

# Cold Chain Management with Dry Ice

May 2012



## Cold Chain Management with Dry Ice

### ■ What is Dry ice

- Dry ice is the solid form of carbon dioxide. It is used primarily as a cooling agent. Its advantages include lower temperature ( $-78.5\text{ }^{\circ}\text{C}$ ) than that of water ice and not leaving any residue. It is useful for preserving frozen foods, ice cream, etc., where mechanical cooling is unavailable.

### ■ Advantages:

1. Natural cooling agent
2. Is cryogenic ( $-78.5\text{ }^{\circ}\text{C}$ )
3. Is bacteriostatic and suppresses the atmospheric oxygen
4. Has a high refrigerating capacity
5. Is antibacterial, tasteless and odorless



## Cold Chain Management with Dry Ice

### ■ Types of Dry ice

- Dry ice is solid CO<sub>2</sub> with a low temperature of -78° C. At atmospheric pressure, solid CO<sub>2</sub> sublimates directly to vapor without a liquid phase. This unique property means that the dry ice simply "disappears" when it heats up, leaving no residue or waste to be cleaned.
- The dry ice is available in the following formats:
  1. 3mm
  2. 16mm
  3. Blocks



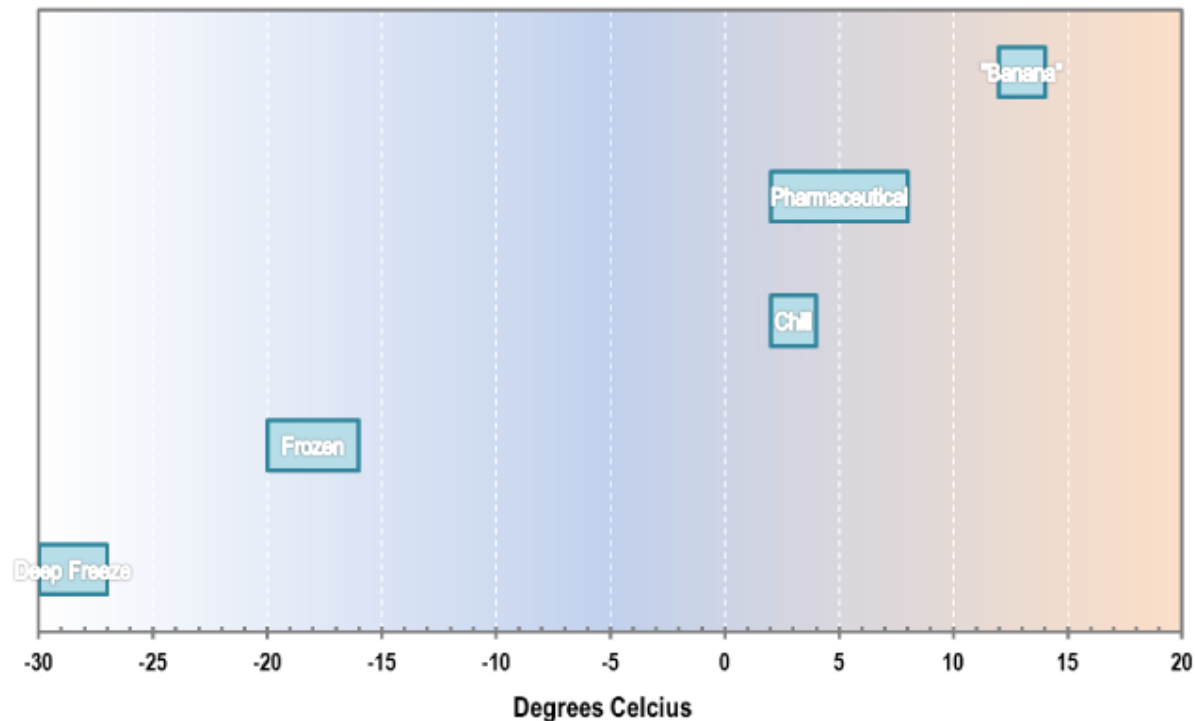
## Cold Chain Management with Dry Ice

### ❑ Cold Chain Management

- ❑ The cold chain refers to the transportation of temperature sensitive products along a supply chain through thermal and refrigerated packaging methods and the logistical planning to protect the integrity of these shipments.
- ❑ Temperature control in the shipment of foodstuffs is a component of the industry that has continued to rise in necessity with international & local trade.
- ❑ The success of industries that rely on the cold chain comes down to knowing how to ship a product with temperature control adapted to the shipping circumstances. Different products require different temperature level maintenance to ensure their integrity throughout the travel process.

## Cold Chain Management with Dry Ice

- Temperature Standards for Cold Chain Management
  - Depending on the type of product being transported through the cold chain, specific temperature standards are enforced.



## Cold Chain Management with Dry Ice

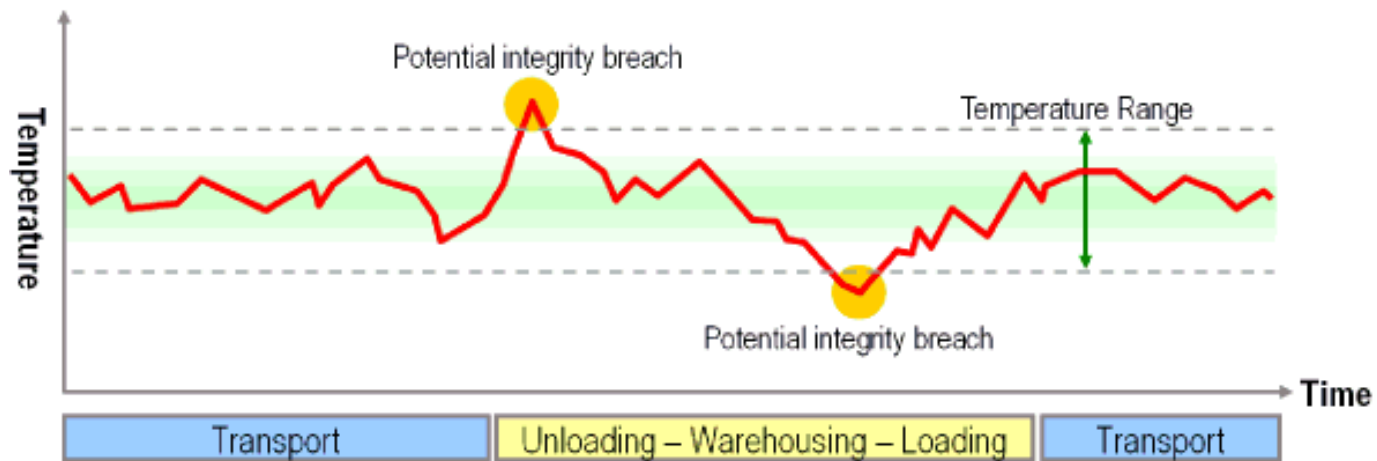
- Temperature Standards for Cold Chain Management
  - Five temperature standards are among the most prevalent:
    1. **Deep freeze** (-28 to -30 Celsius). The coldest temperature range that can be maintained by conventional refrigerated units such as reefer. Mostly for transporting seafood.
    2. **Frozen** (-16 to -20 Celsius). Mostly for transporting meat.
    3. **Chill** (2 to 4 Celsius). Refers to the standard temperature in a refrigerator and is commonly used to transport fruit and vegetables as it confers optimal shelf life.
    4. **Pharmaceutical** (2 to 8 Celsius). Relates to the temperature range most pharmaceutical goods, like vaccines, are transported.
    5. **Banana** (12 to 14 Celsius). Relates to the temperature range that one of the world's most produced fruit is shipped to control its ripening.

## Cold Chain Management with Dry Ice

- Transportation & Warehousing Issues
  - During transport, a malfunction (or an involuntary interruption of power) of the refrigeration equipment can in a couple of hours compromise the cold chain.
  - Furthermore due to wear and tear or defective equipment, may offer an improper cold storage environment, namely poor air circulation and defective insulation at seals (such as doors). Drivers may also voluntarily shut down the refrigeration unit to save on fuel costs, leave doors open for too long during deliveries

## Cold Chain Management with Dry Ice

### □ Transportation & Warehousing Issues



- During the loading, unloading or warehousing of a product, there are many potential situations where a cold chain can be compromised. For instance, a product can be left on the loading dock for an extended period until its is loaded on the local refrigerator.



## Cold Chain Management with Dry Ice

- Cold Chain Management with Dry Ice
  - Dry Ice can be used for the transportation of all products that need to have their temperature controlled, using dry transportation.
  - With the use of dry ice all five temperature standards (deep freeze, frozen, chill, pharmaceutical & banana) can be met for products transportation.



## Cold Chain Management with Dry Ice

- ❑ Cold Chain Management with Dry Ice
  - ❑ Vital component on the Cold Chain management with Dry Ice is the packaging. There are two types of containers from different materials with different levels of thermal losses.
  - ❑ Cryoboxes, available from 50-500lt



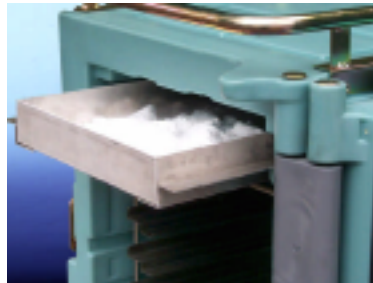
## Cold Chain Management with Dry Ice

- ❑ Cold Chain Management with Dry Ice
  - ❑ Polystyrene boxes, available from 10-50lt



## Cold Chain Management with Dry Ice

- Cold Chain Management with Dry Ice
  - The handling of the products with the packaging is very simple. As soon as the container is filled with the product, dry ice is added on the dry ice drawer



## Cold Chain Management with Dry Ice

- Cold Chain Management with Dry Ice
  - The amount of dry ice needed per container is easily calculated from a software. The parameters that one needs to know are:
    1. Internal volume of the container & wall thickness
    2. Ambient temperature
    3. Set temperature that the products need to maintain
    4. Duration that the products need to maintain the set temperature
    5. Factor of safety

## Cold Chain Management with Dry Ice

### ■ Cold Chain Management with Dry Ice

- The advantages of the use of Dry Ice in the Cold Chain Management are:
  1. Absolute control over the product temperature
  2. No need of mechanical refrigeration
  3. Cost of dry shipping less than the refrigerated shipping
  4. Products have a time buffer from the time they get unloaded to the point that they will be stored again.
  5. No temperature breach so no wasted products
  6. Products with different temperatures can be shipped together in the truck
  7. Dry Ice can last up to 7 days in a cryobox