
Storage of dry ice

1. Purpose

- 1.1. This Safety Alert is issued by the Bahamas Maritime Authority (BMA) to share lessons to be learned on the safe handling and storage of dry ice. It is based on the findings of a preliminary investigation into the death of a service technician.

2. Introduction

- 2.1. A Bahamas flagged drill ship was in an extended maintenance period. Scheduled work included disassembly of a component of the ship's drilling equipment. To complete the work, a subcontractor needed 300kg of dry ice which was supplied in 20 unmarked insulated boxes. The boxes were received onboard three days before work was started and stored in a cold room.
- 2.2. On the evening before the work was to be carried out, a service technician was found, sat down and apparently frozen, in the cold room. There were no signs of disturbance or injury. The emergency door release and entrapment alarm were confirmed to be working and had not been activated. The cold room's lighting was permanently on and functioning.
- 2.3. Other members of the crew had been in the cold room about an hour earlier. Neither they, nor the responders, reported any symptoms or ill health. The ship's doctor's initial diagnosis was that the death was due to natural causes. Results of the post-mortem are outstanding.

3. Safety Factors

- 3.1. Dry ice is the common term for solid carbon dioxide (CO₂). CO₂ solidifies at approximately -78°C. At temperatures warmer than -78°C it turns directly from a solid into a gas (a process known as sublimation). Dry ice must be packaged in non-airtight containers to avoid pressure build up as carbon dioxide gas is produced. Carbon dioxide gas is heavier than air.
- 3.2. Carbon dioxide rich environments do not support human life. Concentrations above 0.5% are dangerous and above 4% can prove fatal. CO₂ is odourless and does not cause irritation, resulting in poor warning properties.
- 3.3. A small amount of dry ice produces a large volume of gas, at an approximate ratio of 1:850. 300kg of dry ice could produce approximately 162m³ of carbon dioxide gas if

allowed to sublime at atmospheric pressure. Due to the sublimation process it is imperative that dry ice is stored in a well ventilated area.

- 3.4. A study conducted by the US Federal Aviation Administration¹ to assess the dangers of carrying dry ice in aircraft identified that dry ice sublimates at a rate of 1% per hour. This rate will vary depending on the packaging, dry ice particle size, surrounding temperature, and atmospheric pressure.
- 3.5. The dry ice was procured without an assessment of the risk it could pose or an appropriate plan for its storage. The insulated boxes were not marked to highlight the danger they posed or the need to be stored in a well ventilated area.



Four of the 20 boxes of dry ice, as found in cold room

4. Lessons to be learned

- 4.1 Dry ice can produce a dangerous quantity of carbon dioxide gas in a relatively short time. It therefore needs to be stored in a well ventilated area.
- 4.2 The hazards associated with the dry ice need to be adequately communicated by the material safety data sheet and the product's packaging. If people are not aware of a hazard, they can't control the risk.
- 4.3 The dry ice could change what was normally a safe space into a highly dangerous enclosed space. The hazard of asphyxiation was unknown to those entering the freezer and so no control measures were in place to protect the people exposed to it.

¹ https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-76A.pdf

5. Further reading

5.1. The use of dry ice is not widespread in the shipping industry but the BMA is aware of three reported incidents when dry ice has been unknowingly loaded into a ship's refrigerated space along with ship's stores, creating a dangerous atmosphere.

- CHIRP report 2024: <https://chirp.co.uk/report/m2205/>
- CHIRP report 2019: <https://chirp.co.uk/report/risk-from-dry-ice/>
- IMCA Safety Alert 2003: www.imca-int.com/resources/safety/safety-flashes/0803-exposure-to-co2-release-from-dry-ice-storage/

6. Validity

6.1. This Safety Alert is valid until further notice.