SAFETY DATA SHEET

Carbon Dioxide

ABN: 81 008 668 371

Section 1 – Identification of the Material and Supplier

Product Name
Carbon Dioxide

Other names
Carbon Dioxide refrigerated liquid, CO_2. Company product code 1553.

Recommended use
Carbonating beverages, pH control and creating inert atmospheres

Company name
CSBP Limited

Address	State	Postcode
Kwinana Beach Road, KWINANA	Western Australia	6167

Telephone number	Emergency telephone number
(08) 9411 8777 (Australia), +61 8 9411 8777 (Overseas)	1800 093 333 (Australia), +61 8 9411 8444

Section 2 – Hazard Identification

Hazard Classification, including a statement of overall hazardous nature

HAZARDOUS SUBSTANCE.

Carbon dioxide is classified as hazardous according to Australian WHS Regulations.

DANGEROUS GOODS.

Carbon dioxide is classified for physicochemical hazards and specified as dangerous in the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code), 7th Edition.

GHS classification(s)

Gases Under Pressure: Refrigerated liquefied gas

Label Elements

Signal word **WARNING**

Pictogram(s)

Hazard Statement(s)

H281 Contains refrigerated gas; may cause cryogenic burns or injury.

Prevention Statement(s)

P282 Wear cold insulating gloves/face shield/eye protection.

Response Statement(s)

P315 Get immediate medical advice/attention.

P336 Thaw frosted parts with lukewarm water. Do not rub affected area.

Storage Statement(s)

P403 Store in well-ventilated place.

Disposal Statement(s)

None allocated.

Other hazards

In high concentrations may cause asphyxiation. Contact with liquid may cause cold burns/frostbite.

Section 3 – Composition/Information on Ingredients

Chemical identity of ingredients	Proportion of ingredients	CAS Number for ingredients
Carbon dioxide	> 99·5 % ($^{vol}/_{vol}$) Remainder	124-38-9

Section 4 – First Aid Measures

First Aid

CARBON DIOXIDE (CO_2) GAS IS A NARCOTIC AND ASPHYXIANT IN LARGE CONCENTRATIONS. IT IS THE MOST POWERFUL CEREBRAL VASODILATOR KNOWN. INHALING LARGE CONCENTRATIONS CAUSES RAPID CIRCULATORY INSUFFICIENCY LEADING TO COMA AND DEATH. CARBON DIOXIDE LIQUID CAUSES FROSBITE BURNS TO THE BODY ON CONTACT. FIRST AID ATTENTION MUST BE GIVEN AS URGENTLY AS POSSIBLE AS OULINED BELOW. ALL SUSPECTED LIQUID CARBON DIOXIDE BURNS SHOULD RECEIVE MEDICAL ATTENTION. TRAINING ON HANDLING CARBON DIOXIDE INCIDENTS USING THIS MSDS SHOULD BE PROVIDED BEFORE ANY CARBON DIOXIDE HANDLING OR USE COMMENCES.

First Aid Facilities

First aid procedures, equipment, medication and training for the treatment of frostbite burns with liquid carbon dioxide should be in place BEFORE the use commences. Company physician, occupational health nurse and first aid personnel should be aware of the nearest hospitals which are familiar with the treatment of liquid carbon dioxide frostbite burns.

Equipment and medication in place should be:

- Safety shower and eyewash stations immediately accessible in the workplace;
- Eye-wash bottle;
- Personal protective equipment for use by first aid personnel;
- Fresh, clean cool drinking water;
- Oxygen;
- “Space” or thermal blankets for treating patients for shock.

FIRST AID PROCEDURES FOR DEALING WITH THIS PRODUCT AND EXPOSURE TO IT

1. Personal Protection By First Aid Personnel

First aid personnel providing first aid treatment to a patient exposed to carbon dioxide should observe the following precautions for their own personal protection:

- Avoid contact with contaminated skin, clothing and equipment by wearing protective gloves to prevent contact of liquid carbon dioxide with skin;
- Wear chemical goggles as a minimum level of eye protection to prevent splashes of liquid carbon dioxide entering eyes;
- Avoid inhalation of carbon dioxide gas during rescue in contaminated areas by wearing suitable respiratory protection.
- Respiratory protection suggested is: an air supplied breathing apparatus, or positive pressure self-contained breathing apparatus.

2. Swallowed

Do not give anything by mouth if victim is losing consciousness, or is unconscious, or convulsing. If victim is conscious, rinse mouth thoroughly with clean fresh water immediately and spit out rinse water. Give water or milk (250 mL) to drink.

DO NOT INDUCE VOMITING.

Seek medical attention urgently.

3. Eyes

Persons with potential eye exposure should NOT wear contact lenses.

Immediately flush the contaminated eye(s) with gently flowing copious amounts of clean fresh water for at

least 15 minutes, holding the eyelid(s) open. Take care not to rinse contaminated water into a non-affected eye. DO NOT rub eyes.

Continue irrigation with normal water until the severe pain of the burn is relieved.

Seek medical attention urgently.

***NOTE:* Do not use anything other than clean fresh water, or sterile saline on the eye.**

4. Skin

First aid personnel must avoid contact with this chemical. Wear protective gloves when assisting patient.

DO NOT USE HOT WATER.

Immediately flush frostbite skin area thoroughly with gently running copious amounts of clean fresh lukewarm water for at least 15 minutes. DO NOT rub affected area. While washing with water remove contaminated clothing, jewellery, footwear and leather goods, e.g., watchbands and belts. Lauder these thoroughly before re-use.

Seek medical attention urgently.

5. Inhalation

Rescuer should wear appropriate personal protection to avoid breathing carbon dioxide gas.

Move patient from exposure to a well ventilated area. Keep warm and at rest. In emergency situations, if breathing is difficult give oxygen. If the affected person suffers cardiac arrest commence cardio-pulmonary resuscitation immediately.

Seek urgent medical attention. Pulmonary effects can be delayed by some hours and careful observation is warranted for at least 6 to 8 hours. Persisting cough beyond 10 to 15 minutes, or the development of chest pain, tightness, or breathing difficulty, are an indicator of a serious inhalation, and require prompt medical assessment.

ADVICE TO DOCTOR.

If cryogenic "burns" are evident, treat for blistering of the dermal surface, or deep tissue freezing. Individual with pre-existing lung conditions may have increased susceptibility to asphyxiant narcotics exposure and pulmonary oedema. For ingestion victims perform endoscopy in all cases of suspected liquid CO_2, or cold CO_2 gas, ingestion. In case of severe oesophageal burns, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchanges, acid –base balance, electrolytes, and fluid intake are also required. Effects of exposure may be delayed.

Further information about the treatment for exposure to this product can be obtained from the Poisons Information Centre on (08) 13 1126 (Australia only)

Section 5 – Fire Fighting Measures

Product flammability

Carbon dioxide is not flammable and does not support combustion.

Suitable extinguishing media

All known extinguishers can be used. Carbon dioxide itself is suitable as a fire extinguisher in most fires.

Hazard from combustion products

Electrical discharges and very high temperatures may decompose carbon dioxide into toxic carbon monoxide and flammable oxygen.

Special protective precautions and equipment for fire fighters

Wear full protective clothing, including respiratory protection.

Carbon dioxide is not flammable; however, vessels containing carbon dioxide may rupture when heated. If safe to do so, move all carbon dioxide containers away from a fire. Cool containers with water from a protected location to avoid heat damage and excessive pressure rise. If unable to keep containers cool, evacuate area.

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Section 6 – Accidental Release Measures

Emergency procedures

The asphyxiant nature of carbon dioxide, require emergency and spill procedures to be effective to avoid both human and environmental exposure. Hazardous conditions may result if material is managed improperly. Make plans in advance to handle possible emergencies, including obtaining stocks of absorbent materials.

Always wear recommended personal protective equipment and respiratory protection. Good ventilation is necessary.

One volume of carbon dioxide liquid evaporates into approximately 845 volumes of carbon dioxide gas at 15 °C and 101.3 kPa. Carbon dioxide gas is heavier than air, and pockets of carbon dioxide are likely to be trapped in low points such as pits, trenches, excavations, drains and the like.

Avoid direct water contact with carbon dioxide leaks as icing may occur.

On contact with liquid carbon dioxide some materials become brittle and may break without warning.

Methods and Materials for containment and clean up

For ALL spills, evacuate unprotected personnel upwind and out of danger.

Shut off carbon dioxide supply, if safe to do so. If carbon dioxide container is leaking, and if possible, try to position it so that gaseous carbon dioxide rather than liquid carbon dioxide leaks out. Stay upwind of vapours. Restrict access to spill site.

Small Leaks

Gas: Increase ventilation and allow gas to vent to a safe area

Liquid: If possible contain the surface area of a spill by bunding with earth or vermiculite. Allow vaporisation to a safe area. Prevent run-off into drains and waterways.

Large Leaks

Gas: Use water fog to dampen a carbon dioxide cloud and reduce vapours. Do not spray water directly on the leak or carbon dioxide container.

Liquid: If possible contain the surface area of a spill by bunding with earth or vermiculite. Use protein foam blanket, at least 150 mm thick, to cover liquid carbon dioxide and thus prevent evaporation into large gas cloud. Use water fog to dampen a carbon dioxide cloud and reduce vapours.

Prevent run-off into drains and waterways.

Dispose of all contained spill residues in accordance with the requirements of the Department of Environment Protection.

For the management of carbon dioxide emergencies during transport by road or rail, SAA/SNZ HB76: Dangerous Goods-Initial Response Guide, Guide 09 should be consulted. This Guide should be carried at all times when carbon dioxide is being transported.

Clean up personnel will need personal protection equipment and respiratory protection. Portable safety shower and eyewash facilities may also be needed for clean up personnel.

Protein foam blanket may be required for large spills. Chemical absorbent and substantial amounts of water will also be required for large spills.

Section 7 – Handling and Storage

Precautions for safe handling

Regulated dangerous goods as Non-Flammable Non-Toxic Gas Class 2.2. Always work in a well ventilated area. Proper protective clothing must be worn that encapsulates the body including the face. A safety shower and eyewash should be available. Avoid breathing CO_2 gas and contact with skin, eyes and clothing.

Do not touch with bare skin any surface that has been iced by the storage of CO_2. If skin sticks to the surface of iced CO_2 storage and carrying equipment, thaw out with lukewarm water before removing – failure to do so will result in serious injury and frostbite.

Do not add water to CO_2 leaks as icing may occur which may cause valves or equipment to seize and fail. Do not touch damaged containers or spilled material unless wearing appropriate personal protective equipment.

Conditions for safe storage, including any incompatibilities

Store in accordance with Australian Standards AS 4332 *The storage and handling of gases in* cylinders, and AS 1894 *Code of practice for the safe handling of cryogenic fluids*.

Always store cylinders upright, in a cool, dry well ventilated area, protected from weather, sunlight and direct heat. Intense localised heat may cause CO_2 containers to explode. Periodically check CO_2storage containers for leaks, by applying a soapy water solution over pipework, flanges, valves, etc.

Store away from dusts of alkali metals, alkaline earths metals, magnesium (above 775 °C), chromium, zirconium, titanium (above 550 °C), uranium (above 750 °C), magnesium-aluminium alloys, acrylaldehyde, aziridine, metal acetylides and sodium peroxide – these react explosively and burn in CO_2 atmospheres.

Carbon dioxide dissolves in water to produce carbonic acid – which is corrosive to carbon steel.

Section 8 – Exposure Controls/Personal Protection

National exposure standards

ES-TWA		ES-STEL		ES-Peak	
5,000 ppm	9,000 mg/m^3	30,000 ppm	54,000 mg/m^3	No data available	No data available

Biological limit values

No data available

Engineering controls

Use in open, or well ventilated areas.
Use local and /or general exhaust ventilation to keep inhalation exposures below the exposure standard and as low as possible.

Personal protective equipment

Personal protective equipment (PPE) should be used where other control measures are not practicable or adequate to control exposure. It should be chosen to prevent routine exposure and to protect workers in the case of accidental splashes, spillage or release.

Eye/face protection: Wear chemical goggles and face shield to prevent eye and facial contact.

Skin protection: Wear PVC (or Viton) gauntlet to prevent skin contact. Wear PVC (or Viton) jacket and trousers to prevent contact. A complete encapsulating suit is recommended for heavy exposures.

Respiratory protection: When opening CO_2 container valves and connecting and disconnecting CO_2 lines wear self contained breathing apparatus (or ensure it is readily available for immediate use) with type ABEK1 cartridge, or air supplied full face mask complying with AS/NZ 1715 and AS/NZ 1716.

Thermal hazard: Wear thermal chemical resistant gloves if handling iced lines.

Section 9 – Physical and Chemical Properties

Appearance (colour, physical form, shape)
Colourless liquefied compressed gas.

Odour
Odourless with a faint acidic taste.

pH
No data available.

Vapour pressure
5,824 kPa at 21·1 ºC.

Vapour density
At 20·1 ºC and 5,824 kPa, Liquid density: 0·775 tonne/m^3; Gas density: 0·194 tonne/m^3

Boiling point/range
Boiling point: -56·6 ºC at 526·9 kPa

Freezing/melting point
Sublimes at: -78·5 ºC and 101·3 kPa.

Solubility
Solubility in water: 0·759 mL/100 mL water at 101·3 kPa and 0 ºC.

Specific gravity or density
Specific gravity gas: 1·53 at 101·3 kPa and 0 ºC (air = 1).

Flash point and method of detecting flash point
Not relevant.

Upper and lower flammable (explosive) limits in air
Not relevant.

Ignition temperature
Not relevant.

Viscosity
Dynamic viscosity gas: 0·015 mPa.s at 101·3 kPa and 26·85 ºC.

Section 10 – Stability and Reactivity

Chemical stability
Carbon dioxide stored in dedicated remains stable.

Conditions to avoid
None currently known.

Incompatible materials
Store away from dusts of alkali metals, alkaline earths metals, magnesium (above 775 °C), chromium, zirconium, titanium (above 550 °C), uranium (above 750 °C), magnesium-aluminium alloys, acrylaldehyde, aziridine, metal acetylides and sodium peroxide – these react explosively and burn in CO_2 atmospheres.

Hazardous decomposition products
Electrical discharges and very temperatures may decompose carbon dioxide into toxic carbon monoxide and flammable oxygen.

Hazardous reactions
No hazardous polymerisation will occur.

Section 11 – Toxicological Information

HEALTH EFFECTS

When handled in accordance with the guidelines in this material safety data sheet, CO_2 should not present any health affects. If this product is mishandled, symptoms that may arise are:

Acute:

Cryogenic, or frostbite "burns" may be experienced when if skin contacts liquid CO_2. Prolonged breathing of cold gas may damage lung tissue. A narcotic agent, CO_2 in concentrations of 1 to 2 % by volume (% $^v/_v$) in air may be dangerous after exposure for some hours, even if there is no lack of oxygen. It initially stimulates respiration and then causes respiratory depression. Symptoms are:

CO_2 Level in % $^v/_v$	Resulting Conditions on Humans
1	Breathing rate increases slightly.
2	Breathing rate increases to 50% above normal level. Prolonged exposure can cause headache and tiredness.
3	Breathing increases to twice normal rate and becomes laboured, Weak narcotic effect. Impaired hearing, headache, increased blood pressure and pulse rate.
4 - 5	Breathing increases to approximately four times normal rate, symptoms of intoxication become evident, and slight choking may be felt.
5 - 10	Characteristic sharp odour noticeable. Very laboured breathing headache, visual impairment and ringing in ears. Judgement may be impaired, followed within minutes by loss of consciousness.
10 - 100	Unconsciousness occurs more rapidly above 10% concentration in air. Prolonged exposure to high concentrations may eventually result in death from asphyxiation.

Inhalation:

Inhalation of liquid CO_2 or cold CO_2 gas will result in freezing injury similar to burns, leading to irritation to the nose and upper respiratory tract. Lesions of the nasal septum, pulmonary oedema and pneumonitis may result. Symptoms include coughing, sore throat and shortness of breath. Damage may appear days after exposure. Severe scarring of tissue and death may result due to inhalation of liquid CO_2.

CO_2 gas is a narcotic and asphyxiant in large concentrations. It is the most powerful cerebral vasodilator known**.** Prolonged breathing of cold gas may damage lung tissue.

At concentration of 3 to 5 % in air, CO_2 causes headaches and dizziness; at concentrations of 8 to 105 % in air, CO_2 causes headaches, dizziness, shortage of breath, nausea, vomiting, muscular weakness and ringing in the ears – can lead to drowsiness, unconsciousness and death.

Higher concentrations in air may lead to coma and death very quickly. LCL_0 (Inhalation, human) = 9 parts per hundred (pph) at 5 minutes.

Skin:

Liquid CO_2 will cause severe burns and necrosis. Cold CO_2 gas will cause freezing injury similar to burns leading to irritation, redness, itching and blistering.

Eye:

Liquid CO_2 will cause severe irritation, and may cause permanent eye damage. Cold CO_2 gas will cause burns and severe irritation, leading to redness and pain following contact. Permanent eye damage may result. CO_2 gas and moisture in the air can lead to the formation of carbonic acid, which may cause irritation to the eyes.

Swallowed:

Liquid CO_2 may cause freezing injury similar to burns to the mouth, oesophagus and stomach accompanied by severe burning sensation. Severe burning of tissue and death may result. Symptoms include bleeding, vomiting, abdominal pain, diarrhoea and fall in blood pressure. Cold CO_2 gas will cause severe irritation and burns to gastrointestinal tract. Damage may appear days after exposure.

Chronic:

Long term exposure to level of carbon dioxide in between 0·5 and 1% $^v/_v$ in air may lead to extra calcium deposition in body tissues including kidneys, and acidosis. Prolonged exposure to an oxygen deficient atmosphere (below 18 % oxygen) may affect the nervous system.

Section 12 – Ecological Information

Ecotoxicity

When discharged in large quantities may contribute to the greenhouse effect. Can cause frost damage to vegetation. Not listed as a marine pollutant.

Global warming factor:1.

Persistence and degradability

None currently known.

Mobility

None currently known.

Environmental fate (exposure)

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

Exposure of female rats to 60,000 ppm CO_2 for 24 hours has produced toxic effects to the embryo and foetus in pregnant female rats. Toxic effects to the reproductive system have been observed in other mammalian species at similar concentrations.

Fish toxicity: 48 days mortality (Brown trout – Salmo trutta): 150,000 ug/L.

Bioaccumulative potential

None currently known.

Section 13 – Disposal Considerations

Disposal methods and containers

Do not discharge into any place where accumulation could be dangerous. Discharge in large quantities should be avoided. Dispose of in accordance with Department of Environmental Protection requirements. Shut all valves in empty containers. As required under the ADG Code treat empty containers as filled containers.

Special precautions for landfill or incineration

No data available.

Section 14 – Transport Information

UN Number

1013

UN Proper shipping name

Carbon Dioxide

Class and subsidiary risk

Class 2.2 Non-flammable Non-toxic Gas; No Subsidiary Risk.

Packing group

None Allocated

Special precautions for user

Not to be loaded with explosives (Class 1), flammable liquids (Class 3), spontaneously combustible substances (Class 4.2), dangerous when wet substances (Class 4.3), oxidizing agents (Class 5.1), organic peroxides (Class 5.2), radioactive substances (class 7) and food and food packaging in any quantity.

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Section 15 – Regulatory Information

Australian regulatory information

Not scheduled poison.

Listed on the Australian Inventory of Chemical Substances (AICS).

Additional national and/or international regulatory information

EC Classification:

Section 16 – Other Information

Key / legend to abbreviations and acronyms used in the SDS

NOHSC	National Occupational Health and Safety Commission
SUSDP	Standard for the Uniform Scheduling of Drugs and Poisons
ES-TWA	Exposure Standard – Time weighted average
ES-STEL	Exposure Standard – Short term exposure level
ES-Peak	Exposure Standard – Peak level
FORS	Federal Office of Road and Safety
LC_{50}	Lethal concentration 50, median lethal concentration
LCL_0	Lethal concentration low. The lowest concentration of a substance in air reported to have caused death in humans or animals. The reported concentrations may be entered for periods of exposure that are less than 24 hr (acute) or greater than 24 hr (subacute and chronic)
LD_{50}	Lethal dose 50. The single dose of a substance that causes the death of 50% of an animal population from exposure to the substance by any route other than inhalation
$\%(^{wt}/_{wt})$	Percent amount on a weight per weight basis
$\%(^{wt}/_{vol})$	Percent amount on a weight per volume basis
PPM	Parts per million
Zone 1 Class 1	An area in which an explosive gas atmosphere can be expected to occur periodically or occasionally during normal operation. (More than 10 hours per year but less than 1000 hours per year)

Literature references

Occupational Safety and Health Regulations 1996, State Law Publisher, Western Australia,

Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals, Safe Work Australia, December 2011.

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Chemical Rubber Handbook, D.R. Lide, CRC Press, 65th Edition, Boca Ratón, 1987.

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Poisons Act 1964, State Law Publisher, Western Australia, Reprinted 22 January 1999.

Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environmant, [NHSC:1003(1991)].

Hazardous Materials Handbook for Emergency Responders, Onguard Training for Life, J. Varela (Editor), Van Nostrand Reinhold, New York, 1996.

Chemwatch www.chemwatch.net

Guidance for the Compilation of Safety Data Sheets for Fertilizer Materials, European Fertilizer Manufacturers Association, online at www.efma.org/Publications/Guidance/Index.asp

Sources for data

No data available.

Important Notes

1. To the best of our knowledge this document complies with the Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals, Safe Work Australia.
2. This safety data sheet summarises our best knowledge of the health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this material safety data sheet and consider the information in the context of how the product will be handled and used in the workplace, including in conjunction with other products.
3. If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact the Safety Department, CSBP Limited on (08) 9411 8777 (Australia), +61 8 9411 8777 (Overseas).
4. Our responsibility for products sold, is subject to our terms and conditions, a copy of which is sent to our customers, and is also available on request.
5. CSBP reserves the right to make change to safety data sheets without notice.