Transport Accident Investigation Commission

Final report
Tuhinga whakamutunga

Report of the Transport Accident Investigation Commission into two stevedoring accidents in April 2022

Maritime inquiry MO-2022-203
Container vessel, Capitaine Tasman
Stevedore fatality during container loading operations
Port of Auckland
19 April 2022

and

Maritime inquiry MO-2022-202
Bulk carrier, ETG Aquarius
Stevedore fatality during coal loading operations
Lyttelton Port
25 April 2022

October 2023

The Transport Accident Investigation Commission
Te Kōmihana Tirotiro Aituā Waka

No repeat accidents – ever!

"The principal purpose of the Commission shall be to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future, rather than to ascribe blame to any person."

Transport Accident Investigation Commission Act 1990, s4 Purpose

The Transport Accident Investigation Commission is an independent Crown entity and standing commission of inquiry. We investigate selected maritime, aviation and rail accidents and incidents that occur in New Zealand or involve New Zealand-registered aircraft or vessels.

Our investigations are for the purpose of avoiding similar accidents in the future. We determine and analyse contributing factors, explain circumstances and causes, identify safety issues, and make recommendations to improve safety. Our findings cannot be used to pursue criminal, civil, or regulatory action.

At the end of every inquiry, we share all relevant knowledge in a final report. We use our information and insight to influence others in the transport sector to improve safety, nationally and internationally.

Commissioners

Chief Commissioner	Jane Meares
Deputy Chief Commissioner	Stephen Davies Howard
Commissioner	Paula Rose, QSO
Commissioner	Richard Marchant (until 31 October 2022)
Commissioner	Bernadette Roka Arapere (recused from these inquiries)
Commissioner	David Clarke (from 1 December 2022)

Key Commission personnel

Chief Executive	Martin Sawyers
Chief Investigator of Accidents	Naveen Mathew Kozhuppakalam
Investigator-in-Charge for these inquiries	Robert Thompson
Lead Investigator for MO-2023-203	Dr Tahlia Fisher
Commission General Counsel	Cathryn Bridge

Notes about Commission reports
Kōrero tāpiri ki ngā pūrongo o te Kōmihana

Citations and referencing

The references section of this report lists public documents. Documents unavailable to the public (that is, not discoverable under the Official Information Act 1982) are referenced in footnotes. Information derived from interviews during the Commission's inquiry into the occurrence is used without attribution.

Photographs, diagrams, pictures

The Commission owns the photographs, diagrams and pictures in this report unless otherwise specified.

Verbal probability expressions

For clarity, the Commission uses standardised terminology where possible.

One example of this standardisation is the terminology used to describe the degree of probability (or likelihood) that an event happened, or a condition existed in support of a hypothesis. The Commission has adopted this terminology from the Intergovernmental Panel on Climate Change and Australian Transport Safety Bureau models. The Commission chose these models because of their simplicity, usability, and international use. The Commission considers these models reflect its functions. These functions include making findings and issuing recommendations based on a wide range of evidence, whether or not that evidence would be admissible in a court of law.

Terminology	Likelihood	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

Figure 1: Container vessel *Capitaine Tasman*

(Credit: Neptune Pacific Direct Line)

Figure 2: Bulk carrier *ETG Aquarius*

(Credit: Brian Saunders, MarineTraffic.com)

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What happened

1.1. On 27 April 2022, the Minister of Transport directed the Transport Accident Investigation Commission to open two inquiries under section 13(2) of the Transport Accident Investigation Commission Act 1990. The inquiries were in response to two fatal stevedoring accidents that occurred at two New Zealand ports.

1.2. Separate investigations were conducted into each accident. There were common systemic safety issues identified in the two accidents and the Commission has therefore published the two inquiries in a single report. These systemic issues are relevant to the wider stevedoring industry.

1.3. The first accident occurred on 19 April 2022 at the Port of Auckland. A stevedore, working onboard the container vessel *Capitaine Tasman*, moved underneath a suspended 40-foot container and suffered crush injuries as a result of the container being lowered onto them. The stevedore was employed by Wallace Investments Limited (WIL), an independent stevedoring company operating at the Port of Auckland.

1.4. The second accident occurred at Lyttelton Port on 25 April 2022. A stevedore, involved in the process of loading coal onto the bulk carrier *ETG Aquarius,* was discovered, deceased, on the deck of the vessel, buried under a quantity of coal. The stevedore was employed by the Lyttelton Port Company Limited (LPC).

Why it happened

1.5. The Commission found that both WIL and LPC were in the process of improving their respective safety systems. However, at the time of the accidents there were deficiencies common to both organisations. The risks associated with work activity were primarily managed with administrative risk controls, yet robust safety assurance processes to ensure that these controls remained effective were lacking. As a result, neither LPC nor WIL adequately understood how the day-to-day behaviour of their employees was negating the effectiveness of already vulnerable control measures.

1.6. While both organisations were attempting to improve their safety management systems, a lack of cohesiveness within the stevedoring community meant there was little ability to benchmark comprehensively with others in the industry. With no best practice guidelines, no minimum training requirements and few safety-related information-sharing platforms, leadership from within the sector was found lacking.

1.7. Historically, stevedoring has a poor safety record (International Labour Office, 2018), yet it is not regulated with the degree of rigour afforded to other high-risk industries. From a regulatory perspective, neither organisation received a satisfactory level of proactive oversight of their stevedoring operations. Most regulatory interactions were limited to LPC and WIL reporting notifiable events under the Health and Safety at Work Act 2015, and to any subsequent follow-up by Maritime New Zealand (MNZ) and WorkSafe New Zealand (WorkSafe) as a result of those notifications. Reactionary reporting and associated regulatory sanctions provide little insight into the health of an organisation's safety system or assurance of future safety performance. Nor do they encourage information sharing within the industry to encourage safety growth across the sector.

1.8. The Commission has made five safety **recommendations** as a result of these two inquiries.

What we can learn

1.9. Those who work in high-risk industries are not necessarily exposed to adverse events on a regular basis. This can lead to a desensitisation to risk, which itself becomes a hazard.

1.10. When risk is not fully understood or appreciated, a variety of factors can lead to employees taking shortcuts or drifting away from rules.[1] Passive safety messages and reminding people to follow procedures are not effective means by which to change risk perceptions or modify behaviours.

1.11. The way in which tasks are designed and procedures are written is often incongruent with how day-to-day work activity is conducted. A critical component of any safety system is the ability to identify, understand and resolve the reasons for the disparity.

1.12. Where administrative risk controls are necessary to manage hazards associated with high-risk activity, appropriate supervision and a culture of strong safety leadership is required to ensure their effectiveness.

1.13. Industry collaboration and benchmarking is one of the most effective ways to improve safety standards and support continuous improvement.

1.14. Reactive interventions are not a substitute for proactive regulatory oversight of high-risk industries, particularly those with a poor safety record.

Who may benefit

1.15. Regulatory bodies, port organisations, stevedoring organisations, stevedores, vessel operators, anyone designing safety standards, and anyone working in a high-risk industry may benefit from this report and the Commission's recommendations.

[1] *See* footnote 16 for explanation of human behaviour within organisations.

2. Factual information Pārongo pono

2.1. On 27 April 2022, the Minister of Transport directed the Commission to open two inquiries under section 13(2) of the Transport Accident Investigation Act 1990. The inquiries were in response to two fatal stevedoring accidents that occurred at New Zealand ports. The first accident occurred at the Port of Auckland on 19 April 2022, when a stevedore employed by Wallace Investments Limited (WIL) was crushed by a container during loading operations onboard the *Capitaine Tasman*. The second accident occurred at Lyttelton Port on 25 April 2022, when a stevedore employed by Lyttelton Port Company Limited (LPC) was buried under a quantity of coal onboard the *ETG Aquarius*.

2.2. During its two inquiries, the Commission identified commonalities between the two accidents, including several systemic safety issues that are relevant to the wider stevedoring industry. For this reason, the two investigations have been published within a single report.

2.3. This section of the report sets out the context for the investigations, specifically an overview of the stevedoring industry within New Zealand. This includes the hazards associated with stevedoring activities and the importance of having an effective safety management system (SMS). Commonalities between the two accidents are also noted. Section 3 discusses the wider safety issues the Commission identified for the New Zealand stevedoring industry. Section 4 outlines the safety actions that have been taken since the two accidents. Section 5 contains the Commission's recommendations arising from its two inquiries.

2.4. Appendix A of this report covers the investigation into the accident at the Port of Auckland, MO-2022-203. Appendix B covers the investigation into the accident at Lyttelton Port, MO-2022-202.

Introduction to port operations

2.5. A **port** is a location where goods are loaded and unloaded from ships. The two locations where these accidents took place are the Port of Auckland and Lyttelton Port (*see* Figure 3). Port companies, such as Ports of Auckland Limited (POAL) and Lyttelton Port Company Limited (LPC), operate and manage the infrastructure and facilities at these ports, such as berthing ships, loading and unloading cargo, and providing storage and transportation.

2.6. **Stevedoring** activity includes loading and unloading of the cargo carried on vessels, stacking and storing cargo on the wharf, and receiving and delivering cargo within the terminal or port facility. Stevedores may be employed directly by the port company, or by a privately owned stevedoring company that is independent of the port company (*see* Figure 4). Stevedores usually operate in teams, known as gangs. Often, several gangs will be supervised by a foreman. The stevedoring roles within the gangs involved in these two accidents are described in the factual information for each inquiry (*see* Appendices A and B).

2.7. **Shipping companies** operate the ships that transport the cargo. Depending on their needs, they can use stevedores from the port company or stevedores from an independent stevedoring company to handle the loading and unloading of cargo at port.

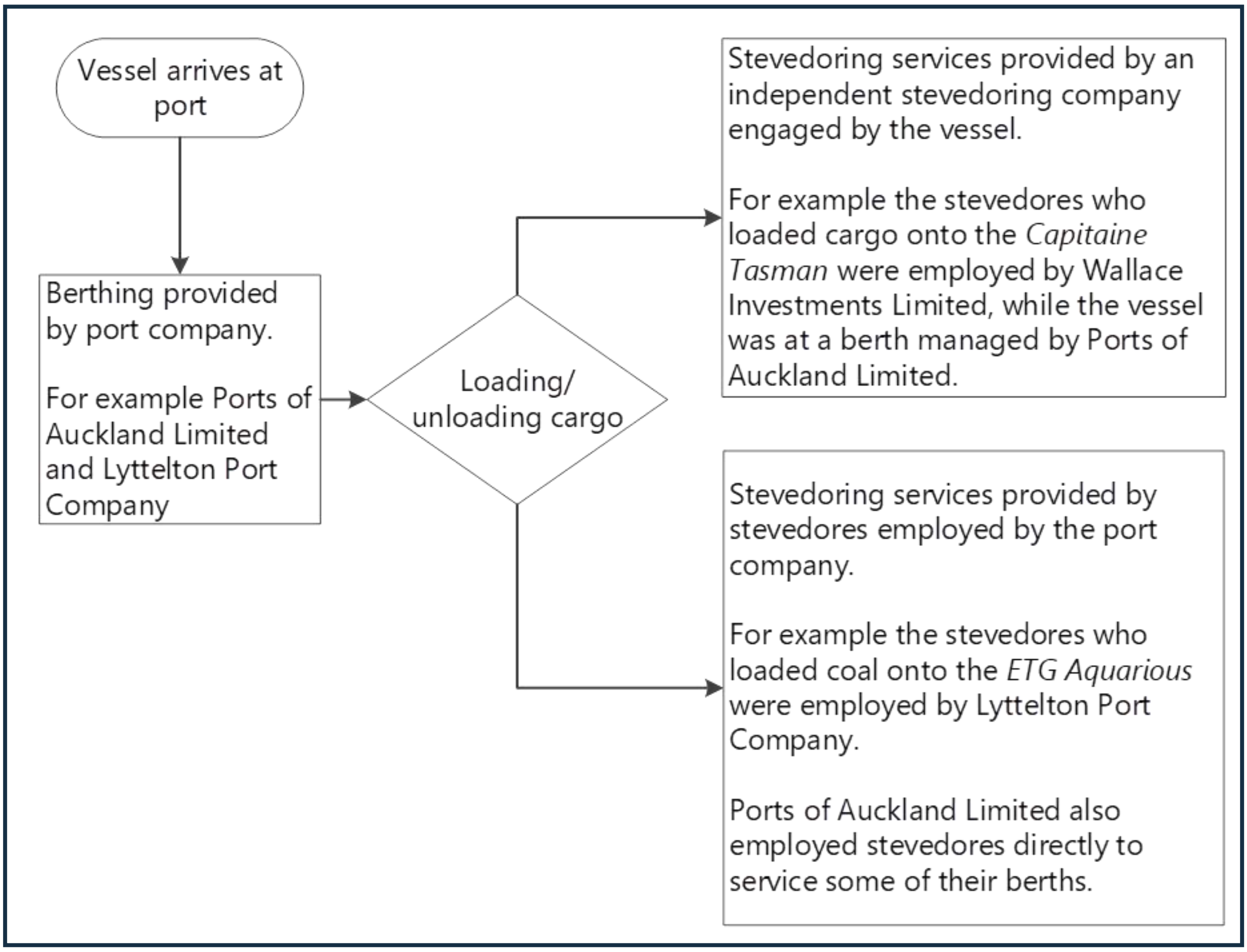

Figure 4: Employment arrangements for stevedoring services

2.8. Stevedores undertake various types of **cargo handling** (*see* Table 1):

Table 1: Cargo handling for vessels

Type of vessel	Stevedoring activity
Containers	Loading and unloading shipping containers on containerised vessels
Roll-on Roll-off (ro-ro)	Loading and unloading cargo via a vessel's ramp eg, cars, trucks, bulldozers
Pure car carriers	Loading and unloading cars only
Break bulk	Loading and unloading non-containerised cargo that is transported as individual units due to being over-sized or over-weight eg, construction equipment, steel, wind turbines
Bulk	Loading and unloading cargo that is not individually packaged eg, grain, coal
Passenger	Loading and unloading passenger vessel cargo

Regulation of stevedoring in New Zealand

2.9. The Waterfront Industry Act 1953 (WIA) was passed in New Zealand to regulate the operations and conditions of the country's waterfront industry. The WIA was intended to protect the rights of workers and employers in the industry and focused on the efficiency and costs of operations on the waterfront.

2.10. The WIA established the Waterfront Industry Tribunal (judicial functions) and the Waterfront Industry Commission (administrative functions).

2.11. However, it was not until the WIA was reconsolidated and amended in 1976 that the Tribunal and Commission could explicitly consider the safety of the waterfront industry.[2]

2.12. Throughout the 1970s and 1980s several legislative changes ultimately saw the dissolution of both the Tribunal and Commission.[3]

2.13. These amendments meant that:

- ports were required to employ their own workforces and function under the Labour Relations Act 1987 in the same manner as any other employer
- the common standard of stevedoring labour administration and regulation was removed.

2.14. These changes effectively resulted in deregulation of the stevedoring workforce, and individual ports and shipping agencies became free to set their own rates and practices for the services they provided.

2.15. It was not until the early 1990s that stevedoring attracted safety regulation again, with health and safety on ports falling under the Health and Safety in Employment Act 1992 (HSE) (administered and enforced by the Department of Labour) and on vessels, falling under the Maritime Transport Act 1994 (MTA) (administered and enforced by the Maritime Safety Authority (MSA), which was renamed Maritime New Zealand (MNZ) in July 2005).

2.16. In 2002, safety for work onboard vessels was moved from the MTA into the HSE. At the same time, a provision for designation was also introduced that allowed the Prime Minister to designate an agency to be the health and safety regulator for an industry, sector or type of work.

2.17. In 2003, MSA was given a designation and new appropriation for activity associated with health and safety regulation onboard vessels. Operational agreements to support the designation were developed between the Department of Labour and MSA.

2.18. In 2015, the HSE was repealed and replaced by the Health and Safety at Work Act 2015 (HSWA), administered by the Ministry of Business, Innovation and Employment (MBIE). WorkSafe New Zealand (WorkSafe) was established as the primary regulator for New Zealand's workplace health and safety, with MNZ retaining their designated role for health and safety onboard vessels.

2.19. HSWA places the responsibility for securing the health and safety of workers and workplaces on the person conducting a business or undertaking (referred to as a

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[2] The Waterfront Industry Act 1976 is sometimes referred to as the Waterfront Industry Commission Act 1976.

[3] The Waterfront Industry Commission Amendment Act 1987 dissolved the Tribunal, and the Waterfront Industry Reform Act 1989 dissolved the Commission.

PCBU). Port companies and stevedoring companies are PCBUs under HSWA, as are operators of New Zealand-flagged vessels. HSWA does not generally apply to foreign-flagged vessels operating in New Zealand waters. However, it does apply when stevedoring companies are undertaking work onboard foreign-flagged vessels at a New Zealand port.

2.20. Given the designation held by MNZ, in a port environment there are two regulators: WorkSafe is the regulator for any shore-based operations and MNZ is the regulator for operations onboard the vessel. The boundaries between shore-based and vessel-based operations can be ambiguous, for example when a vessel's crane is being used to lift cargo from the wharf onto the vessel.

2.21. To facilitate cooperation, the two regulators agreed a memorandum of understanding in 2018. Where jurisdictions or interests overlap, joint work programmes are undertaken. If an incident occurs and it is initially unclear who has jurisdiction, both WorkSafe and MNZ will attend.

2.22. HSWA has 16 pieces of secondary legislation that further define the responsibilities of PCBUs, including those that might apply to specified persons or circumstances. One of those is the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016 (HSWA-GRWM), which prescribe a risk management process for certain working conditions. Those working conditions include raised and falling objects and substances hazardous to health – both of which are inherent in some stevedoring activities.

2.23. HSWA-GRWM requires PCBUs, so far as it applies to specific hazards and/or risks as prescribed in regulation, to identify hazards that could give rise to reasonably foreseeable risks, manage them using a hierarchy of control measures, maintain effective control measures, and review and revise control measures to make sure they are effective (*see* the *Managing the risk of harm in stevedoring operations* subsection below). The regulations also require the PCBU to ensure that the supervision and training provided to a worker is suitable and adequate. Exactly how the PCBU complies with the regulations is left to the discretion of the PCBU.

2.24. HSWA duties for managing health and safety risks will overlap in shared workspaces such as a port, or when services are being contracted or sub-contracted, such as when a shipping company requires the use of stevedoring services at a port. Organisations are not expected to operate in isolation and HSWA requires that PCBUs must, as far as is reasonably practicable, consult, cooperate and coordinate activities with all other PCBUs with whom they share overlapping duties.[4] Which PCBU is best placed to manage a particular risk depends upon the degree of influence and control the PCBU has in the circumstances. For example, if stevedores are working on a vessel, the stevedoring company may be best placed to manage the worksite itself, but the shipping company would likely have a duty to ensure that equipment such as the vessel's cranes were maintained to the required standard and were safe to operate.

2.25. Beyond the responsibilities required of a PCBU, there are no additional or specific requirements for stevedoring activity within HSWA. This was also the case under the previous HSE.

[4] HSWA, s 34(1)

2.26. Since the regulation of safety for work onboard vessels was removed from the MTA in 2002, the MTA has no regulations specific to stevedoring organisations. However, there are several rules relating to port activities that are relevant to stevedoring activity.

2.27. The MTA lays out the responsibilities of port operators for maritime safety, including that port operators must not allow the port to be operated in a manner that causes unnecessary danger or risk to vessels, or people and property on vessels.

2.28. There are no existing Maritime Rules specifically regulating stevedores or stevedoring, although some parts contain provisions that apply to stevedoring.

2.29. Regulatory requirements regarding training for stevedoring activity do not extend beyond the primary duty of care laid out in HSWA, to provide information, training, instruction or supervision that is necessary to protect all people from risks to their health and safety arising from work.

2.30. Non-compulsory qualifications for stevedoring exist within the NZQA framework. The New Zealand Certificate in Port Operations offers three options of study: port administration, cargo handling, and heavy machinery.

Managing the risk of harm in stevedoring operations

2.31. Globally, the modernisation of stevedoring has seen increasingly sophisticated technology within port environments. The introduction of containerised shipping and roll-on roll-off (ro-ro) vessels in the 1960s marked a significant change in cargo-handling, which had until then largely remained unchanged. While many of these developments have reduced the level of human-intensive operations, there has not been a comparative reduction in injury risk (Fabiano et al., 2010). Historically, port work had a poor safety record and it is still regarded as an occupation with very high accident rates (Ronza et al., 2005; International Labour Office, 2018). International data from 2022 shows that approximately 34 per cent of incidents involving vessels occurred when docked in port (Rightship, 2023).[5]

2.32. Domestically, there have been 18 deaths amongst port workers since 2012. A recent examination of port safety within New Zealand (Port Health and Safety Leadership Group, 2022) shows that the number of fatalities across a 10-year period has remained consistent, averaging 1.8 deaths per annum. As a proportion of the workforce, stevedore fatalities occur at a rate of approximately 20 deaths per 100,000 workers, which is the second highest rate of any sector within New Zealand.

2.33. When compared internationally, New Zealand ports do not move high volumes of cargo.[6] For example, in terms of container movements per year, most New Zealand ports would be considered 'small'.[7] However, New Zealand's port-worker fatality rate is higher than other countries that move significantly more cargo, such as the United States. In terms of the number of deaths, considering the amount of cargo moved, New Zealand's fatality rate is two- to three-times higher than both the UK and Hong

[5] Where report data identified location.

[6] Lloyds List One Hundred Ports, 2022.

[7] Less than 0.5 million TEUs (Twenty-foot Equivalent Units) per year, as defined by Container Port Performance Index 2021.

Kong. The fatality rate for New Zealand stevedores is comparable to Australia, despite the amount of cargo handled being considerably less.

2.34. Falls from height and crushing by machinery or vehicles were the two most common causes of fatalities within New Zealand ports, followed by vehicle crashes and being hit or crushed by cargo.

2.35. The *Port Sector Insights Picture and Action Plan* (Port Health and Safety Leadership Group, 2022) reported that there were 397 reported notifiable injuries at New Zealand ports between 2012 and 2022, the most common causes being slips, trips and falls, followed by workers being caught between objects. Information provided by sector participants and analysed as part of this work[8] suggests a correlation between increasing volumes of cargo and rising rates of harm. In the previous five to six years, MNZ has conducted 39 investigations into PCBUs that were undertaking stevedoring activity at New Zealand ports. Four investigations resulted in prosecution. MNZ also issued five prohibition notices and 19 improvement notices.

2.36. Hazard refers to anything that has the potential to cause harm. Some activities have an inherently high risk of causing harm because of the nature of the hazards that are associated with the activity. Stevedoring fits into this category because it puts workers near heavy machinery, significant stored energy hazards and dangerous materials, often whilst working at heights (*see* Table 2).

2.37. Risk management refers to the systematic process of hazard identification, risk assessment and treatment of the risk using risk controls. Risk controls are mechanisms designed to either eliminate, mitigate or reduce to as low as reasonably possible, the unwanted outcomes posed by exposure to hazards.

Table 2: Common hazards associated with stevedoring activity

Hazard	Examples of tasks	Potential harm
Manual activities	Lashing and unlashing Fitting/removing twist locks Working above shoulder height	Strains and sprains, cuts and abrasions
Working at height	Working near open hatches Working on top of containers Climbing ladders	Falls causing injury or fatality
Working in restricted or enclosed spaces	Working in holds Working in between cargo	Crush injuries, respiratory conditions, asphyxia/fatality
Falling objects	Working with suspended cargo or unsecured loads	Crush injuries, fractures, fatalities
Plant and equipment	Working in and around mobile plant eg, straddle carriers, forklifts, vessel- or shore-cranes Working with damaged or poorly maintained equipment eg, electrical cables, ropes/chains, hooks	Crush injuries, disabling injuries, fatalities

[8] *See* paragraphs 4.9 to 4.12 of this report for further information on the *Port Sector Insights Picture and Action Plan.*

Hazard	Examples of tasks	Potential harm
Working environment	Working in: Extreme weather conditions Holds Refrigerated containers Slippery conditions Fumes, atmospheric contaminants	Sunburn, skin cancer, heat stress, slips and falls, respiratory conditions
Stored energy	Working with pressurised liquids and gases Working with tensioned cables or ropes	Disabling injuries, fatalities
Electricity	Lashing next to refrigerated containers Jump-starting vehicles, isolating equipment	Electric shocks, burns, electrocution fatalities
Noise	Using noisy equipment, machinery, tools	Hearing loss
Fire	Carrying out hot works eg, welding or oxy-cutting Handling combustible cargo	Burns, smoke inhalation, fatalities
Dangerous goods	Loading and unloading hazardous cargo, exposure to hazardous chemicals, hold fumigation	Respiratory conditions, burns, skin conditions, fatalities
Lighting	Working with inadequate lighting such as in holds or at night	Slips, trips, falls

2.38. Risk controls can be classified according to where on the potential hazard-to-risk trajectory they are employed. Preventative risk controls are put in place to prevent the risk associated with the hazard from occurring. For example, a guard cover over a switch to prevent inadvertent selection of the switch is a preventative risk control. Recovery risk controls are designed to reduce the consequences of the negative outcome should the risk associated with the hazard eventuate. The use of personal protective equipment (PPE) is a common recovery risk control, such as a harness protecting a worker from injury should a fall from height occur.

2.39. There are multiple ways to control risk and the mechanisms to do so can be grouped depending on their level of effectiveness. This is commonly known as the hierarchy of controls (*see* Figure 5).

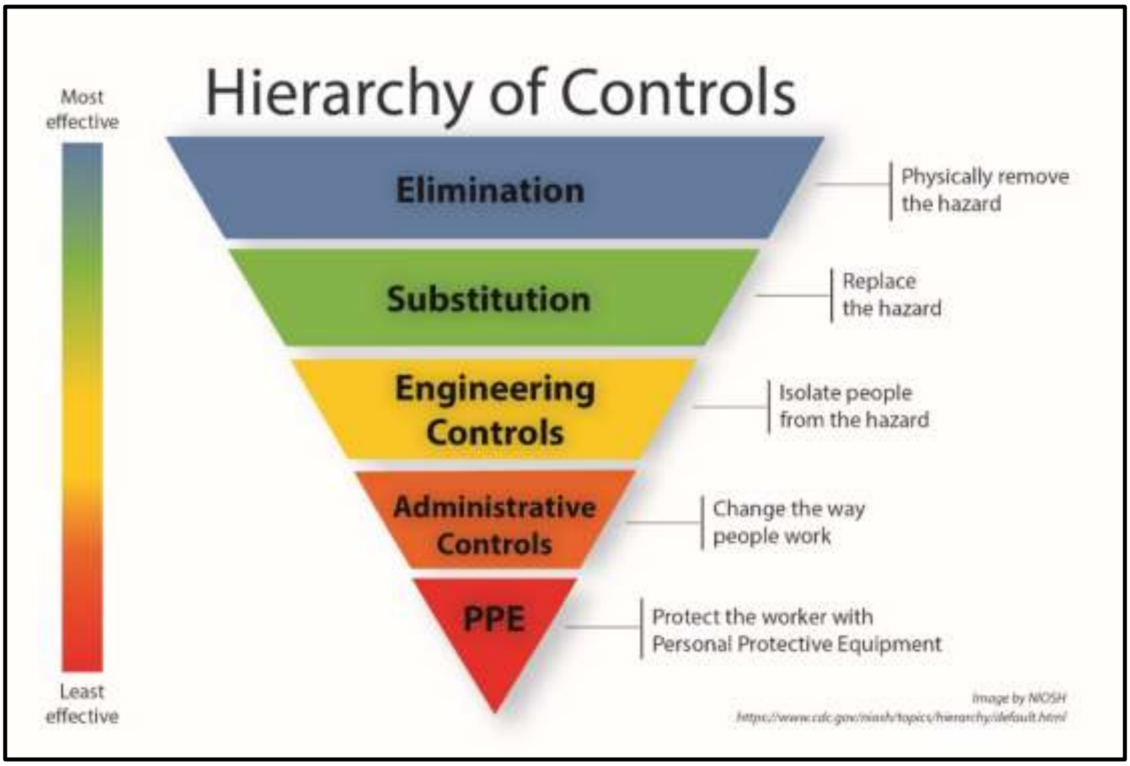

Figure 5: Hierarchy of risk controls

(Source: United States National Institute for Occupational Safety and Health, Centres for Disease Control and Prevention)

2.40. The most effective way to manage a risk is to eliminate its source by removing the hazard altogether; if the hazard does not exist, no risk is posed. If it is not possible to remove the hazard, then the next most efficient control is reduction of any potential risk. This can be achieved in several different ways; however, some methods are more effective than others.

2.41. Firstly, substitution of the hazard should be considered. This involves replacing the hazard source with something that creates less risk. If this is not reasonably practicable, an engineering control will provide the best defence. Engineering controls are physical in nature and can be designed into a system to protect an individual from the hazard. Guard switches and protective barriers are examples of engineering controls where there is some degree of isolation between the worker and the hazard.

2.42. Less effective than engineering controls are administrative risk controls. These consist of measures such as providing workers with information about the hazard through training and having documented procedures or work instructions in place. Safety messaging is an example of an administrative control. Finally, PPE should be used to protect against any remaining risk.

2.43. HSWA-GRWM requires PCBUs to implement risk control measures, so far as they apply to certain working conditions, in accordance with this hierarchy of controls. If it is not reasonably practicable to eliminate a risk,[9] then PCBUs must, so far as reasonably practicable, use substitution, isolation or engineering controls in the first instance[10] followed then by the less effective administrative risk controls and PPE.[11]

[9] HSWA-GRWM, r 6(1)

[10] HSWA-GRWM, r 6(3)

[11] HSWA-GRWM, rr 6(4) and 6(5)

2.44. Once risk controls have been established, they must be reviewed and, as necessary, revised to ensure that their effectiveness is maintained.[12]

Effectiveness of administrative risk controls

2.45. Currently, many of the inherent hazards in stevedoring activities are managed with administrative risk controls. While technological innovation has increased the engineering solutions, most stevedoring operations remain human-centric. As of 2021, there were only 53 container terminals[13] around the world that utilised some degree of automation, which represents 4 per cent of the total global container terminal capacity (International Transport Forum, 2021). Moreover, while some stevedoring activities could be automated, some of the most dangerous aspects of container handling (such as lashing, and fitting twist locks[14]) are considered more problematic in terms of automation (International Transport Forum, 2021). The degree to which automation will increase port-workers' health and safety is still uncertain[15] and, with the ability to fully automate ports still some time away, the requirement for stevedores to work in hazardous environments remains.

2.46. The primary reason that administrative risk controls are not as effective as other types of risk control is that they rely heavily on compliance. For administrative risk controls to work, employees must always follow instructions, never make mistakes and never put themselves in harm's way – a concept that is at odds with human behavioural science.[16,17]

2.47. There are multiple organisational factors that influence employees and can contribute to engaging in at-risk behaviour. At-risk behaviour is a term used to describe behavioural choices that increase risk, specifically where the risk is not recognised or

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[12] HSWA-GRWM, rr 7 and 8

[13] Ports of Auckland's Ferguson Terminal has since reverted to manual saddle cranes.

[14] Twist locks are fitted to shipping containers to allow the containers to lock together when stacked. *See* Glossary for photo of a twist lock.

[15] The argument that increased automation will rapidly lead to a reduction in harm by reducing human involvement in the system, is not straightforward. Automated processes still require supervision and appropriate management. Within the port environment, there is currently little empirical data to support the assumption that the health and safety of container terminal workers has improved in the ports that have introduced automated processes. Several automated ports have had accidents with equipment, including the Ports of Auckland's Freyberg Terminal, which experienced two separate incidents involving automatic straddle cranes. *See* International Transport Forum (2021).

[16] In addition to being susceptible to human error, people rarely always follow rules or instructions precisely. Individuals tend to drift away from rules and procedures as they gain familiarity with the tasks they are performing. While policies and procedures are prescribed to set boundaries for safe operations, workers may experiment with these boundaries to become more productive or obtain some benefit. This experimentation can lead to adaptations of procedures and a shift beyond the prescribed boundaries toward unsafe practices. Without intervention, this can lead to other employees observing what appears to be a successful adaptation of procedures and a spread of such behaviour takes place throughout the workforce. In the absence of any negative repercussions such adaptations are unlikely to be recognised as deviations as often these behaviours result in successful outcomes. Over time, adaptation of procedures slowly becomes the normal behaviour and any risk associated with short-cuts or workarounds is unlikely to be recognised. This is commonly described as 'normalisation of deviance', a phrase first used when examining the 1986 Challenger disaster (*see* Vaughan, (1996)).

[17] For an overview of normalisation of deviance in high-risk industries, *see* Sedlar et al. (2023)

is mistakenly believed to be justified (Marx, 2009). Common motivators[18] of at-risk behaviour within organisations are:

- financial gain
- saving time/making life easier
- impractical safety procedures
- unrealistic operating instructions
- unrealistic operating schedules
- demonstrating skill/enhancing self-esteem
- real or perceived pressure from management to cut corners
- real or perceived pressure from the workforce (peers) to break rules.

Common modifiers[19] of at-risk behaviour within organisations are:

- poor perception of safety risks
- enhanced perception of benefits
- low perception of potential injury/damage event
- inappropriate management/supervisory attitudes
- low chance of detection due to inadequate supervision
- insufficient accountability
- complacency caused by accident-free environments
- ineffective performance management/disciplinary procedures.

2.48. Where administrative risk controls are necessary, they require significant and ongoing effort by workers and their supervisors (United States National Institute for Occupational Safety and Health, 2022). Workers must remain appreciative of and alert to the potential risks within their environment. However, the absence or irregularity of adverse events such as accidents or incidents can lead to a desensitisation to hazards. Passive safety messages and reminding people to follow procedures are not effective risk controls when used in isolation. Procedural adherence is more likely when societal norms dictate the desired behaviour eg, everybody else is following the rules in the workplace. How successfully an organisation manages risks depends on the maturity of their safety management system (SMS) and culture.

Safety management systems and safety culture

2.49. Many international transport regulators require industry participants to implement and maintain a formal SMS that is periodically reviewed as part of regulatory monitoring. Within New Zealand, MNZ requires SOLAS[20] vessels to have an

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[18] Factors that can encourage people to break rules or not follow procedures (Santiago, 2007).

[19] Factors that tend to increase the probability that people will break rules or not follow procedures (Santiago, 2007).

[20] The International Convention for the Safety of Life at Sea (SOLAS) is an international treaty. SOLAS's main objective is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag States are responsible for ensuring that ships under their flag comply with its requirements.

International Safety Management System in place[21] and non-SOLAS vessels to have a certified SMS as part of the Maritime Operator Safety System (MOSS).

2.50. An SMS is an established set of systematic processes to identify hazards and manage safety risks. A common framework for an SMS consists of four independent but interrelated components: safety policy and objectives, safety risk management, safety assurance, and safety promotion.

2.51. An effective SMS will have a tightly coupled relationship between safety risk management and safety assurance (Demming, 2023). The risk management process will provide for hazard identification, risk assessment and treatment of the risk using risk controls. The safety assurance function is vital to ensure that risk controls are achieving their intended objectives of managing risk to an acceptable level.

2.52. One of the primary elements of safety assurance includes the ability to measure and monitor safety performance. To do so effectively requires the collection of a wide variety of both relevant and reliable data to determine whether an organisation's desired safety outcomes are being met. Data sources include employee hazard and safety reports, findings from safety investigations and audits, safety climate surveys, and operational performance metrics.

2.53. Given much of this information is captured from frontline employees, it is essential that organisations not only have suitable reporting mechanisms in place, but also foster a culture in which employees feel comfortable to raise and report on safety issues. Organisational culture is acknowledged as being the most important factor for shaping safety reporting practices; a healthy safety culture underpins a successful SMS (Maurino, 2017; International Civil Aviation Organization, 2018).

2.54. The safety maturity of an organisation encompasses both its SMS processes and its safety culture. While different models of safety maturity exist, the majority bear a distinct resemblance to the original model, which depicts the various levels of an organisation's journey from safety naivety to safety maturity (*see* Figure 6) (Westrum, 1993; Reason, 1997; Hudson, 1999).

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[21] As required by the International Safety Management Code, the International Maritime Organization's standard for the safe management and operation of ships at sea.

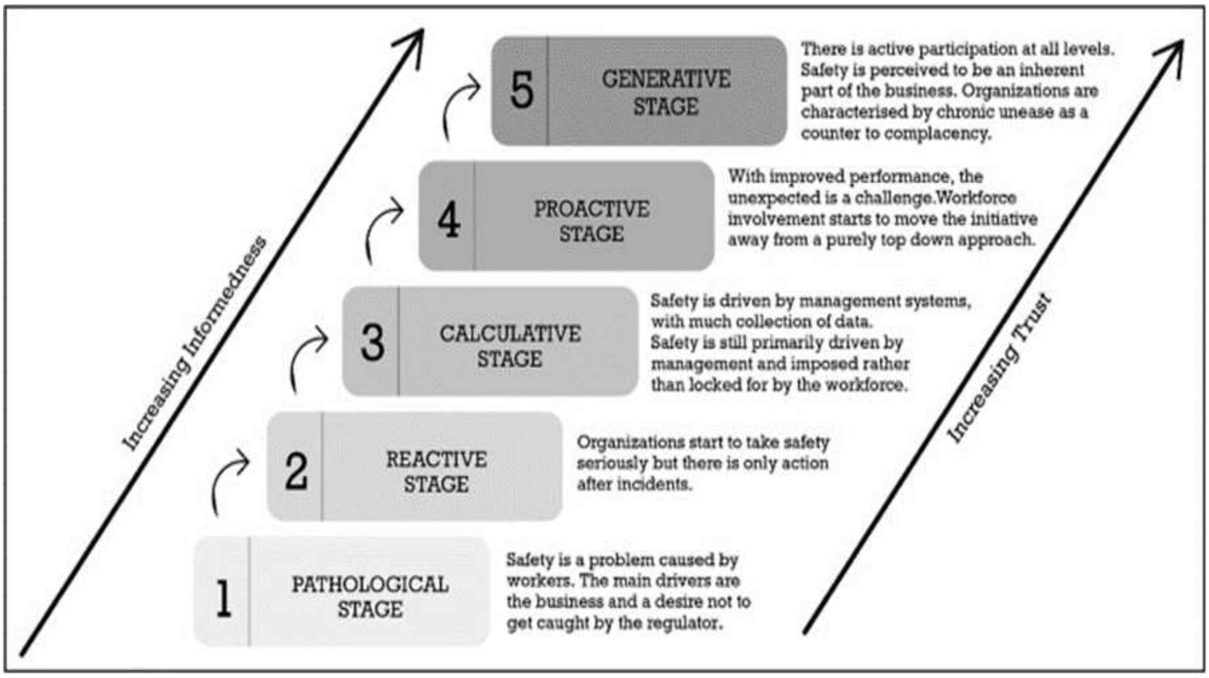

Figure 6: Levels of organisational safety maturity

Credit: (Moreira et al., 2021)

2.55. Safety maturity can be measured by examining different elements across each level of an organisation, considering both the tangible components, such as SMS processes, as well as the more abstract qualities of the system, such as safety culture. An example of the former is how an organisation measures its safety performance. Primarily focusing on Lost Time Injury rates (LTIs) – which do not provide a valid or reliable measure of risk, risk drivers or the effectiveness of risk controls – indicates a less mature safety system (Safe Work Australia, 2013). In contrast, utilising a wide variety of appropriate measures, including leading- or predictive-performance indicators across multiple aspects of an organisation's activity, would reflect a more mature safety system (Kaassis and Badri, 2018).

2.56. A less tangible aspect of organisational safety maturity is related to culture, including the concept of 'who causes accidents in the eyes of management' (Parker et al., 2006) At a pathological stage, accidents are either viewed as 'bad luck' or as an accepted part of the job. Management sees responsibility as belonging to the individuals directly involved with the accident and employees are blamed and punished when events occur. As safety maturity increases, so does an understanding of the complexities of human behaviour. Management begins to accept a shared responsibility for accidents and blame is replaced with philosophies such as an organisational 'just culture'[22]. The generative stage of maturity reflects a true comprehension of the nature of human behaviour and a recognition that safety is an emergent property of a complex sociotechnical system.

2.57. The positive correlation between organisational safety culture and safety outcomes is well documented (Zohar, 2010; Bjornskau and Naevestad, 2013). This has led to

[22] A just culture is a safety culture that promotes accountability and fairness. It encourages people to report errors and share information, without fear of blame or retribution, in order to improve safety performance. Globally, many safety-critical industries, such as aviation, maritime, oil and gas. and healthcare, promote just culture.

regulatory authorities in some sectors evaluating an organisation's safety culture as part of their monitoring and oversight of industry participants.[23]

Summary

2.58. Stevedores work in an environment with numerous and significant hazards. These hazards require effective management to reduce the risk of harm associated with stevedoring activity. The degree to which this can be successfully achieved is largely dependent on the maturity of an organisation's safety system. Whether an individual organisation can create, maintain and continually improve its safety system will depend on many factors. Two significant factors are the extent of leadership and cohesion within the wider industry, and the way the sector is regulated. These factors are discussed in Section 3 of this report.

Overview of the two accidents

Maritime inquiry MO-2022-203, Port of Auckland

2.59. On 19 April 2022, a stevedore employed by the independent stevedoring company Wallace Investments Limited (WIL) was working as a hold operator onboard the container vessel the *Capitaine Tasman,* which was berthed at the Port of Auckland's Jellicoe Wharf. As a hold operator, the stevedore's job was to help guide the containers into the vessel's hold and into their correct positions as they were being lowered by the vessel's crane.

2.60. At the time of the accident, the stevedore was not in sight of either the crane operator or the second hold operator, who was positioned on a different level of the container stack. As the crane operator was manoeuvring a 40-foot container, the stevedore unexpectedly moved under the suspended load and suffered crush injuries followed by a fall from height when the container was lowered.

2.61. WIL had recognised suspended loads as a hazard. The risk controls used were administrative in nature; employees were given training, procedures to follow, and regularly reminded not to position themselves under a suspended load. However, the procedures did not clearly allocate safety responsibilities before giving direction to the crane operator. **The presence of at-risk behaviour in the form of non-adherence to procedures also indicated a desensitisation to workplace hazards and a lack of effective supervisory oversight**.

2.62. WIL's SMS was still in development and had not reached the level of maturity required to provide assurance that risk controls were adequate or that all hazards were being identified. The regulatory framework did little to support the ongoing development of WIL's SMS, nor was the level of regulatory oversight sufficient to provide assurance of WIL's future safety performance.

2.63. *See* Appendix A for details of the Commission's inquiry MO-2022-203.

[23] Internationally, commercial aviation is a recognised example where this occurs. Within New Zealand this is a requirement for aviation certificate holders.

Maritime inquiry MO-2022-202, Lyttelton Port

2.64. On the morning of 25 April 2022, a stevedore employed by the Lyttelton Port Company Limited (LPC) was working onboard the bulk carrier *ETG Aquarius,* which was berthed at the Lyttelton Port coal-loading berth. The stevedore was part of a gang that was loading coal into the number one hold of the vessel. As the coal signalman, the stevedore's job was to monitor the flow of coal from a conveyor belt into the hold.

2.65. At the time of the accident, the coal signalman was not in sight of any of the other gang members, including the stevedore who was operating the machine delivering the coal to the hold. During the final stages of loading coal into the hold, radio communication was lost between the coal signalman and the stevedore operating the coal-loading machine. The coal signalman was subsequently found buried under coal that was accumulating on the vessel's deck.

2.66. LPC had taken significant steps to improve safety of its port operations before the accident occurred. It was in the first year of a three-year programme to improve its SMS in regard to risk identification and management. At the time of the accident, LPC had not identified all the critical risks of the coal signalman's role, which meant that the associated risks, such as medical fitness or working in physical isolation, were not explicitly addressed. **The risk mitigation strategies that were in place for the associated risks tended to rely upon informal administrative risk controls, which were not always well articulated within the SMS.**

2.67. The training system did not ensure that all staff had a thorough understanding of the associated risks and their mitigation measures, reducing the effectiveness of those risk controls. This was compounded by passive supervision of the coal signalman, which did not ensure compliance with risk controls and safety-critical procedures.

2.68. The regulatory framework did not encourage proactive support, monitoring or assessment, via review or otherwise, of LPC's SMS to ensure its effectiveness.

2.69. *See* Appendix B for details of the Commission's inquiry MO-2022-202.

Commonalities between the two accidents

2.70. Despite the difference in the type of stevedoring activity taking place when the accidents occurred, each of the Commission's inquiries found notable similarities regarding how safety was being managed at an organisational, industry and regulatory level.

2.71. At an organisational level, the risks associated with work activity were primarily being managed with administrative risk controls, yet robust safety assurance processes to ensure that these controls remained effective over time were lacking. As a result, neither LPC nor WIL adequately understood how the day-to-day behaviour of their employees reduced the effectiveness of the already vulnerable administrative risk controls.

2.72. Both organisations were attempting to improve their SMSs. However, a lack of industry cohesion meant there was little ability to benchmark with others in the industry. **With no best practice guidelines, no minimum training requirements, and few safety-related information-sharing platforms, leadership from within the sector was found lacking.**

2.73. **Neither organisation received a satisfactory level of proactive regulatory oversight of their stevedoring operations.** Most regulatory interactions were limited to LPC and WIL reporting their notifiable events under HSWA legislation, and to any subsequent follow up by MNZ and WorkSafe because of those notifications. Reactionary reporting and associated regulatory sanctions provide little insight into the health of an organisation's safety system or assurance of future safety performance. Nor does it encourage the sharing of information within the industry to support safety across the sector.

2.74. Section 3 considers common safety issues for the New Zealand stevedoring industry.

3. Safety issues for the New Zealand stevedoring industry

Ngā take haumanu mō ngā kaitītaritari o Aotearoa

3.1. Safety issues are an output from the Commission's analysis. They may not always relate to factors directly contributing to the accident or incident. They typically describe a systemic problem that has the potential to adversely affect future transport safety.

3.2. The two accidents investigated by the Commission occurred in different operational contexts. The Auckland accident involved a private stevedoring company fulfilling a contract to a shipping company and the Lyttelton accident involved stevedores directly employed by the port company. The natures of the stevedoring activities were also different; one involved loading containers using the vessel's crane, and the other involved loading a bulk carrier using port infrastructure and equipment.

3.3. Despite the different operational contexts, the Commission identified common safety issues. Both accidents revealed organisational weaknesses in risk identification and mitigation strategies, communication and supervisory oversight.

3.4. There are thirteen ports and five private stevedoring organisations in New Zealand. The Commission acknowledges that a sample of two is not necessarily representative of how other port and stevedoring organisations conduct their activities or manage safety. Nevertheless, the systemic issues identified in the two inquiries suggest that the industry has not yet reached the level of maturity required to support all participants.

3.5. The safety issues identified have previously been identified in Australia following a stevedoring accident on a container vessel in 2010. The Australian Transport Safety Bureau (ATSB) investigated the accident and in its report (Australian Transport Safety Bureau, 2011) commented:

> A system of safety is a feature of an industry or sector rather than of an organisation and is defined by the shared safety objectives of key stakeholders resulting in a systemic approach to reducing risk in the workplace. Complementary roles and operations of stakeholders promote the system and introduce multiple layers of defences to prevent adverse occurrences. These layers of defence start at the regulatory level, with laws and codes of safe practice, pass through industry bodies all the way down to the training of personnel, safe operating procedures and the mindset of people involved in the operations 'at the coal face'. While a system of safety is more than one specific organisation, the attitudes of personnel at all levels of individual organisations are vital for the ongoing success of any system of safety. The combined effect of legislation and its effective implementation in the workplace, and the attitude of personnel towards safety, enhance both the organisational culture and safety culture within an organisation.

3.6. The ATSB's comment is equally applicable to the New Zealand stevedoring industry. It is the Commission's view that a holistic approach, which includes investment by both the regulatory system and industry, is required to rectify the safety issues identified in these investigations.

Safety issue: Stevedoring is a high-risk activity, yet it is not regulated with the same degree of rigour as other comparable industries. The current degree of regulatory oversight is not sufficient to ensure the safety of stevedoring activity.

3.7. Internationally, working on the waterfront has long been recognised as a hazardous occupation (International Labour Office, 2018). The introduction of container shipping significantly reduced the number of personnel required to undertake traditional stevedoring tasks; yet in the 50 years since many countries have still grappled with unacceptable rates of harm in their port workforce. Automation and technology within the port environment afford future opportunities to improve safety; however, both the cost and associated complexities mean that stevedores will continue to work for some time to come in settings where there are numerous hazards.

3.8. Stevedoring is inextricably connected to maritime operations; stevedores undertake many of the same or similar duties as seafarers, and they face comparable risks in the port environment. In contrast to stevedoring, seafaring is regulated through legislation, specifically the Maritime Transport Act 1994 (MTA). The MTA prescribes risk-mitigation controls and requires regular auditing of certified SMSs against specified criteria for seafarers.

3.9. Regulation of stevedoring activity is under the much broader HSWA. Some of the activities that stevedores are engaged in are specifically regulated. However, unlike other high-risk industries regulated under HSWA, there are no tailored requirements for stevedoring, either in the form of Regulations,[24] Approved Codes of Practice (ACOP),[25] Safe Work Instruments (SWI),[26] auditable SMSs[27] or Safety Case approvals.[28]

3.10. Regulation for stevedoring organisations under HSWA is performance-based; it is up to each individual PCBU to decide how they will meet the HSWA requirements. This type of safety regulation is generally recognised as being positive in terms of flexibility and innovation, allowing organisations to set and manage their own safety processes without being overly prescriptive and regulatorily burdensome (May, 2003). However, it is also recognised that the success of performance-based regimes depends upon a regulator's capability to measure and monitor outcomes (Cogilianese 2017; Natural Resources Canada, 2013).

3.11. Within HSWA, there are a number of mechanisms for regulators to provide leadership and oversight, including:

- ensuring appropriate scrutiny and review of stevedoring activity
- promoting the provision of advice, information, education, and training in relation to work health and safety
- providing a framework for continuous improvement and progressively higher standards of work health and safety.

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[24] eg, Health and Safety at Work (Adventure Activities) Regulations 2016; Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016; Health and Safety at Work (Petroleum Exploration and Extraction) Regulations 2016.

[25] eg, Approved Code of Practice for Safety and Health in Forest Operations.

[26] A Safe Work Instrument is a form of legislation that supports or complements regulations. Safe work instruments have legal effect only where they are referred to in regulations eg, Health and Safety at Work (Asbestos - Prescribed Relevant Courses) Safe Work Instrument 2017.

[27] eg, gas supply systems.

[28] Major hazard facilities.

3.12. Another way for regulators to gauge the safety performance of industry participants is to formally assess and routinely review their SMSs, similar to the approach taken in New Zealand's commercial maritime sector.

3.13. Currently, there is no requirement for stevedoring organisations to have an assessment of their internal safety systems or be periodically reviewed by the regulator to ensure safety objectives are being met. Performance-based regulation typically works well within industries with mature safety systems; however, stevedoring does not enjoy this level of safety maturity. While there is a certain amount of information sharing between industry participants, this has not yet reached the level required to enable effective safety-related data analysis or agreement on best practices.

3.14. In essence, the stevedoring sector operates between two quite different frameworks; activity is not audited as it would be under prescriptive frameworks, nor is it subject to formal safety management oversight and monitoring as required by some other industries that operate within a performance-based system. Whether a stevedoring organisation's SMS is effective or not therefore relies on the organisation's level of safety proficiency. Organisations must not only be motivated to have a robust SMS but must also know how to implement, execute and maintain that system appropriately. Both WIL and LPC were in the process of improving their SMSs, yet they were doing so without the benefit of the regulator monitoring or providing a thorough assessment or questioning the effectiveness of their systems (*see* Appendices A and B).

3.15. In 2019, MNZ and WorkSafe began joint HSWA assessments of New Zealand's 13 major commercial ports, which included an assessment for both LPC and POAL. Other proactivity by the regulators included several focused safety campaigns relating to dangerous goods, loading and unloading of high-risk cargo, COVID-19 requirements, and the development of Fatigue Risk Management guidance. However, there was no effective monitoring and assessment to ensure individual stevedoring organisations were managing their safety risks appropriately. Regulatory oversight of safety management was primarily focused on reactive interventions following notifiable events rather than proactive assessment and monitoring.[29] Notifying a regulator of events when legally obliged provides little useful information about the current or future state of an organisation's safety performance. **The Commission does not consider this level of regulatory oversight is appropriate for an industry where the rate of workplace harm is disproportionately high on both a national and an international front.**

3.16. In the absence of a 'just culture' approach by regulators, it is unlikely stevedoring organisations are willing to voluntarily share their safety information beyond that required by legislation. The negative repercussions associated with regulatory prosecution as a deterrence have been well documented (*see* Dekker, 2011; Heraghaty et al., 2021). This has led to some regulators acknowledging the importance of striking a balance between the imposition of sanctions and the need for data from their industry participants.[30] **While sanctions hold a valid place in regulatory frameworks, the Commission surmised that stevedoring participants**

[29] Information provided by MNZ indicates that, while maritime officers engaged with port and stevedoring companies, most port-related oversight focused on vessel inspections.

[30] Eg, The New Zealand Civil Aviation Authority and the Australian Civil Aviation Safety Authority .

view the regulator as being overly focused on prosecutions whilst providing little educational leadership for this sector. The Commission considers that this has done little to incentivise safety leadership and growth within the stevedoring community.

3.17. The Commission has made a recommendation to address this safety issue in Section 5 of this report. In support of this recommendation, the Commission also makes the following observation. At the time of the accident, WorkSafe regulated stevedoring activity that occurred on the wharf and MNZ regulated stevedoring activity on the vessel. The relationship between WorkSafe and MNZ was managed in part through a Memorandum of Understanding. However, the Commission considers that this arrangement had inherent issues in providing robust safety oversight for an industry that requires a higher level of regulatory stewardship than currently takes place. These issues were recognised by both WorkSafe and MNZ in discussions with the Commission.

3.18. The Commission acknowledges the work done by the Port Health and Safety Leadership Group in identifying ways to address harm on New Zealand ports.

3.19. In April 2023, the Government agreed to extend the HSWA designation of MNZ beyond the existing designation for work onboard ships, to also include work at commercial ports handling containers, logs and/or bulk cargo, excluding major hazard facilities[31] at these ports. The Ministry of Business, Innovation and Employment is currently working with other relevant agencies to draft the designation instrument, with the expanded MNZ designation expected to come into effect on 1 July 2024.

3.20. On 3 July 2023, WorkSafe informed the Commission of the following:

> To support the decision that Maritime New Zealand's (MNZ's) designation will be extended from July 2024 to cover all the major ports, WorkSafe and MNZ have agreed a co-ordinated operational approach in respect of proactive assessment activities in ports. This co-ordinated approach will support MNZ to build its capability to take on the extended designation role over the next year. During this time, the agencies will carry out proactive co-ordinated assessment activity across the 13 international ports. This will be jointly planned to enable WorkSafe and MNZ presence during these assessments. Each quarter, areas of focus for the assessments will be jointly agreed. The agreed focus areas, to date, align with some of the key risks identified in the Ports Sector Insights Picture and Action Plan:
>
> • From March to June 2023 – a focus on traffic management and working in and around vehicles
>
> • From July to September [2023] – a focus on suspended loads, stacking, and hazardous substances.
>
> In October, the agencies will jointly review the outcomes of the work to date, and review the focus areas for the next quarters through to July 2024. While focus areas are set for assessment activity, either agency's inspector may identify, and follow up as appropriate in line with operational practice, any particular immediate risks noted during an assessment visit.

[31] Major hazard facilities are defined under Health and Safety at Work (Major Hazard Facilities) Regulations 2016

Safety issue: The New Zealand stevedoring industry lacks consistency regarding safe work practices:

While international benchmarking is available, New Zealand does not have agreed guidelines on best practices for stevedoring.

3.21. Internationally, there are several documented health and safety standards available for port work. Previously, these documents tended to lack detail or were considered too generic to be useful in a practical sense.[32] In the last decade, however, there has been an increase in more detailed guidelines in the form of best practices, including:

- International Labour Organization (ILO) Code of Practice: Safety and Health in Ports (International Labour Office, 2018)
- Safe Work Australia: Managing Risks in Stevedoring Code of Practice (2016)
- Health and Safety Executive (UK): Approved Code of Practice Safety in Docks (2014)
- Port Skills and Safety (UK): SIP003 Guidance on Container Handling
- Health and Safety Authority (Ireland): Code of Practice for Health and Safety in Dock Work (2016)
- US Pacific Coast Marine Safety Code (2014).

3.22. No similar guidance has been developed in New Zealand. The closest document is the Code of Practice for Health and Safety in Port Operations, prepared in 1997 by the Port Industry Group conjointly with the then Department of Labour's Occupational Safety and Health Service and the Maritime Safety Authority.

3.23. This was a proactive initiative by industry at the time. However, legislation has since been amended and views on safety management have changed, making this Code of Practice obsolete. Information provided to the Commission indicates that some personnel involved in stevedoring safety management either do not know about this Code of Practice or consider it no longer fit for purpose.

3.24. The argument for an approved Code of Practice, rather than relying on industry guidance material, has previously taken place in Australia. In 2013, following what the industry recognised as an unacceptably high accident and fatality rate for port workers,[33] Safe Work Australia considered several options to improve safety within the sector that, like New Zealand, had dual regulation.[34] A cost benefit analysis found that the adoption of an approved Code of Practice would provide a significant reduction in the number of serious harm events. The predicted safety improvements across a 10-year period were comparable to those estimated to occur if specific health and safety regulations were developed for stevedoring, but without the associated regulatory burden (Safe Work Australia, 2015).

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[32] *See* Australia Transport Safety Bureau (2011) for discussion of inadequacy of international guidance, such as that previously provided by the International Labour Organization (ILO) and the International Cargo Handling Coordination Association (ICHCA).

[33] At the time the average death rate for stevedores in Australia was 14.3 per 100,000 workers in comparison to 2.8 per 100,000 workers for construction and 1.05 per 100,000 workers on average. The Maritime Union of Australia also claimed that the fatality rate for stevedores was more than double that of the Australian Defence Force, including those serving in Afghanistan.

[34] The Australian regulator at the time (AMSA) had jurisdiction over seaworthiness of vessel technical standards, including ship lifting equipment (cranes), yet stevedoring workers and their systems of work fell under the relevant state or territorial Workplace Health and Safety (WHS) legislation.

3.25. Within New Zealand, adoption of a Code of Practice has been shown to be effective for other parts of the port sector. The New Zealand Port and Harbour Marine Safety Code 2020 is an example of a successful tripartite relationship between regional councils, port operators and the regulator, MNZ. This Code of Practice is a voluntary national standard that provides a framework to manage the safety of port and harbour activities, although stevedoring is not included.[35]

3.26. Recognising that there is no regulatory requirement for port organisations to have a certified SMS, this Code of Practice 'promotes a systems approach to the management of safety to ensure that risks are identified and managed in a structured and sustainable way that fosters continuous improvement'.[36] This includes a dedicated work programme to support robust safety management practices within the harbour environment. Key principles for managing safety risk have been established,[37] along with best practice guidelines for specific port activities.

3.27. To assess whether individual ports are appropriately managing their risks, an annual report on the performance of their SMS is submitted to the Secretariat. Additionally, an independent panel reviews each port's SMS. The individual results remain confidential, but where good safety management practices are identified, these are shared more widely.

3.28. While this Code of Practice is only voluntary it demonstrates how**,** in the absence of any regulatory requirements to do so, industry stakeholders can come together to establish their own safety standards and share good practice to improve their working environment. At the time of these accidents, neither WIL nor LPC had access to a suitable New Zealand common code of practice for stevedoring. **The Commission considers that, whilst operating under the performance-based HSWA legislation, an approved code of practice would benefit the New Zealand stevedoring industry**. The Commission has therefore made a recommendation in Section 5 of this report to address this safety issue.

There are no minimum training standards for entry to and progression within the industry.

3.29. Following the regulatory changes in the late 1980s, the stevedoring industry became privatised and there was no longer a common pool of stevedoring labour. This was not unique to New Zealand and the International Labour Office[38] commented that 'privatisation of the industry has led to considerable changes in the organisation of ports and the employment of people in them, including an increased use of non-permanent workers' (International Labour Office, 2018).

3.30. This privatisation increased the industry's reliance on transient and low-experience workers, which did not lend itself well to hazardous occupations such as port work. Statistical analysis of 25 years of safety data at Genoa port (Italy) found a relationship between the 'strikingly' high increase of young and/or low-experience workers and

[35] The Code focuses primarily on safe passage of ships navigating in New Zealand ports and harbours.

[36] New Zealand Port and Harbour Marine Safety Code 4.1(a).

[37] Key Principles for Marine Safety Risk Management. https://www.maritimenz.govt.nz/content/commercial/ports-and-harbours/documents/key-principles-marine-risk-management.pdf

[38] The International Labour Office is the permanent secretariat of the International Labour Organization.

the 'remarkable' increase in risk of occupational injuries.[39] This risk could be mitigated with training, however there are currently no minimum training requirements to work as a stevedore in New Zealand.

3.31. The lack of training requirements for stevedores is in stark contrast to vessel crew members who also conduct stevedoring-related activities. While the training standards for crew reflect their remote work environment when at sea, many of the hazards are the same, such as working in confined spaces and at heights and handling dangerous goods.

3.32. While some NZQA qualifications exist for stevedoring, they are not compulsory. Furthermore, some stevedoring organisations found the NZQA framework presented difficulties, particularly that NZQA cannot issue individual unit standards unless an employee is enrolled in the certificate programme. Effectively, an organisation wanting to train their stevedores in a particular area has to enrol each employee in the certificate programme, regardless of inclination or abilities to complete a Level 3 qualification. This is further exacerbated by industry issues such as an aging workforce and difficulty recruiting into the sector.

3.33. For the most part, training is conducted through on-the-job shadowing of other stevedores (*see* Appendices A and B). The lack of common standards for stevedoring activity invariably results in training to different levels, not only within ports, but within gangs. Information gathered during the Commission's investigations of these two accidents found that communication standardisation was particularly problematic. Some stevedores reported they were taught different communication techniques depending on who they happened to be shadowing at the time. Others reported becoming confused on occasion when they received different signals from multiple people at one time; deciding which instruction to follow may simply have been based on which stevedore they trusted most.

3.34. A lack of training standards for progression within the stevedoring industry is also a concern. Unlike mariners, who require formal assessment before taking on additional responsibilities, there is no such requirement for stevedores. For supervisors to be effective, they should possess the correct technical skills and leadership ability. If there are no training competencies required to become a supervisor, it is difficult to assess how well-equipped those individuals are to perform this safety-critical role.

3.35. Under HSWA, a PCBU must ensure training protects employees from health and safety risks arising from work activity. Given the lack of standardisation of stevedoring activity, this presents significant challenges for the industry. This has previously been highlighted by the Maritime Union of Australia to support the inclusion of training provisions in the Australian Code of Practice:

> there is strong support within the maritime community for detailed training guidance. Of the approximately 700 submissions made during the last comment phase, an overwhelming majority argued for better training… [training provisions] should remain within the code as an illustration of how a Person Conducting a Business or Undertaking (PCBU) might satisfy the [WHS Act].[40]

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[39] While the change in port infrastructure to accommodate containerised vessels reduced approximately 80% of the workforce between 1980 and 2006, the percentage of low-experience workers increased from 28% to 74% and injuries per hundred thousand hours worked increased from 13.0 to 29.7 (Fabiano et al., 2010).

[40] https://www.mua.org.au/news/submission-safe-work-australia-national-stevedoring-code-practice

3.36. The absence of minimum training standards has created a divergent workforce with little incentive to standardise in a market of increased commercial competition. Unlike those in other high-risk industries that must factor in the cost of training and maintaining qualifications to adhere to industry standards or regulations, the stevedoring sector does not. The Commission has therefore made a recommendation in Section 5 of this report to address this safety issue.

There is minimal proactive gathering and sharing of safety information in the industry.

3.37. The stevedoring sector attempts to work collaboratively through the Port Industry Association (PIA). Information sharing is encouraged through a range of forums and workshops, and information on potential safety hazards, such as vessel equipment deficiencies, can be circulated to members. At the time of these accidents, however, information sharing conducted in a consistent and effective manner was still in its infancy.

3.38. One of the benefits of a cohesive industry is the ability to share safety learnings. Currently, there is limited facility either internationally or domestically to share safety-related information. An example of this was the use of a lashing platform at Hamburg's Altenwerder terminal, which made twist lock handling considerably safer, yet this was not introduced at many other container ports (International Transport Forum, 2021).

3.39. Information provided to the Commission suggests that while some safety lessons are shared, the benefits of a good safety culture are not as well socialised in the stevedoring industry compared to other more mature industries where participants are considered high-reliability organisations.[41] **There is limited incentive to share information with the regulator beyond what is legally required, and this does little to encourage safety leadership for participants in a highly competitive industry.** If the threat of prosecution is always imminent, it is understandable why those on the front line may not want to report safety-related information, even within their own organisations.

3.40. The benefits of increased safety reporting extend beyond the response and management of an individual event to enabling trend monitoring and proactive risk management across the sector. This would require the stevedoring industry to fully embrace the philosophy of SMSs, where safety is considered a core business function. Within an SMS, safety and efficiency are not in competition; the management of safety is afforded the same importance as other business processes, resulting in a realistic allocation of resources to ensure protection of the organisation's production goals. This in turn creates increased efficiencies.

3.41. By sharing insights and lessons learned, stevedoring stakeholders would learn from one another's experiences and make improvements that would benefit the entire sector. Additionally, by promoting a culture of continuous learning and improvement, stevedoring organisations could work together to identify and mitigate risks, and ultimately increase overall safety of the industry. The Commission has therefore made a recommendation to address this issue in Section 5 of this report.

[41] High-reliability organisations are those that operate in highly hazardous environments with high safety performance, eg, air traffic management systems, commercial aviation, and nuclear power stations.

4. Safety actions
Ngā take haumanu me ngā mahi whakatika

General

4.1. Safety issues may be addressed by safety actions taken by a participant. Otherwise, the Commission may issue a recommendation to address the issue.

Accident at Port of Auckland

4.2. The Commission believes action needs to be taken to ensure the safety of future operations. Therefore, the Commission has made a recommendation to WIL in Section 5 of this report.

Accident at Lyttelton Port

4.3. On 27 June 2023, LPC advised the Commission that following the accident (detailed in Appendix B) it carried out an extensive risk assessment and made a number or changes to the coal-loading process, including implementing a number of engineering controls to the plant involved in the coal-loading operation.

4.4. LPC has also proposed the following safety actions:

- Development and implementation of a suitable Fitness for Work programme and related processes to monitor for changes and reduction in functional fitness that may affect an employee's ability to safely perform the tasks required
    - establish role-specific fitness and medical requirements
    - engage with the workforce to introduce annual medical assessment
- Identification of any additional significant risks at LPC and inclusion of these in its SMS, and independent verification as part of the Material Risk Assurance programme.
- Development and implementation of an LPC Learning and Development Policy, and a Learning and Development system that includes specific:
    - training needs analysis
    - verification of competency
    - enhanced supervisor training, clarifying roles and responsibilities in relation to the requirements of HSWA.

4.5. The Commission welcomes the safety action to-date. However, it believes more action needs to be taken to ensure the safety of future operations. Therefore, the Commission has made a recommendation in Section 5 of this report to address this issue.

Industry-wide safety action

Port sector insights

4.6. As a response to the accidents in Auckland and Lyttelton, the Minister of Transport requested the Port Health and Safety Leadership Group provide the Minister with advice on a collective set of actions, including regulatory standards, to address harm at New Zealand ports.

4.7. The Leadership Group was made up of port and stevedoring companies, unions, the Port Industry Association, MNZ and WorkSafe representatives. The vision of the Leadership Group was to deliver 'A high performing, resilient port sector, where people thrive and worker health and safety is prioritised through high-trust, tripartite collaboration'.

4.8. In November 2022, the Leadership Group presented the Minister with the Port Sector Insights Picture and Action Plan. The Action Plan provided six initial actions focused on addressing some of the issues identified, including:

- developing an Approved Code of Practice on Stevedoring
- implementing the Fatigue Risk Management System Good Practice
- extending MNZ's HSWA designation on ports
- addressing workforce issues and skills
- improving incident reporting, notifications, insights and learnings across the sector
- developing opportunities to share good practice.

4.9. On 13 July 2023, MNZ gave the Commission further information about the action plan, specifically:

> The action plan has six focus areas which address many of the changes the report suggests are need in the stevedoring sector:
>
> - Standards and guidance with a priority to develop an approved code of practice (a draft ACOP is being developed, led by Maritime NZ - there have been industry workshops as part of its development and a draft will be out for broad consultation August/September 2023).
> - Fatigue management (guidance on a Fatigue Risk Management System has been introduced and an implementation programme to support the uptake of the sector is being action).
> - Clarifying regulator arrangements (Cabinet agreed in April that Maritime NZ would be the responsible regulator for ports from 1 July 2024).
> - Workforce sustainability with the priority action to develop new, or refine existing courses and unit standards to cover critical roles and activities on ports (Content being developed for a Port Safe Start Micro Credential is underway and skills gaps in sector are being mapped. Further work is also being considered looking at career pathways and what regulatory support might be needed to encourage uptake of training).
> - Incident Notification, Insights and Intelligence with a priority action to encourage consistent, timely reporting of incidents and notifications; share information around unsafe ships; and develop an on-going insights and intelligence picture on port sector harms (work is currently being scoped).

- Good practice with a priority action to develop a "depository" of good practice that can be built on over time to be a resource for the port sector to learn from others to develop innovative practices (as part of the Port Health and Safety Leadership Group insights picture and action plan a suite of good practice was pulled together. Work is being considered on where to place, and share, good practice and how to add to it over time).

4.10. The Commission welcomes the safety action to-date. However, that action is yet to be completed and the Commission believes more is needed to ensure the safety of future operations, including the way the sector is regulated. Therefore, the Commission has made two recommendations in Section 5 of this report to address this issue.

5. Recommendations
Ngā tūtohutanga

General

5.1. The Commission issues recommendations to address safety issues found in its investigations. Recommendations may be addressed to organisations or people and can relate to safety issues found within an organisation or within the wider transport system that have the potential to contribute to future transport accidents and incidents.

5.2. In the interests of transport safety, it is important that recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

New recommendations

5.3. On 22 August 2023, the Commission recommended that Maritime New Zealand works with industry stakeholders to improve safety standards for stevedoring operations through:

- implementing an Approved Code of Practice for managing health and safety risks associated with stevedoring activity
- establishing minimum training standards for stevedores
- establishing a programme to facilitate continuous improvement of stevedoring safety standards, including the sharing of safety information amongst industry stakeholders. **(024/23)**

5.4. On 27 September 2023, the Commission recommended that Maritime New Zealand and WorkSafe (until 1 July 2024) ensure that their regulatory activity includes a proactive role (such as monitoring and assessment) in the safety of the stevedoring industry. **(025/23)**

5.5. On 22 August 2023, the Commission recommended that Wallace Investments Limited prioritise a review of their safety management system to ensure that:

- the responsibility for safety of each stevedoring role is clearly defined, unambiguous, and understood by all personnel
- procedures for work activity adequately cover scenarios with increased risk
- all risks are identified, and administrative risk controls are only used when more effective risk controls are not reasonably practicable
- adherence to administrative risk controls is effectively managed.
- supervisory oversight is effective and not compromised by competing operational demands
- safety-assurance mechanisms are in place to reliably evaluate the effectiveness of and adherence to risk-control strategies. **(026/23)**

5.6. On 22 August 2023, the Commission recommended that Lyttelton Port Company Limited reviews the medical screening of stevedores to ensure it provides adequate assurance of medical fitness for their duties and responsibilities. **(027/23)**

5.7. On 13 September 2023, Lyttelton Port Company replied:

> On 22 August 2023, the Commission recommended that Lyttelton Port Company reviews the medical screening of stevedores to ensure it provides adequate assurance of medical fitness for their duties and responsibilities.
>
> Accepted: The recommendation was accepted (wholly or in part) and is being, or will be, implemented
>
> Description of the action taken:
>
> - Design of the LPC Fitness for Work programme
> - Introduction in February 2023 of mandatory medical fitness assessments for new employees and will be mandated for all employees by the end of July 2024
> - Employment of a dedicated Occupational Nurse to lead the LPC Fitness for Work programme
> - Awareness campaign for LPC Fitness for Work Programme
> - Consultation with workforce for LPC Fitness for Work programme
> - Consultation with Union for LPC Fitness for Work programme
> - Currently offered to all operational deployment of the LPC Fitness for Work programme to all operational staff
>
> Date of expected implementation
>
> End of July 2024

5.8. On 22 August 2023, the Commission recommended that Lyttelton Port Company Limited prioritises a review of their safety management system to ensure that:

- documented procedures are consistent and reflect all critical aspects of the work as done
- all risks are identified, and administrative risk controls are only used when more effective risk controls are not reasonably practicable
- adherence to administrative risk controls is effectively managed
- supervisory oversight is effective and not compromised by competing operational demands
- radio communications used for safety-critical tasks are consistent and reliable. **(028/23)**

5.9. On 13 September 2023, Lyttelton Port Company Limited replied:

> On 22 August 2023, the Commission recommended that Lyttelton Port Company prioritises a review of its safety management system to ensure that documented procedures are consistent and reflect all critical aspects of the work as done.
>
> Accepted: The recommendation was accepted (wholly or in part) and is being, or will be, implemented
>
> Description of the action taken:
>
> - The appointment of a Training Manager for Lyttelton Container Operations
> - Review of training material, Safe Work Method Statements, and operational procedures to reflect all critical aspects of work.
> - Introduction of improved document control processes
>
> Date of expected implementation

End of Feb 2024

On 22 August 2023, the Commission recommended that Lyttelton Port Company prioritises a review of its - safety management system to ensure that all risks are identified, and administrative risk controls are only used when more effective risk controls are not reasonably practicable.

Accepted: The recommendation was accepted (wholly or in part) and is being, or will be, implemented

Description of the action taken:

- All operational risk registers are undergoing a current review as part of the wider migration to LPC's new integrated Safety Management System
- Indication of the actions intending to take.
- Identification of administrative controls and review to see if higher hierarchy of controls are suitable.

Date of expected implementation

End of Feb 2024

On 22 August 2023, the Commission recommended that Lyttelton Port Company prioritises a review of its safety management system to ensure that adherence to administrative risk controls is effectively managed.

Accepted: The recommendation was accepted (wholly or in part) and is being, or will be, implemented

Description of the action taken:

- The appointment of a Training Manager for Lyttelton Container Operations
- Verification of Competency programme commenced August 2023
- Increased in field operational oversight for high-risk activities.
- Creation of Verification of Competency framework
- Indication of the actions intending to take.
- Embed ongoing review process.

Date of expected implementation

End of Feb 2024

On 22 August 2023, the Commission recommended that Lyttelton Port Company prioritises a review of their safety management system to ensure that supervisory oversight is effective and not compromised by competing operational demands.

Accepted: The recommendation was accepted (wholly or in part) and is being, or will be, implemented

Indication of the actions intending to take.

- A review to be taken to understand competing demands in operational areas which may impact the level of supervisory oversight.

Date of expected implementation

End of Feb 2024

Notice of recommendations

5.10. The Commission gives notice to WorkSafe that it has issued recommendation **(024/23)** and **(025/23)** to Maritime New Zealand and this recommendation will require the involvement of WorkSafe.

5.11. The Commission gives notice to the Ministry of Transport and to the Ministry of Business, Innovation and Employment that it has issued recommendations **(024/23)** and **(025/23)** to Maritime New Zealand and WorkSafe and that these recommendations will require the involvement of the Ministry of Transport and the Ministry of Business, Innovation and Employment.

6. Key lessons
Ngā akoranga matua

6.1. Those who work in high-risk industries are not necessarily exposed to regular adverse events and desensitisation to risk is a hazard itself.

6.2. When risk is not fully understood or appreciated, a variety of factors can lead to employees taking shortcuts or drifting away from rules. Passive safety messages and reminding people to follow procedures are not effective means by which to change risk perceptions or modify behaviours.

6.3. The way tasks are designed and procedures are written is often incongruent with how day-to-day work activity is conducted. A critical component of any safety management system is the ability to identify, understand and resolve the reasons for the disparity.

6.4. Where administrative risk controls are necessary to manage hazards associated with high-risk activity, appropriate supervision and a culture of strong safety leadership is required to ensure their effectiveness is maintained.

6.5. Industry collaboration and benchmarking is an effective way to improve safety standards and support continuous improvement.

6.6. Reactive interventions are not a substitute for proactive regulatory oversight of high-risk industries, particularly those with a poor safety record.

7. Appendix A: MO-2022-203 Fatal accident at Port of Auckland, 19 April 2022

A1. Factual information
Pārongo pono

Narrative

A1.1. On 17 April 2022, the container vessel *Capitaine Tasman* was berthed alongside Jellicoe Wharf at the Port of Auckland, New Zealand, with its starboard side to the quay. The vessel had arrived from Tauranga as part of a routine cargo voyage servicing New Zealand, Australia and the South Pacific islands.

A1.2. Stevedores employed by the private stevedoring company Wallace Investments Limited (WIL) carried out loading and discharging of containers. The stevedores used the vessel's three deck cranes to transfer the cargo between the vessel and the wharf.

A1.3. On 18 April 2022 the discharge of containers was complete and loading had started. Loading operations continued until the evening of 18 April when work stopped for the night.

A1.4. On the morning of 19 April 2022, two stevedore supervisors were rostered to oversee the cargo operation. The supervisors both arrived on site at approximately 0700 to discuss the plan for the day and to check that the wharf area and vessel were ready for cargo operations to start.

A1.5. At approximately 0730, the day-shift stevedores assembled at the vessel's gangway for a pre-start briefing given by the two supervisors. The briefing covered details of the loading plan for the cargo as well as safety-related information pertaining to the work activity (*see* paragraph A1.61).

A1.6. The stevedores were pre-organised to work in three gangs: one gang assigned to each of the vessel's three cranes. The stevedore involved in the accident was assigned to gang number three. Gang three was to load 47 containers using crane number three. The roles of the stevedores within the gang are described in Table 3.

Table 3: Stevedoring roles for gang three

Role	Role description	Number of roles
Hatchman	Responsible for the safety of the suspended load and communications with the crane driver	1
Crane operator	Operates one of the onboard cranes to bring containers on and off the vessel.	1
Hold operator[42]	Positioned onboard the vessel. The hold operators use their hands to help guide the containers into the correct position as they are being landed.	2
Wharf hand	Positioned on the wharf beside the vessel. The wharf hands fit the twist locks to the containers	2

[42] The deceased stevedore had been working as one of the two hold operators.

Role	Role description	Number of roles
	before they are lifted onto the vessel. The containers are also cross-checked against the loading plan to ensure the correct container is being loaded into the correct position.	
Machine operator	The machine operators drive hoists, collecting the containers from the container yard and bringing them to the wharf for loading.	2
Yardman	Positioned in the container yard doing general duties and locating the containers for the hoists to take to the wharf. The yard workers supported all three gangs.	4

A1.7. As loading was about to begin, the number one crane would not start. The issue was rectified, but the crane subsequently lost power again for approximately half an hour. To accommodate for the lost time, the supervisors redistributed some of the containers from gang one to gang two. One of the supervisors then left the port and went to the company office to query what was thought to be some missing cargo.

A1.8. By about 0850, gang three had loaded twenty 20-foot containers onto the main deck of the vessel in bay[43] 32 (*See* Figure 7). The crane's spreader[44] was then changed to accommodate the loading of 40-foot containers, which were to be stacked on top of the previously loaded 20-foot containers.

A1.9. At about 0910, the fifth 40-foot container was delivered from the container yard to the wharf for gang three to load. Two wharf hands from gang three fitted twist locks[45] to each of the four bottom corner castings[46] of the container. They attached the spreader onto the container and signalled to the number three crane operator that the container was ready to be lifted onto the vessel.

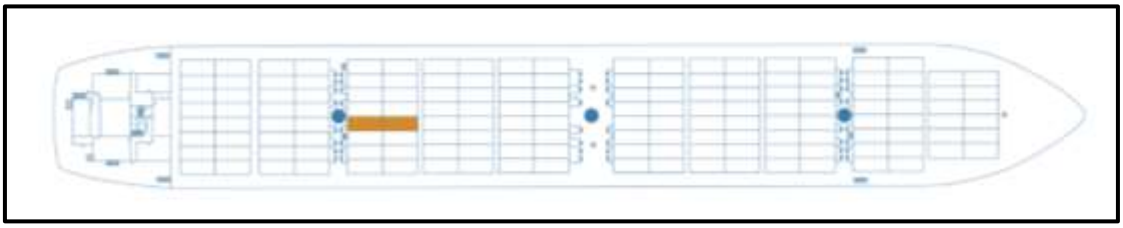

Figure 7: Plan view of Capitaine Tasman depicting container stowage in 20-foot units

The blue circles indicate the position of the three cranes.

The coloured box indicates position of the 40-foot container involved in the accident.

A1.10. At 0912 the crane operator lifted the 40-foot container from the wharf. The stevedores on the wharf observed it had an uneven weight distribution, resulting in

[43] Location numbers used to describe a containers longitudinal position on the deck of the vessel from forward.

[44] A spreader is a device that allows containers to be fitted to the hook of the crane. The spreader is attached to the four corners of the container to allow even weight distribution when lifted. *See* Glossary for photo of the spreader.

[45] A device used to connect the spreader to the corners of the container and for connecting containers together. *See* Glossary for picture of the twist lock used on this container.

[46] Castings are blocks of cast steel positioned on each of the 8 corners of a shipping container. Each casting has three holes to allow twist locks to be fitted so containers can be connected vertically or horizontally. *See* Glossary for a photo.

the container being on an incline when suspended so that the forward[47] end of the container was lower than the aft end.

A1.11. Two stevedores in gang three (hold operators A and B) were positioned on the second tier[48] of containers (*see* Figure 8). The hold operators' task was to guide the containers into the correct position as the crane lowered them. At the time the container was being lifted from the wharf, the hatchman had left the vessel to collect a rain jacket.

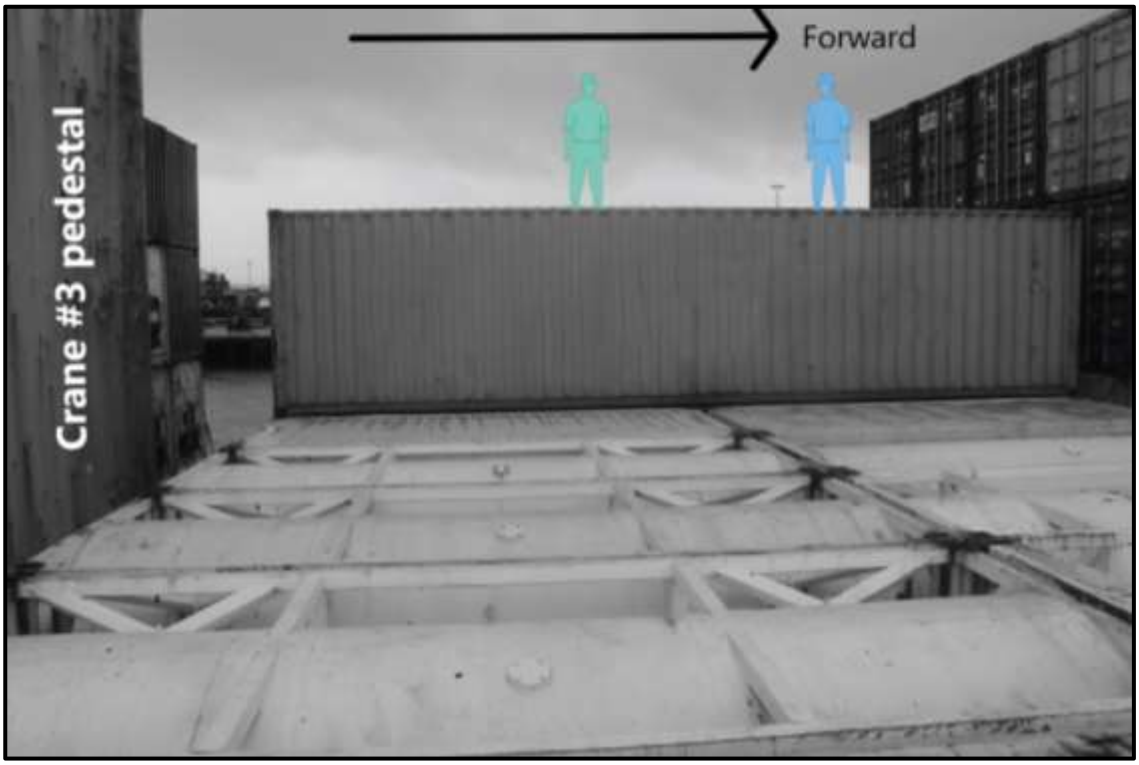

Figure 8: Hold operators A (green) and B (blue) on the second container tier

(Credit: Maritime New Zealand)[49]

A1.12. As the crane operator manoeuvred the container from the wharf onto the vessel, the forward port-side twist lock of the container made contact with a container on the bottom tier, resulting in the twist lock moving slightly within its casting.

A1.13. At 0913, the crane operator attempted to land the 40-foot container onto the vessel. However, the misalignment of the forward port-side twist lock prevented it from locking into the 20-foot container below. When the crane operator lifted the container back up to attempt to re-land it, the twist lock dropped out of its casting and fell onto the container below, obstructing the corner casting of the 20-foot container on which it was to rest.

A1.14. To rectify the issue, hold operator A (the deceased) descended onto the tier of containers below. To enable them to access the lock once they were down, the crane operator manoeuvred the 40-foot container so that its aft end was resting against the

[47] Reference to the orientation of the containers is in relation to the forward end of the vessel.

[48] Refers to the number of containers stacked on top of each other.

[49] Original photo has been modified to remove certain identifying features. Figures superimposed.

turret of the crane. Hold operator A then lowered themselves down onto the first tier of containers using the spreader wire for assistance.[50]

A1.15. Once down on the first tier, hold operator A repositioned the displaced twist lock into the top corner casting of the 20-foot container.[51] Hold operator A remained on the first tier of containers and hand-signalled to the crane operator that the landing could be re-attempted (*see* Figure 9).

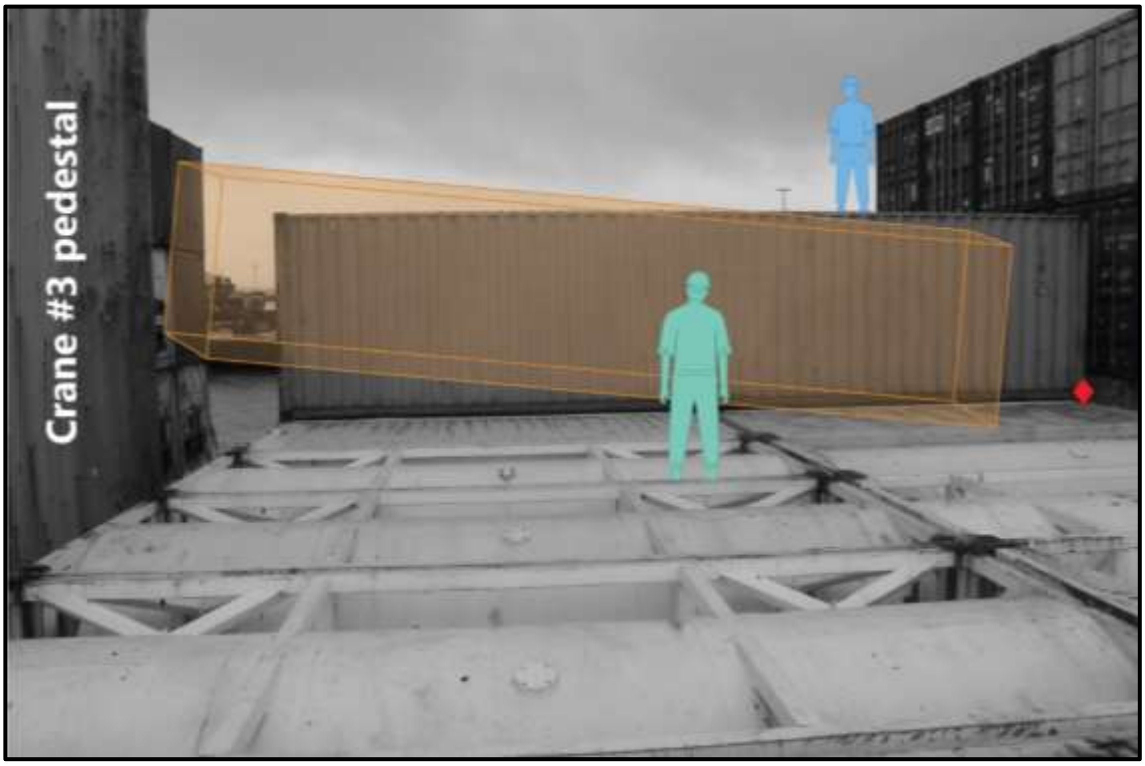

Figure 9: Approximate position of hold operator A (green) after repositioning the forward port twist lock (red diamond)

(Credit: Maritime New Zealand)[52]

A1.16. At about 0916, the crane operator raised the 40-foot container and began to reposition it for landing. The crane operator was taking signals from hold operator B, who had remained on top of the second container tier (blue figure in Figure 9). Due to the unequal weight distribution within the container, the crane operator landed the forward, heavier end of the container first and then lowered the aft end.

A1.17. As the container was being repositioned, one of the vessel's crew members was positioning lashing equipment[53] on the main deck. As they neared the turret of the number three crane, the crew member observed hold operator A standing on the edge of the row of 20-foot containers. They appeared to be in position to guide the aft end of the container as it was being landed (*see* Figure 10).

[50] When the chains and wire of the spreader are slack, a stevedore can lower themselves down a level of containers by hanging onto the wire for support, much like an abseiling movement.

[51] Placing the twist lock upside down into the top of the 20-foot container achieved the same result as placing it the correct way up into the bottom casting of the 40-foot container in that the containers would still lock together in the correct fashion.

[52] Original photo has been modified to remove certain identifying features. Figures superimposed.

[53] Rods and turnbuckles used to secure the first two container layers to the deck.

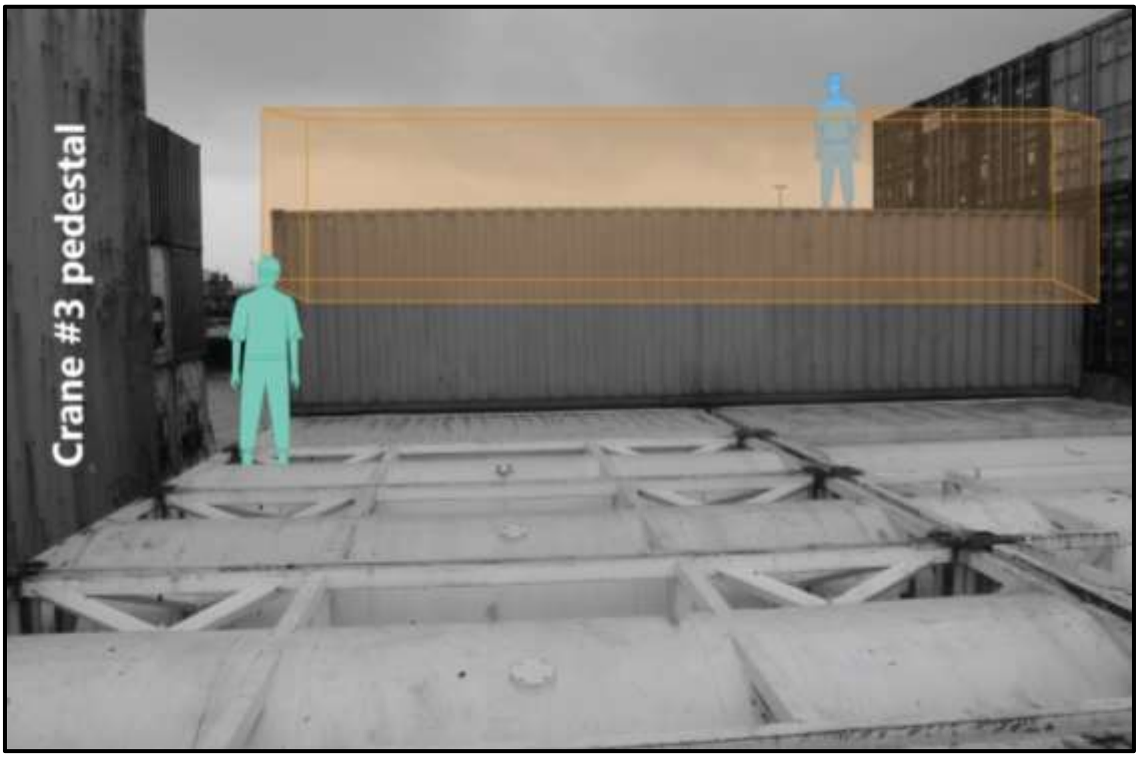

Figure 10: Approximate position of hold operator A (green) on the edge of the first tier of containers immediately before accident

(Credit: Maritime New Zealand)[54]

A1.18. At the time the crew member observed hold operator A, the 40-foot container was suspended approximately 1.5 metres above the first tier. The crew member then saw the hold operator bend down and move underneath the suspended container, reaching with their arm toward the aft port side of the container.

A1.19. Almost immediately after observing this, the crew member saw the container lower, resulting in hold operator A being pinned under the container and crushed by its weight.

A1.20. The crew member attempted to alert the crane operator by shouting but, due to the proximity of bay 32 to the number three crane, could not signal the crane operator visually. The crew member then observed the container rise a small amount and hold operator A fell from the 20-foot container onto the main deck (*see* Figure 11).

[54] Original photo has been modified to remove certain identifying features. Figures superimposed.

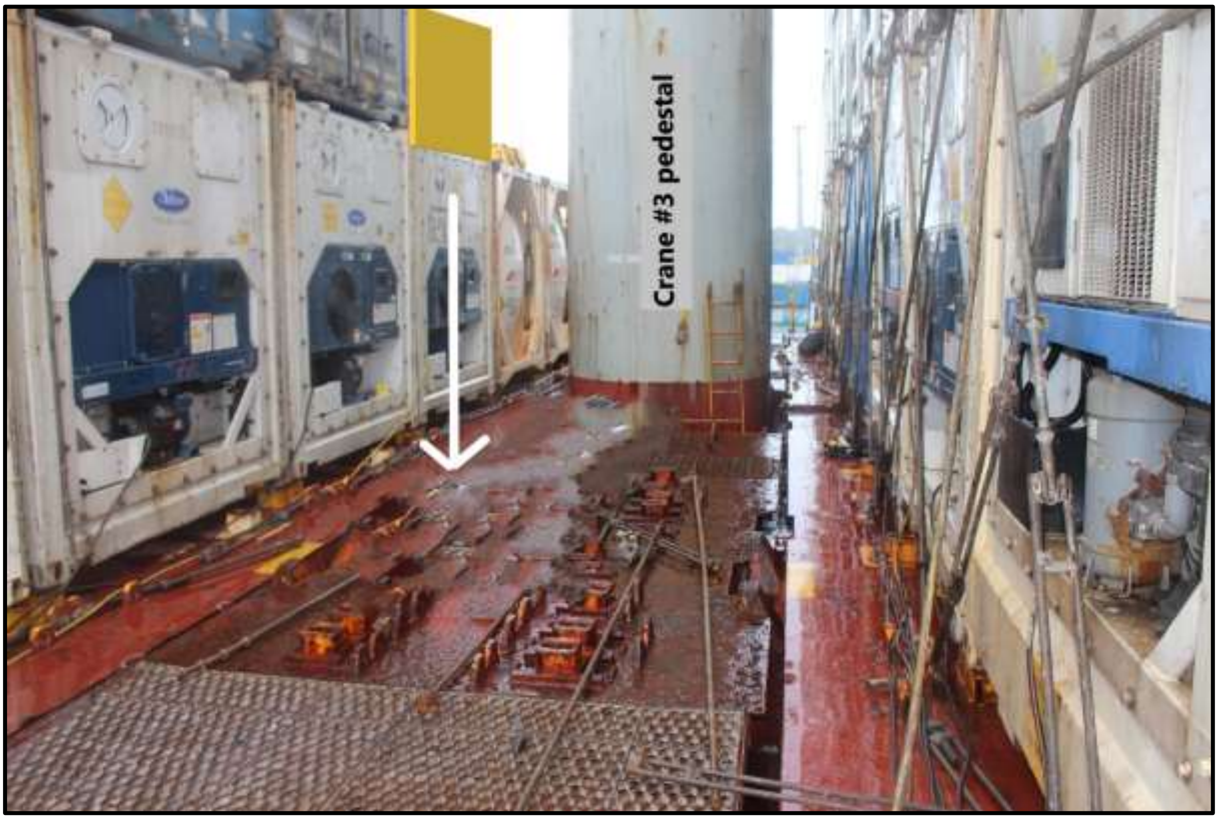

Figure 11: View from where the vessel crew member was standing on the main deck towards where hold operator A fell, as indicated by white arrow.

Yellow box represents where the container was to be positioned.

(Credit: Maritime New Zealand)[55]

A1.21. The crew member, who could not see hold operator B from their position on the main deck, ran to the starboard side of the vessel and alerted the other stevedores, who were working on the wharf.

A1.22. The crane operator, unaware of what had happened below, was having difficulty locking the aft end of the container in place, so stood up at the crane controls and looked down through the forward window of the crane cab (*see* Figure 12). The crane operator observed the victim lying face down on the vessel's main deck and shouted to alert hold operator B on the second tier of containers. The crane operator then used their cell phone and attempted to call the hatchman.[56] However, the call went unanswered.

[55] Original photo has been modified to remove certain identifying features. Images superimposed.

[56] *See* Table 3 for description of stevedore roles.

Figure 12: View looking down from outside the number three crane cab window

Point 1 indicates where the eyewitness initially observed the victim;
Point 2 indicates the victim's position when the container was lowered;
Point 3 is the approximate location of the eyewitness
who was standing below the containers on the main deck level.

(Credit: Maritime New Zealand)[57]

A1.23. Upon being informed of the accident by the crew member, the stevedores who were on the wharf boarded the vessel and attempted to render assistance. One of the supervisors who had been talking with gang three's hatchman at the vessel's gangway when the accident occurred, called emergency services on their cell phone.

A1.24. Within 10 minutes emergency assistance had arrived. The stevedore was pronounced deceased at the scene.

Personnel information

A1.25. Hold operator A was an employee of the Wallace Investments Limited (WIL) stevedoring company. They had joined WIL in 2018 and began by working in general duties[58] before moving up to work as a hold operator on containerised vessels. During their time at WIL, the stevedore had completed the New Zealand NZQA Level 3 Certificate in Port Operations (Cargo Handling).

A1.26. Hold operator B had also joined WIL in 2018. They also held a New Zealand NZQA Level 3 Certificate in Port Operations (Cargo Handling).

[57] Original photo has been modified to remove certain identifying features. Figures superimposed.

[58] General duties typically involve non-specialised tasks such as operating machines in the container yard, unlashing cars and containers.

A1.27. The hatchman, who had been working as a stevedore in Auckland for over 20 years, held NZQA Assessments 20048 *Operate Ships Crane*, and 18954 *Drive a motor vehicle within a port environment*. The hatchman also trained crane operators when required.

A1.28. The crane operator joined WIL in 1998 as a casual employee engaged in general duties. In 2004 they became a permanent employee and trained to operate cranes in 2005.

A1.29. Supervisor A had worked for WIL for approximately ten and a half years. They held a New Zealand NZQA Level 3 Certificate in Port Operations (Heavy Machinery).

A1.30. Supervisor B had previously been employed in an administration role at another stevedoring organisation before joining WIL in 1998.

Vessel information

A1.31. The *Capitaine Tasman* was a Singapore-flagged container vessel operated by the Neptune Pacific Agency Australia. The vessel had a capacity of 1,730 twenty-foot equivalent units (TEU) in its four holds and deck area.

Onboard lifting equipment

A1.32. The vessel's cargo-handling equipment consisted of three onboard cranes. Each crane was operated from a cab that was accessed via internal ladders within the crane pedestals.

A1.33. Each crane had the ability to slew[59] 360 degrees and had a safe lifting weight of 45 tonnes. Crane number three (*see* Figure 13) had a work radius[60] of 3.5 metres to 29.0 metres and the maximum hoist speed with a load was 19 metres per minute.

Figure 13: Crane number three

[59] Movement of the crane boom in the horizontal plane.

[60] The horizontal distance from the centre of rotation to the centreline of the crane hook.

A1.34. Routine maintenance for the cranes included an annual service of the cargo hooks and crane sheaves[61] by the vessel crew. Every three months, the cranes were greased and the wires were inspected. Each month a visual inspection and test of the cranes was carried out. The most recent monthly visual inspection had occurred on 27 March 2022. A rocking test[62] on all three cranes had been conducted on 26 March 2022.

Recorded data

A1.35. Ports of Auckland Limited provided CCTV footage of the accident to the Commission.

Medical and pathological information

A1.36. The hold operator sustained crush injuries as a result of the accident. The accident was fatal. Toxicology results were negative (clear) for any performance-impairing substances.

Organisational information

Ports of Auckland Limited

A1.37. Ports of Auckland Limited (POAL) is a public company, wholly owned by Auckland Council. The port's multi-cargo facility encompasses five wharves, including Jellicoe Wharf where the *Capitaine Tasman* was berthed at the time of the accident. The multi-cargo division of POAL manages the berthage and wharf space for cargo vessels servicing Auckland. This includes container vessels, vehicle carriers and multi-purpose general-cargo vessels for bulk and breakbulk[63] cargo.

A1.38. Many of the port's activities are continuous over a 24-hour period, including some stevedoring activities. POAL's multi-cargo operations staff were on site from 0700 to 2300 on weekdays and from 0700 to 1500 on weekends. Outside these hours an on-call function was provided.

A1.39. Cargo-handling services at the port were provided by either POAL or privately operated stevedoring companies. At the time of the accident there were two primary stevedoring companies, one being WIL. Procurement of WIL stevedore services involving vessels did not involve POAL; arrangements were made directly between the shipping companies or their shipping agents and WIL.

A1.40. When required to help separate different operations on the multi-cargo wharf area, POAL allocated workspaces using concrete blocks or cones. Within these workspaces, whoever was conducting the operations was responsible for all aspects of the activity including safety. Common areas of the port, such as roadways or shared container areas, required each operator to follow POAL's Common User Safety Protocols (CUSP).

[61] The grooved wheels that hold and guide the crane wires.

[62] A rocking test checks the condition of the slew bearing of the crane, ensuring that it is not becoming worn because of insufficient greasing.

[63] Breakbulk refers to cargo that is transported in individual units as opposed to standard shipping containers.

A1.41. POAL contracted WIL as their multi-cargo inter-wharf service provider. This service provided transportation and stacking of containers between the various wharves. When an operator contracted directly to POAL, such as WIL did when providing multi-cargo inter-wharf services, they were required to follow the CUSP.

A1.42. If an on-wharf operator had a contract with another organisation for services provided at the port (such as the contract between a stevedoring company and a shipping company), responsibility for worksite safety was managed between the two parties. In these cases, POAL staff would have some degree of oversight of the operations taking place on the wharf. If dangerous activity was observed, POAL could intervene or issue a stop-work notice to the operator.

A1.43. Operations taking place onboard the vessels were not monitored by POAL. Any work within a vessel's hold was unable to be observed by the CCTV units on the wharf.

Wallace Investments Limited

A1.44. At the time of the accident, Wallace Investments Limited (WIL) was the largest private stevedoring company operating on the Port of Auckland. WIL was established in 1998 and specialised in conventional cargoes. WIL handled most containerised operations at the port as well as the multi-cargo inter-wharf services.

A1.45. WIL employed approximately 200 stevedores including twelve supervisors. WIL's management structure consisted of a Managing Director and a General Manager. They were supported by an Environment, Health and Safety (EHS) Manager and two EHS Supervisors.

Staff training

A1.46. Stevedore training provided by WIL for the different roles was through on-the-job training and shadowing other stevedores.

A1.47. Crane operator, hold operator and hatchman duties required more formalised training and an assessment conducted by a training supervisor.[64] All employees were also able to enrol in the NZQA Certificate in Port Operations as part of their training and development.

A1.48. Safety training for new WIL stevedore employees consisted of a generic POAL induction video. Stevedores were also required to watch a WIL safety-induction video that covered evacuation procedures, how to report safety issues, hazard awareness, staff responsibilities for safety, the role of the health and safety committee, and general safety rules such as drug and alcohol use, PPE, vehicle safety and accident management.

A1.49. Following an accident onboard the *Capitaine Tasman* in 2021 (*see* paragraph A1.56), additional safety-related training had been developed around working at heights. This included use of the man-cage, the requirement to be harnessed when working less than two meters from an exposed edge, and the order in which to stack containers to maximise a safe work area for hold operators.

A1.50. Safety messaging, including the dangers of suspended loads, was also presented through a video feed in the lunchroom.

[64] WIL employed two training supervisors who assessed different types of stevedoring operations in accordance with NZQA standards.

Stevedore gang structure

A1.51. When operating all three cranes on the *Capitaine Tasman*, the stevedores worked in three gangs, each gang working with one crane.

A1.52. At WIL, stevedores working in the hatchman role were also assigned the title of 'foreman'. While there were no formal responsibilities associated with this title, those working in the hatchman position were typically the most experienced stevedores and the role of foreman was understood by the gang to hold an element of leadership within the gang.

Container loading procedures

A1.53. WIL's operational procedures described the work activity required to load and discharge cargo on a container vessel.[65] The procedures were broken up into 12 subtasks. Subtask number eight described the off-load procedure in detail and stated that the process was to be reversed for loading of containers:

- Lashers unlash containers as per instruction of foreman
- Hatchman directs crane operator to container to be lifted
- Crane operator positions wire in correct position
- Hold operators attach spreaders, wires and hooks securely to container and signal when completed
- Hatchman directs crane operator to move container to position on wharf
- When container secure on wharf, general hands unhook wire (if used) from container
- General hand notes the container number in the appropriate log
- Directs mobile operator to move container to yard

A1.54. Roles and responsibilities during container loading operations were also documented in the procedures.[66] The supervisor responsibilities included:

- Facilitate that the vessel is planned and worked in a safe way
- Communicate to all personnel working on or around the vessel regarding the operating and any hazards that may be encountered
- In the event you identify procedures not being followed, STOP and rectify
- Make regular observation of all personnel working under them and remedy any shortfalls
- Encourage employees to report all hazards they encounter.

The foreman/hatchman responsibilities were listed as:

- Be clearly visible to the crane driver always. If this is not possible other means of communication shall be used eg, portable radio
- Give the crane driver clear and efficient signals using standardised signals
- Keep the hook in sight as much as possible

[65] WIL-SWMS-002 Safe Work Method Statement – Discharge/Load Containers

[66] WIL-SOP-068 Roles and Responsibilities – Container Vessels

- Check that the load is fully hooked on or unhooked and the load does not exceed the SWL of the gear before giving the signal to hoist
- Do not walk away from hatch when a load is on the way up – Foreman should follow units until they (units) are at rest ie, on vessel/wharf. Not to lose contact visually with unit until unit at rest
- Do not allow any improperly slung load to be lifted
- In the event you identify procedures not being followed, STOP and rectify.

The crane operator responsibilities included:

- Follow all signals given by the Hatchman
- Follow stop signals given by any person as it may be an emergency.

The hold operator responsibilities included:

- Be clearly visible to the crane driver always. If this is not possible other means of communication shall be used eg, portable radio
- If required give the crane driver clear and efficient signals using standardised signals.
- If you observe personnel venture within 2m of an unprotected edge with no fall protection, STOP operation till procedure is adhered to
- Avoid personnel standing or passing under suspended loads by either directing personnel away from working an area or not directing movement of the load until area is clear One person shall be in sight of the foreman to give emergency signals
- Keep the hook in sight as much as possible
- Get into a safe position when a load is on the way up or down.

A1.55. Other, more general procedures included the following instructions:

For the hatchman:[67]

- The hatchman is responsible for any suspended load at all times
- Ensure that the hook is in sight at all times
- Do not leave position until crane driver is safely on deck.

For the crane operator:[68]

- Follow instructions of hatchman and staff at all times
- Obey all signals given by the hatchman.

For the deck and hold operations:[69]

- Don’t work under suspended loads.

Risk Management

A1.56. About 15 months before the accident, WIL initiated a review of their SMS. This was partly in response to an accident in February 2021, in which a stevedore suffered

[67] WIL-SOP-05 Standard Operating Procedure – Hatchmen

[68] WIL-SOP-027 Standard Operating Procedure – Crane Operator

[69] WIL-SOP-009 Standard Operating Procedure – Deck/Hold Cargo Operation

serious injuries when they fell from height while loading containers on the *Capitaine Tasman*. As a result of the review, WIL were taking steps to improve management of their workplace safety, including upgrading technology, an external quality accreditation, appointment of a new safety manager, and introduction of a critical risk management framework.

A1.57. In January 2021, WIL began transitioning to a new software platform, Mango, to manage their health and safety system and improve internal audit functionality and capability. At the time of this accident in 2022, WIL was not yet using all the safety management functionality that the Mango platform was able to provide, and further customisation was being developed.

A1.58. In May 2021, WIL conducted an internal gap analysis in preparation for ISO 45000 safety accreditation.[70] Certification was achieved in November 2021 following two Telarc[71] audits across a period of three months.

A1.59. In August 2021, WIL appointed a new EHS manager. Following a series of internal audits, on-job observations and review of WIL's health and safety data, the EHS manager developed a critical-risk-management framework. WIL was in the process of rolling out the framework at the time of the accident and new documentation on how critical risks were to be identified, managed and reviewed had been issued on 9 February 2022,[72] two months before the accident.

A1.60. Ten critical risks had been identified by WIL across all stevedoring activities undertaken. These included falling from height, crushing and lifting operations. Critical risk controls were known as 'lifesavers'. These were: equipment inspections, vehicle pre-start checks, safe zones, use of positive communication between personnel, following procedures, being trained and competent for the task, and working to the conditions.

A1.61. The supervisors overseeing the gangs conducted pre-start meetings at the beginning of every shift on an operational worksite. Critical risks associated with each role within the gang were identified along with the applicable lifesaver controls. The briefings were recorded on a whiteboard and were photographed and uploaded to Mango for safety assurance purposes. The pre-start board for 19 April 2022[73] is shown in Figure 14.

[70] ISO 45001 is an international standard for health and safety in the workplace.

[71] Telarc Limited is a Crown Entity Subsidiary owned by the Accreditation Council and recognised as a Certification/Registration Body by the Joint Accreditation System – Australia and New Zealand.

[72] WIL-SOP-100 Critical Risk Management.

[73] The date on the board has been changed to reflect the pre-start briefing which took place when operations resumed following the accident, however, the content remains the same as it was on the morning of the event.

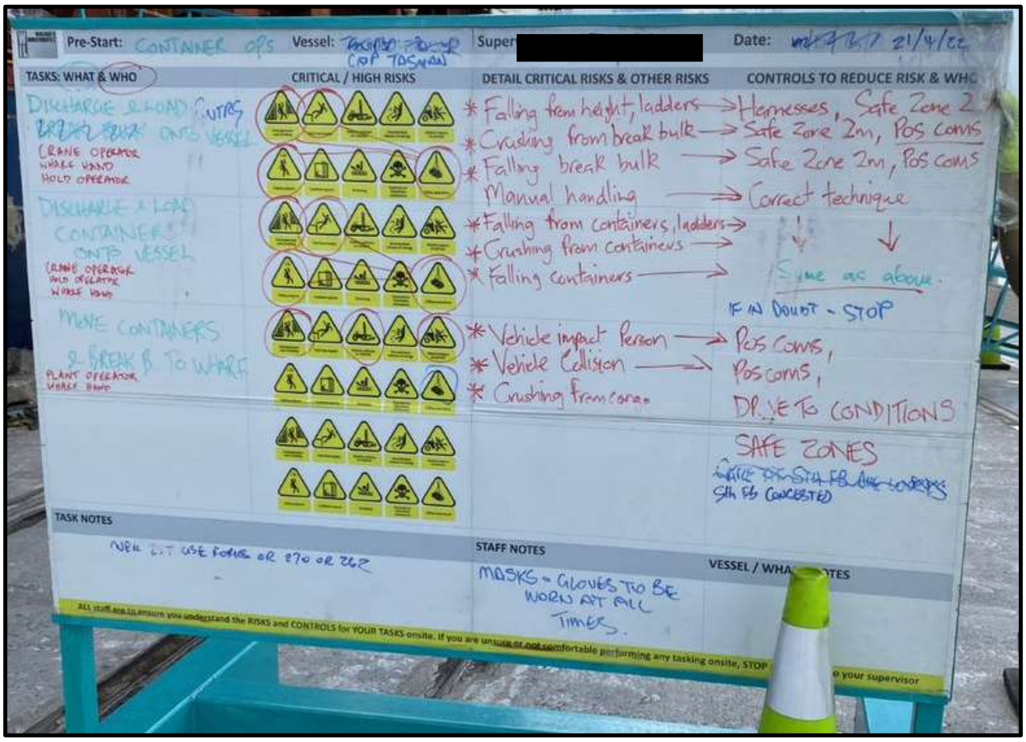

Figure 14: Pre-start meeting board

(Credit: Wallace Investments Limited)

Safety Assurance

A1.62. Following their ISO accreditation in November 2021, WIL had undertaken work to further develop their internal safety-assurance processes. This included expansion of their internal audits as well as improvements in their incident and hazard reporting.

A1.63. At the time of the accident, WIL had procedures in place for Safe Act Observation (SAO). This was a move to encompass more proactive safety assurance, whereby any employee could report an example of work conducted safely. Introduction of SAO allowed for Key Performance Indicators (KPIs) to be established to measure safe working practices and employee reporting rates within the safety system. Previously, only incidents or non-compliances had been recorded, and training competencies had not been assessed against a regular schedule and were only conducted in response to safety-related incidents.

A1.64. Other recent safety-assurance measures included: verification that any corrective actions raised from an internal safety investigation were appropriately addressed and closed (VERA); verification that any newly established procedure had been appropriately implemented (VIP); and quarterly internal audits of high-risk environments. These processes were supported by regular safety meetings, which included the daily pre-start meetings. Quarterly EHS meetings were established and these informed WIL Management Review meetings. As a major on-wharf operator, WIL also attended regular multi-cargo health and safety meetings chaired by POAL.

A1.65. Employees of WIL were encouraged by management to raise any safety concerns with their supervisors on site. This included hazards, near misses, incidents or accidents, as well as any unsafe behaviours that were observed. Paper-based forms were also available in the gear store and lunchroom. The introduction of the new Mango safety software, in 2021, allowed reporting to be done via an electronic app. At the time of the accident, this function was primarily used by supervisors to capture issues raised verbally with them by the stevedores. Reports submitted into the system were reviewed by the EHS team to determine whether any further follow-up by way of an internal investigation was required.

Regulatory oversight

A1.66. As a stevedoring company undertaking work onboard a foreign-flagged vessel, WIL had a duty of care for the health and safety of its employees whilst operating on the *Capitaine Tasman*. The HSWA-GRWM regulations[74] required WIL to demonstrate that they were identifying hazards and managing risk regarding specific situations. This meant WIL had to eliminate risk as far as reasonably practicable, and then to minimise any relevant remaining risk as far as reasonably practicable.

A1.67. WIL reported any notifiable events under HSWA to Maritime New Zealand (MNZ). Depending upon the severity of the event, MNZ could investigate and impose sanctions. Following the accident on 19 April 2022, MNZ issued WIL with a Prohibition Notice.[75] MNZ inspected WIL's container operation on 23 April 2022 and subsequently lifted the prohibition.

A1.68. Aside from the high-level joint HSWA assessments of the major commercial ports by MNZ and WorkSafe, action taken by the regulators was largely because of an accident or incident. There was little proactive safety interaction between either WorkSafe or MNZ and WIL. There were no requirements for either regulator to inspect or review WIL's safety management system.

[74] HSWA-GRWM Part 1 *General duties* rr (5), (6), (7), (8).

[75] Instruction to stop workplace activity until further notice.

A2. Analysis
Tātaritanga

A2.1. This section analyses the circumstances surrounding the event to identify those factors that increased the likelihood of the event occurring or increased the severity of its outcome. It also examines any safety issues that have the potential to adversely affect future operations.

A2.2. During container loading onboard the *Capitaine Tasman*, a stevedore working as a hold operator moved under a suspended 40-foot container that was subsequently lowered. The stevedore's movement was unobserved by any of the other stevedores working in the gang.

A2.3. WIL was continually improving its SMS. However, safety processes were not adequate to provide assurance that all hazards were being effectively controlled.

Rectification of the displaced twist lock

A2.4. Loading operations had been uneventful for gang three until the movement of the fifth 40-foot container, which was being stacked as part of the second tier in bay 32. The container had an uneven weight distribution, resulting in the forward end hanging lower than the aft end. The crane operator became aware of the imbalance as they lifted the container from the wharf but did not consider the load to be unsafe or difficult to manoeuvre.

A2.5. The crane operator attempted to compensate for the imbalance as they slewed the container across the first tier of the stack. However, in not raising it high enough to compensate for the imbalance, the proximity of the lower hanging forward end to the first tier of containers was such that the port-side twist lock made contact with one of the containers and caused it to dislodge in its casting. As the container was being landed, the twist lock fell out and became stuck in the corner casting of the container below.

A2.6. Twist locks falling out of their castings is not uncommon, particularly in the case of the automatic twist locks that were being used on the *Capitaine Tasman*.[76] In this case the lock had to be physically removed for the container to be landed properly. To get down from the second tier of containers to the first tier, the hold operator could either have used the man-cage[77] or the spreader wire.

A2.7. Using the man-cage would have required the crane operator to transport the container back to the wharf for the wharf hands to disconnect the container from the spreader and enable the spreader to return to the vessel. A hold operator could then have stood in the spreader's man-cage and been lowered by the crane operator onto the first tier of containers. After repositioning the twist lock the hold operator could have ridden back in the man-cage up to the second layer of containers. The crane

[76] Automatic twist locks automatically lock when containers are placed on top of one another and unlock without stevedoring intervention when the containers are lifted.

[77] A man-cage is a small area on the top of the spreader that has a circular metal bar at approximately waist-height. Stevedores can stand on this part of the spreader and clip their harnesses on to the bar before being lifted up and down by the crane. Containers are not attached to the spreader when transporting stevedores in the man-cage. *See* Glossary for a picture of the spreader man-cage.

operator would have then returned the spreader to the wharf and had the container reconnected ready for loading.

A2.8. The second option was to use the wire technique, using the spreader wire. This involved a crane operator resting the container down until the chains and wire of the spreader were slack. A hold operator could lower themselves down the container by hanging onto the wire for support. This was the technique hold operator A used on the day of the accident.

A2.9. As part of their safety improvements around working at heights, WIL had elected to discontinue using the wire technique approximately a year before the accident. Personnel were to stand in the spreader man-cage when being transported to and from a container[78] and were instructed not to ride wires or chains.[79] However, using the spreader wires was a quicker means of moving between container tiers, as it did not require time for the container to be removed ashore. Information provided to the Commission during interviews indicated that some employees still regularly used this method despite the change in procedures.

Findings

1. The wire technique used by hold operator A to descend from one tier of containers to another was no longer an approved practice, but was still being used by stevedores at the time of the accident.

Unseen movement under the suspended load

A2.10. After the twist lock had been refitted, hold operator A moved into a position where the crane operator was able to see them and signalled to the crane operator for the container to be re-landed. It was the last time the crane operator saw hold operator A, whom they expected to remain in the same position until the container had landed. Hold operator A was also out of sight of hold operator B, who remained on the second-tier containers. From this point on, the crane operator was focused exclusively on hold operator B on top of the second tier as they needed to follow their signals to land the container.

A2.11. Because the heavier (forward) end of the container needed to be landed first, hold operator B had moved to the forward end of the container stack. The result of this was that the crane operator's attention was now being directed away from hold operator A on the first tier. Exacerbating this was the proximity of bay 32 to the pedestal of the crane; when the crane operator was seated in the cab, the final movements of hold operator A on the first container tier could only have been observed by looking through the floor grating (*see* Figure 15).

A2.12. At the time of the accident, the floor grating was partially covered by the crane operator's bag and by a loading plan that had been left on the floor by a previous operator. These items restricted visibility through the floor grating and reduced any

[78] WIL-SOP-026 PPE.

[79] WIL Safe Work Pack, Accessing and working at height on containers - Vessels v. 3.0.

opportunity to observe hold operator A moving into an unsafe position. However, the Commission believes it is **unlikely** that the crane operator would have noticed the hold operator's movement even if they had unrestricted visibility.[80]

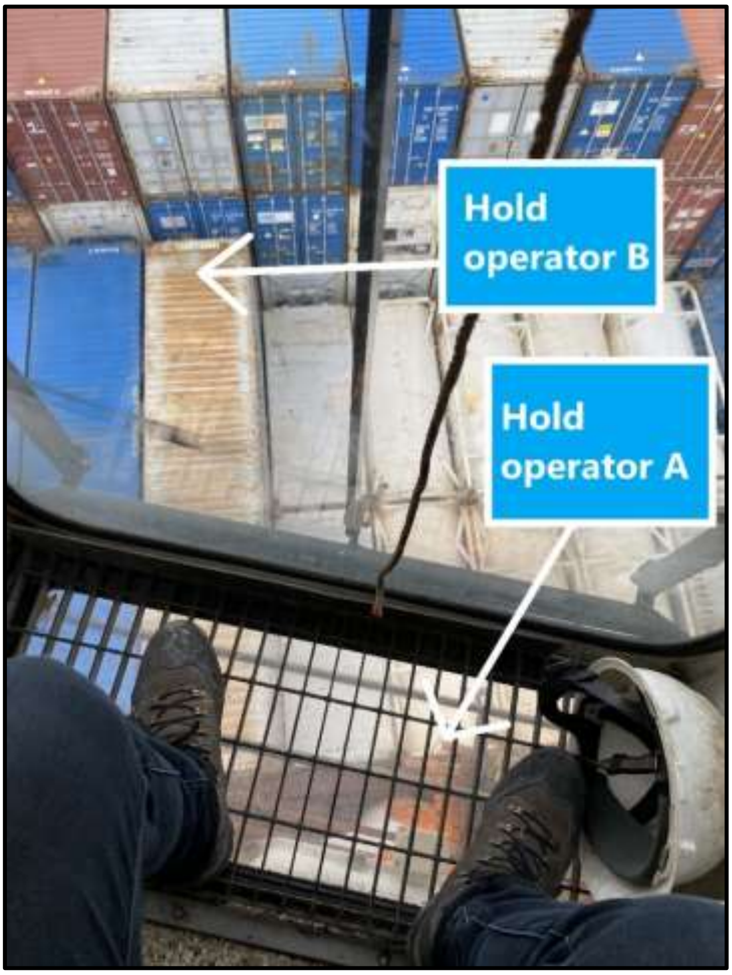

Figure 15: View through crane floor grate

(Credit: Wallace Investments Limited)

A2.13. Why hold operator A moved under the container while it was suspended is unknown, but it is **likely** they became aware of an issue with the twist lock fitted to the aft end of the container. The vessel's crew member saw the hold operator quickly ducking under the load and appearing to stretch out their hand toward the port side of the container. Further, following the accident when the container was returned to the wharf, only the two starboard twist locks were found in their castings. The port-side forward twist lock had remained in the top of the 20-foot container's casting, where hold operator A had repositioned it after it had become displaced, however the aft port side twist lock was missing from its corner casting on the 40-foot container.

A2.14. A twist lock was subsequently found on the vessel's main deck in the immediate vicinity of where hold operator A fell. It did not belong to the vessel[81] and was

[80] Changes in the environment are less likely to be noticed during tasks demanding increased attention, as the visual angle between the location of the change and the fovea increases, and the more that an event is unexpected to occur (Wickens et al., 2021).

[81] Container vessels carry their own supplies of lashing gear. Each ship will have different types of locks for different areas of stowage. However, these locks will all be produced by a particular manufacturer. In the case of the *Capitaine Tasman*, all the lashing equipment was manufactured by German Lashing. Locks are not to be

different from those being used on the *Capitaine Tasman*.[82] It is considered **likely** that this lock had been fitted by the wharf hands before the container coming on-board the vessel. The lock was similar in design to the twist locks being used on the *Capitaine Tasman* and may not have been recognised as being different from the others being fitted. As container corner castings are manufactured to a universal standard, the lock would fit normally when inserted. Had hold operator A noticed the presence of a different lock while the container was still suspended, or if the lock appeared misaligned in some way because of the different design, it may explain why they moved underneath the load.

A2.15. The dangers posed by suspended loads and the potential for crush injuries to occur was communicated to stevedores during their training and as part of the daily pre-start meetings. It is **virtually certain** that hold operator A was aware of this risk. However, familiarity with a task can lead to more automated behaviour and an increased vulnerability to error (Rasmussan, 1982; Reason, 1990).

Findings

2. Hold operator A suffered crush injuries when they moved underneath a suspended 40-foot container that was subsequently lowered.

3. It is **likely** that hold operator A moved underneath the container to rectify an issue with the aft port-side twist lock.

4. Hold operator B was unaware of the position of hold operator A when they signalled to the crane operator to lower the container.

5. Although visibility from the crane operator's cab was limited by objects covering the grating, it is **unlikely** that the crane operator would have noticed hold operator A moving underneath the container.

Risk management for container loading operations

A2.16. A central tenet of risk management is to ensure there are appropriate controls in place to guard against harm. This includes harm that may occur because of human error or an unsafe behaviour or act. While it is not known for certain why hold operator A moved under the suspended load, a situation where they were able to do so without being observed by the other gang members should not have been able to occur.

A2.17. Working at the same level of the container stack allowed the two hold operators to remain in sight of each other and observe any unsafe behaviours should they occur. However, once hold operator A had refitted the displaced twist lock, they elected to remain on the lower level of containers rather than return to the second tier. This

mixed between vessels and the *Capitaine Tasman's* Cargo Securing Manual explicitly stated 'Mixing of smart locks with other types of locks or other maker's locks is not allowed'.

[82] The correct lock for the 40-foot container was a SL-1 Smartlock manufactured by German Lashing. The lock found by where the stevedore fell was a TL-FA Smartlock made by a different manufacturer.

increased risk by creating a situation whereby neither of the two hold operators could see the other.

A2.18. WIL had no specific policy to prohibit working on separate levels of the container stack and this had not been considered as part of the risk-assessment process. As a result, there were no additional control measures identified that may have better protected those working in a heightened-risk environment. This permitted a situation whereby hold operator B could signal the crane driver to lower the container without requiring visual confirmation that hold operator A was in a safe position.

A2.19. Although a 'lack of understanding of responsibilities' had been identified by WIL as a potential risk, at the time of the accident there were ambiguous procedures for signalling the crane operator.

A2.20. WIL's procedures stated that the hatchman was responsible for signalling, but that the hold operators could signal the crane operator if required. Similarly, the crane operator was instructed to obey the signals of the hatchman, but could also take signals from staff. There was no requirement for the hold operators to have one another in sight before signalling, nor was there any requirement for the crane operator to have both hold operators in sight before manoeuvring a load.[83] As to the hatchman responsibilities, in one piece of documentation, the hatchman was instructed to keep the crane's hook in sight 'at all times', yet in another, it was only to keep the hook in sight 'as much as possible'.

A2.21. At the time of the accident, the hatchman had left the vessel to find a rain jacket and then talked with a supervisor at the gangway for around 10 to 15 minutes. While this was not unusual behaviour for a hatchman, who typically moved between the vessel and the wharf at various times, it did not conform with the duties outlined in the operational documentation.

A2.22. The gang three hatchman considered their role was to oversee all aspects of the gang's work, including making sure people were operating safely, as well as checking the wharf hands were tallying the containers correctly and cross-checking that the containers were going to the correct places onboard. These activities were not documented by WIL as part of the hatchman's role for container operations.

A2.23. Formal oversight of the vessel-loading operation was the supervisors' responsibility. The 'foreman' title assigned to the hatchman role had no specific tasks associated with it but implied they had a leadership position within the gang. This **likely** created a situation in which those working in the hatchman role with the additional title of foreman felt a sense of responsibility to oversee other aspects of their gang's work.

A2.24. WIL had recognised that a lack of understanding between roles within a gang was a potential risk when loading container vessels,[84] but their procedures were ambiguous and contradictory. One of the hazards that had been identified for container vessel operations was 'Not understanding the responsibilities, leading to harm'. However, a documented control measure for this hazard was listed as 'Responsibilities get shared

[83] In circumstances where the crane operator could not see either hold operator to receive signals, such as loading into a vessel's hold or when the crane operator was operating 'blind' (loading/unloading over a container stack), they were required to use a radio for communication.

[84] WIL-SOP-068 Roles and Responsibilities – Container Vessels.

to ensure personnel stay safe', a concept that is counterintuitive to having clearly defined responsibilities.

A2.25. At the time of this accident, neither the hatchman, the crane operator nor hold operator B had sight of hold operator A before the container was lowered, nor was this an explicit requirement as part of signalling procedures. A lack of procedural clarity led to a diffusion of responsibility within the gang and there was only one risk-control measure preventing a crushing accident, being a reliance on stevedores not putting themselves in an unsafe position.

Findings

6. The hold operators were working on different levels and did not have sight of one another, increasing the risk of a crush injury.
7. The procedures for container loading included unclear, contradictory and ambiguous descriptions of role responsibilities.

Supervisory oversight

A2.26. While many of the inherent risks associated with stevedoring can be difficult to eliminate, the majority of WIL's risk controls were administrative in nature.[85] Administrative risk controls refer to interventions such as training, procedures and warnings as a means of mitigating risk. Administrative risk controls and PPE are often applied to existing processes where hazards are not well controlled (United States National Institute for Occupational Safety and Health, 2022).

A2.27. Administrative risk controls can provide a defence against hazards but as they are human-centric by design, their effectiveness relies heavily on workers conforming to expectations, despite the many factors known to influence human behaviour. The use of administrative risk controls, such as documented safety procedures, requires considerable effort by front-line workers and an effective level of supervisory oversight (United States National Institute for Occupational Safety and Health, 2022).

A2.28. WIL required the use of an arrestor system[86] when a worker was positioned less than two metres from an exposed edge. Whilst hold operator A was wearing a harness, they did not tether themselves to anything before moving outside their safe zone.

A2.29. Motivation to follow procedures varies with an employee's perception of risk. Even in hazardous situations, it is natural to become desensitised to risk over time, particularly when adverse consequences infrequently occur. In such situations, simply reminding people to follow procedures or not to put themselves in harm's way, such as the discussion that took place at the daily pre-start meetings, is seldom effective and should not be overly relied upon for the assurance of safety.

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[85] *See* Figure 5 for hierarchy of risk controls.

[86] Consisting of a harness and the ability to be tethered to an anchor point.

A2.30. Supervisory oversight provides an additional layer of defence by detecting the presence of at-risk behaviour. The underlying reasons it is occurring can then be examined within the wider safety system. Choosing to use the wire technique instead of using the man-cage on the spreader to change between container levels was a shortcut. While employees often take shortcuts to achieve an outcome, the reasons for doing so vary.[87] At WIL, stevedores were paid for a full shift of work, regardless of how many hours were worked. There is potential for such an arrangement to act as motivation to take shortcuts in order to leave work early. Regardless of whether that was a factor in this accident, the Commission considers it is important to explore sources of system-induced behavioural risk.

A2.31. Supervisors must be supported to be *particularly* focused on safety, not just on productivity or other business demands (Safe Work Australia, 2006).[88] Two supervisors were assigned to oversee the loading operation on the day of the accident. WIL had purposely designed the supervisor role to be one that was present at the vessel and could actively supervise loading operations. However, given the extent of the supervisor responsibilities, it was not possible for them to observe stevedore behaviours across three gangs. This reflects an insufficient understanding of the importance of supervision when relying on administrative risk controls.

A2.32. At the time the accident occurred, there was only one supervisor onboard the vessel. This was not unusual as the supervisor role included overseeing loading operations to check they were being conducted in accordance with the plan, which often required trips to and from WIL's office.

A2.33. The presence of at-risk behaviours, such as not using a harness and using the wire technique that WIL no longer condoned, are indicators that supervisory oversight was not an effective risk control. There was a disconnect between the documented procedures and how operations were being conducted on a day-to-day basis.[89] It demonstrates how WIL's administrative risk controls appeared robust on paper yet in practice proved to be ineffective.

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[87] *See* 'Effectiveness of administrative risk controls' in Section 2 of this report.

[88] Emphasis as in original.

[89] Situations such as this are described as 'work done versus work imagined' meaning that documented procedures that are written are often significantly different from how activities are conducted by those on the front line.

Findings

8. Hold operator A was not using their fall arrestor system while positioned outside a safe zone (less than 2m from an exposed edge).
9. The presence of at-risk behaviour in the form of non-adherence to procedures indicated a desensitisation to risk and an insufficient understanding of the importance of effective supervisory oversight.
10. Many of WIL's risk control measures were administrative in nature and required a high degree of compliance oversight to ensure they were effective.

WIL Safety Management System

Safety issue: At the time of the accident, WIL's SMS was still in development and had not reached the level of maturity required to provide assurance that risk controls were adequate or that all hazards were identified.

A2.34. WIL was in the process of improving their SMS at the time of the accident. The introduction of new safety-reporting systems and the development of a critical-risk framework were examples of this. However, some operational activities fundamental to an SMS were not effective, specifically processes related to safety assurance.

A2.35. Safety assurance can be described as:

> a continuous, ongoing activity aimed at ensuring that the initial identification of hazards and assumptions in relation to the assessment of the consequences of safety risks, and the defences that exist in the system as a means of control, remain valid and applicable as the system evolves over time (International Civil Aviation Organization, 2018).

For a safety system to be effective, a continuous cycle of monitoring and reviewing operations must be in place to provide assurance that hazards are being adequately controlled. Where there is a high dependency on administrative risk controls, such as at WIL, this should include verification of employee behaviour to ensure that procedures are reflective of the way work is being conducted. Any inconsistencies can be indicative of problems either with behaviour or with the procedures themselves.

A2.36. The risks associated with discharging and loading containers were detailed in WIL's Safe Work Method Statement,[90] which had last been reviewed on 14 September 2020. Each of the 12 subtasks were assigned a primary risk score depending on the hazards associated with the task. Control measures were prescribed, which reduced the risk score.

A2.37. Moving containers to and from the wharf had five hazards identified, including crush injuries. The primary risk score for this subtask was Medium. Three control measures had been prescribed to address this risk:

[90] WIL-SWMS-002 Safe Work Method Statement – Discharge/Load Containers

1. Containers only moved on instruction of hatchmen
2. Good hand signals and radio communication between foreman, hatchmen, crane operator and hold operators
3. Careful manoeuvring of spreaders, wires and hooks onto the load by the hold operators.

As a result of these measures, the risk score was reduced to Low. However, the procedures did not reflect how container operations were being conducted and therefore negated the risk control. Had an effective safety-assurance system been in place it is **likely** that these discrepancies would have been captured.

A2.38. At the time of the accident, WIL's mechanisms for safety assurance were limited. The primary method for employees to report safety-related issues was to inform a supervisor. Escalation of issues was then reliant on supervisors submitting reports on their behalf. Feedback from stevedores during the investigation revealed that if they saw unsafe behaviour they would often 'just deal with it at the time' and not necessarily inform a supervisor unless the event involved an incident or accident. Together with the fact that supervisors could not observe all the stevedores across multiple gangs, this meant that the true number of unsafe acts or non-conformances that were taking place on the front line were **almost certainly** much higher than was formally captured by the EHS team.[91]

A2.39. In the months leading up to the accident, WIL had identified the need to increase safety reporting and had set operational objectives for hazard identification, near-miss reports and employee improvement suggestions. There was also a recognition that more rigour and quality control was required for internal auditing processes and training competencies.

A2.40. At the last Management Review meeting before the accident, WIL had assessed the risk of a serious health and safety incident occurring within the company as High. The management of risks was to be supported through ongoing improvements of their safety processes. It would therefore be expected that an accident occurring would act as a mechanism to trigger safety improvements beyond those arising from a normal continuous improvement cycle.

A2.41. However, the Commission found that WIL's safety improvements had been limited to reminding stevedores not to position themselves under suspended loads and to stop work if they observed any unsafe behaviour. During a visit to the worksite two months after the accident, the Commission observed the pre-start briefing board, and noted that it was substantively unchanged from the day of the accident.[92] This suggests that the passive safety messaging was ineffective in causing change. The Commission was also concerned that some staff within WIL believed that nothing could have prevented such an event from happening.

A2.42. The Commission does not consider that WIL's safety system was operating at the standard required to provide rigorous safety assurance. The Commission has therefore made a recommendation in Section 5 of this report to address this safety issue.

[91] Data provided to the Commission for the purposes of this investigation.

[92] The date, name of vessel and supervisors' names were updated.

A2.43. The regulatory framework did little to encourage the ongoing development and continuous improvement of WIL's SMS. There were no requirements for proactive oversight in the form of regular reviews by WorkSafe or MNZ, nor was there any requirement to proactively demonstrate ongoing safety assurance to the regulators.

A2.44. Interaction between WIL and the regulators was primarily limited to reporting notifiable events and any subsequent interventions that were triggered as a result. The Commission does not consider that this level of regulatory oversight was sufficient to provide assurance of WIL's future safety performance. The Commission has therefore made a recommendation in Section 5 of this report to address this safety issue.

Finding

11. The regulatory framework and oversight provided little support to the ongoing development of WIL's safety management system.

A3. Findings
Ngā kitenga

A3.1. Hold Operator A suffered crush injuries when they moved underneath a suspended 40-foot container that was subsequently lowered.

A3.2. It is **likely** that hold operator A moved underneath the container to rectify an issue with the aft port-side twist lock.

A3.3. Hold operator B was unaware of the position of hold operator A when they signaled to the crane operator to lower the container.

A3.4. Although visibility from the crane operator's cab was limited by objects covering the grating, it is **unlikely** that the crane operator would have noticed hold operator A moving underneath the container.

A3.5. The hold operators were working on different levels and did not have sight of one another, increasing the risk of a crush injury.

A3.6. Hold operator A was not using their fall arrestor system while positioned outside a safe zone (less than 2 metres from an exposed edge).

A3.7. The wire technique used by hold operator A to descend from one tier of containers to another was no longer an approved practice, but was still being used by stevedores at the time of *the accident*.

A3.8. The presence of at-risk behaviour in the form of non-adherence to procedures indicated a desensitisation to risk and an insufficient understanding of the importance of effective supervisory oversight.

A3.9. The procedures for container loading included unclear, contradictory, and ambiguous descriptions of role responsibilities.

A3.10. Many of WIL's risk control measures were administrative in nature and required a high degree of compliance oversight to ensure they were effective.

A3.11. The regulatory framework and oversight provided little support to the ongoing development of WIL's safety management system.

A4. Data summary
Whakarāpopoto raraunga

Vehicle particulars

Name:	*Capitaine Tasman*
Type:	Container
Class:	100A1 Container Ship
Limits:	Unlimited
Classification:	Lloyds Register
Length:	184.10 m
Breadth:	25.3 m
Gross tonnage:	16,803 tonnes
Built:	2008
Propulsion:	Sulzer 6RTA62U – 13320kW
Service speed:	20 knots
Owner/operator:	Neptune Pacific Direct Line Pte Ltd
Port of registry:	Singapore

Date and time	19 April 2022 at about 0916
Location	Port of Auckland
Persons involved	Stevedore
Injuries	Fatal

A5. Conduct of the Inquiry
He tikanga rapunga

A5.1. On 19 April 2022 the Commission received notification from MNZ of a stevedore fatality during loading operations onboard the vessel *Capitaine Tasman* while berthed at the Port of Auckland.

A5.2. On 27 April 2022, the Minister of Transport directed the Commission to open an investigation under section 13(2) of the Transport Accident Investigation Commission Act 1990 and the Commission appointed an Investigator-in-Charge.

A5.3. On 4 May 2022, three of the Commission's staff travelled to Auckland to begin evidence collection. On 5 and 6 May 2022, they conducted interviews with four personnel from Ports of Auckland Limited and Wallace Investments Limited.

A5.4. On 6 May 2022 the Commission seized two container twist locks that had been collected from the accident scene by MNZ as part of their investigation.

A5.5. On 17 and 18 May 2022, two Commission investigators conducted interviews with four stevedores who had been working on the *Capitaine Tasman* at the time of the accident.

A5.6. On 24 June 2022, two Commission investigators conducted a background interview onboard the *Capitaine Tasman* with one of the masters who operated the vessel.

A5.7. On 20 and 22 July 2022, Commission investigators returned to Wallace Investments Limited to conduct four further interviews with key personnel.

A5.8. The Commission engaged with WorkSafe, MNZ, the Port Industry Association and other ports and stevedoring companies during the investigation.

A5.9. On 26 April 2023 the Commission approved a draft report for circulation to 12 interested parties for their comment.

A5.10. On 8 June 2023 a draft report was circulated to the 12 interested parties for their comment.

A5.11. Submissions were received from seven interested parties, which included two 'no comment' responses. Any changes as a result of these submissions have been included in the final report.

A5.12. On 28 September 2023, the Commission approved the final report for publication.

8. Appendix B: MO-2022-202 Fatal accident at Lyttelton Port, 25 April 2022

B1. Factual Information
Pārongo pono

Background

B1.1. On the morning of 23 April 2022, the bulk carrier *ETG Aquarius* berthed at Lyttelton Port to load a cargo of coal.

B1.2. The loading of coal at Lyttelton Port was carried out by stevedores employed directly by the Lyttelton Port Company Limited (LPC). Table 4 explains the roles of the stevedores involved.

Table 4: Stevedore roles for loading coal at Lyttelton Port

Title	Role	Number of stevedores
Coal-loading supervisor 1 (supervisor 1)	The supervisor is at the port site and available as required. They spend most of their time in the coal storage area office monitoring the radio and the loading computer.	1
Coal-loading supervisor 2 (supervisor 2)	Same role as supervisor 1.	1
Coal-loading foreman (foreman)	Moves around the various coal-loading operations, mostly in the coal-storage area.	1
Ship-loader operator	Controls the ship-loader and the flow of coal in response to instructions from the signalman. They are positioned in the ship-loader operator office (*see* Figure 14).	1
Coal signalman (signalman)	Positioned onboard the vessel at the hatch coaming[93] to observe the coal loading into the holds and provide instructions via radio to the ship-loader operator.	1
Digger drivers	Operated the diggers to load coal onto the conveyor system in the coal-storage area.	several

Introduction to loading coal at Lyttelton Port

B1.3. The coal loading operation at Lyttelton Port was unique compared to more generalised stevedoring operations at other ports. However there remain many common features and hazards of stevedoring such as safety management,

[93] The hatch coaming is the vertical structure that surrounds the deck opening in the hold. The hatch sits on top of the coaming (*see* Figure 18).

stevedoring gang structures, communications, leadership, hazardous environment, and risk-mitigation strategies.

B1.4. Lyttelton Port has a coal stockpile facility and coal loading operation. The coal was moved from the stockpile to the vessel via conveyor belts. The final stage of the process, loading coal into the vessel's hold, used specialist equipment known as a ship-loader.

B1.5. The ship-loader travelled on rails parallel to the edge of the wharf. The wharf conveyor belt fed coal onto the ship-loader lower conveyor belt, which then fed the coal onto the boom conveyor belt, which in turn fed it into the loader chute, from which it passed out through the jetslinger and into the ship's hold (*see* Figure 16 and Figure 17).

B1.6. The jetslinger incorporated a short conveyor belt moving at high speed to direct the coal in the direction and elevation required.

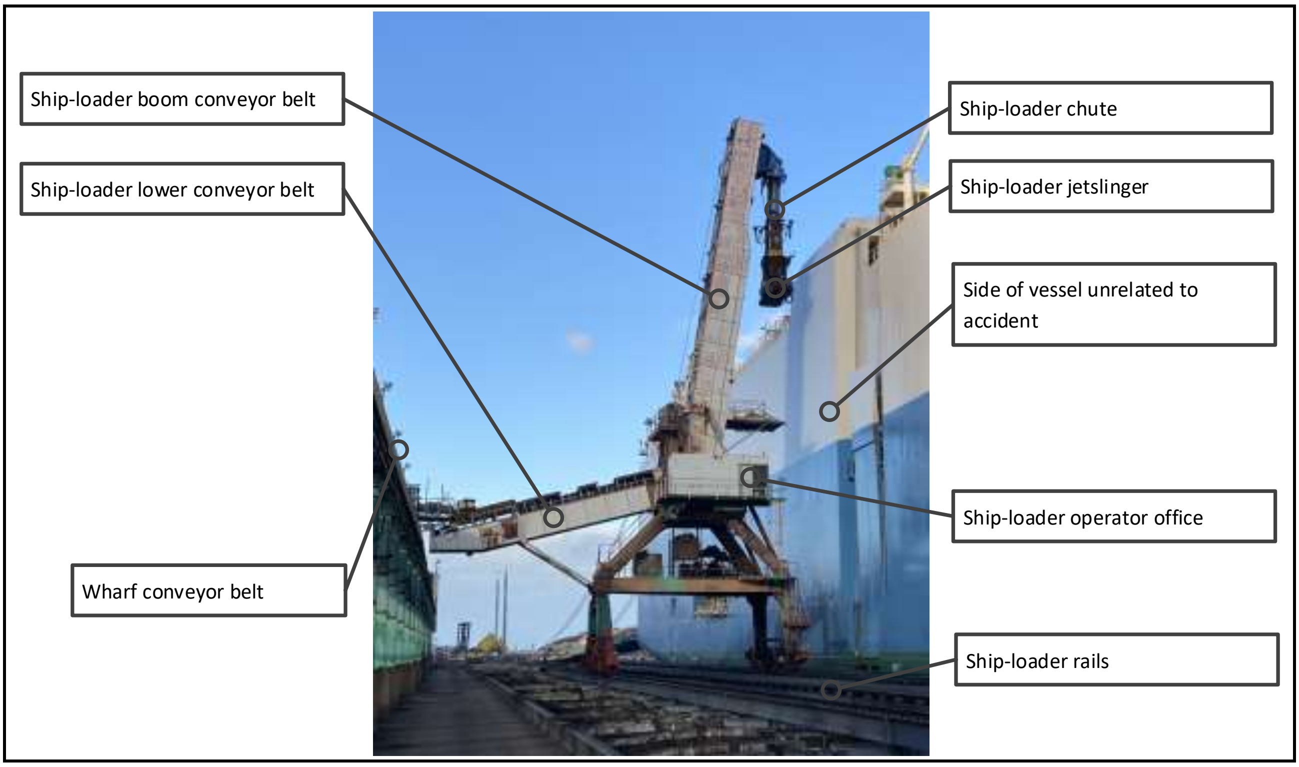

Figure 16: LPC ship-loader in its stowed position next to a car carrier vessel

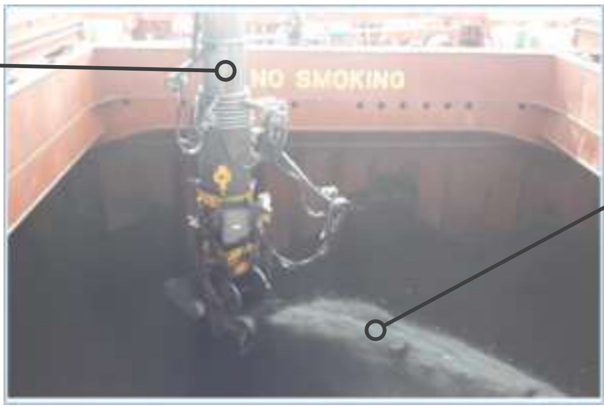

Figure 17: Jetslinger in operation, loading coal onto a different vessel

(Credit: Lyttelton Port Company Limited)

B1.7. During loading operations, the ship-loader operator had limited visibility of the jetslinger, the hold, or the area around the hatch coaming. There was no closed-circuit television (CCTV) system installed on the ship-loader to assist the ship-loader operator in directing the flow of coal from the jetslinger. The ship-loader operator relied upon instructions transmitted over radio from the signalman, who was positioned at the hatch coaming to observe the progress of coal loading. The signalman was responsible for giving instructions to the ship-loader operator by radio to adjust the direction, elevation and flow of coal from the jetslinger to ensure the hold was loaded appropriately.

B1.8. One radio channel was used for coal loading operations. This channel was used by the digger operators, the ship-loader operator and signalman. The supervisors and the foreman monitored both digger operations and ship-loading.

Narrative

B1.9. After the vessel's arrival on 23 April 2022, supervisor 1, supervisor 2 and the foreman went onboard the vessel to discuss the loading plan with the vessel's master, and coal loading started at about 0715 that day.

B1.10. On 25 April, between about 0600 and 0630 the ship-loader operator and signalman both arrived at the port in preparation for the start of their shift at 0700.

B1.11. At about 0635, loading of the vessel was nearly completed by the previous shift but was paused while an independent cargo surveyor, supervisor 1, supervisor 2 and the vessel's chief officer conducted a draft survey.[94] They calculated that about 1,000 tonnes of coal still had to be loaded into the number seven and number one holds.

B1.12. The ship-loader operator made their way to the ship-loader operator office within the ship-loader (*see* Figure 16) and at about 0700, after a limited handover from the ship-loader operator going off-shift, they assumed control of the ship-loader. The signalman had made his way onboard the vessel and began their shift at about 0700.

B1.13. The ship-loader operator moved the ship-loader from its location beside the vessel's number one hold to locate it beside the number seven hold. Working with the signalman's radio instructions they began to load the number seven hold, finishing at

[94] A survey to confirm the vessel's draught and used to determine the amount of cargo loaded or discharged.

about 0825. The ship-loader was then moved to the number one hold and began loading.

B1.14. Based on instructions from the signalman, the ship-loader operator directed the flow of coal towards the port aft corner of the hold (*see* arrow 1 in Figure 18). When the area was full, the signalman instructed the ship-loader operator to 'come around clockwise', which meant to slew the jetslinger in a clockwise direction 'a few degrees' (*see* arrow 2 in Figure 18).

B1.15. The coal continued flowing until the signalman again instructed the ship-loader operator to 'come around clockwise' (*see* arrow 3 in Figure 18). The signalman continued to give instructions to the ship-loader operator, and the jetslinger continued to incrementally rotate in a clockwise direction to load the hold. Most movements were within about 15 seconds of the previous movement.

B1.16. Throughout the loading process, coal was flowing from the jetslinger (*see* Figure 17) continuously. Usually, the flow of coal was only stopped by the ship-loader operator when it was necessary to move the ship-loader between cargo holds.

B1.17. While the coal was being loaded, the foreman, who was not onboard the vessel, used a hand-held radio to check in with the ship-loader operator to determine how much coal was still to be loaded.

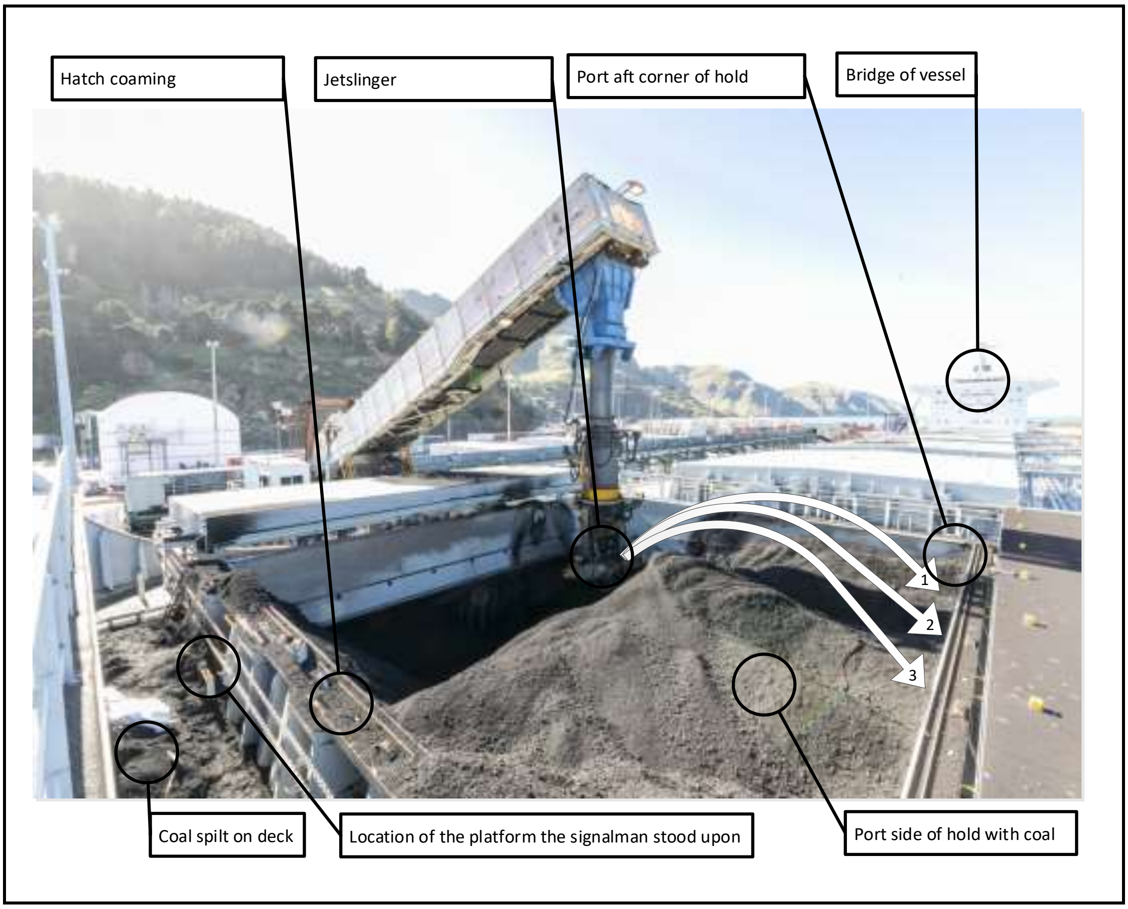

Figure 18: Number one hold after the accident, showing the ship-loader and jetslinger[95]

(Credit: Maritime New Zealand)

[95] The photograph was taken after emergency services had departed.

B1.18. At about 0900 the port side of the hold was nearly full and the signalman positioned himself at the hatch coaming by the platform to observe the progress of loading in the hold (*see* Figure 18). They periodically climbed onto the platform to see into the hold. The jetslinger continued to rotate in a clockwise direction towards the signalman who was standing on the platform.

B1.19. As the coal started to reach the top of the hold, the angle and height of the jetslinger caused some of the stream of coal to spill over the top of the hatch coaming (*see* Figure 18).

B1.20. At 0903:38 the signalman instructed the ship-loader operator to 'come around clockwise'. Then at 0903:47 said, 'that's good', before saying at 0903:50 'back, two clicks.'[96]

B1.21. At 0904:01 the ship-loader operator heard some muffled noises on the radio. A few seconds later the jetslinger finished rotating from the ship-loader operator's most recent command, and some of the coal began to spill over the coaming at the approximate location of the signalman.

B1.22. About this time the signalman **almost certainly** fell off the platform they were standing upon, and as they fell their helmet came off and they hit their head on the deck.

B1.23. After 23 seconds of radio silence the ship-loader operator asked if the signalman was alright but received no reply. The ship-loader operator asked again a few seconds later, and again received no reply.

B1.24. Supervisor 2 (who was on the wharf) had been listening to the exchange over the radio and asked the ship-loader operator if they could see the signalman. The ship-loader operator replied that he could not. Supervisor 2 then said he would go onboard to look for the signalman.

B1.25. The ship-loader operator noticed that coal was spilling over the coaming and at about 0906 asked the foreman if he should hit the stop sequence,[97] which the foreman approved. At about 0907, the foreman noted the coal had stopped.

B1.26. Supervisor 2 arrived onboard the vessel at the number one hatch just after 0907 but was unable to locate the signalman. At about 0910, they radioed for assistance[98] to search the spilt coal. By 0916, three stevedores and some of the vessel's crew began searching the coal looking for the signalman.

B1.27. At about 0918 the foreman radioed to ask port security to call emergency services, but in response was told emergency services would require information and the foreman should call them. At 0928 someone confirmed over radio that emergency services had been called. The signalman was found at about 0930, unresponsive, near the base of the platform they had been standing upon. Emergency services arrived on the scene and the signalman was pronounced deceased at about 0950.

[96] A 'click' referred to a click of the slew button on the ship-loader controls.

[97] The stop sequence was the process to stop the conveyors. It ran the conveyors until they were empty before stopping movement – this took about 1:30 minutes.

[98] The request was made via radio and hence was heard by the rest of the coal-loading team.

B1.28. The signalman was found near the base of the platform they had been standing upon. They had suffered a serious head injury, a medical event and possible asphyxiation, although there is uncertainty about the sequence of events.

Personnel information

B1.29. The signalman began working as a stevedore for LPC in 2013 and completed training as a coal signalman in January 2018.

B1.30. The ship-loader operator began working as a stevedore for LPC in 2012 and completed training as a ship-loader operator in October 2017, completing a refresher course in October 2020. They had also trained as a signalman in February 2015.

B1.31. Supervisor 1 had worked as a stevedore at Lyttelton Port since 1984 and was experienced in all stevedoring roles at the port. He was scheduled to retire in June 2022.

B1.32. Supervisor 2 began working at LPC in 2000 and completed training as a terminal signalman[99] in 2002 and as a ship-loader operator in 2004. They were acting as second in command to supervisor 1 while they finished their training and until the retirement of supervisor 1.

B1.33. The foreman began working at LPC in 2008 and was trained as a ship-loader operator in 2014. They were trained as a coal signalman in 2012, terminal signalman in 2015, and in 2019 completed a ship-loader operator refresher course. There is no record of formal training specific to the role of foreman.

B1.34. The training system at LPC was developed internally and did not result in NZQA qualifications.

Vessel information

B1.35. The *ETG Aquarius* was registered in Liberia and began operating in April 2022. It was a bulk carrier with a cargo capacity of 82,000 tonnes and was on its maiden voyage when it berthed to load coal at Lyttelton Port.

Recorded data

B1.36. Recorded data was used to help determine the timeline and actions of the accident:

- a CCTV was located on the bridge of the vessel. Its field of view included some of the number one hatch during the time leading up to the accident
- the port radio log captured the radio traffic of the stevedore team
- the ship-loader log captured some of the actions of the ship-loader.

Medical and pathological information

B1.37. There were two sources of medical information used in this investigation. The first was the historical employment records of the signalman, and the second was the medical records that related to the accident.

[99] Terminal signalman refers to the role of signalman in the container terminal.

B1.38. Employment medical records included a pre-employment health assessment report, and ongoing health monitoring records.

B1.39. The pre-employment health assessment was conducted by an occupational health nursing service. The assessment included a questionnaire completed by the candidate and resulting discussion with the assessor, with some clinical assessments (*see* Figure 19 for the checklist).

Completed✓			
✓	Health History	✓	Grip Strength
✓	Injury History	✓	Blood Pressure -only if requested - driver etc.
✓	Hearing Test(Attach copy of audiogram if requested)	✓	Vision near/mid/distant, Colour.
✓	Spirometry(Attach copy of result if requested)	✓	Physical Flexibility check
✓	Drug test	✓	ACC Injury History

Figure 19: Checklist for pre-employment health assessment

B1.40. The ongoing health monitoring programme assessment was similar in scope to the pre-employment assessment.

B1.41. The signalman had an undiagnosed pre-existing medical condition. The condition was not identified during the pre-employment health assessment, nor was it identified by the ongoing health assessment.

Organisational information

Lyttelton Port

B1.42. Lyttelton Port was officially established in 1849. Port operations continued until the Port Companies Act of 1988, which led to the creation of Lyttelton Port Company Limited (LPC). LPC took over the port's commercial role, including management of the land, assets and facilities. LPC manages the port itself and two inland cargo processing facilities. LPC is owned by Christchurch City Holdings Limited, which is owned by Christchurch City Council.

B1.43. LPC had an organisational structure that included a board of six directors led by a chairperson, and about 670 staff led by the chief executive officer.

B1.44. LPC employed a pool of stevedores, who spent most of their time working in the container terminal at the port. Stevedores who had been trained for coal operations were assigned to load coal as the need arose, which was approximately once per month.

LPC safety management system

B1.45. LPC's safety management system (SMS) was evolving. Before 2017, the foundations of a health and safety management system were in place and were subject to an audit programme aligned to the ISO 18001 international standard for health and safety management systems.

B1.46. From 2017 to 2019, LPC introduced new safety management systems, including:

- documented descriptions of how to do a task safely, known as safe work method statements (SWMS)
- development of a document management and storage system using SharePoint
- some LPC standards (for example, risk management)
- identification of some critical risks
- a revised risk matrix
- a framework to meet their HSWA obligations.

B1.47. In 2020, LPC gained secondary-level Accident Compensation Corporation (ACC) Accredited Employers Programme (AEP) accreditation and began work to introduce an integrated SMS. The AEP enables employers to assume management of workplace injuries instead of ACC. Accreditation under AEP includes assessment of the health and safety system and annual audits once accredited.

B1.48. In 2021, LPC's Critical Control Assurance Programme was in place, and had identified more critical risks. The 2021 AEP audit resulted in LPC gaining tertiary-level accreditation. The audit report noted that although LPC's health and safety system was in a state of flux 'Improvements are many. ...The health and safety team has more than doubled in size this last year. There is a sense of getting to the starting line with work projects aimed at improving safety'.

B1.49. Also in 2021, recognising a need to improve health and safety led LPC senior leadership to commission an independent review of the SMS, (the Review). The Review report was delivered in July 2021 and described some findings and recommendations pertinent to the Commission's investigation, which are summarised below:

- while all fundamental risk-management tools were in place, including a good understanding of 'critical risks', the understanding of when they should be used, and identification of 'critical' was lacking
- procedures and SWMSs related to several areas, including signalman operations, were not specific enough to minimise risk
- lack of compliance with risk controls was not monitored through visible leadership
- there was no radio-communication protocol.[100]

B1.50. The Review made recommendations, some of which are summarised below:

- produce visible leadership targets and tools for in-field critical control checks
- roll out education and training to all levels for hazard reporting, personal risk assessment, job safety analysis and formal risk assessment
- improve risk reporting
- review procedures for high-risk work with a focus on reducing risk
- define a radio protocol and monitor compliance
- develop trigger action responses for high-risk procedures to assist response to alarms and alerts.

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[100] LPC's marine operations operate using radio protocol as laid out by MNZ and according to international standards.

B1.51. At the time of the accident, LPC had started a programme to address the AEP audit and the Review recommendations.

B1.52. Neither regulator (WorkSafe or MNZ) had undertaken monitoring or a detailed assessment of LPC's stevedoring SMS.

Procedures and training

B1.53. The training system at LPC was based on role-specific modules, and the training was delivered in-house by LPC staff. The training material included module-specific training manuals, SWMSs and module-specific assessment forms.

B1.54. The training manuals provided wider context and guidelines around the role[101] and the SWMSs provided specific procedures and risk controls for the role.

B1.55. The training was developed and delivered by the LPC training coordinator, and was based on procedures, documentation (for example SWMSs) and some NZQA unit standards.

B1.56. LPC staff commented during interviews with the Commission that the training material and programme lacked adequate input from the people with experience in the roles.

B1.57. The AEP audit report 2021 found 'limited evidence that the staff are involved in the review of relevant policies and procedures, measures of performance or the setting of objectives'.

Risk identification and mitigation

B1.58. As noted above, fundamental risk-management tools were in place, including a risk matrix and risk-control assurance.

B1.59. A 'major hazard' that had been identified for the signalman was the flow of coal from the jetslinger. The risk controls set out in the SWMS were administrative and some excerpts are quoted here:

- The signalman should always know movements of the jetslinger
- Keep jetslinger in sight at all times as it could potentially swing causing a change in the trajectory
- The signalman needs to give his full attention to the ship-loader and jetslinger for potential risks.

B1.60. The training manual highlighted the risk of 'standing in front of the coal jetslinger flow'.

B1.61. The 2021 AEP audit report found 'The controls applied in the risk registers are often lower-level administrative controls…'.

Another major hazard identified was working at heights while the signalman stood upon the pedestal to see into the hold. The photo accompanying that section of the SWMS shows the signalman standing on the pedestal onboard a different vessel (*see* Figure 20).

[101] For example, the training manual for the signalman included a description of loading terminology with respect to bulk carrier loading.

Figure 20: Photo in SWMS showing the signalman standing on a pedestal looking over the hatch coaming into the hold

(credit: Lyttelton Port Company Limited)

B1.62. None of the documentation identified that the signalman was working in physical isolation, nor that it was a hazard.

B1.63. LPC staff acknowledged that final loading of hatches increased risk, which they informed the Commission was controlled by reducing the feed rate and stopping as necessary. This process was not documented in the procedures, and it is unclear if it was implemented in practice. A potential need for 'mentoring' when hatches were loaded over 90% was noted in safety meeting minutes, however it is uncertain what was meant by that, nor to what extent it occurred.

B1.64. The Review found that:

> While all Fundamental Risk Management Tools are in place, the understanding of when they should be used, and what is "critical", are lacking. ...Similarly, a review of jobs identified that many elements of the Safe System of Work are not in place.'

The Review also said:

> ...Procedures and SWMS related to a number of high-exposure Operational activities are not specific enough to minimise risk, including dozer operations, isolation of energy sources, lashing and signalman operations.

Risk controls monitoring

B1.65. A key performance indicator for the supervisor role was that 'safe work practices and procedures are always followed.' There was no mechanism to monitor or report on non-compliance with procedures and risk controls.

B1.66. The effectiveness of the risk controls was assessed against the reported incidents and accidents. Hazards and near-miss reporting had identified cases of non-compliance, but they mostly related to vehicle-traffic non-compliance with traffic signals and road markings within the port. The Commission was unable to find any records of non-compliance and actions taken related to coal operations.

B1.67. Monthly Coal Health and Safety meeting minutes did not discuss non-compliance or leadership around enforcing risk controls or adhering to procedures. The need to submit incident forms was, however, a regular agenda item. Compliance with procedures and risk controls was not a reporting item of senior leadership.

B1.68. The 2021 AEP audit report gives an 'inexhaustive' list of safety issues such as 'PPE not in useable condition', and says 'This suggests the effectiveness of the [safety checking] programme is ineffective … The checking of controls should be reviewed and an effective system that gives confidence implemented.'

B1.69. The Review makes recommendations around visible leadership and the need to monitor compliance with risk controls at a supervisory level through to senior leadership.

Radio communications

B1.70. The primary means of communication between team members was a two-way radio.[102]

B1.71. Use of two-way radio as a resource was mentioned in the SWMS of both the signalman and the ship-loader operator. Some radio-communication guidelines were provided in the ship-loader operator's training manual, which included the coal emergency radio communications protocol, radio channels, operating hints and a phonetic alphabet. It required that 'All personnel shall keep radios switched on at all times.'

B1.72. In the two years before the accident, there were seven reported incidents related to poor radio communications across different port operations but not the coal operation. On 27 June 2023, LPC advised the Commission that a separate review of LPC Harbour Control[103] radio communications was undertaken during November 2021 and subsequent work was completed to improve training and procedures. However, at the time of the accident this had not been extended to include the coal operation.

B1.73. The Review found there was no specific radio operations protocol, and that LPC should define them, communicate them, and monitor compliance.

Emergency response

B1.74. The ship-loader operator training manual described a coal emergency response procedure (*see* Figure 21), which included a description of the coal-loading team roles in an emergency, emergency communication radio channels, and protocols and location of emergency stops for the ship-loader itself.

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[102] A two-way radio can transmit and receive radio communications.

[103] Harbour Control relates to LPC's marine operations, not stevedoring.

2. EMERGENCIES 2.1 In the event of an emergency, the Coal Foreman has a mobile telephone plus there is a two way radio in each of the front end loaders. ***All personnel*** must be familiar with locations and operations of ***all emergency stops***. 2.2 There are emergency stops in the cab & lower landing of the Shiploader. These emergency stops apply to the Shiploader only. ***It doesn't stop any other systems.*** 2.3 Refer to Stop Definitions for a description of each type of stop.	Coal Foreman Hatchman/Signalman	Stop Definitions

Figure 21: Procedures for ship-loader emergencies as provided in training material

B1.75. Although it does not provide explicit guidance on when to use the emergency stops, it does note 'If at any stage, there are concerns or doubts of the safety of personnel or state of equipment or the vessel, cease loading and contact the Coal Foreman'. The emergency stop was not activated because the ship-loader operator initially didn't realise there had been an accident; they thought the issue was a communication problem and so they used the normal stop sequence for the ship-loader.

B1.76. The 2021 AEP audit report found 'Insufficient evidence is available to show that other relevant emergency scenarios are practised and that relevant persons know what to do in such an emergency'.

B2. Analysis
Tātaritanga

B2.1. This section analyses the circumstances surrounding the event to identify those factors that increased the likelihood of the event occurring or increased the severity of its outcome. It also examines any safety issues that have the potential to adversely affect future operations.

B2.2. Coal was being loaded onto a vessel at the LPC coal-loading berth when communication with a stevedore involved was lost. The stevedore was subsequently found deceased beneath spilt coal.

B2.3. LPC was in the early stages of changing and improving its SMS. Implementation of risk identification and mitigation was not mature and had not identified the hazards associated with this type of activity.

Sequence of events immediately before the accident

B2.4. The order of events immediately before the accident are uncertain, however it is **virtually certain** that:

- the signalman fell from the pedestal they had been standing on to monitor the flow of coal from the jetslinger into the cargo hold
- the signalman did not have their helmet chin strap fastened and when they fell their safety helmet came off and they suffered a serious head injury
- some of the flow of coal spilt over the hatch coaming and onto them
- at some time during this sequence, they suffered a medical event.

B2.5. The signalman was working in physical isolation at the time of the accident and as a result nobody was aware of the events that were unfolding or able to provide immediate assistance. Lone working in a hazardous environment presents unique dangers that should be addressed as part of a risk-assessment process. In these circumstances, the radio was ineffective for raising an alarm (discussed in following sections), leaving it to other employees to question the signalman's whereabouts.

Medical standards

Safety issue: The medical screening of stevedores did not provide adequate assurance of medical fitness for their duties and responsibilities.

B2.6. Under HSWA, the PCBU must eliminate risks or, if not reasonably practicable to do so, minimise them. One risk to eliminate or minimise was the effect of pre-existing health conditions of a worker on their ability to safely conduct duties. With respect to this accident, medical records prepared after the accident showed that the signalman had a previously undiagnosed medical condition that could cause sudden incapacitation.

B2.7. The HSWA does not prescribe medical fitness for duty and relies upon the PCBU identifying and mitigating these risks. Stevedoring is a high-risk industry and when working onboard vessels stevedores face similar critical risks as seafarers, where medical fitness is an important feature of risk control. One risk control for seafarers, prescribed under New Zealand's Maritime Rules, was a certificate of medical fitness.

However, it is acknowledged that the risks seafarers share with stevedores are only a subset of the full range of seafaring risks.

B2.8. The seafarer's certificate of medical fitness is a comprehensive clinical assessment that confirms the seafarer has adequate hearing and eyesight, physical health, and no medical condition or impairment that will prevent the effective and safe conduct of their duties onboard. The certificate is issued by a registered GP,[104] and the scope of assessment is standardised across the maritime sector. The assessment includes a physical examination and technology-assisted assessments.

B2.9. LPC had identified the risk of medical fitness for duty. Their risk control included a pre-employment health assessment and an ongoing health monitoring programme conducted by independent occupational nursing services. A more comprehensive medical assessment would have **likely** identified the signalman's undiagnosed medical condition.

B2.10. LPCs health and safety assessment of the signalman's suitability for the role would have been significantly improved had the medical assessment identified the medical condition.

Findings

1. A more comprehensive medical fitness assessment would have **likely** identified the signalman's pre-existing health condition and enabled an informed health and safety assessment of their suitability for the role of signalman.

Risk control

Safety issue: LPC's safety management system had not identified all significant risks and many of those that were identified were managed through inadequate administrative risk controls

B2.11. There are two categories of risk controls: preventative risk controls and recovery risk controls.

B2.12. Preventative risk controls are put in place to prevent a negative consequence. For example, LPC had identified that stevedores' safety was threatened by the flow of coal from the jetslinger. A preventative risk control put in place required stevedores remain away from the line of fire from the flow of coal.

B2.13. Recovery risk controls are put in place to minimise negative consequences from a realised hazard. For example, LPC had identified that there was potential for fuel spillage and environmental damage in the coal-loading area. The recovery risk control put in place included a resourced environmental spill response plan.

[104] GP refers to 'general practitioner' – a medical doctor who does not specialise in a particular area of medicine.

Preventative risk controls

Loading hold to full

B2.14. The HSWA-GRWM prescribes a hierarchy of risk controls, which grades them from most effective to least effective. It notes that the least effective risk controls were administrative in nature. Administrative risk controls rely upon thorough training and active supervision. A summary of the hierarchy is described in Section 2 of this report.

B2.15. The final phase of loading a hold to full involves frequent movements of the jetslinger, compared to the initial phase with occasional movements to redirect the flow of coal.

B2.16. Because coal loading is continuous and defaults to 'always flowing', a procedure to reduce risk during final loading was to reduce the volume of coal on the conveyors, and/or stop the flow altogether as necessary.

B2.17. While the Commission was told about this procedure, it was not recorded in the training manual or SWMS. Further, it was an administrative control and was heavily dependent on active supervision.

B2.18. Records showed coal loading was rarely slowed or stopped during final loading, including in this case.

Coal 'line of fire'

B2.19. Another identified preventative risk control was the requirement for the signalman to position themselves on the opposite side of the hatch to where the jetslinger was directed so that they remained out of the 'line of fire' from the flow of coal.

B2.20. This risk control was described in the training material, but not made explicit in the SWMS. In this case the signalman had positioned themselves in the 'line of fire' from the flow of coal.

B2.21. The requirement for the signalman to remain out of the 'line of fire' was an administrative control, and hence its effectiveness was dependent on training and active supervision. However, the signalman's training was not recent, they weren't frequently involved in loading coal, and they were working in physical isolation without active supervision.

Recovery risk controls

Use of personal protective equipment helmets

B2.22. The signalman received a significant head injury when their helmet failed to protect their head because it came off as they fell to the deck. The helmet fell off because the helmet chinstrap was not used and instead had been wrapped over the top of the helmet.

B2.23. The SWMS for the signalman required a helmet be worn, as did the training programme. However, neither required the helmet chinstrap to be worn, and the general practice of the stevedores at the wharf was not to wear their helmet chinstraps.

B2.24. The use of helmet chinstraps is a mature concept in other high-risk industries, such as seafaring. It is normalised during training and across industry stakeholders, making it a common standard across the sector.

B2.25. Once the accident sequence had begun there were limited recovery risk controls in place. The accident did not trigger an immediate alarm nor an automatic emergency response. The accident alert and response emerged as a passive byproduct of a breakdown in normal operations, in particular a breakdown in communication. The alert was raised because the signalman was not answering the radio.

B2.26. It's possible there were no active recovery controls in place because the risk identification process had not identified the risk of the signalman working in physical isolation while exposed to critical risk[105] hazards. That risk was compounded because the risk controls that were applied to the critical risk were administrative, with diminished effectiveness because of passive supervision.

B2.27. An emergency stop mechanism was available on the ship-loader but the coal-loading team members were not aware of the emergency and so it was not activated.

B2.28. The first time anyone considered that something may be wrong was approximately one minute after the signalman's first injury. It was a further two minutes before there was a discussion about stopping the flow of coal, and the flow of coal was stopped a few minutes later using the normal stop sequence for the ship-loader. The coal was flowing at about 20 tonnes per minute, although it is unknown how much of the flow was spilt over the coaming.

Findings

2. Neither the safety management system, nor staff, recognised the need to wear PPE helmets correctly with chinstraps securely fastened.
3. The signalman did not use their helmet chinstrap, which **almost certainly** contributed to the seriousness of their head injury.
4. The routine lack of chinstrap use by stevedores is **likely** due to the lack of minimum common standards and training for stevedores.
5. The safety management system had not identified all critical risks of the signalman's role, which meant that the associated risks, such as working in physical isolation, were not explicitly addressed.
6. The risk mitigation strategies tended to rely upon informal administrative controls, which were not always well articulated within the system.

Training

B2.29. Development of procedures and the training programme did not include clear and consistent instructions for safety-critical risk mitigation methods, which could result in ambiguity in procedures. For example, the final loading procedure for a hold loaded to more than 90% is not consistent with the requirement for the signalman to remain out of the 'line of fire' from the flow of coal. Comments made by staff during

[105] Critical risk refers to hazards with the potential for fatal injuries.

interviews were that development of the training programme lacked adequate input from experienced workers, and an external audit made a similar finding.[106]

B2.30. Safety meeting minutes noted a need for mentoring of stevedores when holds were loaded to more than 90%, but there was no evidence that it had occurred or that it had the effect of ensuring compliance with procedures.

B2.31. The signalman had completed their coal signalman training nearly four years before the accident and had not had any further refresher training since then. Although both the supervisor 2 and the foreman had completed the ship-loader operator training, supervisor 2 had not completed coal signalman training.

B2.32. The administrative risk controls mentioned above rely upon 'significant and ongoing effort by workers and their supervisors'[107] to provide safe working conditions as intended. However, the effectiveness of that effort is dependent on the individuals involved having a thorough understanding of relevant risk mitigation methods. In this case the training system did not assure such an outcome.

Findings

7. The training system did not ensure that all staff had a thorough understanding of the risks and their mitigation methods, significantly reducing the effectiveness of the risk controls.

Radio communication

B2.33. Although radio communication was a primary feature in controlling risk, its effectiveness was not assured as a part of the risk control programme. There were limited prescribed standards for radio use, and there was no training and enforcement to ensure reliable outcomes.

B2.34. When the signalman stopped answering the radio it took several minutes for any emergency alert to be raised. Radio communication was known to be unreliable and inconsistent, and the signalman's silence was considered at the time to be either a misuse of the radio, that it had accidently been turned off, or they were busy doing something else.

B2.35. Supervision of the signalman was almost entirely via radio and so it was subject to a single point of failure.

[106] 2021 AEP audit report

[107] United States National Institute for Occupational Safety and Health, Centres for Disease Control and Prevention.

B2.36. In other high-risk industries such as seafaring, radio communication has mature risk controls with applied standards and training.

Findings

8. The effectiveness of two-way radio as a risk control was limited because it did not have prescribed protocols and was unreliable.

Supervision and oversight

B2.37. It is essential for the success of an SMS that risks are identified, the identified risk controls are used appropriately, and they are monitored and updated as necessary.

B2.38. The accident occurred in an environment where some critical risks had not been identified, and the risk mitigation in place tended to rely upon administrative risk controls, which in turn rely on thorough supervision.

B2.39. The signalman certification for supervisor 2 did not include the specific procedures covered in the coal signalman training. Hence, they were less likely to notice any deviation from procedures.

B2.40. The supervisory roles (supervisors and foreman) with oversight over the signalman and ship-loader operator required them to be physically elsewhere, which excluded active supervision.

B2.41. The nature of supervision and oversight of stevedores while they conducted their duties allowed for routine non-compliance with safety-critical procedures.

B2.42. Although a KPI for the supervisors was 'safe work practices and procedures are always followed', there was no mechanism to monitor or report on non-compliance with procedures and risk controls.

B2.43. Compliance with procedures was not a feature of workers' safety meeting minutes, and was not reported at senior leadership level.

Findings

9. Supervision of the coal-loading process was passive and did not ensure full compliance with, and effectiveness of, the risk controls.

10. Because the safety management system did not include a mechanism to capture or regularly report on compliance with risk controls, LPC's senior leadership's awareness of the risk management system's effectiveness had reduced.

Assurance of the safety management system

B2.44. The independent assessments of the SMS had identified the issues around risk mitigation and management that were inherent in this accident. However, the programme of improvements to the SMS had not yet addressed those issues before the accident occurred.

B2.45. The HSWA-GRWM required that LPC identified certain hazards, and used the hierarchy of controls to control risk, review and maintain risk controls, and provide instruction, training and supervision. LPC had discretion as to how it achieved these requirements. Neither the HSWA nor the HSWA-GRWM included regulatory processes to assure compliance of LPC's SMS.

B2.46. Aside from the high-level joint HSWA assessments of the major commercial ports by MNZ and WorkSafe, action taken by the regulators was largely because of an accident or incident; there was little proactive safety interaction between either WorkSafe or MNZ and LPC. A week before the accident, WorkSafe had contacted LPC in response to a notification. MNZ had not investigated stevedoring operations at LPC.

B2.47. LPC had developed its SMS based on its own expertise (both internal and external). Internationally, there is documentation describing safety standards for stevedoring, but there are no commonly accepted standards or fit-for-purpose codes of practice in New Zealand. The absence of common training standards or thorough sharing of safety information between stakeholders reduced the spread of good practice throughout the industry.

B2.48. Assurance for the SMS was by self-review, which included independent assessments and accreditation by an external body as described in Section B1.

B2.49. LPC had engaged independent external parties to audit the SMS and it was also reviewed during admission to the ACC AEP programme in 2020. The reports from those reviews and audits include descriptions of, and recommendations to address, the same (or similar) themes that were found during the Commission's independent investigation.

B2.50. The findings and recommendations from the reviews, and lessons learned from this accident, have already been well articulated in other high-risk industries. This demonstrates another benefit of sharing safety-critical information.

B2.51. The Commission has made a recommendation to address this safety issue.

Findings

11. The regulatory activity did not provide any proactive support, monitoring or assessment, via review or otherwise, of LPC's safety management system to ensure its effectiveness.
12. LPC had taken significant steps to improve safety of its port operations before the accident occurring. LPC's safety management system was in the early stages of a programme to improve risk identification and management.

B3. Findings
Ngā kitenga

B3.1. A more comprehensive medical fitness assessment would have **likely** identified the signalman's pre-existing health condition and enabled an informed health and safety assessment of their suitability for the role of signalman.

B3.2. Neither the safety management system, nor staff, recognised the need to wear PPE helmets correctly with chinstraps securely fastened.

B3.3. The signalman did not use their helmet chinstrap, which **almost certainly** contributed to the seriousness of their head injury.

B3.4. The routine lack of chinstrap use by stevedores is **likely** due to the lack of minimum common standards and training for stevedores.

B3.5. The safety management system had not identified all critical risks of the signalman's role, which meant that the associated risks, such as working in physical isolation, were not explicitly addressed.

B3.6. The risk mitigation strategies tended to rely upon informal administrative controls, which were not always well articulated within the system.

B3.7. The training system did not ensure that all staff had a thorough understanding of the risks and their mitigation methods, significantly reducing the effectiveness of the risk controls.

B3.8. The effectiveness of two-way radio as a risk control was limited because it did not have prescribed protocols and was unreliable.

B3.9. Supervision of the coal-loading process was passive and did not ensure full compliance with, and effectiveness of, the risk controls.

B3.10. Because the safety management system did not include a mechanism to capture or regularly report on compliance with risk controls, LPC's senior leadership's awareness of the risk management system's effectiveness had reduced.

B3.11. The regulatory activity did not provide any proactive support, monitoring or assessment, via review or otherwise, of LPC's safety management system to ensure its effectiveness.

B3.12. LPC had taken significant steps to improve safety of its port operations before the accident occurring. LPC's safety management system was in the early stages of a programme to improve risk identification and management.

B4. Data summary
Whakarāpopoto raraunga

Vehicle particulars

Name:	*ETG Aquarius*
Type:	Bulk Carrier
Class:	Nippon Kaiji Kyokai
Limits:	Unlimited
Length:	228.9 m
Breadth:	32.24 m
Gross tonnage:	44,500 tonnes
Built:	2022
Owner/operator:	Lucretia Shipping, S.A. / Santoku Senpaku Ltd.
Port of registry:	Monrovia

Date and time	25 April 2022 at about 0900
Location	Lyttelton Port
Persons involved	Stevedore
Injuries	Fatal

B5. Conduct of the Inquiry
He tikanga rapunga

B5.1. On 25 April 2022 the Commission received notification from MNZ of a fatality during loading operations onboard the vessel *ETG Aquarius* while berthed at Lyttelton Port.

B5.2. On 27 April 2022, the Minister of Transport directed the Commission to open an investigation under section 13(2) of the Transport Accident Investigation Commission Act 1990 and the Commission appointed an Investigator-in-Charge.

B5.3. Four Commission staff members travelled to Lyttelton to gather evidence, which included three interviews, on 28 April 2022. One returned to Wellington on 29 April 2022, and the other three returned on 1 May 2022.

B5.4. Two investigators travelled to Lyttelton on 7 July 2022 to gather evidence, which included four interviews, and they returned to Wellington on 8 July 2022.

B5.5. The Commission engaged with WorkSafe, MNZ, the Port Industry Association and other ports and stevedoring companies during the investigation.

B5.6. On 26 April 2023 the Commission approved a revised draft report for circulation to 11 interested parties for their comment.

B5.7. On 8 June 2023 a draft report was circulated to the 11 interested parties for their comment.

B5.8. Submissions were received from ten interested parties, which included two 'no comment' responses. Any changes as a result of these submissions have been included in the final report.

B5.9. On 28 September 2023, the Commission approved the final report for publication.

Abbreviations
Whakapotonga

ACC	Accident Compensation Corporation
AEP	Accredited Employers Programme
CCTV	closed-circuit television
CUSP	Common User Safety Protocols
EHS	Environment, Health and Safety
HSWA	Health and Safety at Work Act 2015
HSWA-GRWM	Health and Safety at Work Act 2015 – General risk and workplace management regulations
ICAO	International Civil Aviation Organization
ISO	International Organization for Standardization
KPI	key performance indicator
LPC	Lyttelton Port Company Limited
MNZ	Maritime New Zealand
MTA	Maritime Transport Act 1994
NZQA	New Zealand Qualifications Authority
PCBU	Persons Conducting a Business or Undertaking
POAL	Ports of Auckland Limited
PPE	personal protective equipment

SAO	Safe Act Observation
SMS	safety management system
SOP	standard operating procedure
SOLAS	International Convention for the Safety of Lives at Sea
SWMS	Safe Work Method Statement
WIL	Wallace Investments Limited

Glossary
Kuputaka

aft	towards the rear, or stern, of a vessel
container spreader	a rigid framed, four-point lifting device that connects the crane wire to the corner-castings of shipping containers. Used for loading and discharging shipping containers. The man-cage can be seen on the right.

corner casting	block of cast steel positioned on the corner of a shipping container. Holes in the castings allow for twist locks to be fitted.

forward	towards the front, or bow, of a vessel
pedestal	tower of the crane that is fixed to the vessel's deck
stevedore	shore-based worker who loads and unloads cargo when vessels are in port
twist lock	inserts into the corner casting of a shipping container to allow the container to be connected and locked to other containers

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Kōwhaiwhai - Māori scroll designs

TAIC commissioned its four kōwhaiwhai, Māori scroll designs, from artist Sandy Rodgers (Ngāti Raukawa, Tūwharetoa, MacDougal). Sandy began from thinking of the Commission as a vehicle or vessel for seeking knowledge to understand transport accident tragedies and how to avoid them. A 'waka whai mārama' (i te ara haumaru) is 'a vessel/vehicle in pursuit of understanding'. Waka is a metaphor for the Commission. Mārama (from 'te ao mārama' – the world of light) is for the separation of Rangitāne (Sky Father) and Papatūānuku (Earth Mother) by their son Tāne Māhuta (god of man, forests and everything dwelling within), which brought light and thus awareness to the world. 'Te ara' is 'the path' and 'haumaru' is 'safe' or 'risk free'.

Corporate: Te Ara Haumaru - the safe and risk free path

The eye motif looks to the future, watching the path for obstructions. The encased double koru is the mother and child, symbolising protection, safety and guidance. The triple koru represents the three kete of knowledge that Tāne Māhuta collected from the highest of the heavens to pass their wisdom to humanity. The continual wave is the perpetual line of influence. The succession of humps represents the individual inquiries.

Sandy acknowledges Tāne Māhuta in the creation of this Kōwhaiwhai.

Aviation: Ngā hau e whā - the four winds

To Sandy, 'Ngā hau e whā' (the four winds), commonly used in Te Reo Māori to refer to people coming together from across Aotearoa, was also redolent of the aviation environment. The design represents the sky, cloud, and wind. There is a manu (bird) form representing the aircraft that move through Aotearoa's 'long white cloud'. The letter 'A' is present, standing for a 'Aviation'.

Sandy acknowledges Ranginui (Sky father) and Tāwhirimātea (God of wind) in the creation of this Kōwhaiwhai.

Maritime: Ara wai - waterways

The sections of waves flowing across the design represent the many different 'ara wai' (waterways) that ships sail across. The 'V' shape is a ship's prow and its wake. The letter 'M' is present, standing for 'Maritime.

Sandy acknowledges Tangaroa (God of the sea) in the creation of this Kōwhaiwhai.

Rail: rerewhenua - flowing across the land

The design represents the fluid movement of trains across Aotearoa. 'Rere' is to flow or fly. 'Whenua' is the land. The koru forms represent the earth, land and flora that trains pass over and through. The letter 'R' is present, standing for 'Rail'.

Sandy acknowledges Papatūānuku (Earth Mother) and Tāne Mahuta (God of man and forests and everything that dwells within) in the creation of this Kōwhaiwhai.

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