



## Introduction – Fire safety

Fire and explosion incidents on ships result in the most expensive insurance claims in the marine industry<sup>1</sup>. Fires spread quickly on ships and can be particularly difficult to contain, often resulting in crew abandoning ship. There have been over 70 reported serious fire incidents on container ships worldwide in the past 5 years<sup>1</sup>.



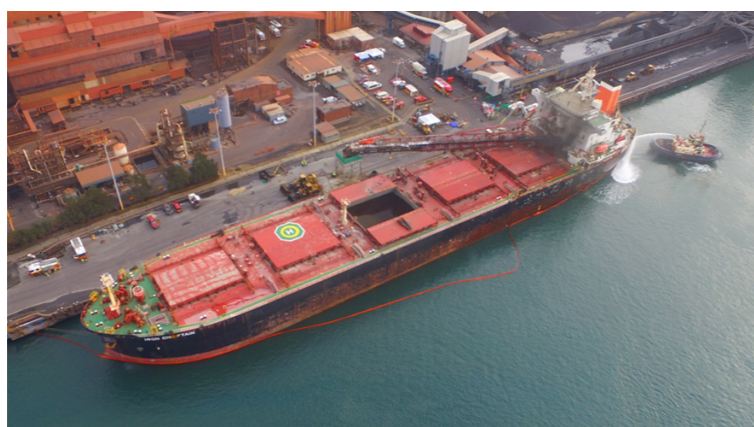
Fire on cargo ship

### Case study 1

A fire broke out in the lower cargo hold of a general cargo ship whilst berthed<sup>2</sup>. The fire started during hot work to remove sea fastenings from the tween deck in preparation for cargo discharge operations.

The investigation identified the operators had not effectively implemented the safety management system hot work permit procedures

and fundamental risk controls such as maintaining a continuous fire watch and protecting combustible cargo with fire retardant coverings to prevent the spread of fire. Items of cargo stowed in the lower hold below the work site were not adequately assessed as a fire risk and protected before starting the hot work. Of concern is that lessons learnt from previous similar incidents were not properly considered, noting this was the tenth fire-related incident on the company's ships in the past 14 years.



Case study 2 – Remotely piloted aircraft system footage of a ship on fire



Case study 2 – Heat damage to engine room forward bulkhead

### Case study 2

During cargo discharge operations while alongside, a fire broke out in the internal cargo handling spaces of the self-unloading (SUL) bulk carrier<sup>3</sup>. The ship sustained substantial structural damage and was declared a total loss.

The investigation identified that the fire was likely the result of a failed bearing in the ship's conveyor system, which created the heat necessary to ignite the rubber conveyor belt. Five years before the fire, the operators identified the fire risk in the ship's cargo SUL system spaces, particularly the C-Loop, as being unacceptably high due to the absence of fire detection or fixed fire extinguishing system. However, at the time of the fire, the prevention and mitigation measures had not reduced the risk to an acceptable level.

The ship did not have an emergency contingency plan for responding to fire in the ship's SUL spaces and there were technical failures of the ship's alarm systems during the emergency response to the fire.

At the time of the fire, 14 of the ship's crew of 20 had not participated in a fire drill on board in the previous month as per SOLAS regulations.

In response to the incident, the operator initiated a fire risk mitigation project with the aim of:

- improving fire detection and suppression technology
- reviewing and improving their firefighting policy
- setting minimum fire safety standards for early fire detection and suppression at the ship design and build stage.

## AMSA incident data

There has been an increase in fire incidents reported to AMSA since 2020 (Figure 1).

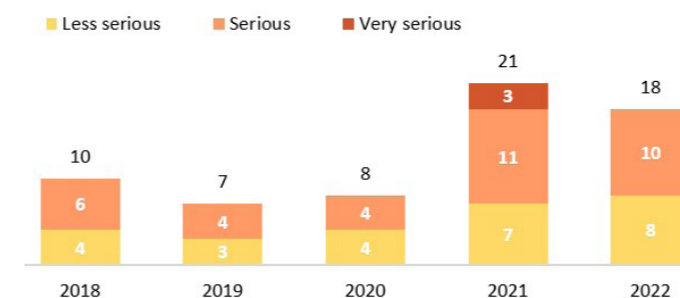


Figure 1: Severity of fire-related incidents reported between 2018 and 2022

In 2021 there were 3 very serious and 11 serious fire incidents reported onboard foreign flagged vessels in Australian waters. In addition, 13.6% of all port State control detainable deficiencies in 2021 were fire safety related issues.

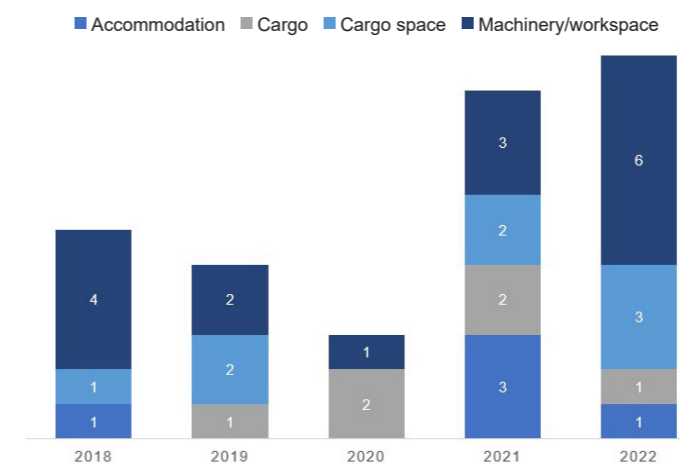


Figure 2: Breakdown of location of ship fires between 2018 and 2022

Most fires were initiated in machinery/workspaces, followed by cargo spaces. The Safety and Shipping Review 2022<sup>1</sup> identified cargo fires are often a result of mis-/non-declaration of hazardous cargo, such as chemicals and batteries. If improperly packed and stowed onboard this can result in ignition and complication in detection and firefighting.

The increasing concern in this area has prompted a Tokyo Memorandum of Understanding (MoU) and plans to commence a Concentrated Inspection Campaign (CIC) focusing on fire safety, with AMSA intending to inspect vessels for fire safety from 1 September 2023 until 30 November 2023.

## Fire safety systems

### Maintenance

Chapter II-2 of the International Convention for the Safety of Life at Sea Convention, 1974 (SOLAS) Regulations and amendments sets out requirements for the provision and maintenance of fire detection, fire suppression, fire prevention and means of escape in case of fire.

As per the International Safety Management code the ship must have a maintenance plan<sup>5</sup> as part of the safety management system to ensure the maintenance and inspection of fire detection, fire prevention and firefighting equipment are carried out at periodic intervals in accordance with the relevant recommendations and manufacturers' guidelines.

### Fire drills

Regular onboard fire drills are prescribed by the SOLAS Convention. The ship should carry out routine and frequent fire drills to address different simulated fire incidents in different areas of the ship, such as machinery space, cargo holds, accommodation areas, etc.

These fire drills are to be realistic and tailored to address foreseeable fire scenarios specific to ship operations including the engine room<sup>4</sup>.

All crew should participate in at least one abandon ship drill and one fire drill every month on a cargo ship. On passenger ships, an abandon ship drill and fire drill should take place weekly.

### Teamwork and communication

The importance of fire drills as per SOLAS requirements must consider the fire-fighting capability of the team. Effective communication and teamwork are essential to ensure the crew are familiar and well-equipped in firefighting and the containment of fires. Lack of operational readiness of firefighting equipment, lack of a centralised chain of command, and gaps in training and familiarisation of crew are some of the aspects that can contribute to delayed response times in actual fire incidents<sup>8</sup>.

The Australian and New Zealand National Council for fire and emergency services (AFAC) published a report identifying psychological factors underpinning decision-making in firefighting<sup>6</sup>. Some shortfalls include:

- command and role confusion
- lack of trust
- unable to predict fire behaviour.



Environmental stressors that can also impact teamwork and performance include<sup>7</sup>:

- multiple information sources
- incomplete, conflicting information
- rapidly changing, evolving scenarios
- adverse physical conditions
- time pressure
- high work or information load
- auditory overload or interference.

Characteristics of good teamwork include leadership, followership, effective communication, trust building, and motivation. It is important that there is accurate and timely transmission of information to avoid miscommunication, which could result in serious consequences.

Good teamwork will build mutual trust and team coordination amongst the crew, as well as reduce risk of error, particularly in life-threatening situations. It is important that crew members are able to respond, communicate, receive and carry out instructions efficiently in the event of a fire onboard.



**Don't ignore it - report it**  
Your experiences help us improve safety.



Australian Government  
Australian Maritime Safety Authority

Report every  
incident to AMSA



## References

- <sup>1</sup> Allianz Global Corporate & Specialty AGCS (2022). *Safety and Shipping Review 2022*.
- <sup>2</sup> ATSB (2022). Fire on board BBC *Rhonetal*. Marine Occurrence Investigation MO-2021-002
- <sup>3</sup> ATSB (2021). Fire on board *Iron Chieftain*. Marine Occurrence Investigation MO-2018-011.
- <sup>4</sup> UK P&I (2016). Risk Focus: Engine Room Fires
- <sup>5</sup> AMSA (2021). Maritime Safety Awareness Bulletin. *Planned Maintenance*
- <sup>6</sup> AFAC (2009). *Fire Note: How human factors drive decisions at fire ground level*.
- <sup>7</sup> CASA (2022). Safety behaviours: human factors for pilots – Resource booklet 5 teamwork
- <sup>8</sup> Gard (2021). *A delayed response to a fire can be fatal for the fire team*.

## Key messages

- Having an effective maintenance plan to prevent and reduce the risk of malfunction or equipment failure will ensure there are no delays in the detection of a fire and in the implementation of firefighting to help protect the crew and passengers, as well as cargo.
- Emergency escape routes should be maintained in a safe condition, clear of obstacles and clearly marked.
- All fire protection systems and firefighting systems are to be maintained ready for use, and properly tested and inspected in accordance to the SOLAS Chapter II-2, Regulations 14 (Operational Readiness).
- Fire drills help the ship's crew better understand the basics of fire prevention and prepare the crew in dealing with emergency situations as a result of a fire on board.