

Vapour

Some comments about the handling and use of dry ice, to be used by the consumer with our material hazard data sheet in the preparation of a COSHH assessment.

Properties and Hazards

- Solid form of CO₂ – very cold (-78° C), can cause cryogenic burns.
- Normally supplied as pellets, flakes or blocks.
- Sublimes (changes state from solid to gas–the product will not melt to a liquid)

Foreseeable Risks

- Burns due to skin contact.
- Sublimation resulting in accumulation of gas in poorly ventilated areas.
- Explosion due to pressure build up if kept in sealed containers.
- Manual handling of large bags of dry ice (10kg is the standard package weight).

Assessment of Potential for Gas Release

It is difficult to evaluate the rate at which the solid form will convert to the gaseous form since this will be dependent on a number of variables:

- The form of the dry ice – pellets or flakes, for instance, will sublime at a faster rate than blocks.
- The ambient temperature – sublimation will proceed faster at higher temperatures.
- The degree of insulation provided by the container. However, the data below can be used to make some approximate estimates as to what concentration of gas will be generated in particular circumstances.
- 1kg of dry ice will produce 0.45 m³ of gas (figure supplied by Gas Safety UK Ltd.).
- Dry ice to CO₂ sublimation rate = approx. 1% of total mass per hour in an insulated container (figure supplied by Gas Safety UK Ltd. - source: FAA).
- Dry ice to CO₂ sublimation rate = approx. 14% of total mass per hour at room temperature in the open (figure supplied by Gas Safety UK Ltd. - source: a study published in Aviation, Space and Environmental Medicine 1977).

Calculating CO₂ in Car Atmosphere

A number of specimens packed in dry ice are being transported by car from one location to another. The container is well insulated and is positioned on the back seat of the car - the cars windows are closed. The journey takes 1 hour. Assuming the interior volume of the car is 2.8 m³

Quantity of Dry Ice (Kg)	Volume of Gas Produced in Journey (m ³)	Concentration of CO ₂ in Car Atmosphere (m ³)
5	0.02	0.8

The concentration of CO₂ in the car reaches 0.8% - between the short term and long term exposure limits and within a range where it will not cause any adverse effects.

The concentration would be increased by any combination of the following:

- Increasing the quantity of dry ice used.
- Using a poorly insulated or open container.
- Using a smaller car.
- Lengthening the journey time.

It can therefore be seen that providing all the factors are taken into account, a reasonable quantitative assessment of risk can be carried out.

Control Measures

- Do not handle with bare hands – use cryogenic gloves.
- Avoid carrying dry ice in the cab of a truck or the passenger compartment of a car. If this is not possible, use as little dry ice as possible, ensure that the container is well insulated (though not tightly sealed) and ensure that the compartment is well ventilated (open windows, ensure ventilation system is set to draw fresh air from outside).
- Unload the material as soon as possible at the end of a journey.
- Store dry ice in well-ventilated areas away from direct sunlight and sources of heat.
- Use suitable storage containers (there are commercially available insulated containers with vented seals specifically designed for storing dry ice).
- Secure to prevent any unauthorised access.
- Use appropriate warning signage where necessary.
- When opening lids to storage containers, allow a few seconds for gas to dissipate and do not lean in for longer than necessary.
- Do not store or use dry ice in any gas tight container.
- Do not store dry ice in a working refrigerator or freezer – it will sublime at a faster rate than in an insulated storage container and the extremely cold temperature may cause the thermostat to cut out.
- Do not play games with dry ice.
- Dispose of unwanted dry ice by allowing it to evaporate in a well-ventilated area – it will sublime leaving no residue.
- Carry out manual handling assessment of bags if necessary.
- Ensure that all users of dry ice are familiar with the hazards and take necessary precautions.
- Always ensure that a responsible adult is present – never allow children to play with dry ice.