Chemical Data Sheet

Identification	
Product Name: Carbon Dioxide **Synonyms:**	**Use:** a) Fire Extinguishing Gas b) Propellant Gas In Fire Extinguishers

Basic Ingredients		
Material: Carbon Dioxide (Co2) UN 1013	**Cas No:** 124/38/9	**HS Commodity Code CCCN (BTN)**

Physical & Chemical Characteristics

Carbon dioxide can exist in three states; as a gas, a liquid or a solid.

In a pressure container (i.e. A fire extinguisher), carbon dioxide is a liquid in equilibrium with gas occupying the space above it.

With a filling ratio of 0.667 & at a temperature of 20°C:
Liquid /gas density is 769 kg/m3 (approx) & vapour pressure is 55 bar (approx).

When the gas is released to atmosphere, it appears as a dense white cloud, due to the solid content & condensation of moisture. On vaporising, it emerges as a colourless or faint white mist with a pungent odour at high concentrations. The gas is heavier than air with a specific gravity of 1.53 at 21°C (Air=1.0). It will remain spread along the ground & disperse, or find its way into low enclosed spaces, where it will remain until ventilated.

Carbon dioxide will not support combustion & is supplied as a liquid in cylinders for use in fire fighting.

Physical Hazards

For most applications, carbon dioxide can be considered as unreactive & the chemical properties are therefor unimportant for normal storage, handling & usage considerations. The gas often employed to provide a chemically inert blanket for reaction purposes.

Under certain conditions of temperature & pressure, carbon dioxide will however react with certain other substances which are themselves highly reactive, e.g. magnesium, sodium, etc. If therefor any new use is contemplated where the chemical reactivity of other substances with carbon dioxide is unknown or uncertain, then the proposed application should first be referred to the supplier for advise.

Health Effects & First Aid

Short Term Effects of Over Exposure

Inhalation: Carbon dioxide is normally present in atmospheric air at the level of approx 300 ppm. (0.03%)

The Health & Safety Executive guidance note EH40/89-Occupational Exposure Limits 1989 (annual) indicates that the recommended exposure limit for carbon dioxide is 5000 ppm (0.5%) by volume calculated as an 8 hour time weighted average concentration in air. A short term exposure limit of 15000 ppm (1.5%) by volume calculated as a 10 minute time weighted average concentration is also mentioned.

As the carbon dioxide concentration in the atmosphere increases beyond the level of 500 ppm, air is displaced & there will

therefor be a corresponding reduction of the oxygen content in the atmosphere. Inhalation has the effect of simulating respiration & may also produce mild narcotic effects. Breathing becomes more laboured as the level is further increased. At high concentrations, carbon dioxide is considered to be toxic & can paralyse the respiratory system.

The potential hazard of asphyxiation should therefor be explained to personnel handling carbon dioxide & they should be trained accordingly. This hazard should also be taken into account where there is a possibility of high concentrations accumulating in enclosed spaces.

Individual tolerances can vary widely, dependant on the physical conditions of the person & the temperature & humidity of the atmosphere, but as a general guide, the effects of inhaling varying concentrations of carbon dioxide are likely to be as follows:

1%.
Slight & unnoticeable increase in breathing rate. No other significant effects.

2%.
Breathing becomes deeper & the rate will increase to about 50% above the normal level. Prolonged exposure for several hours may cause a headache & feeling of exhaustion.

3%.
Breathing will start to feel laboured & increase to approximately twice the normal rate. The gas will be weakly narcotic at this level, giving rise to reduced hearing ability, coupled with a headache & an increase in blood pressure & pulse rate.

4-5%.
Breathing will become laboured & increase to approximately four times the normal rate. In addition to the symptoms produced by lower concentrations, signs of intoxication will become evident after approximately 30 minutes exposure & a slight choking feeling will be experienced.

5-10%.
At these concentrations, carbon dioxide will have a characteristic sharp & rather stimulating smell, similar to the 'gassing' from freshly poured carbonated mineral water.

Breathing will become very laboured, leading to physical exhaustion. This will be accompanied by a headache, visual disturbance & ringing in the ears. Judgement may be impaired & the confusion will probably be followed within minutes by loss of consciousness.

10-100%.
As the carbon dioxide concentration increases above the level of 10%, unconsciousness will occur more rapidly & unless prompt action is taken, further prolonged exposure to high concentrations may then eventually result in death from asphyxiation.

At 100% concentration, death will occur very rapidly.

However, since the gas in heavier than air, it will in practice accumulate in higher concentrations at the lower levels. It is therefor possible for relatively 'safe' & 'unsafe' concentrations to be present as the same time in the space concerned. In the event of accident or loss of consciousness an unaccompanied person could fall to the floor level & be exposed to high concentrations for an extended period before rescue. It is therefor advisable that a second person is present when an enclosed space is entered under such circumstances.

Skin. Direct contact with solid Co2 or a surface that has been cooled to a low temperature may result in severe frost burns.

First Aid

Inhalation.

No special antidote is necessary for carbon dioxide & the object of treatment, bearing in mind the physiological properties, is to restore breathing & return blood oxygen levels to normal by administering oxygen where necessary.

First aid treatment, following inhalation of the gas, should therefor be first to remove the patient from the atmosphere to fresh air & then as follows:

Choking Feeling.

Rapid recovery should occur in fresh air & no administration of oxygen or other attention is likely to be necessary.

Laboured Feeling, Confusion, Exhaustion or Unconsciousness.

Keep the patient warm with blankets. Give pure oxygen under the control of a qualified person. When normal breathing has been restored, seek medical attention. Further treatment is unlikely to be necessary.

Breathing Stopped.

Keep the patient warm with blankets. Apply artificial respiration, preferably with an oxygen pressure respirator, under the control of a qualified person.

Seek medical attention as quickly as possible & keep administering the oxygen to the patient until attention is available.

Frost Burn.

Direct contact with a service that has been cooled to a low temperature by liquefied or, in particular, solid Co2 may result in sections of the skin affected becoming 'stuck' to the surface. The application of warm water, or any other harmless, arm fluid available at the time will assist in removing the effected areas of the body without further skin damage.

Remove or loosen any clothing necessary to maintain good blood circulation in the areas effected.

Maintain the body at normal temperature. Thaw the areas effected by placing them against any other warm part of the body or exposing them to some other moderate source of heat. Do not expose to a naked flame or warm too rapidly.

Avoid rubbing the areas of skin effected & protect, if possible with a clean, dry dressing.

Seek medical attention as quickly as possible.

It is then essential that a clear indication of the possible severe nature of the exposure to very low temperature is given to the medical practitioner to ensure correct treatment. Internal burns & blood vessel damage can result from severe exposure to 'frosting' with possibly little external sign of injury in evidence at the time to assist in diagnosis.

Control Measures & Protective Equipment

Respiratory Protection.
Not normally required. Air supplied respirators should be used when entering areas with potentially high concentrations.

Warning.
Absorptive canister respirators are totally unsuitable & must never be used for this purpose.

Ventilation.
All areas where carbon dioxide is stored or handled should be adequately ventilated.

Skin Protection.
Hand protection should be worn when discharging or handling Co2 equipment where there is a risk of leakage.

Eye Protection.
Suitable eye protection should be worn if there is a risk of leakage from equipment or containers.

Storage.
Containers should be stored in cool, dry & well ventilated areas.

Special Precautions & Spill/Leak Procedures.

No fire risk will arise with carbon dioxide which is supplied as liquid in fire fighting installations.

In the event of a fire in an area adjacent to a carbon dioxide storage compound or usage point, a rise in the outside temperature will rapidly be transmitted to the contents of the cylinders & the internal pressure will increase. If pressures reach the design pressure of the safety discs, these will rupture & discharge the contents to atmosphere.

If possible, cylinders should be moved immediately away from the area to a safe cool place. However, since the product is non-flammable, & in view of the safeguard afforded by the cylinder bursting discs, no serious risks should be taken by personnel in attempting removal.

Fire fighting efforts should otherwise be concentrated on isolating cylinders from heat & flames as far as possible & spraying them with water to keep the contents cool.

If any cylinder is involved in a fire, it must be set aside, clearly marked & the supplier must then be contacted immediately. If the metal of the cylinder has been subject to high temperature, some change in the metal structure may occur, rendering the cylinder unfit & dangerous for further use as a pressure container.

Leakage.

Leakage of carbon dioxide can rise from a single cylinder or from an installation where a number of cylinders are interconnected. The maximum concentration of carbon dioxide which could accumulate in such an emergency should be considered by taking into account the cylinder storage & usage arrangements in relation to the working areas concerned.

If it is evident that high levels of carbon dioxide could arise from a serious leakage, then a clear plan must be made in anticipation of any emergency. In principle, this must be similar to a fire precaution plan, dealing a positive warning system, an evacuation procedure for the working areas likely to be effected & an arrangement for an immediate roll call of the personnel concerned. In the event of such a leakage, the evacuation procedure must be put in immediate operation, with priority attention to any cellars, basements or other working areas below ground level likely to be effected. Evacuated personnel must be assembled upwind of & well away from the point of leakage.

Reference

1. Distillers MG Limited – Safety data book, carbon dioxide cylinders.
2. HSE Guidance Note E.H. 40/89 Occupational Exposure Limits 1989