SAFETY DATA SHEET

Chlorine

SDS 004 / R9
2020-05-02

Reg. No. 2003/017152/07

Safety Data Sheet (SDS) According to ISO/SANS 11014:2009/2010, UN Transport of Dangerous Goods, UN Globally Harmonised System of Classification & Labelling, and EC Directive 1272/2008

SECTION 1. Identification – Chemical Product and Company

Product Identifier	:	Chlorine - Cl_2
Chemical Name /Proper Shipping Name:		CHLORINE
UN number	:	UN 1017
CAS number	:	7782 - 50 - 5
GHS product identifier	:	Liquid Chlorine
Other means of identification	:	Yellow-green liquid or gas with pungent odour
Recommended use and restrictions on use		
Recommended use	:	Water purification and Industrial use. Conduct a Risk Assessment prior to use.
Restriction on use	:	Not for retail or use by untrained persons.
Supplier's details	**:**	NCP Chlorchem (Pty) Ltd
Address	:	Cnr. Allandale Road and Chloor Road Chloorkop, Gauteng, South Africa: PO Box 150, Kempton Park 1620, South Africa
Telephone No.	:	**+27 (0) 11 976 2115**
24hour Emergency phone number	:	**+27 (0) 11 921 3333**

SECTION 2. Hazards Identification

GHS classification of the substance: *Toxic gas with physical risks of oxidizer and corrosive

Hazard classes/Hazard categories **Transport - Class 2.3 Toxic gas**	Hazard Statement
Oxidising gas - Category 1	H270 May cause or intensify fire - oxidiser
Gases under pressure – compressed gas Category 1	H280 May explode if heated
Acute toxicity inhalation – Category 1	H330 Fatal if inhaled
Skin corrosion/irritation – Category 2	H315 Causes skin irritation
Serious eye damage/eye irritation – Category 2	H319 Causes serious eye irritation
Specific target organ toxicity (single exposure) STOT SE Respiratory tract – Category 3	H335 Causes respiratory irritation
Aquatic toxicity - acute Category 1	H400 Very toxic to aquatic life
Aquatic toxicity - chronic Category 1	H410 Very toxic with long lasting effects

The most important adverse effects to know in emergency are –

Compressed gas - under pressure, may explode if heated. **Very Toxic** – can be fatal if inhaled, and corrosive to respiratory tract. **Oxidizer** – highly reactive, will intensify fire. **Corrosive** – causes severe skin burns and eye damage, may cause frostbite, and is a **severe aquatic pollutant.**
GHS label elements, including Precautionary Statements:

Signal word - Danger
Oxidizer - flame over circle
Toxic - skull and crossbones
Corrosive – metals & skin symbol

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Compressed gas symbol
Aquatic toxicity – dead tree and fish

Precautionary statements:
P 220 Keep away from clothing and other combustible materials
P 244 Keep valves and fittings free from oil and grease
P 260 Avoid breathing gas
P 280 Wear protective gloves, clothing and eye or full-face protection.
P 370 + P376 In case of fire, stop leak if safe to do so
P 302 + P352 If on skin, wash with plenty of water
P 333 + P317 If skin irritation or rash occurs get medical help
P 305 + P351 + P338 If in eyes, rinse cautiously with water for several minutes, remove contact lenses if present and easy to do so, continue rinsing, get medical advice
P 304 + P340 + P317 If inhaled, remove person to fresh air and keep comfortable for breathing. Get medical help
P 403 Store in a well-ventilated place
Avoid release to the environment. Wash hands thoroughly after handling

Response:
Refer Sections 5, 6 and 8
Storage:
Refer Section 7
Special Labelling requirements – refer Section 14 for transport labels

Other Hazards – contact with evaporating liquid may cause frostbite or freezing of the skin.

SECTION 3. Composition/information on ingredients

Chemical identity	:	Substance
Other means of identity	:	yellow-green liquid or gas
Common name, synonyms, etc	:	Chlorine
Impurities and stabilizing additives	:	none

Ingredient name	%	CAS number	EC number
Chlorine	100	7782-50-5	231 - 959 - 5

SECTION 4. First-aid measures

Description of most important symptoms/effects, acute and delayed and necessary measures:

Exposure indicates immediate medical attention, and special treatment needed:

Inhalation: Very toxic and can be fatal if inhaled
May cause severe irritation of the nose and throat with burns (gas forms hydrochloric acid in contact with moisture), and severe lung injury with life threatening accumulation of fluid in the lungs (pulmonary oedema). Symptoms may include shortness of breath, difficulty in breathing and tightness in the chest
NB Symptoms may develop hours after exposure and are made worse by physical effort.
Get immediate medical attention.
Remove victim to fresh air (wear self-contained breathing apparatus), keep warm, at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-containing breathing apparatus.
If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel **NB** caution as it may be dangerous to the person providing aid to give mouth to mouth resuscitation – get medical advice.

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If unconscious, place in a recovery position and get medical attention immediately. Maintain open airway. Loosen tight clothing such as a collar, tie, belt or waistband

Eye contact: Corrosive! The gas irritates or burns the eyes, direct contact with the liquefied gas can freeze the eye. Permanent damage, including blindness can result.
Remove any contact lens if possible and rinse cautiously with copious amounts of lukewarm water (running if possible) for at least 15 minutes, keeping the eye open (note - gas forms hydrochloric acid with water).
Get urgent medical attention to reduce potential effects of delayed or permanent damage.

Skin contact: Corrosive! The gas irritates or burns the skin, permanent scarring can result and direct contact with liquefied gas can chill or freeze the skin causing frostbite! Symptoms may include numbness, pricking, itching and in more severe cases burning sensation and stiffness. The skin may become waxy white or yellow, with possible blistering, tissue death and infection in very severe cases.

Flush contaminated skin with plenty of water and **get medical attention.**

Carefully cut and remove contaminated clothing, especially if adhering to the skin, and apply sterile dressing. Continue to rinse for at least 10 minutes. Wash clothing before reuse.
Remove shoes and clean thoroughly to remove any acid residues before reuse.

Ingestion: Irritating to mouth, throat and stomach. As chlorine is a gas, ingestion is not a primary route of exposure, refer to the inhalation section

Most important symptoms and effects, acute and delayed – may be fatal if inhaled
Note to physician: treat symptomatically, e.g. treat with corticosteroid spray after inhalation.
Symptoms – may develop hours later and include wheezing, shortness of breath and tightness in chest (Reactive Airways Dysfunction Syndrome – RADS). NB Long term damage can result from short-term exposure, a single exposure to high concentration can cause long lasting conditions like asthma. If this occurs, exposure to other chemicals and cold temperatures can irritate the airways. Continued monitoring of those exposed for delayed symptoms is recommended.
Protection of first aiders: No actions should be taken by untrained persons. Caution should be exercised in presence of gas / fumes, the rescuer/ first aiders should wear respiratory protection or self-contained breathing apparatus.
NB If fumes are in the lungs it can be dangerous to give mouth to mouth resuscitation.
Get medical attention as soon as possible after exposure to administer any specialised treatment.

SECTION 5. Fire-fighting measures

An area Risk Assessment and Emergency Plan should be done for chlorine Installations and regularly reviewed. All Operational and response personnel should be Trained in the Emergency Plan.
Suitable extinguishing media – Use an extinguishing agent suitable for the surrounding fire. Water spray or fog can be used to keep cylinders cool and reduce vapours. Caution this can form hydrochloric acid.
Unsuitable extinguishing media – none known

Specific hazards arising from the chemical - Contains gas under pressure, prevent from heating as gas will expand and increase pressure in the container, which could then burst or explode.
Strong Oxidizer – highly reactive. Reacts explosively with many chemicals e.g. hydrocarbons, ammonia, and aluminium. Increases the risk of fire and may aid combustion. Contact with combustible material may cause fire.
This material is very toxic to aquatic life, thus contaminated fire water (will contain hydrochloric acid) must be contained and prevented from being discharged to any waterway, sewer or drain**.**

Hazardous thermal decomposition products: Corrosive hydrogen chloride and other halogenated compounds which could pose additional hazards, which need to be evaluated on a case by case basis.

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Special precautions and actions for fire-fighters - Promptly evacuate and isolate the area by removing all persons from the vicinity of the incident if there is a release or fire. Shut off valves and disconnect cylinders. Move cylinders from the fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off valves to stop flow immediately, if it can be done without risk.
No action shall be taken involving any personal risk without suitable training. Keep ALL unprotected and unnecessary persons OUT OF THE AREA.
Contact supplier immediately for specialist advice.
Special protective equipment for fire-fighters – wear only recommended breathing apparatus.
Fire-fighters should wear appropriate chemical protective / gas tight clothing and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

SECTION 6. Accidental release measures – stop release if safe to do so

Personal precautions, protective equipment and emergency procedures.

Evacuate the area immediately and isolate the hazard area. Stay upwind, keep ALL unnecessary and unprotected personnel out of the affected area, and where possible monitor the gas concentration. NB chlorine gas is heavy and may collect in hazardous amounts in low lying areas. Remove or isolate incompatible materials if safe to do so and eliminate any source of ignition.

Emergency responders: Only trained personnel shall respond to a chlorine release. Wear appropriate protective clothing, and respirator or breathing apparatus to deal with the spillage, see information in Section 8 on suitable and unsuitable materials.
Non-emergency personnel: Take precautions for own safety **before** attempting rescue! No action shall be taken involving any personal risk, without suitable training. No smoking or flames in hazard area. **Do NOT breathe gas**. Provide adequate ventilation. Wear appropriate respirator and put on appropriate personal protective equipment see **Section 8**.

Environmental precautions: ensure that emergency procedures are in place to deal with accidental gas release to avoid harm to people both on site and off site, and environmental pollution. Prevent further leakage or spillage if safe to do.
Inform the relevant authorities if the product has caused pollution of waterways, sewers and atmosphere as contact with moisture /water will form hydrochloric acid which can cause severe harm.

Response: Contain and collect spillage and washings as these will be highly acidic which can cause serious environmental and aquatic impacts

In case of fire: Shut off valves and stop leak if safe to do so, and **see Section 5**
If inhaled: Remove victim/s to fresh air and keep at rest and warm in a position comfortable for breathing. **Immediately call for medical help** – **See Section 4.**
If on skin or in eyes - Wash with plenty of water for at least 15mins, remove contaminated clothing. **See Section 4** and get medical attention.

Methods and materials for containing and clean up

Small release or spill: Immediately contact emergency personnel. Stop leak if without risk. Wear protective clothing and escape-type respirator and exit the area.
Use spark-proof and explosion-proof equipment as supplied in the safety kits.

Large release: Immediately contact emergency personnel. Stop leak if without risk, put on escape-type respirator and exit the area as quickly as possible. Warn any personnel in the vicinity to evacuate.
Note: **see Section 1** for emergency contact information and Section 13 for waste disposal.

SECTION 7. Handling and storage – only Trained/experienced persons should handle gases.

Precautions for safe handling – Wear appropriate personal protective equipment - **see Section 8**.

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Avoid exposure, keep equipment free from oil and grease, use on specified equipment suitable for the pressure and temperature of the product.

Use only specified equipment for moving cylinders which should be secured upright at all times, valves should be closed when not in use with valve caps kept in place unless connected to a manifold. Protect cylinders from physical damage, do NOT drag, roll, slide or drop.

Eating, drinking and smoking shall be prohibited in areas where this material is handled, stored or processed. Workers must wash hands and face before eating, drinking and/or smoking.
Remove contaminated clothing and protective equipment before entering eating area.
Cylinders contain gas under pressure - avoid release to the environment. In case of release, do not breathe gas as highly toxic, which can cause burns to respiratory tract, skin and eyes.
Use only with adequate ventilation. Wear recommended protective respirator when ventilation is inadequate.
Keep away from clothing, incompatible and combustible materials, separate from reducing agents.
Keep valves free from grease and oil. Empty containers retain product residue and can be hazardous - **Do not** puncture or incinerate any cylinder or container.

Conditions for safe storage, including any incompatibilities – store below 50°C. Store away from direct sunlight in a dry, cool, well ventilated area, away from incompatible materials, **see Section 10**. Keep storage area locked to prevent unauthorised access.
Store in accordance with local regulations and in a segregated and approved area.
Secure cylinders (chain) in an upright position to a wall, rack or other solid structure. Label with date received and date opened and emptied to ensure first-in, first out inventory. **NB** empty cylinders can contain dangerous residues, thus should be handled with care. Store separately to prevent mistakes!

Keep container and valves tightly closed/sealed with caps in place until ready to connect to off-take for use.

SECTION 8. Exposure controls/personal protection

Control parameters e.g. occupational exposure limit values or biological limit values

Ingredient name	Exposure limits	OHS Act South Africa 1993
Chlorine	STEL OEL:RL 1ppm	TWA : OEL:RL 0.5 ppm
	OEL	0.5ppm & 1.5 mg/l UK 2011 & EU 2009

Recommended Monitoring: workplace and personal monitoring as per OHS Act and its' Regulations, to confirm the effectiveness of closures and any engineering controls in place

Appropriate engineering controls: Enforce Work Permit system for maintenance and use only in well ventilated areas. Use a local exhaust ventilation to control amount in the air or other engineering controls to keep worker exposure below recommended or regulatory limits. Consideration should be given to use more stringent controls with back-up controls to prevent product release e.g. process enclosure and double mechanical pump seals.

Risk Assessment for each operation is essential to identify appropriate actions, and to inform the Emergency Plan.

Environmental exposure controls: Process emissions should be checked to ensure compliance and prevent causing problems to neighbouring process or community. If necessary, scrubbers, filters or engineering modifications may be necessary to reduce emissions to acceptable levels.

Individual protection measures: refer to recommendations from the Risk Assessment -
Eye/face protection: Wear chemical safety goggles and where necessary a face shield
Hand Protection: Chemical resistant gloves should be worn at all times when handling
Body protection: Chemical protective clothing – overalls, apron, boots as per type of work.
Respiratory protection: Use a properly fitted approved air-purifying or air supplied respirator, see **EN689**
Hygiene: Wash hands

Other protection measures: Footwear – Safety shoes should be selected based on the tasks to be performed and risks involved which should be corrosion resistant and anti-static.
Emergencies: Major incidents - wear a chemical protective full-body gas-tight encapsulating suit and self-contained breathing apparatus.
Minor incidents - wear Chemical resistant suit, gloves, and breathing apparatus.
PPE suitable materials: see http://ccohs.ca/oshanswers/prevention/ppe/trade_name.html these include: butyl rubber, neoprene rubber, nitrile gloves thickness greater than 0.3mm, Viton®, Barrier®, Tychem®Responder, etc
Unsuitable materials that should not be used: polyethylene, polyvinyl chloride

SECTION 9. Physical and chemical properties

Appearance (physical state, colour etc.)	: Liquified gas, greenish-yellow
Odour	: Pungent, choking / irritating
Odour threshold	: 1ppm
pH	: no data available, highly acidic if dissolved in water
Melting point/freezing point	: -101°C (-149.8°F)
Initial boiling point and boiling range	: -34°C (-29.2°F)
Flash point	: Not applicable to gases
Evaporation rate	: Not applicable to gases
Flammability (solid/gas)	: Not flammable, but strong oxidiser
Upper/lower flammability or explosive limits	: Not applicable
Vapour pressure	: 665.9 kPa (4995 mm Hg) (20°C)
Vapour density	: 2. 5(Air=1)
Relative density	: 1.6
Solubility	: 5.1g/l @30°C
Partition coefficient: n-octanol/water, Log K_{ow}	: Not applicable to inorganic gases
Auto-ignition temperature	: Not applicable
Decomposition temperature	: No data available
Viscosity	: No data available
Other information	
Critical Temperature	: 144°C
Molecular weight	: 70.91 g/mol (Cl_2)

Caution - gas/vapour is heavier than air hence leaks may accumulate in confined spaces, particularly at or below ground level posing a severe hazard.

SECTION 10. Stability and reactivity

Reactivity – Strong oxidizer – highly reactive and incompatible with many common chemicals e.g. alcohols, ammonia, saturated hydrocarbons e.g. butane, aldehydes, metals such as aluminum.

Chemical stability - The product is stable under normal conditions, but has strong oxidizing properties

Possibility of hazardous reactions – Reacts violently with / oxidises organic materials, may react violently with combustible materials and reducing agents. Such reactions include the risk of causing fire.

Conditions to avoid – Temperatures, above 50°C, moisture.

Incompatible materials – Highly reactive / incompatible with moistures, combustible materials, reducing materials, grease, oil. For compatible materials see ISO 11114 (latest publication).

Corrosive to: aluminum alloys, carbon steel and other metals

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Hazardous decomposition products –Under normal conditions of storage and use, hazardous decomposition products should not be produced, but with moisture forms corrosive hydrogen chloride.

SECTION 11. Toxicological information

Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact)

Acute toxicity				
Product/ingredient name	Result	Species	Dose	Exposure
Chlorine	LC_{50} inhalation gas	Rat	293ppm	1hour

GHS – EU Group Classification:

Acute Toxicity: Category 1, H 270 - Fatal if inhaled

Eye Irritation: Category 2, H 319 – Causes serious eye irritation

Skin irritation: Category 2, H 315 – causes skin irritation Guinea pig; Rabbit

STOT SE – Specific Target Organ Toxicity, Single Exposure Inhalation: Category 3, H 335 – causes severe respiratory irritation

CMR - Carcinogenicity, Mutagenicity, Reproductive toxicity: No known significant effects

Potential Acute Health effects:
Eye contact: irritation or burns, permanent damage including blindness can result if not treated
Inhalation: very toxic, severe irritation of nose and throat, can cause severe lung damage, life threatening accumulation of fluid in the lungs and death in severe cases.
Skin contact: Corrosive – irritates or burns the skin. Permanent damage can occur. Direct contact with the liquid gas can cause frostbite with severe exposure causing burning sensation, stiffness, yellowing of skin, blistering and tissue death – urgent medical attention required.
Ingestion: Unlikely route of exposure

Delayed effects: shortness of breath, difficulty in breathing, tightening of the chest and asthma, delayed *fatal pulmonary oedema is possible.*

Potential Long-Term effects: asthma, sensitivity to other chemicals and cold causing respiratory distress.
Chlorine is extremely destructive to mucous membrane, upper respiratory tract, eyes and skin.

SECTION 12. Ecological information

General - Avoid release to the environment. Do NOT discharge to ground water or water source.

Ecotoxicity: Aquatic acute toxicity Category 1 Hazard Statement H400 very toxic to aquatic life

Fish LC_{50} 96hr 0.032 mg/l ; LC_{50} Daphnia 48hr 0.15mg/l ; EC_{50} Algae 72hr 0.001mg/l

Persistence and degradability: inorganic gas not readily degradable, but will dissolve and eventually disperse in water

Bio accumulative potential: no potential for bioaccumulation

Mobility in soil: low mobility in soil**,** but reacts with moisture and water to form hydrochloric acid.

Other adverse effects: Will have short term environmental impacts, severity depending on the size of the release or spill. Can cause pH change in aquatic systems and can adversely impact on activated sludge. Contain to minimize release /spill and monitor until all effects have gone.
Effect on ozone layer: None

SECTION 13. Disposal considerations

Generation of waste – waste-water from fire hoses or washings or absorption materials for clean-up of release, should be neutralized before disposal.

Contaminated water from release or spills should be contained and collected for safe disposal and NOT be washed down storm water drains or sewer as will be highly acidic and can cause severe damage to the Municipal sewerage system. Washings should be neutralized before disposal.

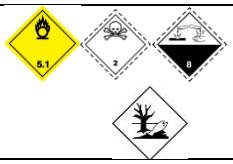
Cylinders which are damaged or corroded should, where possible be returned to the manufacturer for safe disposal, and disposed in line with guidelines from the competent Authority.

Environmental hazards – Acute aquatic Category 1 for fresh water and marine pollutant, do not wash concentrated solutions into waterways.

Special precautions for waste containing chlorine residues which a user needs to be aware of: Corrosive – if not neutralized could be highly acidic and could still have strong oxidizing properties, treat with caution using PPE and dispose of in accordance with recommendations from the disposing party who in terms with South African Waste regulations should supply an SDS for the waste.

SECTION 14. Transport information – NB Transport Risk Assessment essential/route.

General: Avoid Transport on any vehicle where load space is NOT separated from the drivers' compartment and ensure that valves are fully closed and cylinder caps in place prior to transport. The driver shall be Trained, aware of the potential hazard of the load and, what to do in case of accident or emergency.

	SANS 10228/UNTDG	IMDG	IATA
UN Number	UN1017	UN1017	UN1017
UN proper shipping name PSN	CHLORINE	CHLORINE Marine pollutant	CHLORINE
Transport Class 2.3 Toxic gas & Compressed gas 5.1 Oxidiser 8 Corrosive			Forbidden in passenger and cargo aircraft
Packing Group – cylinder Construction & Inspection	N/A refer applicable ISO Standard for size	N/A refer applicable ISO Standard for size	Forbidden
Environmental hazards	Aquatic Pollutant	Marine Pollutant under MARPOL	N/A
Additional information	ERG 2016 Guideline 124	Deck cargo only and EmS – Emergency Schedule F-C; S-U	N/A

SECTION 15. Regulatory information

OHS Act - Occupational Health and Safety Act 85 of 1993: requires site Risk Assessment and monitoring to inform personnel Health / Biological Monitoring. **Section 9A** requirement to provide SDS

MHI – Major Hazards Installations Regulations - OHS Act: require site Risk Assessment to ascertain potential impacts outside of the site and potential impacts on the public or neighbours. Copy to be lodged with the Dept Labour, and local Emergency Services.

Pressure Equipment Regulations - OHS Act: encompasses containers and service equipment + relevant **ISO/SANS Standards** for cylinder and pressure vessel construction, and Inspection periods.

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NEMA – National Environmental Management Act 107 of 1998: Duty of Care and Producer Responsibility for products and packaging on a Life Cycle basis. Environmental Impact Assessment Regulations for new installations or proposed increase in capacity over 25%

NEM:WA – National Environmental Waste Act 59 of 2008: Extended Producer Responsibility, requirements and regulations for waste management, classification and disposal – for licensed premises see www.sawic.environment.gov.za

NEM:AQA – National Environmental Air Quality Act 39 of 2004: AQA Licenses and Emissions

EU Regulation EC 1272/2008 (EU GHS /CLP) – Safety Data Sheets and Labelling

SECTION 16. Other information

Other relevant information including information on preparation and revision of the SDS – ISO 11014:2009 Safety Data Sheets for Chemical Products – content and order of sections adopted as SANS 11014:2010

UN Recommendations for Transport of Dangerous Goods Model Regulations commonly known as **the UN "Orange Books"** 21th revision published June 2019.

UN Globally Harmonized System of Classification and Labelling of Chemicals – GHS commonly known as **the UN "Purple Book" 8th** revision published June 2019

IMDG – International Maritime Dangerous Goods Code, 2019 edition, amendment 39-18

IATA Technical Regulations 61st edition, January 2019 – transport of chlorine by air: Forbidden

Date of original MSDS	**: 1993-10-28**	**Compiled by DD Liebenberg**
Date of Review and Revision 9	**: 2020-05-02**	**Compiled by E Anderson**

EXCLUSION OF LIABILITY

All information and instructions provided in this Safety Data Sheet (SDS) in respect of the substance is given in terms of the provisions of the Occupational Health and Safety Act No 85 of 1993 and its Regulations.

Information is based on best available scientific and technical knowledge as at the date indicated on this SDS, and is presented in good faith to be correct.

The information provided in this SDS apply only to the product in its present form and not to any formulation or mix. It should be used only as directed, and any formulations or other use is at the responsibility of the user of the product as formulated and/or mixed to investigate and establish any hazards or risks which may arise out of its use, wherever such user may be situated.

It is the legal responsibility of the person in receipt of this SDS, whether for transport, storage or use that a Risk Assessment and Emergency plan is done, and to ensure that the information provided is communicated to, and understood by any person who may come in contact with the product in any place and in any manner whatsoever. If such recipient produces formulations or mixes using the product, then it is the recipient's sole responsibility to comply with the provisions of the Act in respect of the provision of the necessary SDS, and/or to comply with any other applicable legislation.