





## 2.1

## Reefer container: Damage to seafood

A shipment of containerised boxed shrimps transported from Argentina to China was found to be badly frosted. The shrimps inside the boxes were also beginning to blacken due to melanosis.

### Melanosis

Shrimps and crustacea undergo melanosis (an enzyme catalysed oxidation) when they are kept at incorrect temperatures and/or past their shelf life. Melanosis is also related to the freshness of the product at the time of freezing and whether it has been treated with any preservatives. While melanosis is not dangerous for consumption, it is a quality control indicator, and renders the shrimps unsightly and unsaleable.

### Frosting

The frosting is a second indicator that the product had suffered temperature abuse. Frosting appears when a product is thawed and then partially refrozen. Usually, the boxes are tightly packed into the containers, restricting airflow through the cargo and effectively insulating the cartons inside the stow compared to the ones in the outside. The product on the inside of the stow would be insulated against the worst damage by the cargo around it. It is then expected to observe a gradient of damage as the condition of the cartons is poorest nearest the

door and the external edges of the stow, with the damage lessening towards the rear of the container.

### Fluctuating temperatures

The container logs showed erratic temperature changes. Seven days after the start of the voyage, the temperature started to rise slowly but steadily from  $-25^{\circ}\text{C}$  to a range between  $-10^{\circ}\text{C}$  to  $-2^{\circ}\text{C}$  on arrival, which is indicative of a refrigeration system malfunction. These temperatures are sufficient for melanosis and frosting to occur. The Master and the crew should have been warned of the malfunction and attempted to repair the container; however, the corresponding alarms were not relayed to the vessel, suggesting a secondary malfunction in the system.

## What can we learn?

- The crew should check that the container set temperature complies with the shipper's specified carriage instructions.
- The crew should keep clear and accurate records. Document each stage of the voyage from loading through to discharge as well as obtaining date-stamped photographs of incidents which occur during the voyage.
- When carrying frozen cargo, the fresh air ventilation ducts should always be closed.
- The cargo should always be kept below the load line of the container, away from the container walls and not beyond the 'T' bars to allow the refrigerated air to flow freely around the whole of the stow.

## 2.2

## Reefer container: Damage to fresh produce

A cargo of bagged white garlic was shipped from China to Central America. On arrival, it was noted that significant portions of the consignment showed signs of germination.

### Storage of garlic

After curing (a process of drying after harvest), garlic can be stored at high temperatures (+25 °C) or low temperatures (-3 °C to 0 °C) to prevent germination of the bulbs and maintain the storage life of the product. Temperatures above 5 °C and below 20 °C are not appropriate for garlic storage and can cause dormancy break, advanced germination, and fungal/bacterial issues. It is common to see garlic transported in containers at low temperature (i.e. -3 °C to 0 °C). At these lower temperatures, the heat generated by respiration of the garlic bulbs is removed, helping to maintain a period of dormancy.

### Temperature records

The temperature records indicated that it took several days for the temperature to reach +4 °C. Furthermore, the situation was exacerbated by the cargo being 'hot-loaded', meaning that the cargo was not pre-chilled before loading. The effect of these two factors was to prevent the cargo from meeting the required temperature range and thus, led to a significant portion of the cargo arriving with unacceptable levels of germination.

The crew should take care when checking that set point temperatures, as outlined in the carriage instructions, are properly applied to the containers. A failure to do so can lead to the onset of germination and/or spoilage of cargo through bacterial or fungal infections.

## What can we learn?

- The crew should check that the container set temperature complies with the shipper's specified carriage instructions.
- It is important to note that the reefer container is designed to maintain the cargo's temperature rather than cool it. Ideally, all cargoes should be loaded at the intended carriage temperature to ensure product quality is maintained.
- The crew should keep clear and accurate records. Document each stage of the voyage from loading through to discharge as well as obtaining date-stamped photographs of incidents which occur during the voyage.



## 2.3

# Reefer container: Meat damaged due to wrong temperature settings

The container vessel had loaded cargo in a South American port, to be discharged in Europe. Several reefer containers with meat were also loaded. The containers had been filled with superior chilled meat at a cargo temperature of around 0°C. The containers were set to chilling mode with a set point temperature of -1.4°C.

### Freezing mode

However, one of the containers was switched to freezing mode with a set point of -18°C and remained at this setting throughout the entire month's voyage to Europe

### Confusion re reefer list

On the bill of lading it was stipulated that the container should be kept chilled at a temperature of -1.4°C. However, during the loading operation the agent supplied an initial reefer list which had two separate entries for this container, one where it stated that the container should be chilled and another where it said it should be frozen. This mistake was discovered by the crew, and the agent then updated the reefer list confirming the set point temperature as -1.4°C for the container.

### Frozen meat

One month later the vessel discharged the containers in Europe. When the cargo receivers inspected the meat, they found it to be frozen. The meat should have been chilled as it becomes damaged when it is frozen.

According to the container unit's records the temperature in the container fell a couple of days after departure. This caused the meat to freeze. Over a sufficiently long time, even a reefer container will achieve solid freezing of the entire cargo. In this case, there was clearly sufficient time.

Each piece of meat was packed in a heat-sealed vacuum plastic liner bag. When the cargo receiver inspected the meat it had turned dark red and slightly brownish and the vacuum bags contained a considerable quantity of blood.

The meat which was initially of superior quality could now only be used for lower end products and had to be sold for a loss.

## What can we learn?

- The crew should check that the container set temperature complies with the shipper's specified carriage instructions.
- If the delivery or return air temperatures are incorrect, it is important to confirm with the shippers that any adjustment to the correct set temperature will not lead to cargo damage during the voyage.
- The crew should keep clear and accurate records. Document each stage of the voyage from loading through to discharge as well as obtaining date-stamped photographs of incidents which occur during the voyage.
- Another concern is miscommunication between the charterers and owners, where multiple entries are made in the voyage instructions for the same reefer container with different corresponding temperatures which have been sent by the shipper/charterer to the owner/Master. Unless these entries are detected, incorrect instructions can be applied.



## 2.4

# Reefer container: Damage to various food products

The container vessel had loaded cargo in a European port, to be discharged in Asia. Several reefer containers with meat, fish and other food had been loaded. The containers had been filled with frozen food at a temperature of  $-20^{\circ}\text{C}$  and the temperature of the containers was set to freezing.

### Temperature logged

During the voyage an AB checked the containers twice a day and logged the temperature between  $-19^{\circ}\text{C}$  and  $-20^{\circ}\text{C}$ .

One month later the vessel discharged the containers in Asia. When the cargo receivers inspected the meat, they found it to be thawing.

### Actual conditions

According to the container units' records, the temperature in the containers had increased over a couple of days after departure from  $-15^{\circ}\text{C}$  to  $+5^{\circ}\text{C}$ . All the alarms for the containers had been disabled.

The airflow outlet to the containers had been open. This allowed a continuous flow of warm air into the containers. Why this had been opened after departure is not known.

The cargo was fully rejected and destroyed by the cargo receivers.

### Incorrect record keeping

The crew had not verified the correct temperature of the container but only written down what should have been the correct temperature in the log as the actual containers' digital log showed  $+5^{\circ}\text{C}$  and not  $-20^{\circ}\text{C}$  as in the vessel's log.



## What can we learn?

- A continuous supply of power to reefer containers is of the utmost importance during the voyage. The vessel's crew should regularly monitor this and ensure that all incidents regarding the vessel's diesel generators and reefer circuit breakers, and their associated alarm systems, are meticulously recorded.
- The crew should check that the container set temperature complies with the shipper's specified carriage instructions.
- The crew should keep clear and accurate records. Document each stage of the voyage from loading through to discharge as well as obtaining date-stamped photographs of incidents which occur during the voyage.
- When carrying frozen cargo, the fresh air ventilation ducts should always be closed.

# Glossary of common industry abbreviations

<b>Term</b>	<b>Meaning</b>
AB .....	Able seaman
AIS.....	Automatic identification system
ARPA .....	Automatic radar plotting aid
COLREGS .....	International Regulations for Preventing Collisions at Sea
COSWP .....	Code of Safe Working Practices for Merchant Seafarers
CPA .....	Closest point of approach
CSM.....	Cargo securing manual
ECDIS .....	Electronic chart display information system
ETA .....	Estimated time of arrival
GM.....	Metacentric height
GPS .....	Global positioning system
IHO .....	International Hydrographic Organization
IMDG Code .....	International Maritime Dangerous Goods Code
IMO .....	International Maritime Organization
IMSBC Code .....	International Maritime Solid Bulk Cargoes Code
ISM .....	International Safety Management Code
JRCC .....	Joint rescue coordination centre
MOU .....	Memorandum of understanding
NM.....	Nautical miles
OOW .....	Officer on watch
PA .....	Public address system
PMS.....	Planned maintenance system
SMS.....	Safety management system
SSAS .....	Ship security alert system
SSP .....	Ship security plan
STS .....	Ship-to-ship (transfer)
TML.....	Transportable moisture limit
UHF .....	Ultra high frequency (radio)
VDR .....	Voyage data recorder
VHF .....	Very high frequency (radio)
VTS .....	Vessel traffic service



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