MARITIME SAFETY AWARENESS

Issue 2

BULLETIN

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Shaping Shipping for People

Thinking – mooring safety

Introduction

Mooring operations are among the most dangerous tasks carried out on board ships. Data collected by the Australian Maritime Safety Authority (AMSA) indicates that mooring incidents occur regularly and often result in injury. Furthermore, in the last 10 years, two fatalities have occurred during mooring operations in Australian waters. [1a, 1b]

While there have been various innovations across the maritime industry to reduce the hazards associated with traditional mooring systems (see example of automated mooring technology below), the majority of vessels still rely on mooring arrangements involving ropes and winches. These systems have benefits, as they are flexible and enable berthing at most ports. However, the risks associated with operating traditional mooring systems continue to increase as vessels become larger.

This bulletin uses data to provide an overview of the factors associated with mooring incidents in Australia and provides some guidance to assist in improving safety.

In this issue

Australian Government
Australian Maritime Safety Authority

Learning from incidents – example

In August 2015, the berthing of a vessel was almost complete when control of the ship's controllable pitch propeller was transferred from the bridge to the engine room.

However, the engine room pitch lever was not at zero pitch and was not aligned with the bridge lever. As a result, when control was accepted in the engine room, the propeller pitch moved ahead and the vessel began to move forward.

This placed considerable load on the mooring lines, causing one of the forward lines to part. Another line that was being tended by a crew member came under tension, slipped off the winch drum and struck the crew member on the leg.

The ship was brought to a halt and the berthing was completed without further incident.

The injured crew member sustained bruising to the leg and was declared unfit to work for five days.

This incident clearly demonstrates how the smallest of lapses, even those far removed from the mooring deck, can have significant consequences during mooring operations.

Mooring incident data

In the last 5 years, AMSA received 227 mooring related incident reports. Fifty-one (22 per cent) of these incidents resulted in injury (Figure 1). There were no mooring related fatalities recorded during this period in Australia. However, mooring fatalities have continued to occur internationally. [2]

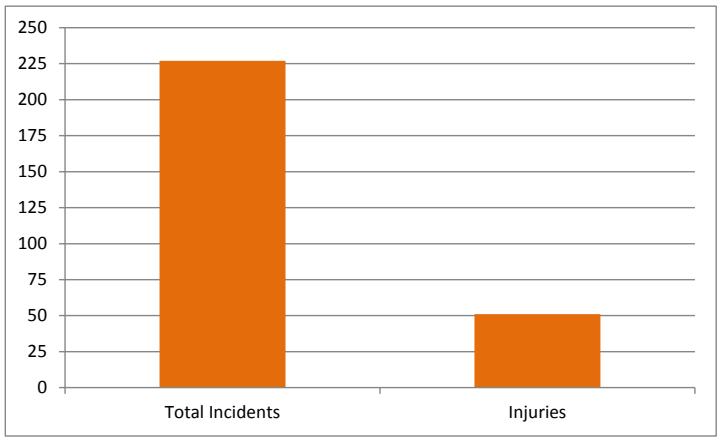

Figure 1: Number of mooring incidents and injuries reported 2010-14 (source: AMSA)

These incident reports have been analysed and categorised into the following four safety factor groups:

- **Individual actions** – observable behaviour/action by operational crew.
- **Local shipboard conditions** – include aspects of the shipboard environment that influence individual actions, such as fatigue, weather, ship motion, workload, skills, knowledge and competency.
- **Organisational influences** – include organisational shortfalls in areas such as; safety management systems, supervision, training and onshore support.
- **Design and equipment** – design shortfalls or component failures, for example mooring line parted.

This analysis shows that design and equipment safety factors played a significant role in 62 per cent of the reported mooring incidents (Figure 2). Of particular note is that 51 per cent of the identified design and equipment safety factors were the result of a parted mooring line.

Shipboard conditions, such as heavy weather, workload and crew competency played a role in 22 per cent of mooring incidents.

Individual actions and organisational influences played a role in 9 and 7 per cent of incidents, respectively.

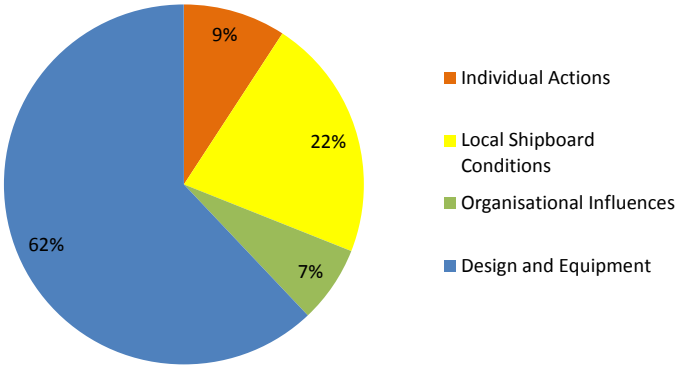

Figure 2: Percentage of safety factors identified in mooring incidents 2010-14 (source: AMSA)

Safety actions following mooring injuries

The Hierarchy of Controls (Figure 3) is a model commonly used to demonstrate the effectiveness of risk controls. It clearly shows that the most effective way to control risk is to eliminate hazards.

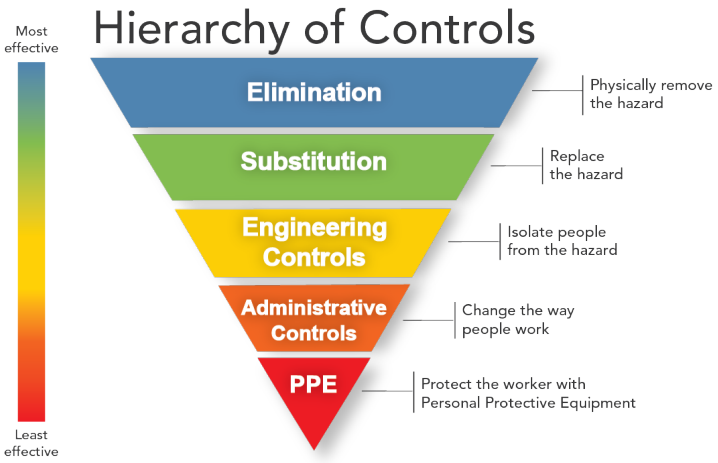

Figure 3: Hierarchy of Controls diagram [3]

The Hierachy of Controls model was used to examine the actions taken following the 51 reported mooring incidents that resulted in injuries. This analysis revealed that only 3 per cent of the reported actions taken following these incidents involved elimination of the associated hazards (Figure 4). Ten per cent of actions involved implementing engineering controls to isolate people from the hazards.

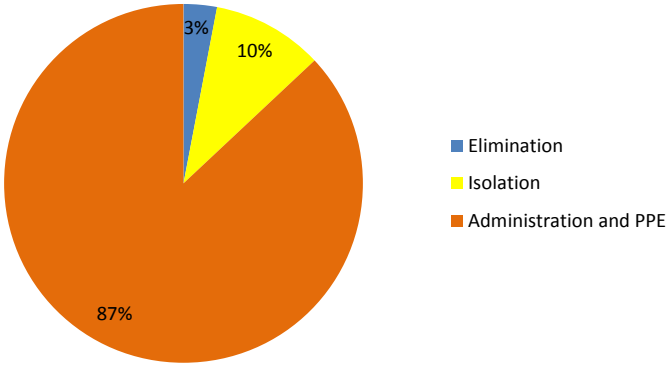

Figure 4: Percentage of safety actions after mooring injuries based on the Hierarchy of Controls (source: AMSA)

The other 87 per cent of preventative actions were taken at the administrative and PPE levels. These actions included:

- safety meetings, briefings and training
- displaying incident photographs
- including incident details in a bulletin
- equipment inspections
- review of procedures.

While these changes assist in improving safety outcomes, they focus on changing behaviours, rather than eliminating hazards. These actions are commendable and worthwhile, but they are not as effective as addressing the source of the hazards.

Focus on mooring lines

Mooring line failures can have disastrous consequences, especially when ships break away from their berth. An analysis of incident reports indicate that the deterioration of mooring line condition due to wear and tear, storage and the operating environment were significant factors in mooring line failure.

Data from BHP Billiton's operations in Port Hedland identified 12 mooring line parting incidents in the 6 months prior to February 2015. Of these, four were the result of poor mooring line condition and eight were the result of unequal or incorrect mooring line tension.[4]

In addition, damage caused by dust, grease, oil and other substances may not be visible. This suggests that the traditional maintenance practice of visual inspections may not be a totally reliable method of monitoring line condition.

Other ports have identified similar trends. In the Port of Esperance, a ShoreTension® system that automatically adjusts mooring line tension as the ship ranges due to tidal changes and loading/unloading, has been installed.

When tested next to a ship with traditional moorings on the same night, the ship with the ShoreTension® system did not part any lines, whereas six lines failed on the ship without the system.[5]

Investigators' corner – effective communication for safe mooring

The Australian Transport Safety Bureau (ATSB) has investigated a number of mooring incidents in Australian waters and has identified communication as a common contributing factor.

At times, little consideration is given to the increased risk that exists when various work groups do not have a clear understanding of each other's tasks and actions. The communication within a single work group (for example, a bridge team), is relatively straightforward. However, when a number of teams or groups involving the bridge team, ship mooring parties, tug crews, lines boats and shore gangs are involved, effective communication is critical. These groups are separated by distance and line of sight, while language, culture, radio communication, background noise and other factors can further complicate matters.

An ATSB investigation into a serious mooring incident on board the bulk carrier *Julia N* in 2014 highlights the importance of proper communications.

Julia N's crew were preparing to cast off the tug's tow line from the aft mooring station while berthing. The second mate had been using hand signals to communicate with the tug's crew who were almost 20 m below (Figure 5). While standing at the handrail, he gestured to the ship's crew on the mooring deck before walking inboard, away from the rail.

Figure 5: Approximate position of the tow line during retrieval [1c]

A rating on the tug saw the gesture, thought that it was a signal to heave in the tow line and passed it to the winch driver. As the line moved through the ship's fairlead, the tug crew's assumption of what was required was reinforced.

However, the ship's crew were not ready for the tow line to be heaved in and a crew member's leg became caught in the messenger line. The crew member was subsequently pulled into the fairlead and his foot was amputated.[1c]

In this case the different work groups did not have a clear and accurate understanding of each other's intentions and actions, and clear means of communication had not been established.

Rethinking mooring operations

Accidents feel sudden when they occur. However, accident investigations show that there are almost always small failures and weak links in the system that were visible beforehand. While studying accidents and learning from them after they occur is important, it cannot make up for the losses suffered.

A proactive way to look at safe operations is to use analytical tools to identify weaknesses that could lead to accidents during normal operations.

Every potential accident will be different, because every ship is different, through design, equipment, crew, company culture, procedures and many other features. Therefore, the best way to determine the weak parts of your mooring system that could lead to an accident is to look at every safe mooring operation carried out on board the ship and think about how it could go wrong. Ask 'why didn't we have an accident?'

This is one of the ways in which high reliability organisations such as air traffic control and the nuclear industry go about improving performance. Industries like these value learning methods which depend on the open flow of information about the potential for failure. They use this information to guide constructive changes without waiting for major accidents to happen. Looking at normal operations and thinking about 'what could possibly go wrong' has shown to be a useful tool for minimising accidents in these industries. [6]

Take-away message

The risks associated with mooring operations continue to challenge the maritime industry. Ship designers, owners, operators, classification societies and regulators must work together to ensure that mooring system designs and layouts are developed along human centred design principles.

Meanwhile, those on board must be wary of becoming normalised to the risks associated with mooring operations. Always remember that the dangers associated with mooring operations are very real, regardless of your experience.

Some key points for seafarers and operators alike to remember from this bulletin are:

- make use of the Hierarchy of Controls and always try to eliminate hazards where possible
- ensure all equipment, especially mooring lines, are maintained in good condition
- maintain clear and effective communications between all stations
- take the opportunity to learn from incidents, whether they are yours or others
- be proactive and identify weaknesses that could lead to accidents during normal operations.

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   c. (2014), Serious injury of a crew member on board *Julia N*
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3. Centers for Disease Control and Prevention (CDC), Controls for Noise Exposure, www.cdc.gov/niosh/topics/noisecontrol/
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Useful resources

- Seahealth Denmark (2013), Mooring – Do it safely, a guide to prevent accidents while mooring, www.seahealth.dk/en
- Singh, B (February 2014), 10 Important Points for Ship's Mooring Equipment Maintenance, www.marineinsight.com/misc/marine-safety/10-important-points-ships-mooring-equipment-maintenance
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