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Chapter 31 – Calcium Hypochlorite

Calcium hypochlorite is a white or yellowish solid, usually found in powder, tablet or granular form. It is soluble in water and has strong decomposing and self-reacting characteristics.

It is mainly used for the disinfection of drinking water and swimming pool water, but can also be used as a bleaching agent for items such as cotton and linen, as well as in household cleaners and weedkillers.

In 2018 'Guidelines for the Carriage of Calcium Hypochlorite in Containers' was jointly published by the Cargo Incident Notification System (CINS) and the International Group of P&I Clubs (IG P&IC). This document (Reference 53) provides additional guidance on cargo hazards and carriage requirements.

Under the *International Maritime Dangerous Goods Code* (IMDG Code, Reference 19), the three most common calcium hypochlorite products are two high strength types: anhydrous (UN1748) and hydrated (UN2880); and a lower strength type, often referred to as bleaching powder (UN2208).

Higher strength calcium hypochlorite substances are less likely to exhibit self-accelerating decomposition, but have more severe consequences in the event of an incident.

Lower strength calcium hypochlorite substances, such as UN numbers 2208, 3486, 1479 and 3077, are more likely to exhibit self-accelerating decomposition, but the consequences are less severe.

31.1 Stowage

Calcium hypochlorite or calcium hypochlorite mixtures should be transported in compliance with the stowage and segregation requirements set out in the IMDG Code.

IMDG Code Special Provision 314, under Part 3, Chapter 3.3, of the Code applies to calcium hypochlorite and states:

314.2 – During the course of transport, these substances shall be shaded from direct sunlight and all sources of heat and be placed in adequately ventilated areas.

In compliance with the IMDG Code (Amendment 41-22) calcium hypochlorite is subject to the provisions of stowage category D and stowage codes SW1 and SW11.

Stowage Category D

- *Cargo ships or passenger ships carrying a number of passengers limited to not more than 25 or to 1 passenger per 3 m of overall length, whichever is the greater number – ON DECK ONLY*
- *other passenger ships in which the limiting number of passengers transported is exceeded – PROHIBITED.*

Stowage Code(s)

SW 1 – Protected from sources of heat.

SW 11 – Cargo transport units shall be shaded from direct sunlight. Packages in cargo transport units shall be stowed so as to allow for adequate air circulation throughout the cargo.

All calcium hypochlorite substances should be stowed out of direct sunlight. If there is a risk that containers could be subjected to long periods of direct sunlight where they are stowed on deck, steps should be taken to restow them. If this is not possible, they should be covered with tarpaulins to provide shade.

Cargoes should ideally be packed in drums, within a container. Packaging this way facilitates airflow through the stow. This is important as airflow will assist in the dissipation of any heat generated. Note that the use of IBCs, bags or sacks for transportation is not permitted. It is also recommended to stow containers of calcium hypochlorite where they are accessible.

According to segregation requirements in the IMDG Code, calcium hypochlorite should be stowed separated from acids, ammonium compounds, cyanides and peroxides. It must not be stored together with combustible material in the same cargo transport unit.

The critical ambient temperature (CAT) for calcium hypochlorite depends on the package shape and size. The CAT is higher for smaller packages because they can dissipate heat in the atmosphere more quickly due to a larger surface area relative to

the amount of the contents. The bigger the package, the lower the CAT and, therefore, the higher the risk of exothermic decomposition, ie release of chlorine and oxygen gases if exposed to temperatures of between 30 to 55°C, or above. Exposure to such temperatures can happen if calcium hypochlorite is stowed in direct sunlight or above bunker tanks. When released, oxygen will sustain any fire caused due to the decomposition reaction already taking place. As chlorine is toxic, the IG P&IC recommends that stowage should be clear of living quarters. It also recommends an individual package limit of 45 kg with a maximum of 14 T net weight per container where a CAT of 40°C may be expected.

Dry or reefer containers may be used provided that a proper risk assessment is carried out. The risk assessment should include all aspects of transport including routeing, climatic temperature, duration, etc. The container control temperature should be 10 °C. 20 or 40 ft containers can be used provided that the maximum net weight of calcium hypochlorite does not exceed 14 T. In the event of a mechanical failure or of an interruption of the power supply, the insulation in a reefer container will initially protect the calcium hypochlorite from external heating. However, if there is an extended interruption to cooling, heat produced by calcium hypochlorite decomposition may accumulate faster in a reefer than in a dry container. The longer the interruption, the greater this risk.

Spontaneous decomposition, which may lead to explosion and fire, can occur at temperatures as low as 30°C for freight containers stuffed with large drums (about 200 kg) of UN 2880 (as described in Reference 54). Such temperatures are encountered in the holds of container vessels where there are heated fuel oil tanks. Therefore, the materials should not be stowed where their CAT can be attained.

31.2 Stowage Issues

Calcium hypochlorite has caused numerous fires, explosions and disasters, most of which can be attributed to one or more of the following causes:

- Improper stowage and consequent damage to receptacles in heavy weather
- improper segregation from goods such as combustible solids or liquids, dyes, oils and textiles, non-combustible liquids containing water, ammonium compounds, etc
- contact with rust after spillage of contents
- the decomposing nature of the product itself, the rate of which is heavily dependent on storage temperature and production characteristics.

The stability of calcium hypochlorite has improved in recent years, and now is increasingly replaced by the safer and more stable isocyanurates. In all circumstances, the shipper should deliver a document stating the percentage of free chlorine in the package. For all shipments of calcium hypochlorite containing more than 70% active chlorine, special clearance to carry the substance should be obtained.

The history of ocean transportation of calcium hypochlorite suggests that all forms pose special challenges concerning safe carriage. The safety issues are complex and are aggravated by a high degree of product variability.

31.3 Synonyms for Calcium Hypochlorite

- B-K powder
- bleaching powder
- bleaching powder, containing 39% or less chlorine
- calcium chlorohydrochlorite
- calcium hypochloride
- calcium hypochlorite
- calcium oxychloride
- caporit
- CCH
- chloride of lime (DOT)
- chlorinated lime (DOT)
- HTH
- Hy-Chlor
- hypochlorous acid
- calcium salt
- lime chloride
- lo-Bax
- losantin
- perchloron
- pittchlor
- pittcide
- pittclor
- sentry.

Some calcium hypochlorite shipped out of China is declared as:

- Prechloroisocyanoric acid (UN 2465)
- sodium di-isocyanorate (UN 2466).

31.4 Case Studies

'Eugen Maersk'

In June 2013, the *'Eugen Maersk'* container ship suffered a fire that broke out in one container and spread to several others nearby. The containers had all been declared as containing household goods and none should have held anything hazardous that might have caught fire in such a way. Containers with flammable contents are usually stored on deck to minimise the risks of fire but, if the contents are misdeclared, they may be stored in locations that cause serious hazards to the ship's crew and cargo. No persons were injured by the fire, but a total of 16 containers were damaged or destroyed.

MSC *'Flaminia'*

In July 2012, the MSC *'Flaminia'* suffered a severe fire which subsequently led to an explosion on board and the eventual abandoning of the ship by the crew. Three crew

members were killed in the incident. While the exact cause for the initial fire starting was never discovered, it is generally assumed that part of the cargo in the number 4 hold was incorrectly declared, and therefore not stored correctly as per the IMDG Code.

'KMTC Hong Kong'

In May 2019, the South Korean flagged *'KMTC Hong Kong'* suffered a severe explosion and subsequent fire while alongside in Laem Chabang, Thailand. Misdeclared containers of calcium hypochlorite were loaded lower down in the container stacks (contrary to the IMDG Code), and once ablaze, proved difficult to extinguish as the smoke emanating from the fire was highly toxic. 37 people were hospitalised due to the toxic smoke, while 143 people were reportedly affected in some way by chemicals within the smoke.

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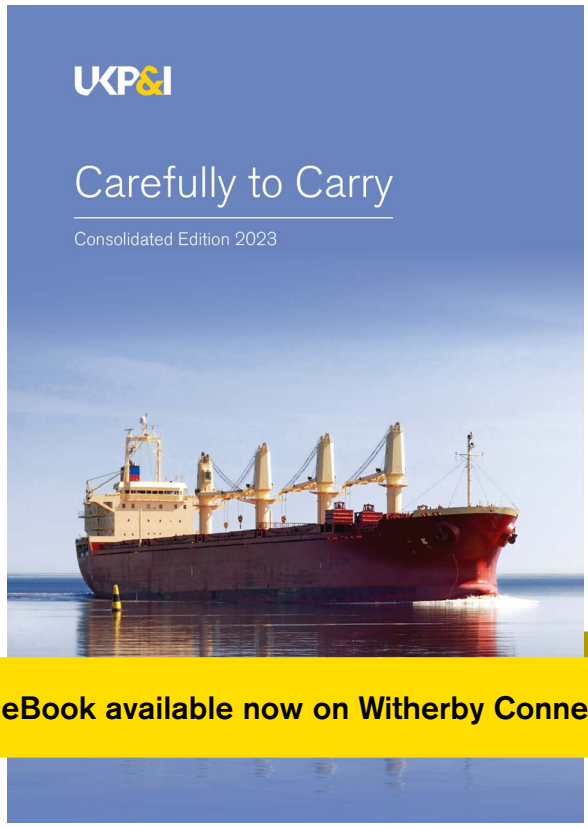

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