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LESSONS LEARNED AND SAFETY ISSUES IDENTIFIED FROM THE ANALYSIS OF MARINE SAFETY INVESTIGATION REPORTS

Report of the Correspondence Group on Analysis of Marine Safety Investigation Reports

Submitted by Canada

SUMMARY

Executive summary:	This document contains the Report of the Correspondence Group on Analysis of Marine Safety Investigation Reports.
Strategic direction, if applicable:	7
Output:	7.4
Action to be taken:	Paragraph 21
Related documents:	MSC-MEPC.1/Circ.5/Rev.6; III 11/4; MSC-MEPC.3/Circ.4/Rev.1 and MSC-MEPC.3/Circ.3

Terms of reference

1 The Sub-Committee on Implementation of IMO Instruments (III), at its eleventh session, taking into account the work completed at this session, re-established the Correspondence Group on Analysis of Marine Safety Investigation Reports, under the coordination of Canada[1], to continue its work intersessionally under the following terms of reference, using IMO Space facilities (III 11/16, paragraph 4.51), to:

.1 conduct a review of the marine safety investigation reports on investigations into casualties submitted by Administrations, in the five years preceding the current session, prioritizing very serious marine casualties involving SOLAS ships; additionally, those that have occurred in the five years preceding the current session for which reports are available will be prioritized in

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consultation with the Secretariat. A summary list of draft Lessons Learned from marine casualties, where appropriate, will be prepared;

.2 review the draft text of Lessons Learned from marine casualties, for the Sub-Committee's consideration prior to release;

.3 review the consolidated text of the analyses, taking into account the marine safety investigation reports to identify safety issues that need further consideration by the Sub-Committee using the procedure approved by MSC 106;

.4 conduct a further analysis for the review of incidents of ruptured portable fire extinguishers to determine if this issue warrants further work by the Organization;

.5 develop a draft proposal for a new output to improve fire safety standards/regulations for the cargo handling spaces of specialized self-unloading bulk carriers taking into account the Committees' method of work (MSC-MEPC.1/Circ.5/Rev.6);

.6 develop a proposal for a new output to address the risks involved with wearing inflatable lifejackets and the importance for people to understand how to safely deflate and remove an inflatable lifejacket while in the water, should they need to do so in an emergency taking into account the Committees' method of work (MSC-MEPC.1/Circ.5/Rev.6); and

.7 submit a report to III 12.

Members of the Correspondence Group

2 Representatives from the following Member States participated in the Correspondence Group's work:

ANTIGUA AND BARBUDA
AUSTRALIA
BAHAMAS
BELGIUM
CANADA
CHINA
CROATIA
GERMANY
INDIA
INDONESIA
IRAN (ISLAMIC REPUBLIC OF)
JAPAN
LIBERIA
LITHUANIA
MARSHALL ISLANDS
MYANMAR
NETHERLANDS (KINGDOM OF THE)
NEW ZEALAND
PAPUA NEW GUINEA
PORTUGAL
REPUBLIC OF KOREA
RUSSIAN FEDERATION
SAUDI ARABIA
SINGAPORE
SOUTH AFRICA
SWEDEN
THAILAND
UNITED KINGDOM
UNITED ARAB EMIRATES
UNITED STATES

And by observers from the following intergovernmental organizations

CARIBBEAN MEMORANDUM OF UNDERSTANDING ON PORT STATE CONTROL
INDIAN OCEAN MEMORANDUM OF UNDERSTANDING ON PORT STATE CONTROL (IOMOU)
MARINE ACCIDENT INVESTIGATORS' INTERNATIONAL FORUM (MAIIF)
EUROPEAN COMMISSION (EUROPEAN MARITIME SAFETY AGENCY (EMSA))

and by observers from the following non-governmental organizations:

INTERNATIONAL CHAMBER OF SHIPPING (ICS)
BIMCO
OIL COMPANIES INTERNATIONAL MARINE FORUM (OCIMF)
INTERTANKO
THE INTERNATIONAL TRANSPORT WORKERS' FEDERATION (ITF)
WORLD SHIPPING COUNCIL (WSC)
NAUTICAL INSTITUTE (NI)

Review of marine safety investigation reports

3 The list of 59 marine safety investigation reports which have been reviewed by the analysts as members of the Correspondence Group is highlighted in document III 12/4/1 and annexed to document III 12/INF.10. Overviews of the analyses and observations on the quality of the reports are presented in paragraphs 16 and 17 as well as 18 to 20 of this document, respectively.

Review of Lessons Learned

4 During the intersession, Lessons Learned have been assigned to the Correspondence Group to be reviewed for the Sub-Committee's consideration prior to release. All Lessons Learned have been prepared and submitted by Member States along with the investigation reports in the Marine Casualties and Incidents module of the Global Integrated Shipping Information System (GISIS).

5 Altogether 78 Lessons Learned have been reviewed by the Correspondence Group, of which 8 Lessons Learned were removed since they contained scanty information and are not likely to be useful as Lessons Learned. This resulted in 70 Lessons Learned which are listed in annex 1 of this document.

Identification of safety issues and recommendations for further consideration

6 During the analysis of investigation reports, two safety issues in one investigation report were raised by the analyst. Members of the Correspondence Group reviewed the safety issues and found that there was insufficient data to support the topics as safety issues, so they were not brought forward. The Working Group has previously identified that there can be difficulties finding related occurrences in GISIS, which may warrant a future review of the process for identifying safety issues.

Further analysis of incidents of ruptured portable fire extinguishers

7 Members of the Correspondence Group reviewed data from a variety of sources and identified several cases where high-pressure cylinders ruptured. These high-pressure cylinders were not limited to portable fire extinguishers but also included the cylinder from a

breathing apparatus and cylinders used for launching lifeboats. Many of the cases did not meet the threshold for mandatory reporting to IMO.

8 Corrosion was identified in 13 of the 19 cases; overpressure or suspected overpressure was found in two cases; and other causes were identified in four cases. Inadequacies in inspection, both on board inspections by crew and in external inspections by flag States and service providers, and record keeping were discussed in many of the reports.

9 Age was a factor in 6 of the 20 investigations. In four of the incidents, the cylinder was beyond its expiry date or had been condemned for other reasons. In another case, the hydrostatic test was overdue, and the investigation report stated that the unit would have likely been condemned following the test. There was an additional case where the cylinder was visibly old but wasn't traceable. Finally, in one accident identified as "other causes" where the hose ruptured, the cause of the rupture was attributed to the age of the unit.

10 The Correspondence Group noted that, in its investigation of a very serious marine casualty on the **Emerald Princess**, New Zealand found that there is no international standard for inspection of high-pressure cylinders.

11 Thus, the Correspondence Group recommends that the above analysis be referred to the Working Group, if established, for consideration including its dissemination to the maritime industry through a III circular (annex 2).

Proposed new output to improve fire safety standards for cargo handling spaces of specialized self-unloading bulk carriers

12 Members of the Correspondence Group reviewed the proposed new output from Australia to improve fire safety standards for cargo handling spaces of specialized self-unloading bulk carriers**.** The Correspondence Group also used the opportunity to review casualty investigation reports into fires on self-unloading bulk carriers from Indonesia. The exchange resulted in the Correspondence Group support of the proposal, which would require installation of fixed fire suppression systems in the cargo spaces of self-unloading bulk carriers.

13 The draft new output is included in this report as annex 3.

Proposed new output to address risks involved with wearing inflatable lifejackets

14 Following a review of New Zealand's submission to III 11 (document III 11/INF.24) raising awareness concerning the risks involved with wearing inflatable lifejackets and the importance for people to understand how to safely deflate and remove an inflatable lifejacket and as instructed by the Sub-Committee, a proposed new output was developed by members of the Correspondence Group. The proposal includes amendments to the LSA Code and the Model Regulations on Domestic Ferry Safety (resolution MSC.518(105)).

15 The draft new output is included in this report as annex 4.

Overview of the marine safety investigation report analysis

16 Of the 59 marine safety investigation reports analysed, concerning 59 marine casualties, 53 were prepared by the marine safety investigation authority of the flag State of at least 1 of the involved vessels, and 6 by the marine safety investigation authority of the coastal or substantially interested State. One (1) marine casualty was reported by both flag State and coastal State authorities. With regard to the marine casualties covered by the marine safety

investigation reports that were analysed during this intersession, and based upon the analyses, the following was noted:

.1 56 occurrences were very serious marine casualties and 3 were marine casualties;

.2 one occurred in 2017, 1 occurred in 2018, 4 occurred in 2020, 3 in 2021, 7 in 2022, 13 in 2023, 25 in 2024; and 5 in 2025;

.3 72 ships were involved, including 5 fishing vessels (7%), 21 bulk carriers (29%), 7 general cargo ships or ro-ro cargo ships (10%), 9 container ships (12%), 12 oil or chemical tankers (17%), 5 passenger ships (7%), and 13 others (18%);

.4 the following table shows the numbers of types of marine casualty, deceased or missing persons, and serious injuries resulting from each type of marine casualty involved;

Type of marine casualty	**Marine casualties**	**Deceased or missing persons**	**Serious injuries**
Collision	10	26	5
Fire/explosion	11	11	25
Stranding/grounding	1	0	0
Occupational accident	30	30	15
Capsizing/listing/foundering	7	48	1
Loss of containment	1	1	0
Total	**60**	**116**	**46**

.5 the following table shows the numbers of deceased or missing persons and serious injuries related to each type of ship involved; and

Type of ship	**Number of deceased or missing persons**	**Number of serious injuries**
Bulk carrier	14	12
Oil/chemical tanker	6	3
Container	9	4
Ro-Ro	1	22
General cargo	5	3
Passenger	8	0
Fishing	17	0
Livestock	42	0
Dredger	5	0
Tug	4	0
Other	6	2
Total	**116**	**46**

.6 there was no loss of oil or other pollutants described in any of the 60 casualty reports.

17 The marine casualties of the loss of the livestock carrier **Gulf Livestock 1** (GISIS ref C0013008), the collision between **Jin Wang Ling** and **Lurishanyu 61027**

(GISIS ref C1000488), and the fire on **Freemantle Highway** (GISIS ref C1000739) may be mentioned owing to the number of lost or missing persons:

.1 On 2 September 2020, the livestock carrier **Gulf Livestock 1** issued a distress signal at 0145 Local Time (LT) in the East China Sea, approximately 100 Nautical Miles (NM) south west of Japan. The ship was en route from New Zealand to China, carrying 5,800 head of cattle, when it crossed the path of a typhoon. Two crew members were rescued. There were 43 people on board (crew members and livestock handlers). Two crew members were rescued and the body of one crew member was recovered during the Search and rescue (SAR) operation.

.2 On 22 December 2022, the Hong Kong, China registered bulk carrier **Jin Wang Ling** and the China registered fishing boat **Lurishanyu 61027** collided in the Yellow Sea. The **Lurishanyu 61027** sank, with five fatalities and three missing. There was minor damage to the bow of the **Jin Wang Ling**.

.3 On 25 July 2023, the car carrier M/V **Fremantle Highway** was on its way from Germany to Singapore with 21 crew members, a pilot, and a superintendent on board. A fire broke out on one of the car decks. The crew attempted to fight the fire but was unsuccessful. Owing to the heat and smoke, the crew were unable to abandon the ship using the lifeboat and the local coastguard responded with ships and helicopters. One person was fatally injured during the evacuation. The other 22 people were all hospitalized with various injuries sustained during the fire response and the evacuation.

Observations on the quality of marine safety investigation reports

18 The following has been observed with regard to the quality of marine safety investigation reports (figures in square brackets "[ ]" relate to previous intersessions, reported in document III 11/4):

.1 59 [39] marine safety investigation reports were reviewed during the intersession by members of the Group. In 59 cases (100%) [97%] quality evaluation forms were completed and submitted to GISIS by the analysts;

.2 34 reports (58% of the evaluated reports) [62%] met the quality criteria set out in paragraph 2.12 of the Casualty Investigation Code;

.3 25 reports (42% of the evaluated reports) [38%] contained inappropriate or insufficient information with regard to the requirements of the Casualty Investigation Code. The areas where information was inappropriate or missing (with reference to paragraph 2.12 of the Casualty Investigation Code) were identified by the analysts as follows:

.1 identity of the flag State, owners, operators, the company as identified in the safety management certificate, and the classification society (subject to any national laws concerning privacy) (paragraph 2.12.2) (6 reports);

.2 where relevant, the details of the dimensions and engines of any ship involved (paragraph 2.12.3a) (2 reports);

.3 description of the crew, work routine and other matters, such as time served on the ship (paragraph 2.12.3b) (7 reports);

.4 analysis and comment on the causal factors including any mechanical, human and organizational factors (paragraph 2.12.5) (8 reports); and

.5 a discussion of the marine safety investigation's findings, including the identification of safety issues, and the marine safety investigation's conclusions (paragraph 2.12.6) (3 reports);

.4 There was one case where parallel investigations were reported by the coastal State. In that case, the flag State has not yet submitted its report, so the analyst was unable to determine if there were any discrepancies;

.5 Other comments or observations relating to the quality of the report were also noted in some cases, describing the analyst's view of the report:

.1 in some cases shortcomings in the report were noted, such as: difficulty in determining the identified safety issues; crew members are named; human factors information could have been examined in more depth; no information on the DOC Company, Safety Management or relevant company procedures; no analysis of the safety management system or risk analysis; report does not articulate any defined investigation findings or identified safety issues; and

.2 in other cases credits were given, such as: good report capturing all necessary information for readers to have a better understanding of the sequence of events and contributing factors; solid, well supported conclusions; well substantiated and written report; the report is of a very high quality; overall a very thorough and in depth report; the report is comprehensive and thorough in laying out the accident and analysing the causes.

19 The analysts were also tasked to identify which appendices in GISIS had been completed for the marine safety investigations, in addition to the marine safety investigation reports submitted to GISIS. It should, however, be noted that this information may be incomplete as not all accidents being reported into GISIS followed the *Revised harmonized reporting procedures – Reports required under SOLAS regulations I/21 and XI-1/6, and MARPOL, articles 8 and 12* (MSC-MEPC.3/Circ.4/Rev.1), which replaced the previous MSC-MEPC.3/Circ.3.

20 Of the 59 marine safety investigation reports, appendix 1: Generic information, had been completed in 48 cases; appendix 2: Factual information, had been completed in 43 cases; appendix 3: Casualty analysis, data had been completed in 36 cases; and Relevant supplementary information had been completed in 6 cases.

Action requested of the Sub-Committee

21 The Sub-Committee is invited to approve the report of the Correspondence Group in general and, in particular, to:

.1 approve the draft text of Lessons Learned from marine casualties and their release on the IMO website in accordance with the agreed procedure (paragraphs 4 and 5, and annex 1);

.2 note the proposed new output for ruptured high-pressure cylinders and refer it to the Casualty Analysis Working Group, if established, for review (paragraphs 7 to 11, and annex 2);

.3 note the proposed new output for fire standards for cargo handling spaces of specialized self-unloading bulk carriers and refer it to the Casualty Analysis Working Group, if established, for review (paragraphs 12 to 13, and annex 3);

.4 note the proposed new output to address risks involved with wearing inflatable lifejackets and refer it to the Casualty Analysis Working Group, if established, for review (paragraphs 14 to 15, and annex 4)

.5 note the overview of the marine safety investigation report analysis and refer it to the Casualty Analysis Working Group, if established, for review (paragraphs 16 and 17); and

.6 note the observations on the quality of marine safety investigation reports and take action as deemed appropriate (paragraphs 18 to 20).

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ANNEX 1

LESSONS LEARNED FROM MARINE CASUALITIES

1 Categories of safety issues: Planning and Procedures

Casualty event: Occupational accident – slipping, stumbling, falling of a person to a lower level

Casualty severity: Very serious marine casualty

What happened:
During the operation of a hatch cover removal, the shipboard Chief Cook who assisted in the operation job fell from the platform inside the No.1 cargo hold to the bottom of the hold which caused a fatal head injury.

Why did it happen:
Job assignments outlined in the shipboard safety management system (SMS) were not adhered to; the requirements of the International Safety Management (ISM) Code were not followed when the task was assigned to the chief cook.

The procedures for work aloft in the shipboard SMS were not adhered to; the chief cook and his team members were not aware of the risk of falling into the opening while working on the platform without proper Personal Protective Equipment (PPE).

The risk assessment and the safety training on board for ship crew were ineffective.

What can we learn:
- Strictly follow the requirements of the shipboard SMS and the Code when assigning new tasks to ship crew, particularly those requirements related to the safety of working aloft;

- Strictly follow the shipboard SMS procedures of working aloft to ensure safety, including proper use of PPE, rigging of safety nets, issuance of permit-to-work, and effective risk assessments; and

- Ensure effective shipboard training to enhance ship crew's safety awareness to the risks of working aloft and necessary preventive measures for personal safety.

Who may benefit:
Crew members, shipowners, ship management companies.

2 Categories of safety issues:

- Planning and Procedures
- Emergency handling
- Natural environment
- Legislation, standards and compliance

Casualty event: Flooding/foundering - foundering

Casualty severity: Very serious marine casualty

What happened:
A passenger/ro-ro ship was carrying a cargo of bulk aggregate and construction equipment in coastal waters of the Caribbean. After encountering a heavy squall, water became trapped on deck as the aggregate cargo blocked scuppers and drains, frustrating efforts to use portable pumps to de-water the deck. The ship became unstable, capsized and sank.

Four of the eight persons onboard were rescued from a liferaft, the remaining four persons are missing, presumed dead.

Why did it happen:
The ship was not suitable for the carriage of bulk aggregate and no steps had been made to contain the cargo, protect it from water ingress or mitigate the risk of blocked scuppers.

The heavy squall was forecasted but the passage plan was not adapted to reflect this information. Regardless, the options to seek shelter were limited, the ship having started the voyage with one of its two engines disabled.

The ship had been operating on one engine for an extended period. There was no evidence of any effective oversight from the vessel's flag State and the vessel was not in Class.

The ship did not have a safety management system in place and crew were not aware of any cargo handling procedures. The vessel did not have visible load lines and the crew were not provided with stability information.

What can we learn:
- Crew on board ships that operate without flag State oversight and without being in Class are at an increased risk of danger.

- Carriage of cargoes on unsuitable ships increases the risk during operation of the ships. Carriage and stowage requirements mandated for specific cargo types should not be adapted without assessing the risk.

- Port State Control is an essential measure for ensuring the safety of ships. It is only effective if vessels that are high risk can be targeted for inspections. States should ensure Port State Control Officers have adequate resources and systems to target ships effectively.

Who may benefit:
Shipping industry.

3 Categories of safety issues:

- Planning and Procedures
- Emergency handling
- Management factors
- Legislation, standards and compliance

Casualty event: Flooding/foundering - foundering

Casualty severity: Very serious marine casualty

What happened:
A general cargo ship, loaded with steel plates, encountered heavy seas. The ship developed a severe portside list after being struck by two large waves, became unnavigable, and ultimately sank about 30 hours later. All 11 crew members were safely rescued.

Why did it happen:
The steel plates in the cargo hold were inadequately secured, with large void spaces left unfilled by timber or dunnage. When the ship was hit by heavy waves, the cargo shifted to port, moving the centre of gravity and causing loss of stability.

Contributing factors included the absence of specific guidelines in the Cargo Securing Manual (CSM) for steel plates, insufficient oversight of loading/securing, failure to implement adequate sheltering measures under worsening weather, and limited weather information support from the shipping company.

What can we learn:
- Heavy metal cargo like steel plates must be stowed compactly, with voids eliminated using timber or other reinforcements, in compliance with international and domestic standards.

- CSMs must include specific methods for all cargo types carried, and crews must follow procedures strictly.

- Masters and companies must take proactive sheltering measures under gale warnings and ensure real-time sharing of weather information.

- Both companies and authorities should strengthen supervision, inspections, and crew education to prevent similar accidents.

Who may benefit:
Shipping companies and ship operators transporting heavy metal cargo; Masters and crew members; Maritime regulators and classification societies; Training institutions; Insurance and P&I clubs.

4 Categories of safety issues: Anthropometric or personal factors

Casualty event: Collision – with other ship

Casualty severity: Very serious marine casualty

What happened:
The fishing vessel crossed the bow of the container ship. Approximately three minutes later, the fishing vessel began changing course diagonally on its port side. It was still casting and plunging fishing traps. Its diagonal change of course brought the two ships closer together, around 1.3 miles off.

The large change in the course of the fishing vessel brought the two ships closer to each other. One of the crew members working on the deck of the fishing vessel saw the container ship and began to shout, "A ship! There's a ship!", the other crew members also saw the container ship and felt alarm at the imminent collision, as they would testify later. The captain then engaged astern propulsion from the wheelhouse. His action was insufficient to prevent the collision of the two ships.

The crew onboard the container ship did verify that the fishing vessel crossed in front of the container ship's bow as well as that the fishing vessel changed its course

The third officer of the container ship had been observing the lights of the fishing vessel through binoculars as the latter had its lights on for fishing. As the fishing vessel continued to approach the container ship, the third officer ordered the able seaman on duty to switch to manual steering and turn the rudder to 10 degrees starboard, blowing the fore whistle three times.

These actions, however, were insufficient to prevent the resulting collision between the bulbous bow of the container ship and the starboard side of the fishing vessel. The weather was fair at the time of the collision, with a visibility of 11 miles, north wind of four to six meters per second, and waves about 1.0 to 1.5 meters high.

Why did it happen:

- The fishing vessel did not maintain a proper look-out and did not comply with ordinary seafaring protocols.
- Inadequacy of the container ship's actions to avoid the collision.
- Lack of familiarity with the collision prevention regulations.

What can we learn:

- Maintain a proper look-out while fishing.
- Communicate to coordinate cooperation towards avoiding collisions.
- Take positive action to avoid an imminent collision.
- Support and management of navigation duty familiarization.

Who may benefit:
Seafarers.

5 Categories of safety issues:

- Maintenance
- Planning and Procedures
- Management factors
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Occupational accident - loss of control of machine, means of transport or handling equipment, hand-held tool, object

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier was loading nickel ore by means of the ship's cranes and grabs from barges that came alongside at anchorage. That afternoon no more barges were available and grabs Nos. 1 and 2 were parked on deck fully open to carry out maintenance on the hydraulic lines.

To drain the hydraulic lines, a plastic drum was placed under the through-beam of the grabs. The plastic drum used to drain grab No. 1 did not fit under the fully opened grab and consequently, the grab was partially closed to lift the through-beam.

When the grab was parked on deck, the Bosun and the Chief Officer (C/O) noticed that the thimble of the grab wire of grab No. 1 was dislodged. It was decided to immediately replace the wire. A risk assessment was completed. The C/O conducted a Toolbox Talk with the crew members involved in the task.

To remove the grab wire, the dead end had to be removed from the wire socket. The crane hoisting wire and the grab wire were both slackened. As a result, the grab rested on the two partially opened scoops without hydraulic pressure in the lines or in the cylinder. A chain block was connected to the grab wire on one end and to a D-ring on deck on the other end to pull the wire out of the wire socket.

Around 17:00 hrs, a crew member went under the grab to operate the chain block. When the chain block came under load, the grab opened unexpectedly to its fully open position, which reduced the space between the through-beam and the deck and pushed the crew member down onto the deck.

Why did it happen:

1 Causal factors that contributed to this very serious marine casualty include:
(a) placing the chain block under tension which applied downward force to the transverse frame and caused the through-beam to drop and trap the crew member against the deck plate;
(b) a lack of procedures and relevant safety warnings in the grab manufacturer's manual and reference in the Company's SMS for changing the grab's hydraulic oil and grab wires;
(c) a lack of awareness of the ship's crew members regarding the working principle of the grabs and their incorrect understanding that the grab could not open after the hydraulic oil had been drained from it; and
(d) inadequate pre-task hazard assessment and planning prior to starting work to renew the grab wire owing to:

i. the Risk Assessment (RA) not including any hazards associated with working on the grab in a non-standard condition;
ii. the lack of available information on board regarding the safety hazards associated with the grab being partially open and in a non-standard condition; and
iii. a lack of familiarity by the crew members with respect to the ship's grabs.

2 Additional causal factors that may have contributed to this very serious marine casualty include:
(a) that neither a RA nor a Toolbox Talk was conducted before the engineers drained the hydraulic oil from any of the ship's grabs; and
(b) non-compliance with the Company's procedures for conducting unplanned work and assessing safety hazards associated with simultaneous operations.

3 Additional issues that were identified but that did not contribute to this very serious marine casualty include:
(a) maintenance instructions within the PMS that were not as extensive as the instructions in the manufacturer's manual.

What can we learn:

- Procedures to execute non-routine and unplanned jobs need to be followed and that simultaneous operations impose additional risks that should be addressed.

- The importance of recognizing unsafe behaviour and the use of the stop-work authority when an unsafe act is observed.

- The need for familiarization with the ship's equipment prior to executing maintenance jobs to the grab and associated components.

Who may benefit:
Seafarers; Manufacturers; Dry Bulk Companies.

6 Categories of safety issues: Safety assessment review

Casualty event: Collision - with multiple ships

Casualty severity: Marine casualty

What happened:
Allision between a bulk carrier and 2 barges within a port.

Why did it happen:
Significant cause of the incident was inadequate pilotage planning and a lack of risk assessment.

What can we learn:
The pilot is an essential part of the bridge team and must be both supported and challenged by the rest of the bridge team.

The pilot should provide the master with relevant ship-handling information (draught, trim, turning circles, peculiar manoeuvring characteristics in restricted water depth/ channel width and other data). This information may be displayed at the conning position.

The master should be provided with relevant information on the tide and current situation, harbour siltation, draught limitation and other port regulation.

Functionality of Electronic Chart Display and Information System (ECDIS) is reduced when the passage does not include acceptable cross-track limits or manually plotted safety corridors when the passage passes the safety contour.

Hand-over briefings are essential so that both the master, having responsibility for the safety of the ship, and the pilot, having responsibility for the conduct of the ship, will be aware of all relevant factors which might affect the safe navigation; and

The pilot will have detailed knowledge of the particular port and will likely have extensive ship handling experience, it is probable that they will not have detailed knowledge of the specific equipment fitted to the vessel or its manoeuvring characteristic.

Who may benefit:
All Companies, Ships, Crews and Shipping Industries.

7 Casualty event: Fire/explosion – fire

Casualty severity: Very serious marine casualty

What happened:
A fire broke out in the engine-room with open flames. Efforts to extinguish the fire using the ship's firefighting team and the onboard fixed CO_2 firefighting system were unsuccessful. Consequently, the ship's captain decided to abandon the ship.

Why did it happen:
The ship's firefighting team, equipped with breathing apparatus and fire-resistant clothing, also made unsuccessful attempts to extinguish the fire. Considering the fire had gone out of control, the evacuation of the specialized crew onboard began with the assistance of nearby vessels. Although the fixed carbon dioxide firefighting system was activated, the hermetic sealing of the engine-room could not be ensured owing to the incomplete closure of the fire dampers, and the fire was not extinguished.

What can we learn:
The duty engineer of the ship, did not adequately perform engine-room watchkeeping and monitor operating machinery in accordance with the company's SMS (Safety Management System) requirements. His delayed shutdown of the starboard main engine upon observing open flames, combined with the crew's inability to ensure the hermetic sealing of the engine-room, rendered the CO_2 firefighting system ineffective.

Who may benefit:
Ship operators; Ship's crew; Recognized Organizations; Flag States.

8 Categories of safety issues:

- Management factors
- Planning and Procedures
- Safety assessment review

Casualty event: Occupational accident - breakage, bursting, splitting, fall or collapse of material agent

Casualty severity: Marine casualty

What happened:
The cargo, with a total weight of approximately 12,000 metric tons. During the discharging operation, workers began unloading steel pipes from hold No. 4 using cargo lifting beams and a shore crane. At approximately 08:30 hrs, as workers moved away from beneath a suspended load of steel pipe bundles, an uncontrolled shift occurred. One of the bundles shifted and pressed down on the worker's left ankle. The lifting wires and lining materials originally used to handle the cargo during loading were misaligned and some were damaged, contributing to the instability of the stowed pipe bundles. Despite efforts from colleagues to free him, the worker sustained an ankle fracture and was transported to the hospital for surgery.

Why did it happen:
Pipe Bundles were unevenly stowed.

Wooden Linings supporting the cargo were either deformed or destroyed.

Discharging cargo primarily from the central area of the hold resulted in an uneven distribution of load height at both ends of the hold.

What can we learn:

- The method of discharging cargo, especially from the central part of the hold, created an uneven load distribution. This height imbalance could have caused or contributed to the uncontrolled shifting of cargo, posing a risk of injury to personnel during the operation.

- Refreshing course for proper adherence to working and safety procedures was held with the direct supervisors, re-familiarization with the technological procedures and practices for safe and healthy work. Particular attention was paid to the procedure determining the extent to which "digging" operations are permitted during cargo discharge.

Who may benefit:
General cargo terminal, Port workers.

9 Categories of safety issues:

- Maintenance
- Tool and hardware (design or operation)

Casualty event: Occupational accident - breakage, bursting, splitting, fall or collapse of material agent

Casualty severity: Very serious marine casualty

What happened:
Soon after departure, the chief mate on board a product tanker held a toolbox meeting with several crew members, in preparation for the cleaning and steaming of the vessel's empty cargo tanks. One of the able seafarers was instructed to proceed to the ballast pump-room to line up the steam line to the water heater. A short instance after the able seafarer received the instructions, a loud explosion occurred in the ballast pump-room. The able seafarer was engulfed in hot steam. The able seafarer managed to walk unaided from the ballast pump-room, but he was suffering from serious scalding burns. The ship diverted its route to return to its departure port. Eventually, the injured crew member was landed on a boat and transferred to a local hospital, where he succumbed to his injuries several days later.

Why did it happen:
Hot steam escaped following a catastrophic failure of one of the steam valves.

Metallurgical examination conducted on the failed valve body and fragments concluded that the mechanism of failure was most likely to have been fatigue.

The examination revealed signs of pre-existing multiple developing cracks on the pipe body.

The metallurgical examination further revealed that exacerbation of crack growth could have been aided by the stencil marks on the valve and the uneven geometry.

What can we learn:

- Steam valves and other critical components should undergo regular non-destructive testing (NDT) to detect early signs of fatigue or cracks;

- Although limited in what it can achieve, a visual and functional check of all critical components should be part of the toolbox meeting discussion before beginning work; and

- Procurement procedures should ensure that critical equipment components are sourced from reliable manufacturers and meet industry safety standards.

Who may benefit:
Seafarers, Ship owners, Ship operators, Ship managers.

10 Categories of safety issues:

Casualty event: Others

Casualty severity: Very serious marine casualty

What happened:
A passenger ship was on passage off the coast of Brazil. Work was carrying on as normal below decks in the waste handling area where incinerator operators were preparing for the transfer of ash to a holding area onboard ready for disposal ashore at their next port.

During the transfer, a wiper was asked to assist in the loading of the ash bag into a cage lift. The ash bag became wedged. When he attempted to free the ash bag, the cage lift gave way, trapping and crushing his leg and lower body.

Despite immediate medical assistance on board and medical care ashore at a local hospital, the wiper later died following complications from his injuries.

Why did it happen:
The cage lift got wedged when an ash bag shifted during hoisting. Horizontal bars that were fitted to prevent cargo from spilling out from under the gate during loading were in place.

The incinerator supervisor was unaware that the chain on the cage lift was slack when he isolated the power, rendering it unsafe for access in any attempt to free the wedged ash bag. The wiper entered the cage to free the ash bag unaware of the potential risks.

What can we learn:
Crew that are asked to assist in unfamiliar operations should refrain until suitably trained and qualified, including work involving lifting appliances.

Personnel working with lifting appliances should be experienced in all aspects of operations including emergency preparedness, especially equipment installed with safety features which should not be bypassed as they are fitted to ensure areas are made safe to prevent harm or severe injuries from occurring.

When systems are being installed on ships, consideration must be given to ergonomics of design, and adapting the workplace to the worker by designing tasks, workstations, tools, and equipment that are within the worker's physical capabilities and limitations

Who may benefit:
Passenger ship operators, Shipping Industry.

11 Categories of safety issues:

- Anthropometric or personal factors
- Maintenance

- Planning and Procedures
- Management factors
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Occupational accident - overflow, overturn, leak, flow, vaporization, emission of material agent

Casualty severity: Very serious marine casualty

What happened:
A crew member was cleaning on the main deck, using an electrical (220V AC) power tool. His legs were inside of a mud tank and the rest of his body was outside, seated on the deck. An explosion occurred in the tank and the blast wave, which was directed vertically, threw the crew member to a height of about 4 meters. He landed on the main deck about 3 meters away. First medical aid was provided immediately by the crew. The injured crew member was evacuated to a medical facility, where he later died.

Why did it happen:
Lack of SMS procedures to facilitate the safety of cargo operations on board, associated risk assessment and corresponding permit-to-work system.

What can we learn:
- Establishing necessary measures to ensure effective implementation of all companies' working procedures, pre-task planning, risk analysis and safe working practices on board its vessels.
- The need to assess the risk of unfamiliar operations to establish suitable precautions.

Who may benefit:
Seafarers, ship/tug owners and operators.

12 Categories of safety issues: Planning and Procedures

Casualty event: Grounding - while under power

Casualty severity: Very serious marine casualty

What happened:
A chemical tanker was stuck in the reef and grounded in the shallow waters. At the time of the accident, the weather was fair with wind blowing from north-west; waves about 1.5 meters high; and visibility about 10 nm.

Why did it happen:
The company's Instruction prescribes that if the planned routes need to be changed, a ship shall establish a corrected voyage plan, verified by the master, before making changes. However, this provision was not followed.

The chemical Tanker altered course to starboard and gave way to a fishing vessel ahead so that she could pass the tanker on the port side. However, the tanker grounded on a reef located on the starboard side. The shallow areas and reefs in the waters on starboard prevented the tanker from continuing to sail, while the waters to port had no shallow areas, reefs, or other hazards to navigation.

According to the company Instruction, the tanker must maintain sufficient distance from islands, rocks, and other hazards to navigation during the passage. The Officer of the Watch (OOW) is tasked with conducting sufficient and frequent observations on the tanker's position by using all necessary and available navigational equipment to ensure the tanker remains on the planned route. In this casualty, the ship continued to deviate to the starboard side of the planned route without fixing location frequently.

When leaving the bridge, the master neither clearly handed over the conning duties nor manoeuvred the tanker until her give-way to the fishing vessel completed.
The company's Instruction stipulates that the tanker must maintain the two-people watchkeeping system, consisting of the OOW and another rating of the watch, when the tanker navigates in coastal waters or waters with high risk. At the time of the accident, however, only one rating was working on the bridge.

The OOW was aware of the danger from reefs and shallow areas. However, he followed the master's orders without presenting his ideas, and the tanker ran aground.

What can we learn:
Strictly re-establishing a voyage plan when changing the route

- A voyage plan is a document which serves as the basis of safe navigation for the scheduled passage. Regardless of who writes up the plan, the master bears the ultimate responsibility for navigational safety.
- In the event a ship needs to change route during the passage after setting up the initial voyage plan, the ship master should renew the voyage plan after thoroughly reviewing the IMO guidelines and the company's Instruction.
- Companies should set up a system to check if a ship is sailing towards her initial voyage route, and if the route is changed, the ship re-establishes her voyage plan. By doing so, the company should assure the quality of the voyage plan and support the ship's safe navigation.

Enhancing Bridge Team Management (BTM)

- In the event of encountering another vessel, the master and the OOW should take into account the surroundings and take give-way actions early. In particular, they must determine in advance where there are any hazards to navigation on the route after giving way to determine the direction to alter the course.
- The OOW should fix the tanker's position fully and frequently during the voyage while keeping a sufficient distance from islands, rocks, and other hazards to navigation. The OOW should check if the vessel deviates from the planned route and take actions to ensure the vessel can sail on the route.
- When the master takes over the conning duties or hands over them to the OOW, he should clearly inform the OOW to avoid any possible confusion. Moreover, when giving way to other vessels, including a fishing vessel, the master should manoeuvre the vessel safely till the moment the give-way action is completed.
- Companies should support safe navigation through regular training and education while checking whether navigational watchkeeping rules and relevant instructions are practically implemented on board.

Establishing a two-people watchkeeping system and strengthening cooperation

- The master should take measures to create and activate an appropriate watchkeeping system during the voyage. When navigating an area with fishing vessels in many shallow waters, such as archipelagic waters in particular, two persons on watch ensures efficiency.
- When the OOW is acting as the sole look-out, he must not hesitate to summon assistance to the bridge, and when for any reason he is unable to give his undivided attention to the look-out, such assistance must be immediately available.
- A two-people watchkeeping system is the basic principle for navigational watch. Companies should check and manage the system so that safe navigation is maintained on board.
- The master should exercise his leadership to enhance communication within and active cooperation among the Bridge Team members. Companies should strengthen education on Bridge Resource Management (BRM) to boost collaboration among crew members and to facilitate a shipboard work environment where crew members can directly report any dangerous situation of the ship to the master at all times.

Who may benefit:
Seafarers. Shipping companies.

13 Categories of safety issues:

- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Occupational accident - loss of control of a machine, means of transport or handling equipment, hand-held tool, object, or animal

Casualty severity: Very serious marine casualty

What happened:
The second engineer on board a chemical tanker was found unconscious, trapped by steel plates in the steering gear compartment. Another crew member raised the alarm, and together with his colleagues, he freed the second engineer and attempted to resuscitate him. The master sought medical help from the nearby shore authorities, and although two medical teams boarded the ship by helicopter, they were unable to revive the second engineer.

Why did it happen:
The second engineer was injured when a stack of steel plates tipped over, trapping him against the store shelving in the steering gear compartment.

The lashing intended to secure the stack was found slackened.

The second engineer was working alone and there was no system in place for him to sound the alarm for assistance.

In order to select and take out a steel plate from the stack, the complete lashing arrangement had to be released.

The crew members had no cues, which would have suggested to them that there was a level of unacceptable risk related to the stack of steel plates, and which had to be addressed.

What can we learn:

- The stowage position and lashing arrangements of the steel plates on board should allow for the use of either a hoist or lifting clamps to transfer / shift the plates safely.

- Lashing arrangements must be properly secured and routinely checked for effectiveness.

- Working alone in hazardous areas and / or when handling heavy or unstable items must be avoided.

Who may benefit:
Seafarers; Ship owners; Ship operators; Ship managers.

14 Categories of safety issues: Management factors

Casualty event: Occupational accident - electrical problems, explosion, fire

Casualty severity: Very serious marine casualty

What happened:
A shipboard explosion and subsequent fire likely originated from an uncapped thinner tin which was placed near to the bottom opening of the empty oil drum used for burning plastic waste. The fire associated with the explosion caused An Ordinary Seaman (OS) to suffer fire injuries. He later succumbed to the injuries.

Why did it happen:
There were significant issues in communication and sharing of information onboard the ship. Despite the master informing the chief engineer about plans to dispose of garbage, including the plastic waste at the next port, other crew members, including the chief mate, were left uninformed. The chief mate did not inform the master of his concern on the building up of plastic waste and his plan to burn the plastic waste. The chief engineer did not inform the third engineer of the reason for not allowing the use of onboard incinerator to burn the plastic waste.

The chief mate and bosun did not adhere to Company SMS and proceeded to burn plastic waste on the poop deck, a practice that was forbidden.

What can we learn:

- Crew members should exercise stop work authority when instructed to perform tasks that are not permitted by the ship's SMS.

Who may benefit:
Shipping community and seafarers.

15 Categories of safety issues:

- Planning and Procedures
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Occupational accident - loss of control of a machine, means of transport or handling equipment, hand-held tool, object, or animal

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier was at anchor, waiting for transhipment of its cargo. Owing to deterioration of weather conditions, it was observed that several vessels in the area were dragging their anchors. Being concerned of a possible collision, the master decided to weigh the anchor and proceed out to open sea.

About an hour after the anchor was aweigh, the master instructed the anchor station team to secure the anchors, switch off the windlass' hydraulic pump and return to the accommodation. While the crew members were leaving the forecastle area, a large wave washed over the port bow. One of the crew members suffered fatal injuries while he was exiting the space. Another crew member was injured lightly.

Why did it happen:
The fatally injured crew member was violently struck by the forecastle store's door, just as he was about to exit.

It was also highly likely that part of the fatally injured crew member's body was violently caught between the door and its frame when it slammed shut.

The force of the wave was likely to be strong enough to slam the open, unsecured door shut, and the rolling of the vessel may have also potentially increased the force with which the door shut.

The crew members did not use the securing hook to hold the door open because they were concerned of the possibility of water entering the forecastle store and flooding and / or causing damages inside it.

What can we learn:
- The importance of implementing a permit-to-work system on board for work to be carried out in adverse weather conditions.

Who may benefit:
Seafarers, Ship owners, Ship operators, Ship managers.

16 Categories of safety issues:

- Emergency handling
- Planning and Procedures
- Safety assessment review

Casualty event: Fire/explosion – explosion

Casualty severity: Very serious marine casualty

What happened:
Late in the evening, a car carrier was under way when a fire broke out.

The ship was loaded with new vehicles, including electric vehicles ("EV") and special construction machinery. The fire alarm was raised at; at that time, the third Deck Officer was on bridge duty together with the watchkeeper AB. As a normal practice, the third Deck Officer acknowledged the alarm on the indicator panel; he instructed the watchkeeper AB to go and check the subject deck/hold. At the same time, the master was called on the Bridge and he instructed the third Deck Officer to join the AB in the inspection.

The AB and third Deck Officer quickly located the fire by observing the smoke and flames. The bridge/master was advised accordingly, and the General Alarm for fire was raised.
The crew were mustered at their muster station, and the fire emergency team (C/O in charge) prepared to investigate the suspected area further and attack/extinguish the fire. For the next approximately 40 min, regardless of the efforts of the fire teams as well as the deployment of the fixed fire-extinguishing system (foam), the fire could not be controlled; instead, the fire spread furiously through the vessel, producing large amounts of smoke, heat and flames.

The master assessed the overall condition, and taking into consideration that the fire could not be controlled, he ordered "abandon vessel; however, owing to heat and heavy smoke, vessel lifeboats/life rafts could not be used. Shore assistance for vessel evacuation was requested. At the time of the fire, were 23 persons on board, including 21 crew members, a pilot and a superintendent.

The crew rescue/evacuation operation was organized/handled by the local coastguard. A patrol aircraft, followed by two rescue boats and one support vessel, approached the vessel; seven crew members jumped into the water and were rescued from the water.

However, taking into consideration the height from where the crew members were jumping and that they were unconscious when rescued, the remaining crew were instructed to stop jumping and wait to be rescued by helicopters. One of the unconscious crew members did not recover from his injuries and later died.

Why did it happen:
The order to abandon the vessel was given after the fire became widespread. Heavy dark smoke from the cargo vents caused crew members to have difficulties with vision and breathing, and they could not approach the lifeboat and life rafts. Closing the cargo vents after the fire expanded was almost impossible since they needed to be closed manually/locally; no remote closure was available.

There were issues related to communication throughout the emergency.

What can we learn:
- Suitable preventive measures need to be put in place to reduce risks and their associated repercussions in the case of a fire. A variety of preventative measures are advised since the effects of fire on vessels carrying EV and Internal Combustion Engine (ICE) cars might be disastrous.
- Crew members tasked with responding to car fires must be made aware of the danger that high-voltage electric components in electric cars represent.
- Crew members, especially those designated for safety patrols, must undergo comprehensive training on the early detection of smoke or heat emanating from within vehicles and to understand signs that signal the start of a thermal runaway event.
- Thermal imaging cameras are a valuable tool for crew members during vehicle deck inspections. Regular use of these cameras and the recording of results can provide early warning of overheated automobiles.
- Crew members should understand "thermal runaway" and be trained to recognize the condition's early warning signals. Additional equipment, such as portable thermal detectors can help minimize the development of a fire.
- The effectiveness of the crew members' training should be evaluated or validated by frequently performing fire exercises with particular scenarios on identification and initial reaction to EV battery fires.

- Vessels built prior to the demand for EV transportation were outfitted with Fire Fighting Equipment (FFE) suitable for loading and transporting ICE vehicles. However, it is now apparent that these vessels also transport EV without any upgrades to their cargo deck areas and FFE. Regulations pertaining to construction, LSA/FFE, and inspections of vessels involved in the transportation of electric vehicles should be updated to reflect the modifications made to the hazard parameters, duration/temperature degree of fire, and means of extinguishment, among others.

Who may benefit:
Owners/Managers, Crew members, Flag Administrations, shipbuilders/shipyards/classification societies, IMO.

17 Categories of safety issues:

- Anthropometric or personal factors
- Management factors
- Planning and Procedures
- Safety assessment review

Casualty event: Occupational accident – Others

Casualty severity: Very serious marine casualty

What happened:
In preparation for cleaning a ballast water tank (BWT) on board a 52,000 GT drill ship, a Second Officer (2/E) and Motorman were tasked with opening the BWT's access hatch. The hatch was located on the tank top beneath the deck plates in a pump-room and was accessed by climbing down a 1.5 m vertical ladder.

After opening the access hatch, the Motorman climbed up the vertical ladder to the deck plates. The Motorman, who had stepped from the ladder onto the deck plates, saw that the 2/E had stopped climbing up the ladder and lay face-down on the deck plates. The Motorman grabbed hold of the 2/E's coveralls and yelled for help. A third-party electrician who was working in the pump-room responded. Within seconds of the third-party electrician reaching the scene, both the 2/E and the Motorman, who was kneeling on the deck plates while holding onto the 2/E's coveralls, fell through the open access hatch into the BWT. The third-party electrician immediately informed crew members who were in the Engine Control Room and the alarm was raised.

Members of the ship's rescue team reported smelling what was described as a "strong smell of rotten eggs" when they entered the pump-room to initiate an enclosed space rescue. Neither the 2/E nor the Motorman were breathing or had a pulse when they were removed from the tank by members of the ship's rescue team. Efforts to resuscitate the 2/E and the Motorman were unsuccessful, and they were determined to be deceased.

Why did it happen:
The marine safety investigation determined that the permit to work for opening the BWT access hatch was not issued in accordance with the ship's manager's established procedures. Though portable gas detectors were available on board, one was not available on-site as required by the Company's Work Instructions when the 2/E and Motorman opened the BWT access hatch. Physical access to the BWT access hatch was restricted, which increased the risk of exposure to any gases that were within the BWT ullage space after the hatch was opened and while

climbing the ladder up to the deck plates. Crew members were aware the atmosphere in the BWT ullage space contained hydrogen sulphide but they may not have been aware that it could potentially contain high concentrations of hydrogen sulphide.

What can we learn:

- Administrative controls, such as permits to work and Work Instructions, must be implemented consistently and in accordance with established procedures to be an effective means of reducing exposure to hazards.

- The importance of identifying connected spaces and their hazards.

- The importance of identifying and addressing hazards associated with the location where the work will be conducted when planning a job.

- The importance of being aware that, when opening access hatches, tanks may contain higher concentrations of hydrogen sulphide, or other toxic gases, than might be expected.

Who may benefit:
Flag and port State Administrations, ship managers, seafarers, training institutions.

18 Categories of safety issues:

- Emergency handling
- Management factors
- Planning and Procedures
- Safety assessment review

Casualty event: Fire/explosion – fire

Casualty severity: Marine casualty

What happened:
A gas tanker was engaged in ship-to-ship (STS) operations for loading and discharging cargo. Early in the morning, the gas tanker raised anchor to go alongside the mother ship for STS operations.

On the way to mother vessel, the Person in Overall Advisory Control (POAC) and the Deputy POAC boarded the ship to supervise mooring and cargo operations under the Joint Plan of Operation (JPO). There was change in JPO at last moment in consultation with master of the mother vessel; however, the master of the gas tanker did not get sufficient time to review it.
The gas tanker started to load propane from the mother vessel. Cargo operations continued for next 12 hours.

After midnight, the Duty AB reported to the Duty officer about the tension on the head lines which were passed from the mother ship. The Duty Officer tried to communicate with the mother vessel on the designated Very High Frequency (VHF) channel to slacken the mooring lines but there was no response despite repeated calls. There was no crew on deck of the mother vessel to attract their attention.
Shortly after, the head lines started to part with tension increasing on the rest of the mooring ropes. Owing to parting of head lines, the distance between the two vessels increased, building up tension on the flexible cargo hoses.

The cargo hose connected to the mother ship parted and snapped back, causing a spark that ignited the propane gas, causing a massive fire. The supply of cargo from the mother ship did not stop, fuelling a huge flame from the other end of the cargo hose. About an hour later, the master of the gas tanker ordered the crew to abandon the ship.

The fire spread to no.3 cargo tank which was near the crew accommodation. The life boat and life raft could not be launched owing to heavy smoke and heat. The master and crew of the gas tanker had to jump overboard. Subsequently, the mother vessel let go the other mooring lines.

All crew of the gas tanker were rescued by the standby tug. The crew was safely brought ashore. The master and some crew members were injured while abandoning the ship. They were given first aid and medical assistance.

Why did it happen:
The fire incident aboard the gas tanker during the Ship-to-Ship (STS) operation highlights several critical failures in operational procedures, communication, training, and risk management. These deficiencies not only led to significant damage to the ship but also put the lives of the crew at great risk. In particular:

- The master of the gas tanker did not enforce his authority.

- There was an inadequate contingency response during cargo and mooring operations

What can we learn:

- Enhance Operational Procedures:
    - Ensure all STS operations are implemented with strict adherence to the established guidelines, especially regarding mooring patterns and cargo handling.
    - Develop clear policies requiring approval and risk assessment procedures when any changes to the established operational procedures are to be implemented.

- Implement Comprehensive Safety Management Systems (SMS):
    - Establish and regularly review safety protocols, ensuring they address all potential risks, particularly during high-risk operations like STS.
    - Conduct periodic audits to ensure adherence to these safety protocols and identify potential gaps.

- Improve Crew Training Programs:
    - Enhance value-added crew training on emergency response, communication protocols, mooring procedures, and cargo operations.
    - Ensure that training includes practical scenarios addressing emergencies such as rope parting, hose failure, and fire outbreaks during STS operations.

- Continuous Evaluation and Risk Mitigation:
    - Continuously evaluate the operational practices and safety management systems of vessels. Recommend improvements based on evolving industry best practices and lessons from incidents.

- The master should always have the authority to stop operations if he believes the safety of the crew, ship, or environment is compromised. This authority must be exercised whenever there are concerns, particularly when the risk level escalates.

- Enhanced Situational Awareness and Decision-Making:
    - Ensure that the crew, including the master, is trained to assess potential risks during operations and recognize warning signs that indicate the need to stop operations.
    - Foster a safety culture where crew members are encouraged to share information and take actions when they identify unsafe conditions.

- Emergency Response Training and Drills:
    - Conduct regular emergency drills covering all potential scenarios, including rope parting, fire outbreaks, and ship abandonment.
    - Ensure the crew is well-versed in the use of lifesaving equipment, including launching life rafts under extreme conditions.

- Risk Assessment and Contingency Planning:
    - Ensure that thorough risk assessments are conducted prior to any STS operation, especially when alterations to standard procedures are made.
    - Develop and regularly review contingency plans to address potential hazards.
- Regulations on STS Operations:
    - Ensure regulations and guidelines compliance for conducting STS operations, including mandatory pre-operation risk assessments and contingency planning.
    - Ensure compliance with international safety standards and conventions, especially for high-risk operations at sea.

Who may benefit:
Maritime industry.

19 Categories of safety issues:

- Planning and Procedures Management factors
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Occupational accident – Others

Casualty severity: Marine casualty

What happened:
A bulk carrier was beginning a manoeuvre for cargo operations. The ship docked on the port side and was carrying out the loading manoeuvre directly from the dock floor to the holds, using its own cranes and its own clamshell grab.

After approximately 6 hours of operation, the upper part of a crane including the command cabin, the crane arm, the wiring pulleys and the machinery, detached and collapsed, falling to the bottom of warehouse No. 2. The crane operator was treated and taken by ambulance to the hospital where he later died of his injuries.

Why did it happen:
There were a total of 60 bolts connecting the upper and lower parts of the crane. In a visual inspection following the casualty, the inspector noted that more than 50% of the bolts broke. Visual inspection showed that many of those bolts were corroded and perhaps already had some micro fracture or were damaged in some way.

There was a lack of maintenance and replacement of some bolts; the crane was inspected by class but did not identify the situation of the bolts.

What can we learn:

- Visual inspection of components, such as bolts, may not be sufficient to identify wear and corrosion. Companies should regularly test bolts, such as through tension tests, or bolts should be proactively changed to avoid material failure.
- Screws and bolts should be assigned a registered useful life and must be inspected or tested within a certain period of time. This can give the surveyor a clear idea of the real state of the structure of said bolts or screws and whether they require maintenance or replacement.
- Ensure that operators have sufficient experience and meet other requirements, such as alcohol and drug testing, before starting the operation.
- Verify that periodic reviews of the structural parts of the cranes, which are subject to tension (screws and others), are included in the ISM manual.
- Verify that periodic reviews of the structural parts of the cranes, which are subject to tension (screws and others), have been performed.

Who may benefit:
Shipping industry, Ship Managers and Owners.

20 Categories of safety issues:

- Maintenance
- Planning and Procedures
- Emergency handling
- Management factors
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Occupational accident - body movement without any physical stress (generally leading to an external injury)

Casualty severity: Very serious marine casualty

What happened:
Whilst a passenger ship was made fast alongside a pier, maintenance works were being performed in the engine-room. During the inspection and cleaning of the injector, the indicator cock was covered by a metal bucket to avoid oil spillage around the engine-room.

When the engine was blown, the pressure release launched the metal bucket onto the engine cadet's head at a high speed. The cadet fell from the top of the engine where he was seated. He was immediately assisted by the engine-room team. Medical assistance was called, including the onboard medic and a medical team from shore. The shore medical team pronounced the cadet deceased.

Why did it happen:
The casualty stemmed from both procedural gaps and a systemic tolerance for informal methods such as using a metal bucket instead of proper containment.

The organizational culture did not adequately distinguish between familiarity and certified competence and expertise. Within the ship's safety culture, there was no clear distinction

between being familiar with tasks and being formally competent to perform them. As a result, informal practices gradually became accepted as standard.

What can we learn:

- No object should be left unsecured near open injector holes during turning with air.
- Compressed air operations require strict controls and clear zone establishment.
- Cadets must be treated according to their formal training stage, not their apparent familiarity.
- Informal practices must be challenged and replaced with standardized methods.
- Every maintenance step must be risk-assessed, particularly involving stored energy (compressed air).

Who may benefit:
Maritime sector - engine-room crews.

21 Categories of safety issues:

- Anthropometric or personal factors
- Planning and Procedures
- Safety assessment review
- Legislation, standards and compliance

Casualty event: Others

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier was berthed and engaged in cargo handling operations, loading palm kernel shells. The hatches had been closed 2 days prior, when work was suspended owing to bad weather. The morning of the occurrence, at around 0700, 2 hatch covers were opened by the vessel's crew.

At around 0715 hrs, 9 stevedores held a pre-operation meeting on the wharf. They discussed the procedure for the loading operation and conducted hazard prediction activities and other safety checks.

At around 0720 hrs, the stevedores moved to their assigned positions. Shortly after, two stevedores entered a cargo hold to carry out tasks related to the use of a backhoe. Shortly after entering the hold, both stevedores lost consciousness and collapsed. The stevedore operation the fore-side crane attempted to contact one of the stevedores at around 0735 hrs. When no response was received, the stevedore rotated the crane so he could see into the cargo hold. Seeing the two stevedores collapsed in the cargo hold, he notified personnel on the wharf, and an emergency call was made. One of the ship's officers brought two sets of self-contained breathing apparatus to the upper deck and the master ordered the crew to remain on standby.

At around 0750 hrs, a team of 15 rescue personnel arrived on the ship and began preparing for rescue operations. The oxygen level was measured and found to be lower than that of normal atmospheric conditions.

Both stevedores were transported to a hospital; one was later pronounced dead, and the other sustained injuries.

Why did it happen:
There was an absence of a safe work procedure manual for the loading operation which resulted from the following factors:

- The company representative judged that, because the ship entered the port in a light (empty) condition and there was no perceived hazard inside the cargo hold, work could be conducted by reversing the unloading procedure and the loading operation did not constitute work involving the adoption of new work methods or procedures as stipulate under the company Occupational Safety and Health Management System.

- The company did not provide direct instructions or comments indicating that a new risk assessment work procedure manual should be prepared, in response to the judgment made by its representative. It was decided that the loading operation could be safely conducted using conventional methods according to experience and procedures related to the loading of bulk cargo, and subsequently the stevedores were instructed to perform the operation in accordance with the planning sheet.

- The representative and stevedores did not recognize that the working environment might change as the loading progressed within the cargo hold, and they were not aware that the operation fell under requirements which mandated the measurement of the working environment in such situations.

What can we learn:

- When performing tasks inside a cargo hold, the need for working environment measurements must be clearly recognized by stevedores. Stevedores should understand the necessary work procedures to ensure that such measurements are always conducted prior to the commencement of operations. Based on the measurement results, if conditions such as decreased oxygen concentration are identified, the working environment should be improved through natural ventilation and by employing forced ventilation or other appropriate means.
- Establish a safety management framework at the worksite that encourages stevedores to express any doubts they may have regarding work procedures to a responsible supervisor without any hesitation.
- When adopting or modifying new work methods or procedures in cargo handling operations, review and revise, as necessary, the operational systems related to the Occupational Safety and Health Management System (A-OSHMS) to ensure that risk assessments are reliably conducted.
- When handling new cargo, collect information in advance regarding any potential hazards, and establish appropriate work procedures that take such risks into account.
- Cargo Handling Companies should ensure the proper operation of the A-OSHMS by effectively utilizing workplace meetings and other opportunities attended by both management personnel and stevedores.

- The departments responsible for supervising and managing should ensure that the A-OSHMS is functioning effectively at each branch and should provide necessary guidance and supporting action.

Who may benefit:
Stevedores and crew. Cargo handling companies.

22 Categories of safety issues:

- Anthropometric or personal factors
- Planning and Procedures
- Management factors
- Safety assessment review
- Natural environment
- Tool and hardware (design or operation)
- Legislation, standards and compliance

Casualty event: Occupational accident - slipping, stumbling, falling of person overboard

Casualty severity: Very serious marine casualty

What happened:
A tanker was in an anchorage area preparing for berthing operations at a private shipyard. The pilot boat approached the starboard side of the tanker and started the transfer operations of the pilot. During the transfer, while making a move to the pilot's ladder, the pilot lost his balance and fell overboard when the pilot boat experienced a hard roll.

Why did it happen:
The pilot transfer did not wait for the leeward option.

The pilot boat pushed on perpendicular to the tanker's hull in order to hold on to the moored vessel, causing the ship to fall into hard rolls.

There was no risk assessment conducted for the approach for the pilotage operation.

The pilot boat crew, including the pilot, did not use personal floating equipment during the pilotage operation.

The first rescue attempt made after the accident was not successful in getting the victim out of the sea. There was a lack of equipment that could be useful in case of man overboard.

What can we learn:
- A life jacket can prevent a catastrophic outcome.

- Pilot boats must be equipped with equipment to recover a man overboard.

- It is important for the ship to make leeward turn for the pilot boat and the operation should not be rushed.

- A risk assessment should be conducted, taking weather conditions into consideration.

Who may benefit:
Pilots, seafarers, pilotage companies.

23 Categories of safety issues:

- Planning and Procedures
- Emergency handling
- Management factors
- Safety assessment review
- Legislation, standards and compliance

Casualty event: Capsize/listing - capsize

Casualty severity: Very serious marine casualty

What happened:
A dredging ship was conducting dredging operations in a river for the first time. The ship had just completed the loading of sand materials and was flushing out the remaining sediment into its hoppers when it started to list to starboard while the portside suction pipe was being hoisted. The ship capsized with some crew members and other personnel trapped inside.
The occurrence resulted in the total loss of the ship with nine reported fatalities and one missing. No severe marine pollution was reported as a result of the occurrence.

Why did it happen:
Sand slurry materials had begun to accumulate at the starboard side of the hoppers, prompting an uneven distribution of weight which caused the starboard list.

What can we learn:
- Importance of proper load management and stability monitoring.
- Need for clear operational procedures in the safety management system (SMS).
- Effective communication is critical.
- There is a need to establish adequate crew and supervision requirements.
- The importance of ensuring compliance with regulatory requirements.
- The importance of accurate and timely cargo information-sharing.
- The need for oversight during high-risk operations.

Who may benefit:
Shipping industry.

24 Categories of safety issues:

- Anthropometric or personal factors
- Management factors

Casualty event: Occupational accident - overflow, overturn, leak, flow, vaporization, emission of material agent

Casualty severity: Very serious marine casualty

What happened:
A Liquefied Petroleum Gas (LPG) tanker was crossing the Pacific Ocean. During routine inspections the second engineer reported fluctuations in pressure and temperature from the auxiliary boiler. A decision was taken by the chief engineer to inspect the boiler the following day. Following the inspection, it was identified that the furnace exhaust drainpipe was blocked with carbon deposits. A fitter, motorman and a wiper were assigned the task of removing the furnace drainpipe and unblocking it. When opening an adjacent handhole cover in an attempt to gain access to the furnace drainpipe from inside, the fitter suffered severe burns when he was exposed to steam and hot water. Despite immediate medical assistance on board and medical care ashore the fitter died as a result of his injuries.

Why did it happen:
The fitter opened the handhole cover in the belief that he could gain access to the furnace drainpipe in order to unblock it. Unknown to him or the crew he was working with, the cover actually gave access to the water side of the boiler which was full of water at 127°C and pressurized to 2.5 bar. Although a meeting was carried out that morning, the work party did not assess all potential risks, including gaining access to the boiler from an entry point not specified or approved by the engineer in charge of the works.

What can we learn:
- A shared mental model is vital when work is being carried out on complex systems that are pressurized. Personnel working on such systems should be suitably trained and appropriately briefed.
- All personnel working where a potential risk of harm exists are encouraged to exercise the Stop Work Authority if an unsafe condition arises but, if you don't understand the system, you cannot necessarily see the risk.

Who may benefit:
Shipping Community

25 Categories of safety issues:

- Planning and Procedures
- Legislation, standards and compliance

Casualty event: Collision – with other ship

Casualty severity: Very serious marine casualty

What happened:
A container ship ("ship A"), with the master and 17 crew members aboard, was sailing southbound in a seaway. Meanwhile, a cargo ship ("ship B"), with the master and 4 crew members aboard, was sailing north-west. Around midnight, the two vessels collided, causing ship B to capsize.

As a result, two crew members of ship B died, and three sustained serious injuries. Ship A sustained damage, including a breach to its bow, however, there were no injuries among its crew. ship B, adrift in a capsized state, sank around 2 days later.

Why did it happen:
It is probable that Officer B_1, while working at the chart table in the aft of the bridge, did not maintain look-out and did not notice ship A until it was too close in range, resulting in delayed action. Meanwhile, Officer A_1, assumed that ship B would give way to ship A according to the navigation rules for a crossing situation. Officer A_1 neither confirmed ship B's intentions via VHF nor gave a warning signal, and instead repeatedly steered slightly to port and to starboard. As a result, both vessels collided.

It is probable that ship B did not maintain a look-out, because after the previous watch personnel left the bridge, Officer B_1 was engaged in tasks that should have been completed during the handover. This resulted in a diminished safety awareness regarding navigation and an improper handover of the bridge watch.

It is probable that the ship A did not confirm ship B's intentions via VHF or gave warning signals, and instead took action only through repeated slight steering, owing to the ineffective implementation of BRM/BTM.

ship A's radar and automatic identification system (AIS) transmitter had not been updated with the latest firmware. As a result, the radar did not display Class B AIS information for ship B, such as its name and call sign.

What can we learn:
- OOWs shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision. Especially in traffic-congested areas, they should focus on navigation and avoid engaging in non-priority tasks.
- OOWs, as well as other person on bridge watch, should use navigational equipment such as radar, ECDIS, and AIS effectively, alongside visual look-out, and promptly call the master to come to the bridge if there is any doubt.

- Masters and officers should ensure proper handover using tools like checklists to communicate essential information such as course, speed, intended route, and surrounding conditions. Outgoing watch officers must remain on the bridge until all necessary information has been passed on, and look-out must also be maintained during handover.

- OOWs should consider the possibility that other vessels may not be aware of their ship's presence in close quarter situations. They should use VHF, whistles, or other means to inform other vessels of their presence and navigation intentions.

- OOWs must take action that will best avoid collision, even if their vessel is a stand-on vessel, when close to a give-way vessel and it becomes apparent that the give-way vessel's actions alone will not prevent a collision. Such actions may include significant course alterations to starboard or speed reductions with ample time and enough space. If a collision becomes unavoidable despite all efforts, they should promptly use the main engine to reduce speed and adjust manoeuvres to avoid a near-right-angled collision to minimize impact and damage.

- Shipowners, ship management companies, and operators should ensure their own fleet complies with relevant laws, regulations, company safety manuals, and other directives, and strive to maintain and enhance the safety awareness of crew members.

- Shipowners, ship management companies, and masters should educate officers on watch regarding their responsibilities, and strengthen BRM/BTM to ensure that appropriate resources are effectively utilized.

- Ships using AIS transmitters or radar systems that do not display the names of vessels transmitted by Class B AIS should update their firmware to the latest version, as this may enable such information to be displayed.

Who may benefit:
Seafarers

26 Categories of safety issues:

- Maintenance
- Tool and hardware (design or operation)

Casualty event: Occupational accident - electrocution

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier was on passage in the Indian Ocean with a cargo of phosphate rock. Shortly after a coffee break, a member of the crew found the bosun unconscious on the deck in the forecastle store, holding onto an electrical cable and portable lamp. The crew responded to the subsequent call for help but the bosun could not be revived.

Why did it happen:
A post-mortem identified that the cause of death was electrocution. Burns on the victim's wrist/forearm matched the position of the lamp when the victim was found by the deck rating. Neither the extension cable's residual current device, nor the ship's circuit breakers protected the victim. The source of current leakage was not confirmed by laboratory tests but the lamp's electric cable was constructed of two different diameter cables that had been jointed in a way that adversely affected protection.

What can we learn:
- Poorly maintained equipment is a major cause of electrical accidents involving portable equipment. At least three seafarers have been electrocuted by portable cargo lamps in a two-year period.
- Portable equipment is likely to be subjected to, and more vulnerable to, physical damage and wear. The most vulnerable item of any portable equipment is often the cable.
- There is no regulatory mandate to test portable electrical equipment – operators need to put appropriate controls in place to ensure equipment with the potential to cause injury is maintained in a safe condition.
- Effective maintenance of portable electric equipment may be achieved by a combination of checks by the user, formal visual inspections by a competent person and, where necessary, a combined inspection and test, also known as a portable appliance test, by an electrically competent person.

- The human drive to help those who may be hurt is incredibly strong but can prove fatal: the first responder received an electrical shock when he touched the victim. Before approaching a casualty, you must first check for danger to yourself.

Who may benefit:
Shipping Community.

27 Categories of safety issues: Management factors

Casualty event: Flooding/foundering – flooding

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier was on passage from China to Singapore when the engine-room started to flood owing to a fractured seawater pipe. The ship was pitching and rolling heavily as a typhoon approached. The efforts to stop and mitigate the flooding were unsuccessful and the evacuation of the crew by helicopter commenced as the ship drifted towards an island. The evacuation was completed after the ship had grounded. The ship was a total loss but there was no significant pollution. Other than the captain, who sustained broken ribs during the evacuation, none of the crew were injured.

Why did it happen:
The source of the flooding was a fractured weld on a connection flange on the main seawater pipe connecting the high and the low sea chests. The stresses resulting from the ship pitching and rolling up to 20˚ might have been sufficient to cause the weld on the seawater pipe flange to fracture.
The vessel's engineers were very quick to respond to the seawater ingress from the fractured pipe but efforts to pump out the seawater from the bilges using the emergency suction and ballast pumps, and to isolate the fractured section of the seawater pipe to stop the seawater ingress, were unsuccessful.
It is feasible that emergency pumping arrangements were not configured as intended and that the fractured pipe was never isolated.
A lack of planning during change of ownership, management, registration and crew of the ship impeded crew familiarization.
The intention of the master to evacuate non-essential crew and anchor with tug assistance was not understood by the radio operators on shore, and no assistance was initially available owing to the weather and sea conditions.

What can we learn:
- Significant changes in ship operation or management should be planned.
- The importance of crew familiarization

Who may benefit:
Shipowner/Ship Management.

28 Categories of safety issues:

- Management factors
- Safety assessment review
- Planning and Procedures

Casualty event: Occupational accident - slipping, stumbling, falling of person to a lower level

Casualty severity: Very serious marine casualty

What happened:
A fatal accident happened on board the multipurpose dry cargo ship. During cleaning of a shipboard fuel oil tank, one of the shore workers went missing inside the tank when he entered the tank to rescue another injured worker. The injured worker was rescued but the missing worker was showed no vital signs when he was found inside the tank.

Why did it happen:
The shore workers did not follow safety requirements for enclosed space entry; there was no detailed risk assessment conducted before work started; there was a lack of effective communication between the ship's crew and the shore workers, and among the shore workers; and the shore workers lacked safe awareness and underestimated the risks and potential hazards associated with enclosed space entry.

What can we learn:
- Strictly follow the safety requirements and procedures for enclosed space entry
- The importance of proper risk assessment, effective communication, and close supervision.

Who may benefit:
Ship crew; ship owner and management company.

29 Categories of safety issues:

- Natural environment
- Planning and Procedures

Casualty event: Occupational accident - body movement under or with physical stress (generally leading to an internal injury)

Casualty severity: Very serious marine casualty

What happened:
Three crew members on board a bulk carrier sailing in the South Atlantic Ocean were tasked to select and relocate steel plates.

The steel plates were stacked vertically and left unsecured at the side of the railings. The crew selected the steel plates by laying them horizontally before moving them for cutting, leaving the other steel plates stacked vertically. While relocating one of the selected steel plates, the remaining vertical steel plates collapsed and fell on top of one of the crew members. He was subsequently pulled out from under the collapsed steel plates and first aid was administered. The crew member was treated onboard with advice from shore medical doctors as the ship made its way to the nearest port but unfortunately the Engine Cadet (EC) succumbed to his injuries and died.

Why did it happen:
The task of selecting and relocating steel plates was carried out when the vessel was navigating in rough sea conditions, and the crew did not re-secure the steel plates that were left. The storage location of the steel plates was inappropriate and posed a falling hazard when the steel plates were not secured.

What can we learn:
- Risk assessments should consider the effects of ship movement due to weather conditions
- Risk assessments should evaluate the specific hazards associated with each stage of the task, the characteristics of the load, and the physical exertion required to carry out the task.

Who may benefit:
Seafarers and ship managers.

30 Categories of safety issues:

- Emergency handling
- Anthropometric or personal factors
- Management factors
- Planning and Procedures

Casualty event: Collision - with other ship

Casualty severity: Very serious marine casualty

What happened:
A 57,000 deadweight (DWT) bulk carrier and a 36-meter fishing vessel collided during the early morning hours while in a crossing situation. The bulk carrier was the give-way ship and the fishing vessel, which was not engaged in fishing, was the stand-on vessel. The weather was good with visibility more than 5 NM.

The bulk carrier's OOW was alone on the bridge. A designated look-out had not been posted so that the deck ratings would be fully rested before undertaking the replacement of a running wire for one of the ship's deck cranes prior to arrival at its next port. The fishing vessel's master was on watch and the mate was also in the wheelhouse assisting with maintaining a proper look-out.

The bulk carrier did not make any sound or light signals until the collision was imminent, at which time the OOW made a single blast of the ship's whistle. The fishing vessel did not make any sound signals, but the master did attempt to attract attention by shining a laser pointer at the bulk carrier's bridge. The collision occurred soon after the fishing vessel turned towards the bulk carrier when the fishing vessel was less than 0.7 NM off the bulk carrier's starboard bow. At the time, the bulk carrier's OOW was using the autopilot to turn the ship to starboard.

The fishing vessel sank approximately three hours after the collision. All six of the crew members who had been on board were rescued by another fishing vessel. The bulk carrier's OOW did not inform the ship's master of the collision or assist in the recovery and rescue of the crew members from the fishing vessel and continued on the ship's planned voyage.

Why did it happen:
Neither vessel made effective use of all available means to assess the risk of the collision as the two vessels approached each other.

The bulk carrier, which was the give-way vessel, did not take early and substantial action to keep clear of the fishing vessel.

The fishing vessel, which was the stand-on vessel, did not take any action to avoid collision until the vessels were in a close quarters situation. The fishing vessel then turned towards the bulk carrier, which is contrary to COLREGs.

Other factors that contributed to the collision included the fact that the bulk carrier's OOW was alone on the bridge and that he used the autopilot to manoeuvre the ship while in a close quarters situation.

The white deck lights on board the fishing vessel interfered with the ability of the bulk carrier's OOW to see the navigation lights that were exhibited by the fishing vessel and of the ability of the fishing vessel's master to see the navigation lights exhibited by the bulk carrier.

What can we learn:

- The risk of collision is significantly increased when COLREGs are not adequately applied as two vessels are approaching each other.

- Maintaining a proper look-out must be prioritized over shipboard maintenance tasks.

- Navigation watchstanders need to make effective use of all available means to assess the risk of collision and to take early and substantial action when it is determined that there is a risk of collision.

- Autopilot should not be used when large alterations of course are required to resolve a developing situation with another vessel. An additional watchstander should be called to the bridge in ample time so that the changeover from autopilot to manual steering can be made before a close quarters situation exists and so that the continuity of the look-out is not broken.

- Navigational watchstanders need to use extra caution when navigating in the vicinity of fishing vessels.

- Laser pointers should not be used to attract another vessel's attention.

Who may benefit:
Ship managers, seafarers, training centres, flag States.

31 Categories of safety issues:

- Anthropometric or personal factors
- Planning and Procedures
- Emergency handling
- Management factors
- Fatigue
- Legislation, standards and compliance

Casualty event: Capsize/listing – capsize

Casualty severity: Very serious marine casualty

What happened:
A fishing vessel capsized after a close encounter with a bulk carrier in the Eastern Indian Ocean. The fishing vessel was affected by the bow wave of the bulk carrier, leading to her capsize and the loss of four crew members.

Why did it happen:
The accident occurred owing to a combination of poor look-out practices, fatigue, and misjudgement by both vessels. Bulk carrier's crew assumed the fishing vessel would give way, while the fishing vessel had insufficient manning and lacked proper equipment like AIS. Regulatory gaps for small fishing vessels also contributed to the incident.

What can we learn:
- The incident highlights the importance of maintaining proper look-out, especially in mixed-traffic waters, and the need for all vessels, regardless of size, to be equipped with basic safety and communication tools.
- It also underscores the risks of relying on assumptions and the need for better training and oversight of small fishing operations.

Who may benefit:
Mariners, fishing vessel operators, maritime regulators, training institutions, and search and rescue authorities.

32 Categories of safety issues:

- Anthropometric or personal factors
- Planning and Procedures

Casualty event: Occupational accident - body movement under or with physical stress (generally leading to an internal injury)

Casualty severity: Very serious marine casualty

What happened:
A container ship was alongside, discharging containers. At around 03:30 hrs, with discharge continuing close by, a deck fitter began hot work to repair a stopper from the lashing bridge. With the repair almost completed, the fitter was kneeling on a container in the cargo area to gain better access to the work area when he was struck by the container spreader attached to the ship's gantry crane. He did not survive his injuries.

Why did it happen:
The deck fitter was working alone and unsupported. His location had been relayed to the person controlling the cargo operations but this information did not alter the cargo discharge plan.
The design of the vessel's gantry crane meant that the operator's view of the casualty location was obstructed.

There was no hatchman present to mitigate this hazard. The officer overseeing the work, expected the repair to be completed from inside the lashing bridge's rails but the task could not be completed in the manner imagined – the victim moved onto the adjacent container in order to complete the repair.

What can we learn:
- Personnel involved in any potentially hazardous operation should be consulted to identify the hazards associated with completion of the task. If you don't understand the task, you cannot identify the hazards. If you haven't identified the hazards you cannot assess the risk or implement effective controls.

- Risk assessments are ineffective if risk control measures are not implemented. When conducting work in port, clear and effective communication between the ship and terminal is key.

Who may benefit:
Shipping Community

33 Categories of safety issues:

Casualty event: Collision – with other ship

Casualty severity: Very serious marine casualty

What happened:
During the evening, a general cargo ship was at anchor when it was hit on its port side by a passing fishing vessel. The hull of the cargo ship was damaged, allowing water ingress. The cargo ship quickly sank. The fishing vessel departed from the site of the collision. The crew of the general cargo ship were rescued by another ship. There was no oil spill from the sunken ship.

Why did it happen:
The general cargo ship did not use sound signals required by rule 35(g) of the COLREGs (sound signals in restricted visibility). The master spotted the fishing vessel when it was approximately 1 NM away, but did not take action because he thought the fishing vessel had passed by. The master gave a light signal when notice the fishing vessel again when it was 0.5 NM away, travelling at approximately 10 knots.

The fishing vessel did not perform watchkeeping duties.

What can we learn:
- The importance of sound signals in restricted visibility.
- The importance of maintaining a look-out in restricted visibility.

Who may benefit:
Seafarers, Operators

34 Categories of safety issues:

- Natural environment
- Planning and Procedures
- Safety assessment review

Casualty event: Occupational accident – Slipping, stumbling, falling of a person on the same level

Casualty severity: Very serious marine casualty

What happened:
A ship was heading southwest off the eastern coast of South Africa. The wind force increased and the sea condition worsened from moderate to rough, which caused the ship to pitch moderately with seawater washing frequently over the forward mooring deck from the port bow.

At about 18:00 hrs, the bow was struck by two consecutive waves, causing seawater to surge over the bulwark into the forward mooring deck and washing along the upper deck while the ship's crew was working to prevent water ingress at the bow.

In the accident, one of the crew survived after the waves' attack under the shelter of the windbreaker, several others were injured, including one crew member who was declared dead after remote radio medical consultation.

Why did it happen:
The bad weather. The master improperly adjusted the vessel's course and/or speed in the avoidance of encountering large waves.

The master did not adhere to the precautionary measures for navigating off South Africa in the SMS.

Neither the master nor the chief officer took proper measures to ensure crew safety. The ship's crew did not follow the requirement of the shipboard SMS to secure all watertight doors, hatches before the coming of the predicted heavy weather. The ship crew did not adhere to the SMS requirement to conduct a risk assessment for hazardous work.

The safety training on board lacked effectiveness and pertinence, especially the training on safety awareness and practical measures against heavy weather.

What can we learn:
- Secure all watertight doors and hatches before the arrival of heavy weather and properly adjust vessel's course and/or speed for safety;
- Pay special attention to the dangers caused by severe weather in specific seas and ensure proper precautionary measures are taken for safety;
- Conduct a risk assessment for hazardous work and to ensure that the senior officers take proper measures to ensure the crew's safety;
- Ensure effective and pertinent safety training on board to enhance crew's safety awareness and understanding of practical measures against heavy weather.

Who may benefit:
The shipowners/ management companies, masters, officers and crew members.

34 Categories of safety issues:

- Management factors
- Planning and Procedures
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Occupational accident – Slipping, stumbling, falling of a person on the same level

Casualty severity: Very serious marine casualty

What happened:
A deck rating fell from a suspended portable gangway while working aloft in a hold. The ship was at anchor. The deck rating was transferred ashore by a local passenger launch and then on to a nearby hospital by ambulance. He was declared to be deceased shortly after arrival.

Why did it happen:
The portable gangway was jury-rigged to enable its use as a painting platform. It was suspended about 11 m above the hold bottom when the deck rating fell.

The portable gangway was stationary and stable at the time, and the trigger for the deck rating's fall was not seen. Rope guardrails fitted around the portable gangway were ineffective, possibly owing to insufficient tension. Although the deck rating was wearing a safety belt and lanyard, the lanyard was not attached to the gangway structure or crane slings and therefore the rating's fall was not arrested.

The portable gangway was used to work aloft because the ship did not carry a dedicated platform, and it was necessary for the holds to be maintained prior to the next cargo being loaded.

What can we learn:
- The importance of work process such as supervision, communication, and emergency response.
- The importance of assessing the specific risks of a task rather than relying on generic risk assessments.

Who may benefit:
Shipowners, ship managers and seafarers.

36 Categories of safety issues:

- Legislation, standards and compliance
- Management factors
- Planning and Procedures
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Fire/explosion – fire

Casualty severity: Very serious marine casualty

What happened:
A cargo ship was under way, proceeding to port for bunkering. Work procedures in the Engine-Room and machinery spaces were organized under the Chief Engineer, who planned daily tasks and discussed safe working procedures with the engineering team.

The Management Company instructed the vessel to transfer Heavy Fuel Oil (HFO) from one storage tank another one, then clean the emptied tank to accommodate the Low Sulphur Fuel Oil for future chartering. The next day, the fuel transfer was completed. The tank was confirmed empty, with only unpumpable residue remaining. The C/E instructed the 3/E to open the lower manhole of the HFO storage tank in the purifier room to facilitate ventilation and ensure the tank was gas-free before cleaning. The manhole was opened under the C/E's supervision, who visually confirmed the tank was empty.

In the afternoon, the 2/E commenced his ER watch with the Oiler. The C/E asked the 2/E to check whether the HFO storage tank had a second manhole and report back to him. The Oiler was cleaning and painting in the steering gear room during his watch. The doors leading to the ER were open. After finishing a section near the doors, he stepped into the compartment between the steering gear room and the ER and noticed the ER deck covered in a black shiny

liquid flowing port to starboard. Hearing only normal machinery sounds, he stepped inside the engine-room and looked around. He saw the 2/E drenched in the black liquid, holding the foam extinguisher trolley handle and facing the transformer space. Looking forward, the Oiler saw flames around the main and auxiliary engines, with thick black smoke. He left the space and ran up to the main deck.

The upper manhole of the Low Sulphur Fuel Oil (LSFO) storage tank was opened without authorization, instead of verifying the presence of a second manhole cover on HFO storage tank. Approximately 150 tonnes of low-sulphur fuel oil spilled into the engine-room. The fuel contacted hot machinery surfaces, ignited, and led to a major fire and explosion.

One crew member died from smoke inhalation. The ship lost propulsion and suffered extensive damage and was subsequently towed to a recycling yard.

Why did it happen:
The LSFO storage tank manhole was mistakenly identified as the HFO storage tank manhole, without conducting sounding or cross-checking. There was no double-check system for tank identification, and the work deviated from enclosed space entry protocols.
There was a lack of implementation of SMS procedures and risk assessment, no Permit-to-Work was issued.
No second toolbox meeting was held before the manhole check; unclear instructions may have led to misinterpretation. There was inadequate supervision. There was an organizational reliance on informal communication.

What can we learn:
- Critical tasks involving fuel systems require strict procedural compliance, formal risk assessment, and supervisory oversight.
- The importance of double-checking systems and clear labelling must be enforced.
- Toolbox meetings should precede every hazardous operation.
- Safety culture must prioritize written instructions over verbal communication.

Who may benefit:
Ship operators, management companies, crew training institutions, flag administrations, and the wider shipping industry implementing SMS and risk-based operational controls.

37 Categories of safety issues:

- Management factors
- Planning and Procedures
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Occupational accident – others

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier was berthed to discharge cargo. Upon completion of cargo discharge operations, the Duty Officer (DO) instructed the deck crew to begin securing the deck in preparation for departure. Once the steps were completed, the crew initiated the jacking-up process to close the hatch cover for a cargo hold. The Bosun was positioned forward of the cargo hold port side, while the OS was stationed at a safe position at the forward starboard corner to monitor the area for any obstructions.

The Bosun began checking the hydraulic pipes for any leakage during the closing of the hatch cover when he sighted a white safety helmet caught between the hatch cover stiffener and the coaming. He immediately instructed the crew to halt the closing operation and proceeded to investigate the situation. A crew member discovered the OS lying unconscious nearby. He immediately called for assistance from other crew members. Upon arriving at the scene, the Bosun promptly informed the master of the situation via portable radio, and the emergency alarm was activated.

Despite immediate emergency response and CPR, the OS was declared deceased.

Why did it happen:
No toolbox meeting or hazard briefing took place before the hatch cover operation.
There was a lack of supervision; no responsible officer was overseeing the hatch cover closing.
Communication was inadequate: there was no formal readiness confirmation or verbal headcount before activation.

There was an absence of physical barriers or warning signs around hazardous zones; this was a procedural non-compliance with risk assessment requirements.

What can we learn:
- High-risk operations require strict adherence to risk assessment procedures.
- Toolbox meetings and hazard briefings are critical for crew awareness.
- Supervisory presence ensures compliance and safe practices.
- Communication protocols, including headcount verification, prevent personnel exposure.
- Physical barriers and warning signs reduce risk of accidental entry into hazardous zones.

Who may benefit:
Ship operators and managers, Deck officers and crew involved in cargo operations, Safety management teams and Designated Persons Ashore, Training institutions and maritime academies.

38 Categories of safety issues:

- Anthropometric or personal factors
- Planning and Procedures
- Safety assessment review

Casualty event: Collision

Casualty severity: Very serious marine casualty

What happened:
A 5000 Gross Tonnage (GT) tanker, after completion of loading operations, departed from port early in the year. Four days later, after midnight, the master of the vessel communicated with Vessel Traffic Services (VTS) before the northern entrance of a strait with a traffic separation scheme. The tanker kept on course 241° to go to the anchorage site, as instructed by VTS.

On the same day, before sunrise, a 140 GT fishing vessel departed port for fishing. The fishing vessel was sailing at 340°.

The bridge crew of the tanker noticed a cluster of fishing vessels heading towards them at a distance of approximately 3 nautical miles on the radar. When they set the distance of the radar to 1.5 nautical miles, they noticed the 140 GT fishing vessel sailing towards them for the first time. When they were able to see the fishing vessel, the distance between their vessel and the fishing vessel was around 300-500 metres.

While the tanker maintained her course and speed without any alteration within the traffic separation scheme, the fishing vessel first commanded full ahead with her engine and then manoeuvred towards her starboard at the very last minute by switching the rudder from autopilot to manual mode. However, the vessels collided.

The collision resulted in the fishing vessel getting stuck on bulbous bow of the tanker. Although the master of the fishing vessel manoeuvred full speed back and forth with the engines, he could not disengage from the tanker. The fishing vessel began to list to starboard and take on water. Meanwhile, since the master of the fishing vessel couldn't get out of the bridge door, he got out through the windscreen and tried to warn the tanker by shouting.

After approximately 0.5 nautical miles, the tanker stopped and manoeuvred full astern to disengage from the fishing vessel. Immediately after, the fishing vessel capsized. The fishing vessel sank approximately 5 minutes later. Although 3 out of 6 crew members on board survived, 2 people lost their lives and 1 was reported missing. The tanker sustained no damage due to the collision.

Why did it happen:
No sound signals were used and neither vessel conducted a look-out; the tanker did not identify the fishing vessel before the collision.

The fishing vessel identified the tanker just before the collision and manoeuvred, but the last-minute manoeuvre was not effective to avoid the collision and speed was not reduced.

The fishing vessels, including the wrecked fishing vessel, were sailing in a convoy in the opposite direction of the traffic separation scheme.

The AIS device of the fishing vessel was out of operation.

What can we learn:
- All vessels should act in accordance with COLREGs and should take early and substantial action to avoid a collision.
- It is essential during the navigational watch to make use of all available means to maintain situational awareness.
- In cases where it is not possible to contact a give way vessel, use VTS Communications at an early stage to request navigational aid to avoid the risk of collision.

Who may benefit:
Seafarers, ship operators and Vessel Traffic Services

39 Categories of safety issues:

- Planning and Procedures
- Safety assessment review

Casualty event: Occupational accident - fall from height

Casualty severity: Very serious marine casualty

What happened:
During daylight hours, five crew members were tasked to carry out general cleaning in the cargo hold, with one of the tween deck's pontoons opened for natural lighting and ventilation. After the crew had completed the cleaning, while walking along the walkway on the tween deck to prepare to close the pontoon, one of the crew members fell about 7 m to the lower hold.

The SMS for bridge watchkeeping did not state any requirement for the watchkeeping duty rating to carry any means of communications when tasked for other permitted work at other locations. One of the crew members had to go to the accommodation to inform the master of the accident.

Why did it happen:
The fall occurred because the opening created by the removed pontoon was not protected. Safety barriers and warning signage were not in place as required by the safety management system. The responsible officer did not verify that these safety measures were implemented.

The similarity in colour between the walkway and the deck edge reduced visual distinction. In the absence of barriers and clear visual cues, the Carpenter likely made a misstep at the edge and fell into the lower hold.

What can we learn:
- Open deck openings should be protected with safety barriers at all times.
- Required safety measures should be verified before work continues.
- Clear visual markings should be used to distinguish hazardous edges.
- Warning signage should be displayed when hazards are present.

Who may benefit:
Shipowners, ship managers, ship crew, port operators and stevedores.

40 Categories of safety issues:

Casualty event: Occupational accident – breakage, bursting, spitting, fall or collapse of material agent

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier was proceeding in the Baltic Sea and preparing to enter port when a pilot boarded the ship. The crew had prepared a combination pilot transfer arrangement, consisting of a pilot ladder and pilot assistant ladder. After the pilot boarded the ship, and while the ship's crew was lifting the pilot assistant ladder and preparing to secure it, the wire rope holding one end of the ladder parted. When the rope parted, the end of the pilot assistant ladder fell into the water together with the bosun, who was standing on the ladder. The ship's crew threw out two lifebuoys, and a search and rescue operation was launched for the bosun. The bosun was not found.

Why did it happen:
The pilot assistant ladder rope parted owing to long-term operational loads, when the cross-section of the wires forming the rope, being affected by corrosion, decreased to a critical limit. The interval for replacing the pilot assistant ladder rope set in the safety management system procedure was longer than recommended by the ladder manufacturer, and the rope

was not replaced at all even after the rope replacement deadline set in the safety management system had passed.

The partition occurred in a difficult-to-access area, where the rope was not sufficiently greased. It is likely that the crew greased only those places of the rope that were easily accessible.
Risk assessment for the combination pilot transfer arrangement rigging and hoisting/securing had not been carried out. Both the ship's master and the crew had noticed and were aware that the bosun was accustomed to standing on the ladder when it was being lifted. However, no action was taken to prevent the bosun's habit, which contradicted the safety requirements specified in the manufacturer's instructions for the pilot assistant ladder.

Although the Safety Management System documents specify mandatory and recommended safety measures when working in over side areas, the bosun did not use the mandatory safety belt, safety harness and helmet, and reflective vest as recommended. The bosun was also not wearing a buoyancy garment or a life jacket, so he lost the ability to stay afloat and be spotted or found more quickly by the ship's crew and/or the rescue services.

No permit was obtained for either lowering or lifting/securing the pilot assistant ladder.

What can we learn:
- Pilot transfer arrangements must be systematically and properly maintained.
- Risks associated with the use of the pilot transfer arrangements should be assessed and reviewed when necessary.
- Use of personal protective equipment (safety harness, safety belt, buoyancy garment) is vitally important when working in over side zones.
- To promote compliance with safety requirements and the use of personal protective equipment, companies should not only provide safety rules, but also strengthen seafarers' awareness through training, practical exercises, setting a positive example and motivating seafarers for safe behaviour.

Who may benefit:
Shipowners, companies, operators, seafarers.

41 Categories of safety issues:

- Legislation, standards and compliance
- Planning and Procedures

Casualty event: Occupational accident – Others

Casualty severity: Very serious marine casualty

What happened:
While at sea, some deck crew on a 29,000 GT general cargo ship were carrying out maintenance work comprising hot work and painting on the booby hatch covers and D-rings.

The Bosun was supervising the hot work being done by the Fitter on one of the booby hatch covers. When the hot work was almost completed, the bosun left the site to get something from the forward deck store. Upon the Bosun's return, the Fitter was found unconscious, lying on top of the steel scraps inside the cargo hold, next to the vertical ladder of the booby hatch. An emergency rescue was initiated but the Fitter could not be resuscitated.

Why did it happen:
The Fitter had likely entered the cargo hold to retrieve dropped or fallen item(s) and had succumbed to the oxygen-deficient atmosphere. Although the cargo hold was deemed as an enclosed space as per the Safety Management System (SMS), the Fitter had likely perceived the entry to be safe and overlooked on the hazards associated with the cargo of steel scraps.

There was no ship-specific list of enclosed spaces maintained onboard as required by the SMS.
Although the booby hatch covers were painted with warnings to caution personnel about entering the cargo hold, there was no additional signage in the vicinity nor physical barriers in place to prevent an unauthorized entry.

What can we learn:
- Cargo holds, regardless on the type of cargo carried, are to be treated as an enclosed space which requires proper authorization to be granted for entry so that an appropriate risk assessment can be carried out with mitigating measures introduced.
- Even if an enclosed space's opening has been kept open, the space should not be treated safe for entry unless its atmosphere has been thoroughly checked and the space verified safe for entry.
- Absence of a warning signs or physical barriers such as a rope or a chain can lead to a presumption that a space with an open hatch is ventilated and safe for entry, which may not be the case.
- Ship's specific list of enclosed spaces should be drawn up and posted in conspicuous places for the crew to have a proper understanding when performing their work. Additional signage(s) and poster(s) in conspicuous places highlighting the risks associated with enclosed space entry, especially unplanned and unauthorized can serve as a reminder to the crew.

Who may benefit:
Seafarers, ship owners, ship managers

42 Categories of safety issues:

- Maintenance
- Planning and Procedures

Casualty event: Fire/explosion – fire

Casualty severity: Very serious marine casualty

What happened:
A fire was detected in the engine-room of an oil-chemical tanker. The crew mustered on the poop deck, where it was confirmed that the duty engineer and the motorman were missing. Quick closing valves were activated and the engine-room fire dampers were closed.

The CO_2 fire-extinguishing system in the engine-room could not be used owing to the missing engine-room watchkeepers. After the fire was brought under control and extinguished in a relatively brief period of time, the two missing crew members were found wearing Emergency Escape Breathing Device (EEBDs). First aid was given on the vessel and both crew members were then evacuated by helicopter. Neither of the crew members survived.

Why did it happen:
The main diesel oil non-return valve spindle assembly was found missing, possibly dismantled to investigate the lack of diesel oil flow and left unattended.

The fire appeared to be related to either accidental spillage or spray of diesel oil / waste oil onto the incinerator, directly from the deck above, whilst the incinerator was either in use or hot after being operated just before the fire. The spilled diesel oil came in contact with the hot incinerator's furnace door.

Although both crew members tried to escape the space, one EEBD was not activated and the other EEBD ran out of air. There was no indication that the two crew members were heading towards the space's emergency escape routes.

What can we learn:
- Parts on fuel oil system need to be either isolated or bypassed before they are dismantled, as part of a risk assessment to clearly understand the related hazards.
- The need for realistic drills to ensure that crew members are fully conversant with the use of emergency equipment and familiar with all the emergency escape routes.

Who may benefit:
Seafarers, Ship owners, Ship operators, Ship managers.

43 Categories of safety issues:

- Anthropometric or personal factors
- Emergency handling

Casualty event: Occupational accident – body movement without any physical stress (generally leading to an external injury)

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier was under way in the open ocean when it experienced inclement weather. The voyage plan was progressively amended, based on the advice received from a weather routeing service.

Three days into the voyage, the eductor was started to pump out the water from the forecastle store, which was found flooded by the crew members. The next day, the eductor developed a fault and five deck crew members, including the deck cadet, were instructed to extract the remaining water from the forecastle store and chain lockers using portable pumps, dry up the store, cover the spurling pipes on the forecastle deck, and arrange and secure all equipment within the store. The ship's course was altered to minimize the rolling and pitching and thus, facilitate the safety of the deck ratings.

Whilst the crew members were covering the spurling pipes, a large wave washed over the forecastle deck. All five crew members were swept across the forecastle, and several were injured. Injured crew members were helped back to the accommodation, and the vessel diverted to the nearest port for medical attention. One of the crew members succumbed to his injuries a few hours later.

Why did it happen:
The spurling pipe covers were blown off owing to the strong winds and spray washing frequently over the forecastle deck. As the spurling pipes were uncovered, water filled up into

the anchor chain lockers. This water then leaked out of the chain lockers, past worn-down seals around the bitter end release pins, and flooded the forecastle store.

The crew members were concerned that the flooding of the forecastle store would affect the stability of the vessel. Consequently, they felt it necessary to cover the spurling pipes at the earliest opportunity.

The weather conditions limited the extent of the course alteration.

What can we learn:

- Risk perception and decision-making can be influenced by at least two critical factors, i.e., a situation which would not have been experienced before and the context, which may not allow a serene assessment of the evolving situation.

Who may benefit:
Seafarers, Shipowners, Ship operators, Ship managers.

44 Categories of safety issues:

- Management factors
- Planning and Procedures
- Safety assessment review

Casualty event: Occupational accident – others

Casualty severity: Very serious marine casualty

What happened:
A ship commenced discharging its cement cargo with a vacuum machine. The machine had a turning fork on the bottom, which churns and aerates the cement, allowing it to flow freely for proper suction. At the same time, two members of the ship's crew were situated in a gondola work platform, suspended by the ship's crane, brooming & sweeping down residue of the cement cargo dust from under the cross-deck frames, bulkhead & structure, inside the cargo holds.

At about 06:00 hrs, when the crew in the gondola were preparing for a change of shift, the gondola frame got stuck under the hatch coaming. On lowering the gondola to ease the messenger cum guideline, it was freed and swung with a rebound. One of the crew members who was in the gondola hit his head on the steel structure under the cross-deck.

The emergency alarm was sounded and the gondola was landed on the jetty, along with the two crew members. Paramedics arrived soon after the incident, at about 06:15 hrs. Lifesaving measures were tried but the crew member was declared dead.

Why did it happen:
There were lapses in the SMS system including not having a daily safety meeting.

The procedures for operating the crane did not include a signal man.

The crew on the gondola cage giving instructions were inexperienced.
It was the "Astronomical Twilight Zone Period". The crew were working in shifts, and the accident took place at the end of the shift. Since it was the end of shift, the crew could have been fatigued leading to:

- Impaired ability to think rationally.
- Poor concentration on critical decisions.
- Improper judgement.
- Inability to focus.

What can we learn:

- Permits are a means of communication between those who carry out the work and the person responsible for their safety.
- Issuing a permit does not by itself make a task safe, however the thoroughness of those preparing, supervising, and carrying out the work makes it safer. The crew should be trained to use and follow the permit system.
- Working aloft, such as when cleaning hatches, is a critical operation for which a safety meeting is normally held and a work permit is issued, prior to undertaking the job. It should be emphasized that a permit system should not be carried out without sufficient thought i.e., a tick-box mentality.
- While issuing a work permit following should be considered:
  - A permit should specify the period of its validity and any time limits applicable to the work that it authorizes.
  - Is there sufficient monitoring of the work permit system (e.g. permit out of date/time)
  - The Permit to Work system should be reviewed to ensure that it is being properly managed, that permits are actually being used, are correctly completed, and are effective.
  - Permits to work should not be issued for too long a period of time as circumstances can change. A permit's validity should normally not exceed 24 hours.

Who may benefit:
The maritime industry.

45 Categories of safety issues:

- Management factors
- Planning and Procedures
- Safety assessment review

Casualty event: Collision – with other ship

Casualty severity: Very serious marine casualty

What happened:
In the early morning on board a north-eastern bound bulk carrier, the second officer was keeping the navigation watch on the bridge. The ship was proceeding at 10.5 knots. All of the statutory navigation equipment on the bridge was in good order and both radars were on the 12 nm range. On the radar, the second officer spotted a fishing vessel off the starboard bow approximately 5 nm away, with the closest point of approach of 0.5 nm and posing risk of collision.

Later on, the second officer altered course to 010° to keep clear of patches of floating fishing nets. He attempted to contact the fishing vessel by VHF on channel 16 but did not receive a response.

The fishing vessel kept a speed of about 9 knots, and the course varied from 298, to 307, 271, 282, 287, 305. Shortly after the final course change, the fishing vessel collided with the bulk carrier. The fishing vessel sank as a result of the collision, and 11 crew members on the fishing vessel were declared dead or missing.

Why did it happen:
As a give-way vessel in the crossing situation, the bulk carrier did not take substantial action as early as possible to give way to the fishing vessel. As a stand-on vessel, the fishing vessel did not fulfil the obligation of maintaining course and speed; it made several changes in its course within 10 minutes before the collision.

Because the bulk carrier could not establish VHF contact with the fishing vessel, both ships were unable to understand each other's intention.

The second officer on the bulk carrier excessively relied on radar equipment, the situation between the two ships and the risk of collision were not accurately judged; the bulk carrier did not slacken speed in dense traffic.

The bulk carrier's pre-job training was not specific and the navigational operation characteristics of coastal fishing boats and collision-preventing measures were not emphasized in its officers' training.

The supervision of the performance ability of the second officer on board the bulk carrier was inadequate, and the manager did not find and correct his watch keeping habits, such as excessive reliance on radar and unfamiliarity with the navigational characteristics of fishing boats.

The manning on the fishing vessel was not adequate in terms of the number and qualification of its officers.

What can we learn:
- The importance of pre-job training, bridge resource management, and collision avoidance rules, especially for training about the operation mode of coastal fishing boats and collision avoidance.
- The importance to crew fishing vessels adequately.
- The importance of keeping a proper watchkeeping arrangement on fishing vessel bridges.

Who may benefit:
Shipping companies, seafarers.

46 Categories of safety issues:

- Maintenance
- Tool and hardware (design or operation)

Casualty event: Occupational accident – electrical problems, explosion, fire

Casualty severity: Very serious marine casualty

What happened:
While on passage, the boiler fuel consumption was changed to very low sulphur fuel oil on the two boilers fitted on board a chemical tanker. Both boilers failed to fire because of a low fuel oil temperature. Subsequently, the port boiler started working normally, but the starboard boiler

failed to fire again. Eventually, another attempt was made to restart it. While it was on the purge cycle, the second engineer went up to the burner platform to inspect it. Moments later, a loud explosion was heard, and a fire started at the top of the starboard boiler. The fire alarm sounded within a few seconds.

The engineers went up to the boiler platform, to find the second engineer lying unconscious on the top of the starboard boiler.

The water mist system installed above the port boiler activated and the crew extinguished the fire with the help of portable extinguishers. The second engineer was carried outside onto the poop deck and placed in the dry provision room. The master sought medical advice from the company doctor and broadcast an emergency signal on the Digital Selective Calling system. Although the crew members attempted cardiopulmonary resuscitation, the second engineer passed away.

Why did it happen:
Excessive vaporised gas oil inside the furnace led to the explosion inside the starboard boiler furnace. The gas oil had an elevated temperature due to the bunker fuel system pre-heating, in preparation for the changeover to very low sulphur fuel oil.

Failure of one of the solenoid valves caused it to remain closed, resulting in an increase in pressure within the fuel circuit. The physical status of solenoid valve was not designed to be monitored and therefore provided no cues to the crew members of its imminent failure.

The risk that the boiler burner would not fire may have well been considered by the crew members, but this was not seen as a potential compromise to the vessel's safety, given that the boiler's safety systems had always operated as designed.

What can we learn:
- The change over to fuel oil can introduce operational complexities, such as changes in fuel viscosity and temperature requirements, that need to be fully accounted for.
- Purging cycles are critical to clear accumulated combustible gases before ignition attempts.
- Ship owners should consider investing in real-time monitoring or alarms for critical components, to enable early detection of malfunctions.
- Access to hazardous areas, especially during high-risk operations like purging and firing boilers, must be restricted.

Who may benefit:
Seafarers, Ship owners, Ship operators, Ship managers.

47 Categories of safety issues:

- Maintenance
- Natural environment
- Planning and Procedures
- Safety assessment review

Casualty event: Unknown

Casualty severity: Very serious marine casualty

What happened:
During a voyage through the Atlantic Ocean, a container vessel encountered high waves and heavy weather and experienced a slamming effect which resulted in strong sea sprays on deck.
The master had issued a standing order which included an instruction to not go on deck during heavy weather. Prior to the accident, the Chief Officer assessed that weather conditions had improved and assigned work activities on deck at the aft section, but he did not inform the master.

When the Bosun was tasked by the Chief Officer to carry out some de-rusting work at the aft station, the Bosun went to the Bosun store to get the relevant tools. Inside the Bosun store, water was noticed flowing on the floor which was suspected to have entered from the mushroom ventilator on the forecastle deck.

While inspecting the mushroom ventilator, both the Bosun and Ordinary Seaman (OS) were likely hit by sea spray that came on deck resulting in the OS to be fatally injured and the Bosun to suffer head injuries.

Why did it happen:
Going to the forecastle deck to inspect the mushroom ventilator was unplanned work and was not made known to any other crew, including the Officer of the Watch and the Chief Officer.

The Bosun and the OS had missed the discussion on the risk assessment for navigating in heavy weather.

The mushroom ventilator had been defective which resulted in seawater entering and flooding the Bosun store. The ventilator was not identified as an item to be secured (covered with a canvas) during the heavy weather preparation prior to departing the previous port.

What can we learn:
- Defective items onboard should be addressed as early as possible.
- Risk assessments should involve all personnel when a vessel's passage is expected to enter/pass heavy weather areas, so that all crew are aware of the associated risks and are prepared and have necessary safety precautions in place before executing any tasks on deck.
- The OOW and supervisors should be aware of any tasks to be carried out on deck during heavy weather.
- Preparations for entering heavy weather should be discussed and thoroughly checked to avoid any missing items.

Who may benefit:
Shipping companies and crew.

48 Categories of safety issues:

- Anthropometric or personal factors
- Management factors
- Natural environment

- Planning and Procedures
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Occupational accident – slipping, stumbling, falling of person to a lower level

Casualty severity: Very serious marine casualty

What happened:
The crew of a 33,000 GT bulk carrier were cleaning and painting the ship's cargo holds at night while the ship was at sea enroute to the next load port. The weather conditions were good.

After painting the upper portions of frames inside one of the ship's cargo holds, the Bosun, who was standing on scaffolding approximately 9.5 m above the tank top, directed the two crew members who were assisting him to move the scaffolding by 3 m. The scaffolding, along with the Bosun, fell as the two crew members were putting the stabilizer arms in place.

A crewmember who was on deck near cargo hold no.3 heard a noise inside the cargo hold. He looked inside the cargo hold, saw that the scaffolding had fallen, and immediately reported what happened to the OOW using a handheld radio. The ship's C/O, who had just gone out on deck, heard the radio call and immediately entered the cargo hold.

The C/O examined the Bosun and determined that he was unconscious, had laboured breathing, a weak pulse, and that his eyes did not respond to light. The C/O, with assistance from other crew members, began to administer first aid. The Bosun remained unresponsive and was determined to be deceased.

Why did it happen:
The Bosun remained on the scaffolding when it was moved. The lifeline connected to the Bosun's safety harness was secured to the scaffolding. When the scaffolding fell, the Bosun was attached.

The onboard implementation of stop-work authority was ineffective.

There was ineffective supervision of the crew members who were working in the cargo hold.

What can we learn:
- Safe-work procedures are administrative controls that must be implemented consistently by all crew members to be an effective means of reducing exposure to hazards.
- Scaffolding, bosun's chairs, staging, portable ladders, etc. must be set-up and used in accordance with the manufacturer's instructions.
- Lifelines connected to a safety harness must be secured to a strong point on the ship or a fall arrester connected to the ship and not scaffolding, staging, portable ladders, etc. to provide protection from falls.
- The use of stop-work authority can prevent marine casualties. For stop-work authority to be effective, crew members must not only be aware that they have this authority, but they must also have confidence that the authority is non-negotiable and can be exercised without fear of repercussion. Crew members must also be as familiar with how to issue and respond to a stop-work action or instruction as they are with their other shipboard duties.
- Work plans must prioritize watchstanding requirements (e.g., maintaining a proper look-out) and the rest-hour requirements in the STCW Code and MLC, 2006 over the course of the completion of routine shipboard tasks, such as preparing cargo holds for loading.

Who may benefit:
Ship managers, seafarers, seafarer training centres

49 Categories of safety issues:

- Emergency handling
- Legislation, standards and compliance
- Management factors
- Planning and Procedures
- Tool and hardware (design or operation)

Casualty event: Fire

Casualty severity: Very serious marine casualty

What happened:
A container ship, carrying approximately 8000 containers, was about 900 nautical miles offshore when a severe fire started in a cargo hold at about 1945 LT. All 27 crew members responded to fight the fire by commencing boundary cooling and releasing the carbon dioxide (CO_2) fixed fire suppression system into the cargo hold, but the fire intensified and could not be contained. Toxic smoke spread into the accommodation spaces. Some ventilator flaps on the sides of No.3 cargo hold hatch covers remained open. The crew sent out a distress signal and eventually abandoned ship at about 22:15 LT. Among all 27 crew members, one crew member died and four were reported missing.

Why did it happen:
As most of the evidence was destroyed by the fire, it is not possible to conclusively determine the cause of the fire. One or more containers in the cargo hold were assessed to have contained a Class 9 cargo susceptible to self-decomposition which could have initiated the fire. The block stowage of the Class 9 cargo further exacerbated the rate of reaction and heat production, resulting in rapid and uncontrollable spread of the fire.

The actual temperature at which exothermic decomposition is initiated is much lower than the values typically declared by the shipper, and the presence of free water and/ or stowage of the Class 9 cargo in large packages or consignments could have further reduced the onset temperature of decomposition.

The delay in activating the fire alarm affected the timely closure of the magnetic fire doors within the accommodation, and the non-closure of exterior ventilation vents allowed toxic smoke to enter and spread within the accommodation spaces. The muster list did not clearly roles, which resulted in some crew members waiting for instructions.

The design and location of the ventilator flaps on the sides of No.3 cargo hold hatch covers made the crew members difficult to access and close under conditions of intense heat and smoke.

What can we learn:
- Cargo that is susceptible to thermal decomposition may present hazards that are not fully reflected in its classification. Its behaviour under actual carriage conditions, including stowage arrangement and environmental factors, should be carefully considered. Stowage of such cargo in large quantities or in block stowage can accelerate heat generation and increase the risk of rapid fire development.

- Fixed CO_2 systems may have limited effectiveness for certain cargo fires, particularly where the cargo hold is not effectively sealed. The timely closure of ventilators and other openings is critical to support the effectiveness of the system.
- Early activation of appropriate alarms and prompt emergency response actions are essential to support timely containment of fire and smoke.
- Clear assignment of roles and responsibilities in muster lists and emergency procedures is necessary to ensure a coordinated and timely response.
- Shipboard emergency procedures should adequately address containment measures, including the closure of ventilation and access openings.
- Ship design, including ventilation arrangements, should support effective fire containment and limit the spread of smoke into accommodation spaces under fire conditions.

Who may benefit:
Seafarers, Flag Administrations, Port Authorities, Recognized Organizations, Ship Designers, Shipowners, Ship operators, Charterers, Shippers, Consignees, Salvors, Container terminals. SAR authorities, HAZMAT agencies.

50 Categories of safety issues:

- Anthropometric or personal factors
- Fatigue
- Legislation, standards and compliance

Casualty event: Fire/explosion – explosion

Casualty severity: Very serious marine casualty
What happened:
While under way, crew members on a tanker were carrying out tasks on deck when a cargo hold exploded. The tanker had recently unloaded a cargo of benzene. The explosions occurred two to three times consecutively and then the hull rapidly listed to starboard.

The ship's master, who was adjacent to the bridge wing, gave the order to abandon ship, pressed the distress button, and directed the crew to lower the life rafts. All persons on board, including 19 crew members and three pilots, were rescued. The fire was extinguished at around 2000. This accident severely damaged the tanker's cargo tank, deck, bulkhead, and cargo pipes, and partial damage to the accommodation area. There were no fatalities, but three crew members suffered burns or other injuries.

Why did it happen:
The ship's bosun cracked open the hatch of the cargo tank as instructed by the C/O, probably resulting to the creation of a flammable gas mixture inside the tank. Although the master had ordered the C/O not to carry out any operations on the deck until the tanker passed out of the river, the bosun regarded the opening of the hatch as preparation work for tank cleaning, and thus he connected a portable rubber hose to the hatch and pumped in compressed air so that the residue could be removed from the cargo pipe. In this process, it is presumed that static electricity was generated inside the cargo tank which ignited an explosion.

Tank cleaning operations carry a significantly high risk of explosion and asphyxia. Therefore, significant tasks must be taken to prepare prior to the operation and those who engage in the cleaning are required to have a thorough understanding of the operation and comply with the safety rules. In this instance, however, no preparations were done or plans made for the tank

cleaning as required in the Cargo Tank Cleaning Instruction. Moreover, they neither conducted a risk assessment on flammable cargoes nor checked the gas level inside the cargo tank. Also, procedures that were in place allowing the crew to refuse the instruction of unsafe operations were not followed.

Blowing residue out of the cargo pipe with compressed air may generate static electricity as a result of friction. Thus, if a flammable gas mixture exists in the cargo tank, so does the risk of explosion. The company's Cargo Management Procedures also prescribe that compressed air cannot be used for cleaning a line for of flammable or static accumulator cargoes, but this provision was not followed.

The C/O and the bosun did not communicate clearly with each other on work instructions and the tank cleaning confirmation. As a result, the crew performed the operation in a manner that differed from the provisions, and eventually an explosion resulted.

The company was satisfying the hours-of-rest standards set by the MLC by assigning additional officers to the tanker to reduce the risk of C/O. Still, the C/O stated that he had made a mistake out of fatigue when giving instructions at the time of the accident. It cannot be ruled out that he may have made a mistake if he had indeed had an extremely high level of fatigue.

What can we learn:
- The importance of strictly carrying out the master's instructions.
- The need for complying with the Cargo Tank Cleaning Instruction and the relevant regulations.
- The need for strengthening management of flammable and static accumulator cargoes.
- The benefits of enhancing communication skills of the crew with different nationalities.
- The need for developing measures to manage the crew's fatigue during cargo operations.

Who may benefit:
Seafarers

51 Categories of safety issues:

- Management factors
- Planning and Procedures
- Tool and hardware (design or operation)

Casualty event: Occupational accident - loss of control of machine, means of transport or handling equipment, hand-held tool, object, animal

Casualty severity: Very serious marine casualty

What happened:
During cargo operations on an offshore supply vessel, the starboard pedestal-mounted crane onboard a 1966 built, self-elevating accommodation unit collapsed. The incident occurred while the crane was being used to shift the position of a container that was on board the ship. The crane cab, gantry structure and boom fell onto the deck. It then slipped overboard and sank with the crane operator in the cab.

The crane operator's body was recovered from the crane cab during a subsea search. No crew members on board the vessel were injured. The vessel suffered minor damage.

The weather at the time of the incident was good with winds of 10 kts and seas of less than 1 m.

Why did it happen:
The crane collapsed as a result of a structural failure in the pedestal structure. The likely cause of this failure was material fatigue. The manufacturer of the crane had previously issued service letters addressing fatigue cracks in cranes of similar design and construction but had not indicated that these letters could also apply to the model of the crane that failed.

The operator's procedures for lifting operations did not establish requirements for managing dynamic amplification factors when making offboard lifts nor did the load chart posted in the cab of the crane include Safe Working Loads (SWLs) for onboard and offboard lifts.

The crew on board the unit had routinely conducted lifting operations without complying with the operator's procedures.

The standards in place when the crane was designed and built did not require that dynamic amplification factors be taken into account.

What can we learn:
- The need for ship operators and third-party inspectors to be aware of the potential for material fatigue in older equipment.
- The need for ship operators to ensure that procedures for use of lifting gear are appropriate for the types of operations that will be conducted.
- The importance of conducting all lifting procedures in accordance with established procedures.

Who may benefit:
ship operators, crew members who conducting lifting operations, classification society surveyors, flag States.

52 Categories of safety issues:

- Planning and Procedures
- Safety assessment review

Casualty event: Occupational accident – others

Casualty severity: Very serious marine casualty

What happened:
The ship was at anchor waiting for a berth. Since departure from the previous port, the ship had remained in the anchorage over two weeks. Owing to the vessel's proximity to shore, sewage could not be discharged overboard.

On the day of the occurrence, the master noticed that the sewage holding tank was nearly full. During the morning planning meeting, he instructed the Chief Officer to transfer approximately 50 m^3 of sewage from the holding tank to a nearby drain tank.

The Chief Officer instructed some engineers to prepare pumps and some deck ratings to open a manhole leading to the tank where the sewage was to be transferred.

Witnesses reported specific instructions to secure a fire hose inside the tank prior the sewage transfer operation.

On completion of the transfer, one AB climbed down into the tank to unsecure the hose. He lost consciousness and fell while presumably climbing back up to the deck to leave the tank.

Two crew members found the AB unconscious in the tank and immediately climbed down to rescue him without any safety precautions taken. Once they entered the tank, the two crew became dizzy, having difficulty to breathe and loosing vision. They immediately decided to climb back to deck where they slowly recovered while the remaining crew gathered to rescue the unconscious AB.

The crew performed CPR once they recovered the AB from the tank. The unconscious AB did not survive.

Why did it happen:
The SMS did not contain ship specific identification of enclosed spaces onboard or detailed procedures to be followed prior entering an enclosed space. Only a checklist related to enclosed space entry permit form was available onboard.

The last internal audit was overdue and did not mention anything about enclosed space procedures, drills or familiarization by crew.

No risk assessments covering entry into an enclosed space available onboard.

There was a lack of safety warnings or reminders related to enclosed space entry on board.

The two crew members overlooked the dangers of enclosed spaces to immediately rescue the AB without proper personal protective equipment such as breathing apparatus.

Based on the symptoms, it is assumed that the content of hydrogen sulphide accumulated in the tank after transferring sewage was high. The concentration was never verified with a multigas detector instrument. There was a lack of training in the use of testing instruments as well as lack of use of individual portable equipment.

There was a generalized lack of understanding of enclosed space dangers and procedures. There was a lack of observance of the principles of enclosed spaces.

The SMS referred to a guide issued by the P&I Club. Another guide had a similar title, which can create some confusion since the second guide only applies to ventilation in a shipyard.

What can we learn:
- SMS manuals should include clear and detailed procedures for entering enclosed spaces.
- Companies should ensure that crews are familiar with the proper use of personal protective equipment including the use of multi-gas instruments.
- The crew must identify all enclosed spaces onboard through the corresponding risk assessment form.
- Companies must place visible safety posters on vessels so that crew members can recognize the dangers of entering confined spaces.

Who may benefit:
The Maritime Sector and Shipowners.

53 Categories of safety issues:

- Management factors
- Planning and Procedures
- Safety assessment review

Casualty event: Occupational accident – others

Casualty severity: Very serious marine casualty

What happened:
A general dry cargo ship was discharging fumigated logs. A stevedore entered a spiral ladder space of an almost fully loaded cargo hold from an access entrance on the main deck. The crew lost contact with the stevedore. Soon after, the chief officer tried to rescue the stevedore and contact with him was also lost after entering the ladder space. Both the stevedore and the chief officer were found dead in the spiral ladder space which contained poisonous phosphine and lacked oxygen.

Why did it happen:
The requirements of the "Code of Safe Working Practices for Merchant Seafarers" (the Code) and the shipboard safety management system (SMS) to properly control the entry into enclosed spaces were not met.

The crew did not conduct a full risk assessment nor was an entry permit issued before the stevedore entered the ladder space.

The shipboard safety training and drills, including enclosed space entry and rescue as well as knowledge of the limitations on the use of mask respirators, were ineffective.
Both the stevedore and the chief officer lacked awareness of the fatal risk inside the ladder space.

What can we learn:
- The ship management company, all masters, officers and crew members should strictly follow the requirements of enclosed space entry, cargo fumigation, risk assessment and plan the cargo handling properly, enhance crew's safety awareness and enhance crew training and drills.
- The management company should ensure crew strictly follow the proper procedures for enclosed space entry and cargo fumigation.

Who may benefit:
Companies, Masters, Crew.

54 Categories of safety issues: Tool and hardware (design or operation)

Casualty event: Capsize/listing - capsize

Casualty severity: Very serious marine casualty

What happened:
An unregistered service tugboat was tasked to tow a 66-meter cargo vessel from a shipyard towards open waters for a sea trial.

The cargo ship put both engines on standby in preparation for transit. Thereafter, the ship's master ordered to put the starboard side throttle to dead slow ahead.

The service tugboat slightly manoeuvred to port but was pulled broadside by the towline coming from the cargo vessel when the cargo vessel began to overtake the towing vessel. Subsequently, the towing vessel began to heel to starboard while being dragged by the towline.

Owing to the tension exerted by the towline from the cargo ship, the tug's righting lever drastically diminished and was completely overwhelmed by a high athwartships towing force. This caused the service tugboat to capsize & sink.

Why did it happen:
The length of towline from the service tugboat to the cargo ship was only 20 meters, less than the required length of 50 meters as per Amendment to SOLAS regulation 11-1/3-4 (res. MSC.256 (84) "Emergency Towing Arrangements and Procedures").

There was an absence of a towline emergency quick release mechanism on the service tugboat.

What can we learn:
- The emergency release function is to take priority over any emergency stop function.
- Activation of the winch emergency stop from any location is not to inhibit operation of the emergency release system from any location.

Who may benefit:
Tugboat community

55 Categories of safety issues:

- Planning and Procedures
- Safety assessment review

Casualty event: Occupational accident – slipping, falling of person overboard

Casualty severity: Very serious marine casualty

What happened:
During the winter months, the master on a bulk carrier instructed the crew to secure the pilot – accommodation ladder combination arrangement. The bosun and two ordinary seafarers were carrying out this task, with the bosun down at the bottom platform of the accommodation ladder that was still inclined and two ordinary seafarers assisting with the task from the deck. During the task, the bosun fell overboard.

The crew members immediately responded to the emergency and the local authorities were contacted for assistance in recovering the bosun from the water. The bosun was eventually recovered in an unconscious state by a pilot boat and was transferred to a hospital on shore. He was pronounced dead in the hospital.

Why did it happen:
The crew member may have fallen overboard either while trying to adjust the accommodation ladder's bottom platform or he may have slipped on the ladder, owing to ice accretion.

The crew member was wearing neither a safety harness nor a working life vest / life jacket, while working on the accommodation ladder.

What can we learn:
- The importance of using fall prevention equipment when working aloft.
- Safe work procedures must be implemented in full in order to ensure safe conduct of operations.
- Proper supervision of work activities to ensure safe work procedures are implemented and followed.

Who may benefit:
Seafarers, Ship owners, Ship operators, Ship managers.

56 Categories of safety issues: Management factors

Casualty event: Occupational accident – slipping, stumbling, falling of a person overboard

Casualty severity: Very serious marine casualty

What happened:
Two crew members on a container ship were preparing mooring ropes at the forward mooring station. One crew member heard something and saw the other person fall into the water but could not see him in the water. The crew member on deck contacted the bridge to report the accident.

The crew immediately activated Man Overboard (MOB) procedures and began to search for the missing crew member. Three nearby vessels joined in the search along with a SAR helicopter. After 9 hours the search was stood down. The crew member was declared missing and presumed deceased.

Why did it happen:
The missing crew member was not wearing any lifesaving or personal protective equipment while working on the mooring deck without supervision from the responsible officer.

What can we learn:
- The importance of safety precautions and supervision when the crew is working near the ship's sides.
- The importance of using proper instructions, guidance, and safety gear.

Who may benefit:
Masters, Seafarers, Managers and the shipping community.

57 Categories of safety issues:

- Anthropometric or personal factors
- Emergency handling
- Legislation, standards and compliance
- Management factors
- Natural environment
- Planning and Procedures
- Tool and hardware (design or operation)

Casualty event: Grounding - while under power

Casualty severity: Very serious marine casualty

What happened:
The cargo ship was drifting for the purpose of time adjustment off the west of Ishigaki Island, Ishigaki City, Okinawa Prefecture, pushed by the wind and waves. The ship therefore started its main engine and navigation; however, the ship continued to be pushed without gaining sufficient propulsion or rudder effect and ran aground on a shallow reef.

The ship's hull subsequently broke in two at its centre section.

Why did it happen:
It is probable that the accident occurred when, under conditions in which a gale warning as well as a high winds advisory and heavy seas warning had been issued. The ship drifted off the west of an island, where the Shallow Reef exists to the south, and received northerly wind and waves from her port side and was pushed south; she continued to drift even after the wind and waves intensified until her distances to the Shallow Reef reached about 3 M. The ship subsequently started her main engine and began navigating in an attempt to proceed north but could not gain sufficient propulsion and rudder effect to overcome the external forces, and therefore she continued to be pushed in an uncontrollable state and ran aground on the Shallow Reef.

It is somewhat likely the ship could not gain sufficient propulsion and rudder effect after she started her main engine because the master continued to use the main engine at half-ahead revolutions and did not use the maximum available output, resulting in main engine output that was approximately 40% of the Maximum Continuous Rating (MCR).

It is probable that the Vessel drifted off the west of the Island, where the Shallow Reef existed to the south and where she received wind and waves from the north, without taking refuging steps, such as heaving to using the main engine, because the master thought based solely on weather information he obtained from on overseas weather information website that the weather and sea conditions would not present a problem for navigation if they were as forecasted.

It is probable that the ship continued to drift even after the wind and waves intensified until her distance to the Shallow Reef reached about 3 M because the master thought the weather and sea conditions would not present a problem for navigation if they were as forecasted and therefore did not instruct the officer of the watch to monitor and maintain the ship's position during drifting and did not specify matters to be reported to the master concerning changes in weather and sea conditions, etc., or the timing of such reports.

What can we learn:
- In cases where a passage plan must be changed, the master of a ship should obtain the latest data and information on the revised destination and weather and sea conditions from the ship management company or local ship's agent.
- The master should make weather predictions based on comprehensive judgments from multiple sources of weather information, including forecasts from local weather authorities. When weather and sea conditions are expected to worsen and a safer anchorage is available inside port, the master should coordinate with their ship's agent or other concerned party to permit early port entry. If a suitable place to refuge is unavailable, the master should consider moving to safe waters away from the shore and using the main engine to turn the bow to windward or heave to.

- When drifting, the master should select a drifting location with no shallow reefs or other such features downwind that is suitable for the forecasted weather and sea conditions as well as geographical conditions.
- The master should confirm in advance the possibility of arranging a tugboat in case the vessel's control becomes difficult. When intending to use a tugboat, the master should request it with plenty of time to spare.
- When drifting, the master should give clear instructions to the officer of the watch concerning monitoring and maintaining the ship's position and specify the matters to be reported to the master concerning changes in weather and sea conditions, etc., and the timing of such reports, and should have officers of the watch make reports to the master so that moving to a safe area can be completed as soon as possible before the danger of approaching a shallow reef, etc., increases.
- The master and officers should, based on a full understanding of the vessel's manoeuvring performance and engine performance, handle the main engine within a range that extends to its maximum available output so that sufficient propulsion can be obtained for early movement to a safe area if the vessel encounters stormy weather.
- The master should share information on the status of ship operations, use of the main engine, and other matters between the bridge and the engine-room, and should establish an operating environment that allows him or her to receive advice on the use of the main engine not only from the crew members on the bridge but also from those in the engine-room.

Who may benefit:
seafarers and Shipping Industry

58 Categories of safety issues:

- Natural environment
- Safety assessment review

Casualty event: Grounding - while under power

Casualty severity: Very serious marine casualty

What happened:
A ship was under way and the master planned to put the vessel on drifting outside the port to wait for the entrance time. Around 03:00 hrs the ship stopped the engine and started drifting. The AIS shows that from 03:00 to around 7:30 the vessel approached shallow water at a speed of around 1.5 KN without change of speed or direction.

By 7:30 hrs, the C/O noticed the approaching reef and asked that the engine be put on stand by and call the master. The master used the engine, trying to move the ship away from shallow water but it did not work. The master ordered hard to port. AIS shows that speed and direction started to change, and vessel movement changed to port. By 09:20 hrs, the ship started communication with a local coastguard patrol boat that was close to the ship. The master asked for tug boat assistance due to engine power was not enough but the patrol boat replied that no tug boat was available. The master ordered to drop port side anchor; the crew dropped it with five shackles on deck. About 10:00 hrs the ship touched the ground.

The master ordered sounding ballast and fuel tanks. Several tanks and engine-room were found flooded, 10-15 mins later the master ordered abandon ship and requested assistance. The patrol boat could not approach owing to the weather. By 13:00 hours all crew were rescued by helicopter; there were no injuries. No oil spill was detected.

Why did it happen:
It was an accident caused by the weather, strong wind and waves combined with lack of care from watch keeping officer, also low output power from engine.

Based on sequenced event shows that poor judgment from crew to take preventing measure to avoid the accident from drifting time the ship approached to shallow water in a constant speed and direction, the preventing action start about two hours before when vessel was very close from shallow water, about 0.5 miles as per RADAR information.

The master reported to the coastguard and was informed during interview that vessel did not respond to engine power owing to wind and waves. Wind was force 7-8 and seas were high.

What can we learn:
- Inform the company about the danger to change the vessel plan and take provide to the crew with all the necessary information the prevent any accident.
- Instruct the crew about the danger of last-minute changes on the vessel operation and take careful and consider all possible dangerous scenarios.
- Instruct crew about proper reaction under bad weather conditions and proper timely reply.

Who may benefit:
The shipping industry

59 Categories of safety issues:

- Anthropometric or personal factors
- Management factors

Casualty event: Collision – with multiple ships

Casualty severity: Very serious marine casualty

What happened:
During the early morning hours, a 56,000 DWT geared bulk carrier encountered a large concentration of fishing vessels. The weather was good with visibility of over 5 NM.

After passing through a concentration of fishing vessels, the ship encountered two additional fishing vessels. One was off the ship's starboard bow and the other was off the ship's port bow. The fishing vessel that was off the starboard bow was engaged in fishing and was on a northerly course. The fishing vessel that was off the ship's port bow did not appear to be making way. The bulk carrier's OOW initially determined the ship would pass between the two fishing vessels.

As the bulk carrier approached the fishing vessels from the west, the fishing vessel that was off the ship's starboard bow started manoeuvring sporadically towards and away from the ship as the fishing vessel's crew members tried to cut the trawl free. Seeing the fishing vessel turning back and forth, the bulk carriers' OOW decided it was necessary to change course and ordered the Helmsman to make two successive 5° turns to port. The collision occurred a short time later. The fishing vessel's hull was damaged and began flooding. All 10 of the crew members who had been on board were rescued before the fishing vessel sank approximately three hours after the collision.

Why did it happen:
The application of navigation watchstanding principles on board the bulk carrier were ineffective.

The fishing vessel's captain was concurrently conducting manoeuvres and monitoring crew members' work on deck and therefore was not maintaining a safe navigational watch.

The white deck lights on board the fishing vessel interfered with the ability of the bulk carrier's bridge team to see the navigation lights that were exhibited by the fishing vessel.

What can we learn:
- The importance of navigation watchstanders making effective use of all available means to assess the risk of collision and of taking early and positive action when it is determined that there is a risk of collision.
- The need for navigation watchstanders to use extra caution when navigating in the vicinity of fishing vessels.

Who may benefit:
Ships' Masters and navigational watchstanders; ship managers; fishing vessel operators; training centres

60 Categories of safety issues:

- Legislation, standards and compliance
- Management factors

Casualty event: Fire/explosion – explosion

Casualty severity: Very serious marine casualty

What happened:
A 90,000 DWT bulk carrier was under way with a cargo of timber. As per the voyage instructions, cargo holds were required to be topped up with fumigant. The initial fumigation process involved introducing a calculated dosage of fumigants via open hatch covers directly onto the logs as well as fumigant materials in blankets to be hung in the cargo hold access hatches (booby hatches).

The fumigant company and fumigation technician discussed the top-up procedure, the fumigant company instructed the fumigation technician to top-up the fumigant only via the booby hatches. The fumigant product was prepared according to the procedure/instructions by the technician on the main deck. The ship's crew remained inside the accommodation during the initial fumigation of the cargo holds except for 2 crew members (the bosun and an AB) who were assisting with closing the hatch covers.

About 3 hours into the operation, two crew members were attempting to open a booby hatch cover. The cover was difficult to open and the bolts had to be forced. There was a loud noise and a release of trapped pressure and smoke. The booby hatch cover blew off, and the bosun was flung 3 meters away. The explosion flung the booby hatch cover and the AB about 10 meters away, resulting in acute fatal injuries.

Why did it happen:
The pressure created by the gases formed by a chemical reaction between the fumigant blanket and the accumulated moisture the hold pushed open the booby hatch cover with force.

The responsible crew members were not adequately trained regarding the hazards associated with the use of aluminium phosphate, and the fumigant technician was not familiar with the particular fumigant or with topping up via the cargo hold booby hatch.

The shipper and the fumigant company did not provide the appropriate procedure for topping up of the fumigant considering the enclosed spiral stairwell.

The hazard of fumigating a cargo hold through an enclosed booby hatch stairwell with a passage obstructed owing to loaded logs was not considered by the technician and/or the vessel team.

The responsible crew was not aware of the hazard associated with opening booby hatch covers when they are under apparent pressure.

What can we learn:

- In-transit fumigations should be conducted by at least 2 crew members (including one officer) who have received appropriate training and have available all necessary fumigation equipment to ensure their safety, in accordance with IMO MSC.1/Circ.1264.
- The importance that the crew is aware of all of the safety requirements and procedures for fumigation operations.

Who may benefit:
Masters, Crews, Managers, Owners, Fumigation experts, Shipping community

61 Categories of safety issues:

- Anthropometric or personal factors
- Natural environment
- Planning and Procedures
- Safety assessment review

Casualty event: Other

Casualty severity: Very serious marine casualty

What happened:
A refrigerated cargo vessel was on passage and was making way during a period of adverse weather. Owing to the forecast, the chief officer held a shipboard safety meeting with all crew present the day before the accident.

On departure, the master requested that all deck machinery and lines be secured for sea owing to forecasted adverse weather conditions. Around 04:00 hrs, the bosun reported the forecastle was secure, leaving the deck to rest with a plan to come back later to secure the mooring lines.

In the afternoon, after resting, the bosun and members of his deck team made their way forward to make fast the lines and secure the deck machinery. Four crew members were at the forward mooring station to secure mooring lines when the vessel was struck by a series of large waves, washing the four crew members off their feet, and propelling them into the ship's structure and deck machinery. Of the four crew members, two suffered fatal injuries, one sustained minor injuries and the other required emergency medical assistance ashore.

Why did it happen:
Despite the safety meeting and intervention from the master to reduce slamming, no action was taken to restrict access to the deck. The Company's heavy weather checklist identified

the need to ensure access to the deck was avoided as well as ensuring all deck machinery was to be secured prior to sea, but the checklist was not used as there was no identified thresholds for what constituted heavy weather.

Prior to the casualty, work and rest periods had been adjusted for eight consecutive days to accommodate port arrivals and departures and for cargo operations. This meant that the deck crew were operating staggered hours of work and rest which affected their sleeping patterns.

Despite the points raised during the previous day's shipboard safety meeting, neither the chief officer nor the deck team considered the risk of heavy weather when making their way out on deck. As such, no consideration was given to delaying the work or using personal protective equipment such as personal flotation devices or lifelines.

What can we learn:

- Work activity on open decks during adverse weather should be restricted and, where essential, appropriately assessed for known hazards and risks and only conducted with the appropriate personal protective equipment, including the use of lifelines, lanyards or securing arrangements are to be considered.
- The importance of communicating with members of the bridge team and or colleagues cannot be over emphasized, especially as to one's whereabouts or planned areas of work.

Who may benefit:
Maritime community

62 Categories of safety issues:

- Legislation, standards and compliance
- Safety assessment review

Casualty event: Occupational accident - slipping, stumbling, or falling of a person to a lower level

Casualty severity: Very serious marine casualty

What happened:
A pipe laying ship was mobilizing for a project. Work was conducted by crew and subcontractors, with each team independently completing their own permits to work. Permit controlled work included work aloft by a rope access team and hot work at a higher level.

The welders had already started work when the rope access technician and assistant arrived at their work area. The assistant raised concerns about visible sparks, but the rope access technician assured him that the risk was negligible and proceeded to climb to the work area with an open container of paint thinner attached to his safety line. Meanwhile, the welder's assistant noticed the rope access technician but did not mention anything to the welder.

Shortly afterwards, sparks from the hot work ignited the paint thinner. The rope access technician pushed the paint thinner container away, but the ignited material splashed onto the safety harness, causing it to melt and fail. The rope access technician fell approximately five meters to the deck and died from his injuries.

Why did it happen:
There was a lack of full team representation and involvement in pre-planning meetings.

Safety management system requirements were implemented, but in isolation, rendering them ineffective by other simultaneous operations.

There was inadequate high-level supervision and control for multiple activities.

The vessel's "stop work" policy was ineffective.

What can we learn:

- While conducting simultaneous operations, effective supervision means maintaining oversight of the entire operation to enable identification of areas which overlap and the associated potential risks.
- During simultaneous operations, job safety analyses, permits to work and risk assessments lose their effectiveness if each team completes their own in isolation. It is important to think of ship and crew safety holistically, not as isolated departments.
- Stop work authority is a safety policy that authorizes employees to put a stop to unsafe work, even when they normally don't have that level of authority. It is only effective when considered more than a written policy and actually utilized.

Who may benefit:
Crew, contractors and subcontractors involved in simultaneous operations, companies, operators and managers.

63 Categories of safety issues: Natural environment

Casualty event: Others

Casualty severity: Very serious marine casualty

What happened:
A passenger ship was at anchor. In the afternoon, passengers were being taken to and from shore in the vessel's inflatable boats, driven by staff from a specialist expedition company that had joined the vessel for this section of its itinerary.

After several shuttle runs had been completed without incident, a boat with its coxswain and 10 passengers, was shaping up to enter the harbour when it was caught in a breaking wave. In the trough of the swell, the boat's propellor touched the seabed, stopping the engine and halting the boat's momentum. Subsequent waves washed passengers overboard and took the boat close to the beach.

As passengers were being helped ashore the coxswain noticed someone was trapped under the boat. Once freed, the unconscious victim was transferred to shore where a medical team made efforts to resuscitate but he could not be revived.

Why did it happen:
Entry into the harbour was made difficult by the passage of a larger set of swells than had been experienced previously and complicated further by the presence of surfers in the water nearby. The boat's engine stopped when its propellor touched the seabed, leaving the boat and its passengers at increased risk from breaking waves.

Once passengers were washed out of the boat, the coxswain had to deal with multiple issues without support of another member of crew in the boat. Once in the water, any effort to conduct an immediate head count was confounded by the distribution of passengers on the beach and the presence of people coming to assist.

What can we learn:

- The use of inflatable boats for tendering operations or coastal expeditions is not addressed by any specific International Maritime Organization (IMO) instruments. The industry could benefit from further assessment of risks posed and a legislative framework to operate in.
- The operation was prepared to deal with an onshore emergency with a nurse and defibrillator present at the landing site but with the coxswain as the sole member of crew in the boat, their ability to instantly respond to multiple passengers overboard may have been a factor.

Who may benefit:
Expedition cruise ship operators and contractors

64 Categories of safety issues:

- Anthropometric or personal factors
- Maintenance
- Management factors
- Planning and Procedures

Casualty event: Occupational accident – electrocution

Casualty severity: Very serious marine casualty

What happened:
Engine-room watch standers observed that the seawater discharge pipe for the main engine cooling pump was leaking on a board 8,900 deadweight oil tanker, while under way. The Chief Engineer determined that the leak could be repaired by pad welding over the corroded area of the discharge pipe. He informed the Fitter and instructed him to prepare to weld the pipe.

As required by the ship manager's safety management system (SMS), the Chief Engineer completed a risk assessment and a hot work permit for the planned work. The risk assessment and hot work permit both indicated that the discharge pipe was dry and that the welding equipment was free of defects. The risk assessment also indicated that the worksite was inspected and was free of water. It also indicated that the ground cable for the welder would be connected to the saltwater discharge pipe. The risk assessment and hot work permit were both approved by the master.

With assistance from another crew member, the Fitter started work after the risk assessment and hot work permit had been approved. The Fitter was wearing insulted gloves, a welding helmet, overalls, and safety shoes.

The Chief Engineer and other crew members who were in the Engine-Room reported hearing the Fitter yelling about 40 minutes after he had started working. They immediately responded and saw the Fitter lying on the tank top. The crew members disconnected the welding leads from the welder and also disconnected the welder from the power supply. They then lifted the Fitter, who was not breathing and did not have a pulse, up onto the deck plating. They administered cardiopulmonary resuscitation, but the Fitter did not respond and was determined to be deceased.

Why did it happen:
The tank top was free of water but was damp in the area where the Fitter was working. This created an electrocution hazard.

The pre-task hazards assessment conducted by the Chief Engineer was insufficient since it did not identify the hazards associated with the tank top being damp.

What can we learn:

- The importance of risk assessments for ensuring that the potential hazards associated with the conditions that exist at the time that a task is going to be performed are identified and addressed when planning the task.
- That consideration should be given to using insulating mats when operating electric welding equipment or portable electric tools in wet or damp areas.
- The importance of conducting regular, periodic inspections of machinery and associated piping systems to identify signs of deterioration before failure and conducting the necessary repairs in a timely manner.

Who may benefit:
ISM managers, seafarers

65 Categories of safety issues:

- Maintenance
- Planning and Procedures
- Safety assessment review

Casualty event: Occupational accident - slipping, stumbling, or falling of a person to a lower level

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier departed under ballast condition. During the voyage, the deck crew of the ship was divided into three groups to wash a cargo hold by using fire hoses with seawater. Before the hold cleaning, the Chief Officer conducted a toolbox meeting which included issues on risk assessment for the hold cleaning, briefing of safety control measures when working aloft, and the issue of a permit for working aloft by the master.

Two crew members were on the athwartships forward platform to wash the forward upper part of the hold. When one crew member walked to the port side of the hold on the fore platform with a pressurized fire hose, the grating detached from its support. As a result, the crew member, together with the detached grating, fell onto the tank top from a height of about 15.8 meters. The Bosun immediately reported the accident to the C/O and the master. The master then assembled the rescue team to provide first aid to the crew member and altered the ship's course heading to seek shore emergency medical assistance. Afterwards, the crew member was transferred to a local hospital by the local coastguard for further medical treatment. Unfortunately, he was certified dead on the same day.

Why did it happen:
The crew did not follow the requirements of the shipboard Safety Management System (SMS) to effectively carry out a risk assessment onboard before the hold cleaning, including identifying the risk of dislocation of the grating of the platform.

Crew members were not wearing safety belts when working aloft.

There was inadequate supervising of the hold cleaning while working aloft.

The crew did not carry out proper maintenance of the platform nor identify the defective platform in the last detailed inspection of the hold.

The crew did not check the condition of the platform in the hold before entry for the hold cleaning.

The accident also revealed that the shipboard training on working aloft for the crew was ineffective.

What can we learn:

- The importance of strictly following the shipboard SMS to carry out an effective risk assessment.
- The need to ensure the crew wear safety belts when working aloft.
- The importance of supervision.
- The importance of inspecting structures to verify that they are properly maintained.
- The importance of shipboard training of the crew on working aloft and their safety awareness.

Who may benefit:
Crew, Company

66 Categories of safety issues:

- Management factors
- Planning and Procedures
- Safety assessment review
- Tool and hardware (design or operation)

Casualty event: Fire/explosion – fire

Casualty severity: Very serious marine casualty

What happened:
In the early morning, a 10,000 DWT liquified gas tanker had completed loading ethylene, when the ship's gas engineer identified that liquid cargo was leaking from the cargo manifold. Having identified that the blank was probably missing a gasket, the gas engineer and duty able seafarer were unbolting the blank when the cargo vapour ignited, creating a fire ball that engulfed the manifold platform and extended in excess of 10 meters in diameter.

The automatic water-spray system did not operate as required but the crew extinguished the fire after 17 minutes. The able seafarer was seriously injured. The gas engineer died owing to complications from burns five days after the fire.

Why did it happen:
The ethylene was introduced to the manifold owing to the incorrect line up of valves during cargo sampling. It was exposed to atmosphere from the leaking blank and when the manifold drain valve was opened. The ignition source could not be determined with certainty but the spanners being used at the manifold were not suitable for use with highly flammable cargoes owing to the risk of sparking. Additionally, the gas engineer was wearing a cold weather jacket that was of a type that could produce a static electricity charge.

Despite concerns about the gas engineer's conduct and competency, the gas engineer was working without support or supervision on a complex system.

Firefighting efforts were complicated by a blocked head on the automatic water spray system. Readiness (both onboard and ashore) was reduced on completion of cargo operations when the risk of fire was thought to be reduced.

What can we learn:

- The use of non-suitable spanners on deck had become normalized as the necessary non-sparking tools to get the job done were not readily available.
- The Company's stop work authority was not robust enough to counter individual culture – none of the crew that were aware of the cargo at the manifold felt empowered to stop the work of a superior.
- A retributive approach to mistakes and errors undermines a just culture: if people are worried about the consequences, it is more difficult for them to speak up.
- Manufacturer's recommended planned maintenance methodology and frequency for water-spray systems may not ensure operability when the water-spray is actually needed.

Who may benefit:
Ship managers, gas tanker operators and crew

67 Categories of safety issues:

- Anthropometric or personal factors
- Emergency handling
- Legislation, standards and compliance
- Management factors
- Planning and Procedures
- Safety assessment review

Casualty event: Collision – with other ship

Casualty severity: Very serious marine casualty

What happened:
A loaded 175-meter chemical/oil tanker was entering the eastbound separation lane of the North Channel Traffic Separation Scheme (TSS) while under conduct of a pilot. A dredger, loaded with 7,000 m^3 of sand, was on transit along the inbound TSS of the North Channel when the Officer of the Watch (OOW) noticed an approaching vessel on the port side, showing a green navigational light. The OOW of the dredger tried to establish radio communication with the crossing vessel on channel 16 VHF radio but failed to receive any response.
The bulbous bow of the tanker collided with the port quarter of the dredger, resulting in a breach of the dredger's hull below the water line, and eventual ingress of seawater inside the engine-room.

As a result of the collision, the dredger was dragged by the chemical/oil tanker and turned counterclockwise before listing to port and capsized.

Three crew members were confirmed dead and 2 dredger technicians were declared missing. The dredger was a total loss.

Why did it happen:
Prior to the collision, the two vessels were in a crossing situation with the tanker being the give-way vessel and the dredger as the stand-on vessel.

The bridge team on the tanker did not acquire the dredger as a target on the X-band radar.

The bridge team on the dredger neither established radio communication nor acquired the tanker as a radar contact, in order to monitor the bearing of the approaching vessel and determine its course and speed.

Neither vessel adequately assessed the risk of collision in accordance with the relevant collision regulations.

Both vessels demonstrated inadequate bridge resource management and a lack of communication between ships and the Vessel Traffic Management System (VTMS). In addition, neither ship complied with the standard procedures reflected on their SMS and shipboard operational procedures.

There was a lack of situational awareness by the pilot and master of the tanker.

What can we learn:
- The importance of situational awareness
- The importance of adherence to COLREGs
- The need for effective communication between vessels.
- The importance of bridge resource management

Who may benefit:
To all shipowners/operators and crew

68 Categories of safety issues:

- Maintenance
- Management factors
- Planning and Procedures
- Safety assessment review

Casualty event: Fire/explosion – fire

Casualty severity: Very serious marine casualty

What happened:
A bulk carrier was on passage in good weather. At around 02:30 hrs, a fire alarm sounded indicating that a fire had broken out in the engine-room on the third deck. A minute later, the water mist system automatically started but had little or no impact on the fire.

The crew were ordered to muster on the main deck, and a mayday was broadcast. The crew noticed that the chief engineer, who was on duty at the time, was not at the muster station. The master ordered a search of the accommodations, but the chief engineer was not found. The fire team made several attempts to enter the engine-room, but they were pushed back by the fire. There were numerous attempts made to contact the chief engineer in the engine control room, as it was believed he went there directly after hearing the alarm. The master was reluctant to release the CO_2 into the engine-room until he had exhausted all possible options to locate the chief engineer.

Once he had assessed that the fire would endanger the safety of the crew and vessel, the master ordered the release of CO_2 into the engine-room. As ordered by the master, the second engineer activated the CO_2 system to flood the engine-room. About 20 minutes later, the fire was reported out. Approximately 0500, the fire team tried to enter the engine-room via the steering gear room to find the chief engineer but without success owing to the high temperature in the engine-room.

At about 13:30 hrs, two crew members tried to enter the engine-room to close the sea chest valve. While descending a staircase they saw the chief engineer but owing to the high temperature and the presence of smoke, they were unable to go further. They exited the engine-room without shutting off the sea chest valve or retrieving the chief engineer.

A few hours later, the temperature was found adequate for entering the engine-room and at about 16:30 hrs, the rescue team entered the engine-room and recovered the chief engineer.

Why did it happen:
The fire may have started in the engine-room around the common control panel of the three generators, which is about 1 to 2 meters distance from the generators. An electric fire may have been the root cause, as the floor and structure around generators No. 2 and No. 3 were not heavily deformed. The inspection and maintenance of the common control panel was not adequate and needed to be improved.

It was later determined that the chief engineer most likely died owing to a lack of oxygen, before the CO_2 was released.

What can we learn:
- The importance of maintaining electrical equipment
- CO_2 releasing procedures.

Who may benefit:
Master, crews, managers, owners, shipping community.

69 Categories of safety issues:

- Legislation, standards and compliance
- Maintenance
- Management factors
- Natural environment
- Planning and Procedures
- Safety assessment review

Casualty event: Capsize/listing – capsize

Casualty severity: Very serious marine casualty

What happened:
A tanker was proceeding to coastal waters for a ship-to-ship transfer operation with a low freeboard of approximately 1 m. With moderate swell of approximately 2 m, seawater entered the port ballast tank through a broken air vent on deck. This resulted in a port list. The water also entered the engine-room through a hole in a corroded drain pipe.

The ballast pump was inoperative and could not be used to correct the list, and the vessel eventually sank. All eight crew members abandoned the vessel and were safely rescued by a passing ship.

Why did it happen:
The inoperative ballast pump could not be used to correct the port list.

The failure of the two shipboard generators and the resulting loss of propulsion and steering exacerbated the situation and resulted in the tanker's status becoming not under command. The defects of the hull and equipment observed by the ship's crew suggested that the tanker was not fit for the intended coastal voyage. These defects were not rectified before commencement of the voyage.

The master did not exercise his overriding authority as stated in the Company's SMS procedures to terminate the voyage knowing the defects were affecting the safety of the crew and vessel. The master acceded to the Company's instruction to continue the voyage and to have the defects rectified after the voyage.

What can we learn:
- Ships deployed to an open sea area should be fit for the intended voyage and risk assessed with safety control measures in place before commencement of the voyage.
- The ISM manager and ship's crew should ensure that critical equipment is well maintained and can be readily operated in an emergency.
- The master of a vessel should exercise overriding authority for the safety of crew and ship as provided in the ISM Code and the Safety Management System procedures.

Who may benefit:
Ships' crew, ship managers and owners

70 Categories of safety issues: Anthropometric or personal factors

Casualty event: Occupational accident – slipping, stumbling, falling of person overboard

Casualty severity: Very serious marine casualty

What happened:
At around 03:30 hrs, a man overboard incident was reported on an Offshore Supply Vessel while "double banked" with other vessels.

Attention was drawn to the incident by the crew members of a sister vessel, who raised the man overboard alarm. According to the crew, they heard someone calling for help in the water, and they pointed their vessel's search light towards the direction where they heard the voice but could not reach the person with a life buoy owing to distance, strong current, and wind speed.

The vessel carried out a head count at 03:33 hrs to determine whether the incident involved any of her crew members; one of the crew members was not counted. A thorough search was carried out onboard the vessel but the crew member was not found.

Prior to the incident, the crew member was said to have retired to his cabin. He was said to be resting in his cabin after he finished his watchkeeping duty at 00:00 hrs. He was not seen outside or anywhere else on board until the MOB was reported. The vessel's crew only found a torch light by the crew member's bedside.

At 03:36 hrs, the vessel and three nearby vessels commenced a search and rescue operation for the MOB almost immediately. The search and rescue continued until 06:20 hrs but the crew member was not found.

Why did it happen:
At some point after retiring to his cabin, the crew member came outside to the deck without safety equipment and headed towards the stern of the vessel where it is open and had no bulwarks. The bulwarks provide safety for crew and passengers. They act as a barrier, preventing individuals from accidentally falling overboard, which is crucial especially in rough sea conditions, significantly reducing the risk of accidents.

All floatation devices were accounted for on board the vessel after the incident; it is likely that the crew member was not wearing a personal flotation device at the time of the MOB. In the absence of a personal floatation device, the chances of survival were reduced, especially in the prevailing conditions (darkness) at the time of the incident.

What can we learn:
- Given the sheer number of man overboard incidents that go unwitnessed, proper supervision of crew on deck is essential. Crew members should not work on deck alone, and they should be wearing proper PPE and a MOB alarm. Otherwise, they may fall without anyone knowing until it is too late.
- Reducing fall overboard hazards: Eliminating falls overboard starts with reducing the hazards that cause crew to fall overboard in the first place.
- Man overboard safety training & drills: When crews are properly trained and drilled on man overboard incidents, their ability to complete a successful rescue and recovery will be far greater. Shipping Companies should ensure that all crew members are well trained on how to handle man overboard incidents, both as victims and rescuers, and routine drills should be conducted to make sure crew members know what to do and what not to do regarding MOB emergencies.
- Working on deck of an offshore vessel requires good safety awareness by both the deck crew and those on the bridge controlling the operation. The risk of personal injury is always present. The first defence against this is keeping to proper planning procedures and proper use of personal protective equipment. This includes a hard hat, safety footwear, high visibility jackets, gloves, eye protection and flotation devices, etc. These must be put on correctly so that they do not come off should the user fall into the water.
- Ensure that a risk assessment is conducted for all jobs, and that the possibility of falling into water is one of the hazards addressed.
- It is important to confirm that bulwarks and safety rails are uninterrupted/continual and provide adequate protection for the ship's crew. If it is possible to fall between gaps, the use of chain guards as a suitable measure of control should be applied.
- Familiarizations, safety meetings/safety briefing/toolbox talk should be done in accordance with the approved ship's SMS manuals.
- There is a need for all crew onboard to adhere to emergency response procedures onboard during emergencies in line with section 8.1 of the ISM Code.

Who may benefit:
The entire maritime community including seafarers, shipowners, shipping companies, maritime training institutions, etc.

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ANNEX 2

FURTHER ANALYSIS OF INCIDENTS OF RUPTURED PORTABLE FIRE EXTINGUISHERS

The Casualty Analysis Correspondence Group (CACG) identified 20 occurrences related to the rupture of high-pressure cylinders (portable fire extinguishers, components of lifeboat launching systems, and breathing apparatus). There were no reports that identified deficiencies in the design or material standards for the cylinders. As a result, the CACG has proposed that the Casualty Analysis Working Group consider the wording of the analysis with the aim of dissemination through a III Circular to remind the maritime industry of the risks of high-pressure cylinders and the need for enhanced inspection of such equipment when it is stored or used in harsh conditions.

Proposed III Circular

The Casualty Analysis Correspondence Group reviewed casualty investigation reports related to the failure of high-pressure cylinders. There were 20 cases identified, of which 1 was part of the self-contained air support system on a lifeboat, 2 were nitrogen cylinders that were part of a lifeboat launching system, and 17 were portable fire extinguishers.

In 14 of the 20 cases, corrosion was identified as a contributing factor; overpressure or suspected overpressure was found in 2 cases; and other causes were identified in 4 cases. Inadequacies in record-keeping and inspection, both on board inspections by crew and in external inspections by flag States and service providers were discussed in many of the reports.

Seafarers, service providers, and those performing inspections of high-pressure cylinders are reminded of the risks posed owing to the amount of stored energy. High-pressure cylinders have a set service life and it is particularly important to track this interval, considering the risks to seafarers in the case of cylinder failure.

In its investigation of a very serious marine casualty on the **Emerald Princess**, New Zealand found that there is no international standard for inspection of high-pressure cylinders. To ensure that a high-pressure cylinder is adequately inspected, steps should include examination of the cylinder under any rubber footing, removal of the cylinder from a location where the entirety of the cylinder cannot be visually inspected.

The following table provides a summary of the occurrences. Twelve of the 20 occurrences were considered near misses and did not result in an injury or fatality.

What happened	Persons affected	Cause(s)
Failure of a 5kg CO_2 fire extinguisher during hydrostatic pressure testing	0	Age-related degradation, material fatigue
Several 50kg wheeled dry powder fire extinguishers on board a vessel were found to have low pressure and heavy signs of corrosion. The corrosion was discovered during an audit walk-around by shore-based personnel	0	Maintenance/inspection failure
A person was discharging a dry chemical powder fire extinguisher which	1 fatality	Corrosion of the unit base

What happened	Persons affected	Cause(s)
had been condemned during an annual third-party inspection. When the internal CO_2 cylinder was activated, the unit ruptured at the corroded base		Inadequate job planning and risk assessment
The safety valve assembly of a twin cylinder hyperbaric fire extinguisher blew off during 'routine' checks	0	Over-pressurization Safety valve burst disc did not actuate Gap in records
While the crew were restoring pressure to a bank of high-pressure nitrogen-gas cylinders that formed part of a launching davit 'stored energy' system, one of the nitrogen bottles burst	1 fatality	External corrosion-induced wall-thickness loss Overdue hydrostatic test Ineffective periodic inspection
During an inspection, a technician noticed an unusual amount of corrosion around the internal brass fitting connecting the aluminium stem to the internal thread of the pillar valve. The technician touched the stem and it fell apart. The internal inspection of the cylinder found that it was in good condition with no signs of corrosion; it was the first inspection for the unit	0	Galvanic corrosion at brass–aluminium interface (internal stem/fitting) Early-life mechanism not obvious on exterior of unit
While being used, a fire extinguisher suddenly exploded	1 fatality	Corrosion under rubber base Failure to remove rubber foot during inspection
While explaining the safe handling and positioning of a fire extinguisher, it suddenly exploded	1 fatality	Corrosion under rubber base Failure to remove rubber foot during inspection
During operation of a gas cartridge-type dry chemical powder-filled fire extinguisher, the bottom of the body failed. The fire extinguisher was propelled upwards	1 fatality	Corrosion at the base of the unit Shell failure upward on activation Failure to remove rubber foot during inspection
During the decommissioning of portable foam extinguishers, the crew could not remove a valve assembly. To facilitate work, they attempted to discharge the extinguisher. The body of the extinguisher ruptured at the base	1 fatality	Corrosion at the base weld led to structural failure of already condemned unit Third-party inspection did not flag unit
In attempting to move an old foam fire the extinguisher, the unit exploded causing multiple injuries	1 injured	Corrosion of shell led to explosive rupture when handled Lack of recent inspection/ test
While recharging the water fire extinguisher, a crew member was trying the force a stuck CO_2 cartridge. The inner tube suddenly broke off the extinguisher's headcap assembly; the broken tube snapped	1 injured	Mechanical failure of inner tube Improper methods used Inadequate PPE

What happened	Persons affected	Cause(s)
During annual maintenance a dry powder extinguisher was inadvertently activated, and the headcap flew off	1 injured	Inadvertent activation of cartridge Inadequate supervision and procedures
The hose of a fire extinguisher ruptured under use	0	Age-related degradation Deficiency in maintenance/inspection interval
When attempting to recharge a fire extinguisher with the pressure unit, the base of the extinguisher blew out, propelling it into the deck head	0	Failure likely due to a structural weakness from corrosion
When the extinguisher was activated, the pressure diffuser nozzle broke away and the hose whipped back under pressure	1 injured	Failure of pressure diffuser nozzle/coupling Defect at nozzle interface
During a demonstration of a dry powder fire extinguisher, the operating lever was activated and the head of the extinguisher blew off	0	Head separation due to thread wear from repeated use (training unit) Method used for tightening contrary to manufacturer's instructions
During charging, an 8-year-old gas bottle exploded. The labels showed different numbers/dates	1 injured	Possible over-pressurization Inadequate verification of cylinder history/fitness
Whilst refilling a bank of nitrogen cylinders that form part of a lifeboat launching system, one cylinder exploded	1 injured	External corrosion-induced wall-thickness loss Inadequate oversight by third-party service provider
A cylinder from the self-contained air support system in a lifeboat ruptured, sending fragments into the overhead flotation chamber and creating a large hole in the hull. A second cylinder was lost to the sea	0	Corrosion, likely due to partial submersion in water as a result of horizonal storage in the compartment. Difficult access to inspect cylinders Infrequent inspection due to vessel being in the process of decommissioning

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ANNEX 3

DRAFT PROPOSAL FOR A NEW OUTPUT TO IMPROVE FIRE SAFETY STANDARDS/REGULATIONS FOR CARGO HANDLING SPACES OF SPECIALIZED SELF-UNLOADING BULK CARRIERS

Background

1 At its eighth session, the Implementation of IMO Instruments (III) Sub-Committee instructed the Working Group on Analysis of Marine Safety Investigation Reports (Working Group) for a detailed review and action with respect to document III 8/4/3 (Australia) which identified the safety issue concerning inadequate fire safety standards and regulations for cargo handling spaces of specialized self-unloading (SUL) bulk carriers (III 8/19, paragraph 4.12.16).

2 The Working Group reported to the Sub-Committee that there was full support to bring forward this safety issue and support for a new output to develop improved fire safety standards/regulations for the cargo handling spaces of specialized SUL bulk carriers (III 8/19, paragraph 4.39). Consequently, the Sub-Committee instructed the Correspondence Group on Analysis of Marine Safety Investigation Reports (Correspondence Group) to use the safety issue to test the revised Casualty Analysis Procedure (Procedure) for identifying and forwarding safety issues and report to III 9 (III 8/19, paragraph 4.40).

3 At its ninth session, the Sub-Committee noted the Correspondence Group's report that the Procedure was tested using the safety issue and found to work well (III 9/4, paragraph 21). The Working Group at III 9 also confirmed that the Procedure had been satisfactorily tested (III 9/WP.3, paragraph 25). In noting these test results, the Sub-Committee confirmed that MSC 106 had approved the Procedure (III 9/19, paragraph 4.32). However, while the tests had verified the existence of the safety issue, the issue itself had not been forwarded to the relevant sub-committee for consideration.

4 At its eleventh session, the III Sub-Committee considered document III 11/4/6 (Australia) which noted that this safety issue had not been addressed (III 11/4/6, paragraph 8). The Sub-Committee recalled the work and discussions in relation to this safety issue at its eighth and ninth sessions, and that further action to address the issue had not been taken (III 11/16, paragraph 4.12).

5 In the ensuing discussion, the Sub-Committee noted the views that it was important to review the existing fire safety standards applicable to specialized SUL bulk carriers and identify opportunity for regulatory enhancement for this and similar ship types; the necessity to forward this safety issue to enhance fire safety standards as the submission exposed a critical regulatory gap in the applicable standards; and the trend that the similar cases involving **Ambassador** (C0001338), **Yeoman Bontrup** (C0008120) and **Iron Chieftain** (C0011114) indicated that this was a systemic risk affecting this ship type (III 11/16, paragraph 4.14).

6 Consequently, the Sub-Committee referred document III 11/4/6 (Australia) to the Working Group for detailed consideration, taking into account relevant comments made and decisions taken in plenary (III 11/16, paragraph 4.15). The Working Group considered the safety issue, recognized its existence, noted there was no existing output to address the issue and recommended the Sub-Committee to instruct the Correspondence Group to develop a proposal for a new output to address the issue (III 11/WP.3, paragraphs 26 and 27). Following its consideration, the Sub-Committee noted the discussion and instructed the Correspondence

Group to develop a proposal for a new output on addressing the safety issue (III 11/16, paragraphs 4.36 and 4.44.5)

IMO's objectives

7 IMO's mission to promote safe, secure, environmentally sound, efficient and sustainable shipping through cooperation relies on creating a regulatory framework for the shipping industry that is fair and effective, universally adopted and universally implemented. Therefore, addressing this safety issue by improving fire safety standards and regulations for the cargo handling spaces of specialized SUL bulk carriers is well within the scope of the Organization's mission.

8 Improved fire safety standards for specialized SUL bulk carriers will contribute to strategic direction (SD) 2 seeking the adoption and integration of modern or emerging fire detection and extinguishing technologies into existing and new-build SUL bulk carriers and SD 7 through the development and implementation of effective and relevant regulations. The regulatory framework includes mandatory IMO instruments and importantly the International Convention on the Safety of Life at Sea, 1974, as amended (the SOLAS Convention) to reduce the risk of such serious fires on ships.

9 The proposed new output could also address the regulatory gap noted in paragraph 5, which exposes SUL bulk carriers to the systemic risk identified in various marine safety investigation (MSI) reports. IMO recognized the role of timely and accurate MSI reports in enhancing safety to achieve its broad maritime safety and environment protection objectives when it adopted the Casualty Investigation Code and associated Guidelines for carrying out an MSI.

Need

10 The Australian Transport Safety Bureau (ATSB) MSI report into the 2018 fire in the SUL spaces of the Australian flagged **Iron Chieftain** which resulted in its constructive total loss concluded that these spaces present a very high fire risk. The report identified the inadequacy of standards or regulations for SUL systems, including for conveyor belts and dedicated fire detection/fixed fire-extinguishing systems was a principal contributing factor in at least three major fires on SUL bulk carriers over a 25-year period in addition to several other significant fires.

11 The MSI reports into the major fires on board **Ambassador**, **Yeoman Bontrup** and **Pramudita** (C0009859) also identified a need for improved fire safety standards and regulations in the SUL spaces of these types of ships. These recurring, similar fires on this ship type indicate the increasingly compelling need to address the underlying safety issue.

12 The lack of harmonized international fire safety requirements for SUL cargo handling spaces results in inconsistent designs and protection levels, with reliance on ad hoc or non-mandatory guidance that may not address SUL-specific fire risks. This regulatory gap undermines uniform safety standards and highlights the need for an IMO led, risk-based fire safety provisions.

Analysis of the issue

13 In order to analyse the inadequacy of the existing fire safety standards and regulations, it is necessary to describe these standards and regulations and how and to what extent they apply to specialized SUL bulk carriers. In large part, these are contained in the SOLAS Convention in chapter II-2 (Construction - Fire protection, fire detection and fire

extinction). The fire safety objectives stated therein are – prevent the occurrence of fire and explosion; reduce the risk to life caused by fire; and contain, control, and suppress fire and explosion in the compartment of origin.

14 Regulation 2, chapter II-2 of the SOLAS Convention sets out functional requirements necessary to achieve the fire safety objectives stated in paragraph 13 above. Of these, the following requirements are relevant to this safety issue: restricted use of combustible materials; detection of any fire in the zone of origin; containment and extinction of any fire in the space of origin; and ready availability of fire-extinguishing appliances.

15 **Iron Chieftain**, **Ambassador** and **Yeoman Bontrup** were assessed as being designed, constructed, and equipped in accordance with the applicable regulations and standards, including the functional requirements identified in paragraph 14 above. However, in each case, the regulations and standards were not effective in preventing the fire or reducing the consequential damage. Some principal contributing factors to the fires assist the further analysis of this issue below and the measures that could address it.

16 Firstly, no specified standards or regulations to address the flammability properties of the rubber used for shipboard conveyor belts exist. Laboratory tests performed as part of the investigation into the **Iron Chieftain** fire showed its conveyor belt rubber displayed no significant fire-retardant properties and, once alight, burned until fully consumed. Similarly, the MAIB[2] investigation into the **Yeoman Bontrup** fire identified that the maximum average heat release (MAHRE) value for its conveyer rubber and belt components was 157.2 kW/m^2 and 271.5 kW/m^2, respectively. In contrast, the United Kingdom rail industry mandated a maximum allowable MAHRE[3] value of 90 kW/m^2 for similar parts.

17 The SUL system spaces of **Iron Chieftain** were not equipped with an automated fire detection system and there were no SOLAS regulations or classification society rules that mandated fire detection in the cargo handling spaces of SUL ships.

18 The typical design and layout of SUL systems on this ship type means the port and starboard tunnels, along with the vertical C-Loop casing and communicating spaces, form one large compartment. There are generally no internal divisions or doors that can be used to further compartmentalize the space. There is also no means of sealing the upper termination of the C-Loop, where the inner and outer conveyor belts separate to deposit cargo onto the boom conveyor. In addition, the cargo hold gates are not airtight making it almost impossible to completely seal off the SUL system space.

19 Finally, **Iron Chieftain** was not equipped with a fixed fire-extinguishing system to protect the C-Loop or tunnel spaces. While the SOLAS regulations required a fixed gas (for example, carbon dioxide) fire-extinguishing system or a system that provided equivalent protection (such as, a water mist system) the cargo spaces of ships like **Iron Chieftain**, SOLAS regulation 10.7.1.4, chapter II-2 allowed an exemption from this requirement if the ship was constructed and intended solely for the carriage of cargoes considered to constitute a low fire risk such as cargoes in groups A and C identified in International Maritime Solid Bulk Cargoes (IMSBC) Code which **Iron Chieftain** was restricted to carrying.

20 Addressing one or more of the functional requirements (paragraph 14) to achieve the fire safety objectives (SOLAS chapter II-2) could address this safety issue and should, therefore, be the focus of the proposed new output. This could include amending or

[2] United Kingdom Marine Accident Investigation Branch (MAIB).

[3] Maximum Average Heat Release Rate.

augmenting the standards and regulations governing the restricted use of combustible materials by specifying flammability properties for conveyor belt rubber in SUL systems; detection of any fire in the zone of origin; and containment and extinction of any fire in the space of origin through the availability of appropriate means of fire-extinguishing.

21 Practical technology and systems to achieve the proposed improvements in paragraph 20 exist as demonstrated by proactive safety action taken by **Iron Chieftain's** owners and operators across its fleet of SUL bulk carriers. The safety action included the development and installation of early-warning heat and fire detection systems (thermal imaging cameras, linear heat detection alarm systems integrated with closed circuit television camera systems (CCTV) and engine-room cameras with flame/smoke/mist video analytics) and fixed fire-extinguishing systems for SUL spaces (Hi-Fog water mist fire suppression system) and crew training for utilizing these systems.

Analysis of implications

22 Implementation of improved fire safety standards and regulations for the cargo handling spaces of specialized SUL bulk carriers as a result of the proposed new output will most probably require installation or upgrade of one or more of the: SUL conveyor belt systems, fire detection systems and fixed fire-extinguishing systems in existing ships. In addition, any ships of this type being built as well future new build ships will need to be designed and constructed accordingly.

23 Improving existing SOLAS regulations and standards will require work at IMO, most probably by the Sub-Committee on Ship Systems and Equipment (SSE), and subsequently, by respective administrations and classifications societies to review, interpret and adopt the regulations and standards. Subsequently, port and flag State administrations will be responsible for inspecting, auditing, and verifying compliance with SOLAS regulations once adopted and in force. Classification societies will retain their existing responsibilities with respect to new regulations and standards.

24 The proposed amendment to SOLAS chapter II-2 and the completed Checklist for Identifying Administrative Requirements (MSC-MEPC.1/Circ.5/Rev.6) are respectively included in annex 1 and 2 to the present annex.

Benefits

25 A new output which effectively addresses the safety issue can result in a material improvement in fire safety on board specialized SUL bulk carriers because, under existing regulations, their cargo handling spaces present a very high fire risk as detailed in paragraphs 11 and 12. This safety improvement should result in a corresponding increase in safety for the crew, ship, cargo, and environment.

Industry standards

26 As discussed in paragraphs 16 to 19, the MSIs into the fires involving **Ambassador**, **Yeoman Bontrup** and **Iron Chieftain**, in particular, identified that there were no SOLAS regulations or requirements for their SUL system equipment or conveyor belt standards. Similarly, the investigations found that there were no classification society rules governing the flammability of conveyor belt systems or the fitting of fire detection or fixed fire-extinguishing systems in the SUL system spaces either.

27 Following the MSI into **Yeoman Bontrup** fire, the Sub-Committee on the Carriage of Cargoes and Containers (CCC) introduced an amendment to The International Maritime Solid

Bulk Cargoes (IMSBC) Code. Under amended section 3.1.2 of the IMSBC Code, ship's crew were required to carry out routine and regular onboard operational fire safety risk assessments for cargo handling areas of SUL bulk carriers which featured internally installed conveyor systems. Consideration was to be given to fire prevention and the effective operation of fire detection systems, containment and suppression under all anticipated operating conditions and cargoes.

28 However, the ATSB[4] MSI into the **Iron Chieftain** fire found that compliance with the IMSBC Code requirements identified in paragraph 27 above did not effectively mitigate the risk of fire in the ship's SUL spaces. The ship's fire safety risk assessment had identified that the risk of fire in the SUL spaces was unacceptable owing to the absence of effective means of fire detection and suppression. Measures to address the risk were either inadequate or ineffective. It was considered that there was opportunity to improve the requirements for ships to put in place effective measures to detect a fire in the space of origin and provide alarm for effective firefighting.

29 The ATSB MSI assigned the safety issue of the inadequacy of fire safety standards and regulations for specialized SUL bulk carriers to the Australian Maritime Safety Authority (AMSA) for it to raise the issue with the Organization so that it could be addressed. The progress of this initiative is outlined in paragraphs 1 to 7, and this draft proposal for a new output is a continuation of the process.

30 The ATSB MSI also assigned the safety issue to **Iron Chieftain's** classification society, Lloyd's Register (LR), to have the issue addressed through International Association of Classification Societies (IACS) rules. However, LR advised the ATSB that a proposal for a Unified Requirement (UR) to address fire detection and extinction for SUL bulk carriers was raised with the General Policy Group of IACS in June 2021 but a majority of IACS members voted to wait for new SOLAS regulations or other guidelines from the Organization instead of developing a UR.

31 As noted in paragraphs 16 and 26, fire safety standards for the rubber and components of SUL bulk carrier conveyor belts do not exist and introducing standards would not only need to reduce safety risk to a broadly acceptable level but also be cost-effective. In summary therefore, there are currently no SOLAS regulations, classification society rules or other standards that exist or being developed to address this safety issue.

Output

32 Subject to the consideration and decision of the Sub-Committee on Ship Systems and Equipment (SSE) and/or other relevant organ(s), the proposed new draft work output is amendment of the SOLAS Convention and, as relevant, the Code of Fire Safety Systems (FSS Code) and/or the IMSBC Code to best address the high fire risk of the cargo handling spaces of specialized SUL bulk carriers.

33 Specifically, the application of SOLAS chapter II-2 regulations to specialized SUL bulk carriers with no exemption under regulation 10.7.1.4 for low fire risk cargoes should largely address the issue. Annex 1 details this proposed amendment, which can be justified in the following SMART terms:

.1 **Specific:** The proposed new output requires amendment to the SOLAS Convention (and/or the FSS Code and IMSBC Code) and, specifically, the

[4] The Australian Transport Safety Bureau.

application of SOLAS chapter II-2 to address the high fire risk on in the cargo handling spaces of specialized SUL bulk carriers.

.2 **Measurable:** Regulatory changes will mean mandating one or more of the following safety measures for specialized SUL bulk carriers: Flammability standards for conveyor belt rubber, installation of an appropriate fire detection system and/or the installation of an appropriate fixed fire-extinguishing system in the cargo handling spaces.

.3 **Achievable:** As detailed in paragraph 21, practical technology and systems to achieve the proposed fire safety improvements for specialized SUL bulk carrier fire safety exist.

.4 **Relevant:** The proposed amendment can adequately address this systemic safety issue which poses a very high fire risk to specialized SUL bulk carriers as described in paragraphs 11 and 12.

.5 **Time-bound:** The proposed new output may require more than one session in the biennium to identify the most effective means of regulatory change followed by the adoption of the amendments and their implementation.

34 The Initial assessment of capacity-building implications (annex 2, appendix 1 of MSC-MEPC.1/Circ.5/Rev.6 and the Check/monitoring sheet for the process of amendments to the Convention and related mandatory instruments (MSC.1/Circ.1500) are respectively included in annex 3 and 4 to the present annex.

Human element

35 The completed *Checklist for Considering and Addressing the Human Element* (MSC-MEPC.1/Circ.5/Rev.6) is included in annex 3 to the present annex.

Urgency

36 The inadequacy of fire safety standards and regulations for the cargo handling spaces of specialized SUL bulk carriers has been a contributing factor in at least three major fires over a 25-year period and several smaller fires. These similar, recurrent fires in recent decades indicate that a systemic safety issue impacting this type of ship exists. While some ship owners and operators have taken proactive safety action to varied extents, a consistent approach to address this safety issue needs regulatory action, which should be taken as soon as reasonably practicable.

37 The Organization can help ensure that IMO instruments continue to be relevant, globally implemented and applicable, and maintain a level playing field by maintaining a focus on the development of regulations and goal-based standards under strategic direction 7. Improvement of the fire safety standards and regulations for the cargo handling spaces of specialized SUL bulk carriers is entirely consistent with this strategic direction.

Action required

38 The Committee is invited to consider the proposed new output in paragraphs 32 and 33 and take action as appropriate.

ANNEX 1

Note: The underlined text shows additions or changes to SOLAS Chapter II-2 / Reg. 10.7.1.4. Grey shading is used to highlight all modifications and new insertions, including deleted text.

Proposed Amendment

SOLAS Chapter II-2

CONSTRUCTION-FIRE PROTECTION, FIRE DETECTION AND FIRE EXTINCTION

Regulation 10 – Fire Fighting

SOLAS 1999/2000 Amend / Chapter II-2 / Reg. 10.7.1.3

7.1.3 Except for ro-ro and vehicle spaces, cargo spaces on cargo ships of 2,000 gross tonnage and upwards shall be protected by a fixed carbon dioxide or inert gas fire-extinguishing system complying with the provisions of the Fire Safety Systems Code, or by a fire-extinguishing system which gives equivalent protection.

SOLAS 1999/2000 Amend / Chapter II-2 / Reg. 10.7.1.4

7.1.4 The Administration may exempt from the requirements of paragraphs 7.1.3 and 7.2, cargo spaces of any cargo ship, except self-unloading bulk carriers featuring internally installed conveyor systems within the ship's structure, if constructed, and solely intended for, the carriage of ore, coal, grain, unseasoned timber, non-combustible cargoes or cargoes which, in the opinion of the Administration, constitute a low fire risk*. Such exemptions may be granted only if the ship is fitted with steel hatch covers and effective means of closing ventilators and other openings leading to the cargo spaces. When such exemptions are granted, the Administration shall issue an Exemption Certificate, irrespective of the date of construction of the ship concerned, in accordance with regulation I/12(a)(vii), and shall ensure that the list of cargoes the ship is permitted to carry is attached to the Exemption Certificate.

* Refer to the International Maritime Solid Bulk Cargoes (IMSBC) Code, adopted by the Organization by resolution MSC.268(85), as amended, appendix 1, entry for coal, and to the Lists of solid bulk cargoes for which a fixed gas fire-extinguishing system may be exempted or for which a fixed gas fire-extinguishing system is ineffective (MSC.1/Circ.1395/Rev.4)

ANNEX 2

Checklist for identifying administrative requirements

MSC-MEPC.1/Circ.5/Rev.6

<table>
<tr><td colspan="3">This checklist should be used when preparing the analysis of implications required in submissions of proposals for inclusion of outputs. For the purpose of this analysis, the term "administrative requirement" is defined in accordance with resolution A.1043(27), as an obligation arising from a mandatory IMO instrument to provide or retain information or data.

Instructions:

(A) If the answer to any of the questions below is YES, the Member State proposing an output should provide supporting details on whether the requirements are likely to involve start-up and/or ongoing costs. The Member State should also give a brief description of the requirement and, if possible, provide recommendations for further work, e.g. would it be possible to combine the activity with an existing requirement?
(B) If the proposal for the output does not contain such an activity, answer NR (Not required).
(C) For any administrative requirement, full consideration should be given to electronic means of fulfilling the requirement in order to alleviate administrative burdens.</td></tr>
<tr><td>1. Notification and reporting?
Reporting certain events before or after the event has taken place, e.g. notification of voyage, statistical reporting for IMO Members</td><td>NR</td><td>Yes
□ Start-up
□ Ongoing</td></tr>
<tr><td colspan="3">Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)

No new notification and reporting requirements.</td></tr>
<tr><td>2. Record-keeping?
Keeping statutory documents up to date, e.g. records of accidents, records of cargo, records of inspections, records of education</td><td>YES</td><td>Yes
✓Start-up
✓Ongoing</td></tr>
<tr><td colspan="3">Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)

There will be a need to maintain records of installation (if applicable), certification, inspection, maintenance and repairs, surveys, drills and training for any additional fire detection and fixed fire-extinguishing systems in the same way as other similar shipboard fire-fighting systems in accordance with its safety management system.</td></tr>
<tr><td>3. Publication and documentation?
Producing documents for third parties, e.g. warning signs, registration displays, publication of results of testing</td><td>NR</td><td>Yes
□Start-up
□Ongoing</td></tr>
<tr><td colspan="3">Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)

No additional publication and documentation requirements.</td></tr>
</table>

4. Permits or applications? Applying for and maintaining permission to operate, e.g. certificates, classification society costs	**YES**	Yes ✓Start-up ✓Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes) **Maintaining certification, classification society survey documentation and any related costs associated with any additional fire detection and fixed fire-extinguishing systems in the same way as other similar shipboard fire-fighting systems.**		
5. Other identified requirements?	**NR**	Yes □Start-up □Ongoing
No administrative requirements other than under 2 and 4 above have been identified.		

ANNEX 3

Checklist for the identification of capacity-building implications

(Annex 2, appendix 1 of MSC-MEPC.1/Circ.5/Rev.6);

1 For Administrations

☐ Is new legislation required? NO
☐ Is there a requirement for new equipment and/or systems? NO
- Does equipment manufacturing capacity exist internationally?
- Do equipment repair/servicing facilities exist internationally?
- Is there capacity to develop new systems?

☐ Will the implementation require additional financial resources? NO
☐ Is there a need for additional human resources or new skills? NO
☐ Will there be a need to upgrade the current infrastructure? NO
✓Is there enough lead time towards implementation? YES
☐ Will a rapid implementation procedure be adopted? NO
☐ Is there a substantial modification of existing standards? NO
☐ Will a guide to implementation be needed? NO

2 For the industry

✓Would the industry require new and/or enhancement of existing systems? YES
Self-unloading bulk carriers with internally installed conveyor systems would require installation of fixed fire-extinguishing systems (this specialized ship type is a small proportion of the global bulk carrier fleet).
✓Does capacity exist internationally to develop new systems? YES
☐ Is there a need for additional training of seafarers? NO
- Do related and validated training courses exist?
- Are sufficient simulation training courses available internationally?

✓Will there be a requirement for new equipment? YES
✓Does manufacturing capacity exist internationally? YES
✓Is there repair/servicing and/or retrofitting and does maintenance capacity exist internationally? YES

ANNEX 4

Check/monitoring sheet for the process of amendments to the Convention and related mandatory instruments
*(*MSC.1/Circ.1500*)*

Part I – Submitter of proposal (refer to section 3.2.1.1)*

1	*Submitted by (Document number and submitter):* the Casualty Analysis Correspondence Group, III 12/4/X
2	*Meeting session:* III 12
	Date (date of submission): 17 April 2026

Part II – Details of proposed amendment(s) or new mandatory instrument (refer to sections 3.2.1.1 and 3.2.1.2)*

1	*High-level action plan*
Submission of proposed amendment to MSC for approval as a new work item Submission of proposed amendment to SDC or appropriate sub-committee for review	
2	*Planned output*
Amendment to the amendment of the SOLAS Convention and, as relevant, the Code of Fire Safety Systems (FSS Code) and/or the IMSBC Code to best address the high fire risk of the cargo handling spaces of specialized SUL bulk carriers	
3	*Recommended type of amendments (MSC.1/Circ.1481) (delete as appropriate)*
	• Four-year cycle of entry into force
4	*Instruments intended for amendment (SOLAS, LSA Code, etc.) or developed (new code, new version of a code, etc.)*
	Amendment to SOLAS Chapter II-2, Regulation 10.7.1.4
5	*Intended application (scope, size, type, tonnage/length restriction, service (International/non-international), activity, etc.)*
	Specialized self-unloading bulk carriers
6	*Application to new/existing ships*
	Application to new and existing ships
7	*Proposed coordinating sub-committee*
	SDC
8	*Anticipated supporting sub-committees*
	N/A
9	*Timescale for completion*
	2 years to approve the new output and review 4 years coming into force
10	*Expected date(s) for entry into force and implementation/application*
	2030
11	*Any relevant decision taken or instruction given by the Committee*

ANNEX 5

Checklist for Considering and Addressing the Human Element

MSC-MEPC.1/Circ.5/Rev.6

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Workload			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
1	**Does the "output" affect workload?**				
1.1	**On board, especially in the already intensive phases of the voyage and port operations to:**	No		This proposal is for a new output to amend the SOLAS Convention and, as relevant, the Code of Fire Safety Systems (FSS Code) and/or the IMSBC Code to address the high fire risk of the cargo handling spaces of SUL bulk carriers. A successful outcome for SUL bulk carriers will involve positive improvements to one or more of the functional requirements necessary to achieve the fire safety objectives in paragraph 2.1 of Reg. 2 of SOLAS Ch. II-2. Where this results in the installation of detection systems and/or fixed fire-extinguishing systems in the cargo handling spaces of SUL bulk carriers, it will provide additional options for ship's crews to fight fires	Not applicable.

				in these spaces but should not increase workload.	
1.1.1	Operations including navigation, cargo and engineering	No		As above.	Not applicable.
1.1.2	Maintenance of the ship's structure and its equipment	Yes		Actioning of the proposed measure will introduce a need to maintain any installed fire detection and fixed fire-extinguishing systems in a similar manner to the maintenance of existing detection and extinguishing systems.	In a manner consistent with existing systems and processes for equivalent systems in other ship spaces.
1.1.3	Onboard administration in support of the ships' management systems	Yes		As above.	As above.
1.1.4	Onboard administration related to regulation involving flag States, classification societies, port State and other bodies such as charterers and port authorities	Yes		Actioning of the proposed measure will introduce a need to document and maintain any installed fire detection and fixed fire-extinguishing systems in a similar manner to maintenance of existing detection and extinguishing systems.	In a manner consistent with existing systems and processes for equivalent systems in other ship spaces.
1.1.5	Increased workload or time pressure on personnel if involved in implementation of changes prior to the implementation date	Yes		As above.	As above.
1.2	**Ashore, in a manner that would affect the ships operation to:**	Yes			As above.
1.2.1	Companies' administration	Yes		As above.	As above.
1.2.2	Flag State, port State and classification societies administration such that certification and other processes are compromised or delayed	Yes		As above.	As above.

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Decision-making			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
2	**Does the "output" impact decision-making on board the ship?**				
2.1	By confusion with existing requirements and regulations	No		Successful implementation of the proposal should result in an improvement to shipboard fire safety for SUL bulk carriers.	Not applicable
2.2	By changing responsibilities as laid out in the ISM Code	No		As above.	Not applicable.
2.3	By creating complexity in its implementation and/or in the safety management systems	No		As above.	Not applicable.
2.4	By requiring increased mental effort, such as the need to find, transform and analyse data or result in the need to make judgements based on incomplete information	No		As above.	Not applicable.
2.5	By limiting the time available to establish situational awareness, decide, communicate (possibly across time zones) or check	No		As above.	Not applicable.

2.6	By increasing reliance on judgement and administrative controls to manage major risks such as oil spills and collisions	No		As above.	Not applicable.
Living and Working Environment			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
3	**Does the "output" affect the living and working environment?**				
3.1	By interfering with existing arrangements for abandonment, fire-fighting and other emergency plans or procedures	No		Successful implementation of the proposal should result in an improvement to shipboard fire safety for SUL bulk carriers.	Not applicable.
3.2	By introducing new materials that could create an explosion, fire, environmental or occupational health risk	No		As above.	Not applicable.
3.3	By introducing new high energy sources such as high-voltage, high pressure fluids	No		As above.	Not applicable.
3.4	By affecting access or egress and causing lack of ventilation in working spaces	No		As above.	Not applicable.
3.5	By affecting the habitability of accommodation spaces due to noise, vibration, temperatures, dust and other contaminants	No		As above.	Not applicable.

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Operation and Maintenance			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
4	**Does the "output" affect the operation and maintenance of the ship, its structure or systems and equipment?**				
4.1	By introducing equipment that the user may find difficult to operate or maintain or may be unreliable	No		Actioning of the proposed measure will introduce a need to maintain any installed fire detection and fixed fire-extinguishing systems in a similar manner to maintenance of existing detection and extinguishing systems.	In a manner consistent with existing systems and processes for equivalent systems in other ship spaces.
4.2	By introducing new and/or novel technology, or technology that changes the role of the person	No		As above.	Not applicable.
4.3	By introducing requirements for new competencies and roles	No		As above.	Not applicable.
4.4	By overloading existing infrastructure such as power generation and ventilation systems	No		As above.	Not applicable.
4.5	By poor integration with existing systems and controls	No		As above.	Not applicable.
4.6	By introducing new and unfamiliar operations/procedures	No		As above.	Not applicable.

4.7	By introducing new and unfamiliar operating interfaces?	No		As above.	Not applicable.
4.8	By introducing risks to the ship during any modifications required prior to the implementation date of the output	No		As above.	Not applicable.
Measures to address the human element			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
5	**Does the "output" require changes to:**				
5.1	Training	Yes		This proposal is for a new output to amend the SOLAS Convention and, as relevant, the Code of Fire Safety Systems (FSS Code) and/or the IMSBC Code to address the high fire risk of the cargo handling spaces of SUL bulk carriers. Where this results in the installation of detection systems and/or fixed fire-extinguishing systems in the cargo handling spaces of SUL bulk carriers, it will necessitate crew familiarization with the operation of the system.	In a manner consistent with training and familiarization conducted for equivalent systems in other ship spaces.

5.2	Practical skill development and competences	Yes		As above.	
5.3	Operating, management and/or maintenance procedures	Yes		This proposal is for a new output to amend the SOLAS Convention and, as relevant, the Code of Fire Safety Systems (FSS Code) and/or the IMSBC Code to address the high fire risk of the cargo handling spaces of SUL bulk carriers. Where this results in the installation of detection systems and/or fixed fire-extinguishing systems in the cargo handling spaces of SUL bulk carriers, it will necessitate inclusion of these systems in the ship's planned maintenance routine.	In a manner consistent with maintenance conducted for equivalent systems in other ship spaces.
5.4	Information/manuals for operation and maintenance	Yes		This proposal is for a new output to amend the SOLAS Convention and, as relevant, the Code of Fire Safety Systems (FSS Code) and/or the IMSBC Code to address the high fire risk of the cargo handling spaces of SUL bulk carriers. Where this results in the installation of detection systems and/or fixed fire-extinguishing systems in the cargo handling spaces of SUL bulk carriers, it will necessitate amendment to the ship's fire plans, FFA manuals, SMS and other associated procedures.	In a manner consistent with the documentation of equivalent systems in other ship spaces.
5.5	Spares outfit	Yes		This proposal is for a new output to amend the SOLAS Convention and, as relevant, the Code of Fire Safety Systems (FSS Code) and/or the IMSBC Code to address the high fire risk of the cargo handling spaces of SUL bulk carriers.	In a manner consistent with the maintenance of spares for equivalent systems in other ship spaces.

				Where this results in the installation of detection systems and/or fixed fire-extinguishing systems in the cargo handling spaces of SUL bulk carriers, it will necessitate maintenance of appropriate spares.	
5.6	Occupational safety requirements including guarding and PPE	Yes		This proposal is for a new output to amend the SOLAS Convention and, as relevant, the Code of Fire Safety Systems (FSS Code) and/or the IMSBC Code to address the high fire risk of the cargo handling spaces of SUL bulk carriers. Where this results in the installation of detection systems and/or fixed fire-extinguishing systems in the cargo handling spaces of SUL bulk carriers, it may necessitate installation of guard systems depending on the type of fixed fire-extinguishing systems used.	
5.7	Shore support	Yes		This proposal is for a new output to amend the SOLAS Convention and, as relevant, the Code of Fire Safety Systems (FSS Code) and/or the IMSBC Code to address the high fire risk of the cargo handling spaces of SUL bulk carriers. Where this results in the installation of detection systems and/or fixed fire-extinguishing systems in the cargo handling spaces of SUL bulk carriers, it will require shore checks and maintenance in a manner consistent with that for equivalent systems in other ship spaces.	In a manner consistent with the shore maintenance for equivalent systems in other ship spaces.

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ANNEX 4

PROPOSED NEW OUTPUT TO ADDRESS RISKS INVOLVED WITH WEARING INFLATABLE LIFEJACKETS

BACKGROUND

1 This document proposes a new output to amend MSC.48(66) International Life-Saving Appliance (LSA) Code and *Model regulations on domestic ferry safety* Res.MSC518(105) to include instructions for doffing and deflation.

2 In 2022, the occupants of the New Zealand flagged domestic commercial passenger ship **I-Catcher** felt a sudden impact from underneath the hull before the **I-Catcher** rapidly capsized. Five passengers and the skipper managed to climb on top of the upturned hull, while the other five passengers remained in an air pocket underneath the ship. The six people on top of the upturned hull were retrieved by responding ships and all survived. The remaining five passengers from underneath the upturned hull were found deceased within the air pocket under the upturned hull wearing inflated lifejackets, hindering their ability to escape.

3 The resultant marine safety investigation identified that:

.1 lifejackets are a critical lifesaving appliance. On the day of the accident, the ships' occupants were well equipped, wearing inflatable lifejackets suitable for the ship's operation. The circumstances of this accident highlight the importance for people to understand how to safely deflate and remove an inflatable lifejacket while in the water should they need to do so in an emergency.

.2 standard ISO 12402 should be amended so that it requires manufacturers to attach the following information on lifejackets:

.1 doffing and deflation procedures for inflatable lifejackets; and

.2 the potential hazard of inflating a lifejacket when obstructed overhead.

.3 all people wearing lifejackets should also have a complete understanding of its full operation including how to remove it in water if needed. This information is best shared during pre-departure safety briefings to ensure all ships occupants are well informed.

.4 an amendment to the resolution MSC.48(66) International Life-Saving Appliance (LSA) Code could be made to include a requirement for inflatable lifejackets to be marked with doffing and deflation instructions; and

.5 Resolution MSC.518(105) on *Model regulations on domestic ferry safety*, article 17 definition of safety brief could be amended to include doffing and deflation of lifejackets.

4 In response to these concerns, New Zealand submitted an Information Paper to the eleventh session of the Sub-committee on Implementation of IMO Instruments (III 11/INF.24). The Sub-Committee's Chair observed that the issues raised in the paper were a safety issue.

5 III 11 instructed the Casualty Analysis Correspondence Group, under the coordination of Canada, to develop a proposal for a new output to address the risks involved with wearing inflatable lifejackets and the importance for people to understand how to safely deflate and remove an inflatable lifejacket while in the water should they need to do so in an emergency taking into account the Committees' method of work (MSC-MEPC.1/Circ.5/Rev.6).

NEED

6 In addition to the very serious marine casualty involving the **I-Catcher**, there have been other casualties as set out below.

Year	Vessel	Flag	Investigating State	Summary	Deaths	Serious injury	GISIS / other reference
2007	Army cadet force rigid raiding craft Mk2	Scotland (UK)	UK	The lifejacket worn by the female cadet was not suitable for use by children and would have prevented her escape from the upturned hull once inflated. One fatality.	1	0	MAIB report
2014	Orca	UK	UK	Following a collision with a dredger, the sailing yacht Orca suffered catastrophic damage and sank within minutes. The automatic inflation lifejacket worn by the yacht's skipper failed to operate and they escaped through the emergency escape hatch. The body of the skipper's wife was recovered from inside the yacht's cabin with her lifejacket fully inflated as designed.	1	0	MAIB report
2015	Fletcher speedboat	UK	UK	An unnamed Fletcher speedboat with one adult and three teenage children on board capsized after encountering a large wave. Three of the occupants managed to swim clear of the upturned hull but one of the children became trapped when a strap on the back of the girl's buoyancy aid became snagged on the starboard aft mooring cleat.	1	0	MAIB report
2020	Norma G	UK	UK	A family were enjoying a day out on the water on their 5.4m motor cruiser Norma G. The boat was capsized by a large wave and owner's 17-year-old daughter became trapped in the cabin. Her inflated lifejacket prevented her from swimming down and out of the submerged cabin door, and she was unable to escape before the cabin filled with water and she drowned.	1	0	MAIB report

7 These involved deaths due to the entrapment underwater while wearing an inflated lifejacket and the inability to remove or deflate the lifejacket.

8 The casualties outlined above demonstrate that, in certain emergency scenarios, the inflation of lifejackets can hinder escape from enclosed or submerged spaces when occupants are unable to deflate or remove them. The absence of mandatory, standardized instructions on doffing and deflation, both on inflatable lifejackets and in safety briefings, indicates a regulatory gap that contributes to avoidable fatalities. This clearly demonstrates the need for IMO action to address this safety risk through targeted amendments to existing instruments.

ANALYSIS OF THE ISSUE

9 Lifejackets are a critical lifesaving appliance and have contributed to countless lives being saved around the world. The outcome of this accident does not diminish the importance of wearing lifejackets; rather it reflects the need for people to understand how to use and wear them safely and properly.

10 Without removing a lifejacket, the buoyancy provided can make it difficult for the wearer to exit an upturned ship. This issue is not exclusive to inflatable lifejackets. However, because of their more complex operation and increased buoyancy, inflatable lifejackets can be more difficult to remove when the wearer is in the water if they are unfamiliar with how to do so.

11 A review of the international requirements and standards for life jackets shows that none of these standards required the operating instructions on lifejackets to include doffing procedures or to identify the risk to the wearer of a lifejacket while obstructed overhead.

12 The circumstances of the casualty investigation reports highlight the importance for people to understand how to safely deflate and remove an inflatable lifejacket while in the water, should they need to do so in an emergency. This information is best shared during pre-departure safety briefings and by way of manufacturer's instructions attached to the lifejacket.

13 The proposed amendments (annex 1 to the present annex) to MSC.48(66) "International Life-Saving Appliance (LSA) Code" and *Model regulations on domestic ferry safety* (Res.MSC.518(105)) have been tailored to address these issues.

ANALYSIS OF IMPLICATIONS

14 The cost to manufacturers to include doffing and deflation instructions on lifejackets is negligible as there is already a requirement for them to include donning instructions.

15 The completed administrative checklist, as set out in annex 6 to the *Organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.5/Rev.6), is set out in annex 2 to the present document.

BENEFITS

16 The proposal will enhance the safety of wearers of lifejackets involved in maritime transport activity by improving their understanding of how to use and wear lifejackets safely and properly.

INDUSTRY STANDARDS

17 IMO's MSC.48(66) International Life-Saving Appliance (LSA) Code is the industry standard for SOLAS-approved lifejackets. Paragraph 1.2.2.9 requires life-saving appliances to be clearly marked with approval information including the Administration which approved it, and any operational restrictions

18 Chapter II of the Code sets the standards for lifejackets and in paragraph 2.2.2, the requirements for inflatable lifejackets are described. These requirements include the information described in paragraph 1.2.2.9 but do not include operating instructions on doffing procedures nor the risk to the wearer of lifejacket while obstructed overhead.

19 Proposed amendments in annex 1 to paragraph 1.2.2.9 of the Code would address this issue.

20 IMO's resolution MSC.518(105) *Model regulations on domestic ferry safety* provide framework provisions on domestic ferry safety for incorporation into national law. Article 17 states the regulations that must be met prior to departure and arrival, and includes

Safety briefing
Pre-departure safety briefing shall be conducted that shall include an abandon domestic ferry demonstration, donning and wearing of lifejackets and boarding of any life-saving equipment or usage of floating devices as appropriate.

21 Article 17 does not include a demonstration of doffing and deflation of lifejackets.

22 Proposed amendments, at annex 1, to article 17 would address this issue.

OUTPUT

23 The Committee is invited to consider including a new output on "The amendment of MSC.48(66) International Life-Saving Appliance (LSA) Code and MSC.518(105) *Model regulations on domestic ferry safety*" in the biennial agenda of the SSE Sub-Committee.

24 The new output may be expressed in SMART terms:

.1 **Specific:** The output aims to incorporate the lessons to be learned from entrapment related casualties identified in paragraphs 7-8 of this document. This will improve safety for those involved in maritime transport activity.

2. **Measurable**: Given the limited amendments required to existing instruments, the output can be completed in single session.

3. **Achievable**: Proposed amendments to MSC.48(66) and MSC.518(105) are attached. Amendments reflect analysis of entrapment related casualties. Further refinement to create a final text is achievable over one session if supported by a correspondence group.

4. **Relevant**: The proposed amendments would address the systemic safety issue for people to understand how to use and wear inflatable lifejackets safely and properly to avoid unnecessary deaths.

5. **Time-bound**: It is proposed that the output can be completed in one session.

25 Proposed amendments to MSC.48(66) International Life-Saving Appliance (LSA) Code and MSC.518(105) *Model regulations on domestic ferry safety* are set out in annex 1 to this document. The new proposed text is in grey shading.

Road map

26 It is proposed that the output can be completed in one session [SSE 14].

Human element

27 A completed checklist for considering human element issues by IMO bodies is set out in annex 3 to this document.

Urgency

28 Avoidable deaths as a result of entrapment from being unable to remove or deflate inflatable lifejackets will continue until the systemic safety issues identified in the analysis of entrapment related casualties are addressed. It is proposed that a priority output be placed on the biennial agenda of the Committee with a view to inclusion on the provisional agenda of SSE 14.

Action requested of the Committee

29 The Committee is requested to consider the information provided above and endorse the request for a new output as proposed.

ANNEX 1

Note: The underlined text shows additions or changes to MSC.48(66) "International Life-Saving Appliance (LSA) Code" and MSC.518(105) "Model Regulations on Domestic Ferry Safety". Grey shading is used to highlight all modifications and new insertions, including deleted text

Proposed amendments

MSC.48(66) "International Life-Saving Appliance (LSA) Code"

1.2 General requirements for life-saving appliances

1.2.2 Unless expressly provided otherwise or unless, in the opinion of the Administration having regard to the particular voyages on which the ship is constantly engaged, other requirements are appropriate, all life-saving appliances prescribed in this part shall:

…

.9 be clearly marked with doffing and deflation instructions, the risk to the wearer of overhead instructions, and approval information, including the Administration which approved it, and any operational restrictions; and

MSC.518(105) "Model Regulations on Domestic Ferry Safety"

ARTICLE 17
Prior to departure and arrival

…

Safety briefing

Pre-departure safety briefing shall be conducted that shall include an abandon domestic ferry demonstration, donning and wearing of lifejackets, doffing and deflation of lifejackets, and boarding of any life-saving equipment or usage of floating devices as appropriate.

ANNEX 2

Checklist for identifying administrative requirements

<table>
<tr><td colspan="3">This checklist should be used when preparing the analysis of implications required in submissions of proposals for inclusion of outputs. For the purpose of this analysis, the term "administrative requirement" is defined in accordance with resolution A.1043(27), as an obligation arising from a mandatory IMO instrument to provide or retain information or data.

Instructions:

(D) If the answer to any of the questions below is YES, the Member State proposing an output should provide supporting details on whether the requirements are likely to involve start-up and/or ongoing costs. The Member State should also give a brief description of the requirement and, if possible, provide recommendations for further work, e.g. would it be possible to combine the activity with an existing requirement?
(E) If the proposal for the output does not contain such an activity, answer NR (Not required).
(F) For any administrative requirement, full consideration should be given to electronic means of fulfilling the requirement in order to alleviate administrative burdens.</td></tr>
<tr><td>6. Notification and reporting?
Reporting certain events before or after the event has taken place, e.g. notification of voyage, statistical reporting for IMO Members</td><td>NR</td><td>Yes
□ Start-up
□ Ongoing</td></tr>
<tr><td colspan="3">Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)</td></tr>
<tr><td>7. Record-keeping?
Keeping statutory documents up to date, e.g. records of accidents, records of cargo, records of inspections, records of education</td><td>YES</td><td>Yes
□ Start-up
□ Ongoing</td></tr>
<tr><td colspan="3">Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)

Records would need to be kept of the details of the seafarer training on doffing and deflation of lifejackets.</td></tr>
<tr><td>8. Publication and documentation?
Producing documents for third parties, e.g. warning signs, registration displays, publication of results of testing</td><td>NR</td><td>Yes
□ Start-up
□ Ongoing</td></tr>
<tr><td colspan="3">Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)</td></tr>
<tr><td>9. Permits or applications?
Applying for and maintaining permission to operate, e.g. certificates, classification society costs</td><td>NR</td><td>Yes
□ Start-up
□ Ongoing</td></tr>
<tr><td colspan="3">Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)</td></tr>
<tr><td>10. Other identified requirements?</td><td>NR</td><td>Yes
✓Start-up
□Ongoing</td></tr>
<tr><td colspan="3">No new documentation requirements.</td></tr>
</table>

ANNEX 3

Checklist for Considering and Addressing the Human Element

	1 Question	2 Yes/ No	3 IMO References	4 Considerations	5 Instructions
Workload			***Other relevant references may be added*** ***Strike out references that are not relevant***	***If answer to question is "yes" identify considerations. If answer is "no" make proper justification***	***Identify how human element considerations should be addressed in the output***
1	Does the "output" affect workload?				
1.1	On board, especially in the already intensive phases of the voyage and port operations to:	No		This proposal is for a new output for an amendment to Res.MSC.48(66) and Res.MSC.518(105) to enhance the safety of wearers of lifejackets involved in maritime transport activity by improving their understanding of how to use and wear lifejackets safely and properly. The proposal does not call for change to any IMO instrument that will have a direct effect on the workload of seafarers, managers or other parts of the industry.	Not applicable.
1.1.1	Operations including navigation, cargo and engineering	No		As above.	Not applicable.

	1 Question	2 Yes/ No	3 IMO References	4 Considerations	5 Instructions
1.1.2	Maintenance of the ships structure and its equipment	No		As above.	Not applicable.
1.1.3	Onboard administration in support of the ships' management systems	No		As above.	Not applicable.
1.1.4	Onboard administration related to regulation involving flag States, classification societies, port State and other bodies such as charterers and port authorities	No		As above.	Not applicable.
1.1.5	Increased workload or time pressure on personnel if involved in implementation of changes prior to the implementation date	No		As above.	Not applicable.
1.2	Ashore, in a manner that would affect the ships operation to:	No			Not applicable.
1.2.1	Companies' administration	No		As above.	Not applicable.
1.2.2	Flag State, port State and classification societies administration such that certification and other processes are compromised or delayed	No		As above.	Not applicable.
Decision-making			***Other relevant references may be added*** ***Strike out references that are not relevant***	***If answer to question is "yes" identify considerations. If answer is "no" make proper justification***	***Identify how human element considerations should be addressed in the output***
2	Does the "output" impact decision-making on board the ship?				

	1 Question	2 Yes/ No	3 IMO References	4 Considerations	5 Instructions
2.1	By confusion with existing requirements and regulations	No		As above	Not applicable
2.2	By changing responsibilities as laid out in the ISM Code	No		As above.	Not applicable.
2.3	By creating complexity in its implementation and/or in the safety management systems	No		As above.	Not applicable.
2.4	By requiring increased mental effort, such as the need to find, transform and analyse data or result in the need to make judgements based on incomplete information	No		As above.	Not applicable.
2.5	By limiting the time available to establish situational awareness, decide, communicate (possibly across time zones) or check	No		As above.	Not applicable.
2.6	By increasing reliance on judgement and administrative controls to manage major risks such as oil spills and collisions	No		As above.	Not applicable.
Living and Working Environment			***Other relevant references may be added*** ***Strike out references that are not relevant***	***If answer to question is "yes" identify considerations. If answer is "no" make proper justification***	***Identify how human element considerations should be addressed in the output***
3	Does the "output" affect the living and working environment?				

	1 Question	2 Yes/ No	3 IMO References	4 Considerations	5 Instructions
3.1	By interfering with existing arrangements for abandonment, fire-fighting and other emergency plans or procedures	No		As above.	Not applicable.
3.2	By introducing new materials that could create an explosion, fire, environmental or occupational health risk	No		As above.	Not applicable.
3.3	By introducing new high energy sources such as high-voltage, high pressure fluids	No		As above.	Not applicable.
3.4	By affecting access or egress and causing lack of ventilation in working spaces	No		As above.	Not applicable.
3.5	By affecting the habitability of accommodation spaces due to noise, vibration, temperatures, dust and other contaminants	No		As above.	Not applicable.
Operation and Maintenance			***Other relevant references may be added*** ***Strike out references that are not relevant***	***If answer to question is "yes" identify considerations. If answer is "no" make proper justification***	***Identify how human element considerations should be addressed in the output***
4	Does the "output" affect the operation and maintenance of the ship, its structure or systems and equipment?				
4.1	By introducing equipment that the user may find difficult to operate or maintain or may be unreliable	No		As above.	Not applicable.

	1 Question	2 Yes/ No	3 IMO References	4 Considerations	5 Instructions
4.2	By introducing new and/or novel technology, or technology that changes the role of the person	No		As above.	Not applicable.
4.3	By introducing requirements for new competencies and roles	No		As above.	Not applicable.
4.4	By overloading existing infrastructure such as power generation and ventilation systems	No		As above.	Not applicable.
4.5	By poor integration with existing systems and controls	No		As above.	Not applicable.
4.6	By introducing new and unfamiliar operations/procedures	No		As above.	Not applicable.
4.7	By introducing new and unfamiliar operating interfaces?	No		As above.	Not applicable.
4.8	By introducing risks to the ship during any modifications required prior to the implementation date of the output	No		As above.	Not applicable.
Measures to address the human element			***Other relevant references may be added*** ***Strike out references that are not relevant***	***If answer to question is "yes" identify considerations. If answer is "no" make proper justification***	***Identify how human element considerations should be addressed in the output***
5	Does the "output" require changes to:				
5.1	Training	Yes	Res.MSC.48(66) and Res.MSC.518(105)	This proposal is for a new output for an amendment to Res.MSC.48(66) and	

	1 Question	2 Yes/ No	3 IMO References	4 Considerations	5 Instructions
				Res.MSC.518(105) to enhance the safety of wearers of lifejackets involved in maritime transport activity by improving their understanding of how to use and wear lifejackets safely and properly. The proposal would require seafarers to be familiar with the doffing and deflation instructions and to practice doffing and deflation regularly to remain current.	
5.2	Practical skill development and competences	Yes		As above.	
5.3	Operating, management and/or maintenance procedures	No		This proposal is for a new output for an amendment to Res.MSC.48(66) and Res.MSC.518(105) to enhance the safety of wearers of lifejackets involved in maritime transport activity by improving their understanding of how to use and wear lifejackets safely and properly. The proposal would not require changes to the operating, management and/or maintenance procedures.	Not applicable.

	1 Question	2 Yes/ No	3 IMO References	4 Considerations	5 Instructions
5.4	Information/manuals for operation and maintenance	No		This proposal is for a new output for an amendment to Res.MSC.48(66) and Res.MSC.518(105) to enhance the safety of wearers of lifejackets involved in maritime transport activity by improving their understanding of how to use and wear lifejackets safely and properly. The proposal would not require changes to Information/manuals for operation and maintenance.	Not applicable.
5.5	Spares outfit	No		This proposal is for a new output for an amendment to Res.MSC.48(66) and Res.MSC.518(105) to enhance the safety of wearers of lifejackets involved in maritime transport activity by improving their understanding of how to use and wear lifejackets safely and properly. The proposal would not require changes to spares outfit.	Not applicable.
5.6	Occupational safety requirements including guarding and PPE	Yes		This proposal is for a new output for an amendment to Res.MSC.48(66) and Res.MSC.518(105) to enhance	

	1 Question	2 Yes/ No	3 IMO References	4 Considerations	5 Instructions
				the safety of wearers of lifejackets involved in maritime transport activity by improving their understanding of how to use and wear lifejackets safely and properly. The proposal would require changes to PPE, with replacement of old lifejackets with new lifejackets containing the doffing and deflation instructions.	
5.7	Shore support	No		This proposal is for a new output for an amendment to Res.MSC.48(66) and Res.MSC.518(105) to enhance the safety of wearers of lifejackets involved in maritime transport activity by improving their understanding of how to use and wear lifejackets safely and properly. The proposal would not require changes to shore support.	Not applicable.

ANNEX 4

Checklist for the identification of capacity-building implications
(Annex 2, appendix 1 of MSC-MEPC.1/circ.5/rev.6);

1 For Administrations

☐ Is new legislation required? NO

☐ Is there a requirement for new equipment and/or systems? NO

- Does equipment manufacturing capacity exist internationally?
- Do equipment repair/servicing facilities exist internationally?
- Is there capacity to develop new systems?

☐ Will the implementation require additional financial resources? NO

☐ Is there a need for additional human resources or new skills? NO

☐ Will there be a need to upgrade the current infrastructure? NO

☐ Is there enough lead time towards implementation? YES

☐ Will a rapid implementation procedure be adopted? YES

☐ Is there a substantial modification of existing standards? NO

☐ Will a guide to implementation be needed? NO

2 For the industry

☐ Would the industry require new and/or enhancements of existing systems? NO

- Does capacity exist internationally to develop new systems?

☐ Is there a need for additional training of seafarers? NO

- Do related and validated training courses exist?
- Are sufficient simulation training courses available internationally?

☐ Will there be a requirement for new equipment? NO

The requirement will only be for new labelling

- Does manufacturing capacity exist internationally? YES

☐ Is there repair/servicing and/or retrofitting and does maintenance capacity exist internationally? YES

ANNEX 5

Check/monitoring sheet for the process of amendments to the Convention and related mandatory instruments
(Annex 2 of MSC.1/Circ.1500)

Part I – Submitter of proposal (refer to section 3.2.1.1)*

1 Submitted by (Document number and submitter): the Casualty Analysis Correspondence Group, III 12/4/X
2 Meeting session: III 12
3 Date (date of submission): 17 April 2026

Part II – Details of proposed amendment(s) or new mandatory instrument (refer to sections 3.2.1.1 and 3.2.1.2)*

1 High-level action plan
2 Planned output
New labels for inflatable lifejackets
3 Recommended type of amendments (MSC.1/Circ.1481) (delete as appropriate)
• exceptional circumstance
4 Instruments intended for amendment (SOLAS, LSA Code, etc.) or developed (new code, new version of a code, etc.)
The amendment of MSC.48(66) *International Life-Saving Appliance (LSA) Code* and MSC.518(105) *Model Regulations on Domestic Ferry Safety*
5 Intended application (scope, size, type, tonnage/length restriction, service (International/non-international), activity, etc.)
Applies to inflatable lifejackets
6 Application to new/existing ships
Will apply to new and existing ships as lifejackets are replaced
7 Proposed coordinating sub-committee
SSE
8 Anticipated supporting sub-committees
N/A
9 Timescale for completion
2 years to approve the new output and review Implementation as soon as possible afterwards
10 Expected date(s) for entry into force and implementation/application
2028
11 Any relevant decision taken or instruction given by the Committee