regulations", "Singapore Environmental Protection and Management Act (EPMA) - List of Controlled Hazardous Substances", "Singapore Food Regulations - Food Additives - Permitted General Purpose Food Additives", "Singapore Permissible Exposure Limits of Toxic Substances", "United Nations Consolidated List of Products Whose Consumption and/or Sale Have Been Banned, Withdrawn, Severely Restricted or Not Approved by Governments".

PDV Salt (CAS: 7647-14-5) is found on the following regulatory lists;

"International Fragrance Association (IFRA) Survey: Transparency List", "OECD List of High Production Volume (HPV) Chemicals", "Singapore Food Regulations - Food Additives - Chemical preservatives", "Singapore Food Regulations - Food Additives - Permitted General Purpose Food Additives", "Singapore Misuse of Drugs Act Third Schedule Controlled Equipment, Materials or Substances Useful for Manufacturing Controlled Drugs Part I".

Water (CAS: 7732-18-5) is found on the following regulatory lists;

"IMO IBC Code Chapter 18: List of products to which the Code does not apply", "International Fragrance Association (IFRA) Survey: Transparency List", "OECD List of High Production Volume (HPV) Chemicals", "OSPAR National List of Candidates for Substitution Norway".



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No data for Sodium Hypochlorite 5-15% (CW: 3313032)

SECTION 16: OTHER INFORMATION

LEGEND

- ppm : Part per million
- CAS : Chemical Abstracts Service Registry Number
- OSF : Odour Safety Factor
- RTECS : Register of Toxic Effects of Chemical Substances.
- CPR : Cardiopulmonary resuscitation (CPR)
- OSHA : Occupational Safety & Health Act

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
Sodium hypochlorite	7681 – 52 – 9, 10022 – 70 – 5
Sodium hydroxide	1310 – 73 – 2, 12200 – 64 – 5

- Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the MSCI Committee using available literature references.
- The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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