IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 4, April 2015.
www.ijiset.com
ISSN 2348 – 7968

Dry Ice Use And Hazards

Mohammad Jameel Hasan* and DR. Nehal A.Siddique**

*Health, safety and environment, college of Engineering, university of petroleum and energy studies, Dehradun, India.

** Department of Health, safety and environment, college of Engineering, university of petroleum and energy studies, Dehradun, India.

ABSTRACT

Normal carbon di-oxide gas is considered as a non-poisonous gas and available 0.03% in atmosphere but dry ice (solid CO2) is very low at -78.5 C and may cause frostbite if touched without protection. It is used in industry for dry cleaning and in food industry used as protective bacteriostatic . Carbon dioxide at low concentration have no health impact but at high concentration its effects are toxic and damaging health and during transportation of dry ice many case of Asphyxiation happen and resultant in fatality.

Introduction

Dry ice is CO_2 in its solid form, produced by expanding liquid CO_2 to atmospheric pressure. The product can be supplied as either blocks, slices or pellets and is generally packed into plastic, Paper or composite bags that are stored and transported in insulated containers. Some products (Particularly pellets) can also be supplied "loose" in containers, with no wrapping. Dry ice is used in practically all types of industries, mainly because of its cooling properties. It is particularly interesting for applications where "spot cooling" is needed.

Safety Information
Non Toxic, Non Flammable.
Extremely cold, -78.5°C.
Contact can cause severe frostbite.
Carbon dioxide gas can cause asphyxiation.
Carbon dioxide is heavier than air.

The most common uses

1. Cooling
    a. Cooling of catering trolleys in airplanes, trains.
    b. Cooling of food, pharmaceutical products, etc. during transport without direct contact
2. Between product and dry ice (to maintain the “cold chain”)
    a. Cooling of food with direct contact between dry ice and the product (meat, grapes)
    b. Direct application in food mixing processes in order to maintain the temperature
    c. Cooling metal
3. Blast cleaning with dry ice
4. Bacteriostatic use
    a. Modified atmosphere packaging in food to produce a protective, bacteriostatic

ISSN 2348 – 7968

Properties

Solid state (Dry ice)

The expansion of liquid CO_2 to atmospheric pressure is used to produce CO2 snow at a temperature of -78.5°C. The snow is compressed to form dry ice blocks, slices or pellets.

Hazards
1-Asphyxiation

ISSN 2348 – 7968

Carbon Dioxide is classified as a non-flammable, non-toxic liquefied gas. It is normally present in atmospheric air at a level of approximately 380 parts per million (0,038 %). It is a normal product of metabolism being held in bodily fluids and tissues where it forms part of the bodies normal chemical environment. In the body it acts in the linking of respiration, circulation and vascular response to the demands of metabolism both at rest and in exercise.

The effects of inhaling low concentrations of carbon dioxide are physiological reversible but in high concentrations the effects are toxic and damaging.
The effects of carbon dioxide are entirely independent of the effects of oxygen deficiency.
The oxygen content in the atmosphere is therefore not an effective indication of the danger. It is possible to have an acceptable low oxygen content of 18% and a high carbon dioxide content, 14 % being very dangerous.
Individual tolerances can vary widely, dependent on the physical condition of the person and the temperature and humidity of the atmosphere, but as a general guide, the effects of inhaling varying concentrations of carbon dioxide are likely to be as follows:
Concentrations by volume - likely effects:
1-1.5% Slight effect on chemical metabolism after exposure of several hours. 3% the gas is weakly narcotic at this level, giving rise to deeper breathing, reduced hearing ability, coupled with headache, an increase in blood pressure and pulse rate.4-5% Stimulation of the respiratory center occurs resulting in deeper and more rapid breathing. Signs of intoxication will become evident after 30 minutes exposure.
5-10% Breathing becomes more laborious with headache and loss of judgement.10-100% When the carbon dioxide concentration increases above 10% unconsciousness will occur in under one minute and, unless prompt action is taken, further exposure to these high levels will eventually result in death.
The recommended operational exposure limit for carbon dioxide is 5.000 parts per million (0.5%) by volume, calculated on an 8 hour time weighted average concentration in air.
Depending on regulations in individual countries, carbon dioxide concentration peaks up to 30000 parts per million (3%) in air are allowed, whereby the duration of exposure is between 10 minutes and 1 hour.Cardiac or respiratory defects are likely to increase the hazards of inhalation.

2-Low temperature of product: Extreme cold
Dry ice is extremely cold (-78.5°C) and may cause frostbite if touched without protection. If dry ice particles come into contact with the eyes, severe eye injury may result. Touching pipes and installations containing liquid carbon dioxide may cause frostbite. Where there has been a major release of gas, visibility is likely to be limited due to the fog formed by the condensation of water vapor in the air and there is a risk of asphyxiation. These factors can make escape or rescue difficult.

Safety:

CO_2 monitoring system
There must be a system in place to ensure that OEL levels are correctly monitored. The work area shall be equipped with continuous CO_2 monitoring and, if necessary, the staff shall carry a personal

ISSN 2348 – 7968

monitoring device.

Wrapping and packaging

Wrapping, packaging and labels must be suitable for use at low temperature (down to -78.5ºC). The Packaging shall be designed to prevent pressure buildup due to sublimation.It is advisable to print safety instructions on the packaging material.

Transport

Special attention shall be paid to the securing of the cargo. Dry ice is not subject to ADR/RID(agreement concerning the International Carriage of Dangerous Goods by Road/ Regulation concerning the International Carriage of Dangerous Goods by Rail) regulations but can constitute an asphyxiation hazard when transported in closed vehicles. Therefore it is advised to ensure that the vehicles are well ventilated, or to use gas detection systems during transport.

Personnel safety

Extremely cold, -78.5°CContact can cause severe frostbite

Dry ice is extremely cold (-78.5°C) and may cause frostbite if touched with bare hands. There are other risks present: mechanical (wrapping, container handling), chemical (cleaning agents).
All hand protection is made for specific purposes and should be selected on risk basis and should conform to the requirements of a recognized standard such.
If dry ice particles come into contact with the eyes, severe eye injury may result. High pressure hydraulic and liquid CO_2 system also present a risk to workers. All eye protection should conform to the requirements of a recognized standard. Regular glasses must never be considered as eye protection.
Due to the risk involved in the handling of blocks and containers, and the movement of fork lift Trucks.Protective footwear is necessary. All safety shoes should conform to the requirements of a recognized standard.

ISSN 2348 – 7968

The Choice of the hearing protection (e.g. ear defenders, helmet-mounted ear defenders, earplugs etc.) should be determined by taking into consideration both separately and in combination:
Frequency of useNoise level,Duration of exposure,Ambient noise level. Noise frequency
For safety and hygiene reasons the wearing of protective clothing is advisable. Cotton is recommended.

1. Overalls should be food type with no external pockets
2. Restrictions on the wearing of jeweler.
3. The condition and length of hair and nails.

Conclusion

Carbon Dioxide is classified as a non-flammable, non-toxic gas. It is normally present in Atmospheric air at a level of approximately 380 parts per million (0,038 %) which is a part of breathing air but high concentration mixture is **Asphyxiation** so it is dangerous in case of high concentration.

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