ACCIDENT REPORT

Report on the investigation

of the fatal crush accident

on the general cargo vessel

# *Karina C*

at Seville, Spain

on 24 May 2019


MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

VERY SERIOUS MARINE CASUALTY REPORT NO 18/2020 NOVEMBER 2020

**The United Kingdom Merchant Shipping**

**(Accident Reporting and Investigation)**

**Regulations 2012 – Regulation 5:**

*"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."*

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.



Front cover image courtesy of Peter Ronke and www.vesseltracker.com

All MAIB publications can be found on our website: www.gov.uk/maib

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# GLOSSARY OF ABBREVIATIONS AND ACRONYMS

| | | |
|---|---|---|
| 2/O | - | Second Officer |
| AB | - | Able Seaman |
| BAC | - | Blood alcohol content |
| BV | - | Besloten Vennootschap (Limited Company) |
| ºC | - | Degrees Celsius |
| Carisbrooke | - | Carisbrooke Shipping Ltd |
| C/O | - | Chief Officer |
| CCTV | - | Closed-circuit television |
| CoC | - | Certificate of Competence |
| COSWP | - | Code of Safe Working Practices for Merchant Seafarers |
| CPR | - | Cardio-pulmonary resuscitation |
| DPA | - | Designated Person Ashore |
| g | - | gram |
| ISM Code | - | International Management Code for the Safe Operation of Ships and for Pollution Prevention |
| kg | - | kilogram |
| LOLER | - | The Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment) Regulations 2006 |
| m | - | metre |
| MCA | - | Maritime and Coastguard Agency |
| mg | - | milligram |
| MGN | - | Marine Guidance Note |
| ml | - | millilitre |
| mm | - | millimetre |
| MSMU | - | Monthly Safety Management Update |
| NMHO | - | Near Miss or Hazardous Occurrence |
| OOW | - | Officer of the watch |
| PM | - | Postmortem |
| PPE | - | Personal protective equipment |
| RA | - | Risk assessment |

| | | |
|---|---|---|
| SFF | - | Shipboard Familiarisation Form |
| SMN | - | Sky Mare Navigation |
| SMS | - | Safety management system |
| STCW | - | International Convention on the Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended |
| t | - | tonne |
| VHF | - | Very high frequency |

**TIMES:** all times used in this report are ship's local time unless otherwise stated.

Image courtesy of Peter Ronke and www.vesseltracker.com


*Karina C*

# SYNOPSIS

At 0945 on 24 May 2019, the second officer of the UK registered general cargo vessel *Karina C* was fatally injured when he was crushed between the vessel's gantry crane and a stack of cargo hold hatch covers during post-cargo loading operations in Seville, Spain. The second officer had been working at the aft end of the main deck and was attempting to pass between the hatch covers and the stationary crane. As the second officer climbed onto the hatch coaming, the vessel's chief officer drove the crane aft, trapping and crushing the second officer against the hatch covers. The chief officer immediately reversed the crane and the second officer fell onto the deck, where he received first-aid and cardio-pulmonary resuscitation from the deck crew and shore paramedics.

An emergency services doctor, who was informed that the second officer had fallen from the hatch coaming onto the deck, told the crew that the second officer probably died after having a heart attack. Based on the doctor's initial assumption and the evidence provided by the vessel's crew, the accident was not reported to the MAIB. Following receipt of the second officer's postmortem report and close examination of *Karina C*'s closed-circuit television recordings, the vessel's managers, Carisbrooke Shipping Ltd, reported the accident.

The accident occurred on the second officer's birthday and his postmortem toxicology report showed that he had a significant quantity of alcohol in his bloodstream. The investigation concluded that:

- The second officer did not know the chief officer was about to move the crane and the chief officer did not know where the second officer was or what he intended to do because the deck operations were not being properly controlled or supervised and the deck officers did not communicate with each other.

- The second officer's judgment and perception of risk were probably adversely affected by alcohol.

- Tiredness might also have adversely influenced the second officer's actions.

- The master did not adequately investigate or report the accident.

- The safety culture on board *Karina C* was weak; company procedures were not followed, and several unsafe working practices were observed.

- The company's drug and alcohol policy was not being enforced.

Carisbrooke Shipping Ltd has: updated its gantry crane operating procedures and safety measures; updated its incident reporting policy; fitted additional emergency stops to all its gantry cranes; improved the profile of its employee confidential reporting system; and, reviewed and amended its alcohol policy to include frequent random testing of all crew and sanctions on masters in the event of policy breaches.

Recommendations have been made to Carisbrooke Shipping Ltd to improve the safety culture on its ships and the level of crew compliance with established safe systems of work and to investigate alterations to crane movement warning systems.

# SECTION 1 - FACTUAL INFORMATION

## 1.1 PARTICULARS OF *KARINA C* AND ACCIDENT

| **SHIP PARTICULARS** | |
|---|---|
| Vessel's name | *Karina C* |
| Flag | UK |
| Classification society | Bureau Veritas |
| IMO number | 9558000 |
| Type | General Cargo |
| Registered owner | Carisbrooke Shipping 6250 BV |
| Manager | Carisbrooke Shipping Ltd |
| Construction | 2010 |
| Year of build | Steel |
| Length overall | 106.07m |
| Registered length | 100.92m |
| Gross tonnage | 4151t |
| Minimum safe manning | 5 |
| Authorised cargo | General Cargo |

| **VOYAGE PARTICULARS** | |
|---|---|
| Port of departure | Canical, Portugal |
| Port of arrival | Seville, Spain |
| Type of voyage | Short International |
| Cargo information | Cement |
| Manning | 9 |

| **MARINE CASUALTY INFORMATION** | |
|---|---|
| Date and time | 24 May 2019, at 0945 |
| Type of marine casualty or accident | Very Serious Marine Casualty |
| Location of accident | Seville |
| Place on board | Main deck |
| Injuries/fatalities | 1 fatality |
| Damage/environmental impact | None |
| Vessel operation | Cargo |
| Voyage segment | In port |
| External & internal environment | Daylight with bright sun, good visibility and light winds. Temperature 20ºC. |
| Persons on board | 9 |

## 1.2 NARRATIVE

On 21 May 2019, the general cargo vessel *Karina C* arrived in Seville, Spain and berthed port side alongside the Muelle del V Centenario. The vessel was in ballast and was visiting the port to load a cargo of cement, which commenced during the morning of 23 May.

Shortly before midnight, the vessel's second officer (2/O), Maciej Michal Reszkiewicz, came on watch. The chief officer (C/O), who had been on cargo watch from 1800, stayed with the 2/O until completion of loading at 0115 (24 May). The 2/O remained on watch until the C/O took over again at 0540.

During the first hour of his watch the C/O conducted a draught survey, and at 0700 shore workers arrived on board to dismantle the cargo loading pipes. This was complete by 0830, after which the C/O lifted the cargo hatch covers and instructed the deck crew to commence cleaning cement dust from the top of the cargo hatch coamings. This task had to be completed and the hatch covers replaced prior to sailing.

At about 0900, the vessel's agents informed the master that the berth was required for another vessel and *Karina C*'s sailing time had been brought forward. The agent also explained that the departure pilot would be boarding at 1130, and not at 1400 as previously planned. When the master told the C/O of the revised plan, the C/O advised him that he would need all available hands to complete the cleaning operation and requested that the 2/O be called back on deck. The master agreed and called the 2/O.

The 2/O arrived on deck at about 0930 and commenced sweeping cement dust from the hatch cover landing surface on the starboard side of the aft cargo hold coaming **(Figure 1)**. At that time, one of the vessel's two able-bodied seamen (AB) was sweeping cement dust from the top of one of the aft hold's hatch covers. The other AB and the deck cadet were working on the port side walkway, sweeping dust from the top of the forward hold coaming. The C/O was on the gantry crane, moving various hatch covers as required for the work.

At 0942, the C/O moved a hatch cover to the forward end of the forward hold and lowered it into position. At 0943:19, he started to drive the gantry crane aft towards the aft hold **(Figure 2)**; at the same time, the 2/O finished his sweeping task and started to walk slowly forward along the raised walkway. A couple of seconds later, he stopped, leant against the walkway guardrails, and spoke to the AB working on the aft hold hatch cover **(Figure 3)**. At 0943:38, the 2/O resumed his slow walk forward, with the crane still moving towards him.

At 0944, the C/O stopped the crane just short of a stack of hatch covers at the forward end of the aft hold and started to raise the crane's lifting bar. At the same time, the 2/O arrived at the forward end of the hatch cover stack. At 0944:10, the 2/O climbed onto the cargo hatch coaming **(Figure 4)** and stepped towards the gap between the crane and the stacked hatch covers **(Figure 5)**. As he did so, the lifting bar cleared the hatch cover stack and the C/O drove the crane aft. The 2/O screamed out in pain as he was trapped and crushed between the hatch covers and the crane's ladder access platform.

The crane stopped abruptly and the C/O stepped or stumbled forward from his driving position and looked down towards the trapped 2/O. He immediately reversed the crane. As the crane moved forward, the 2/O was rolled between the crane's ladder platform and the hatch covers and then fell off the coaming onto the walkway below. As he fell, his head struck the guardrails on the side of the walkway. Reacting to the 2/O's screams, the ABs and the deck cadet rushed to the scene.

The C/O quickly climbed down from the crane and was met at the foot of the ladder by one of the ABs and the cadet. The 2/O was lying on his back on the walkway, and soon lost consciousness and stopped breathing. The deck crew immediately commenced cardio-pulmonary resuscitation (CPR).

The C/O called the master on his very high frequency (VHF) radio, informed him that the 2/O had fallen and asked him to call an ambulance. The master quickly made his way to the scene, arriving within a minute. Seeing that the 2/O needed urgent assistance, the master returned to the vessel's superstructure, where the phone

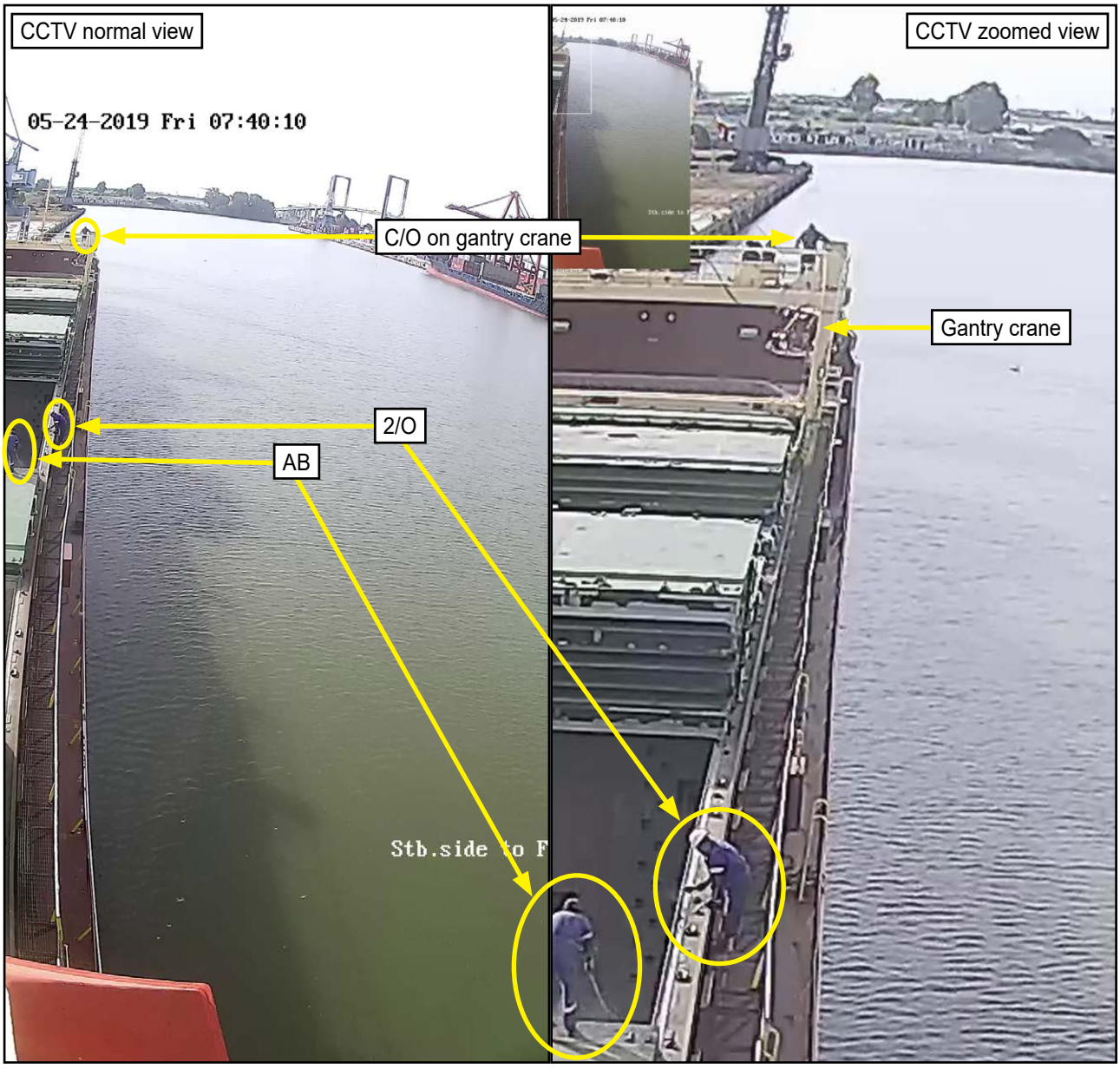


**Figure 1:** Crew working on deck

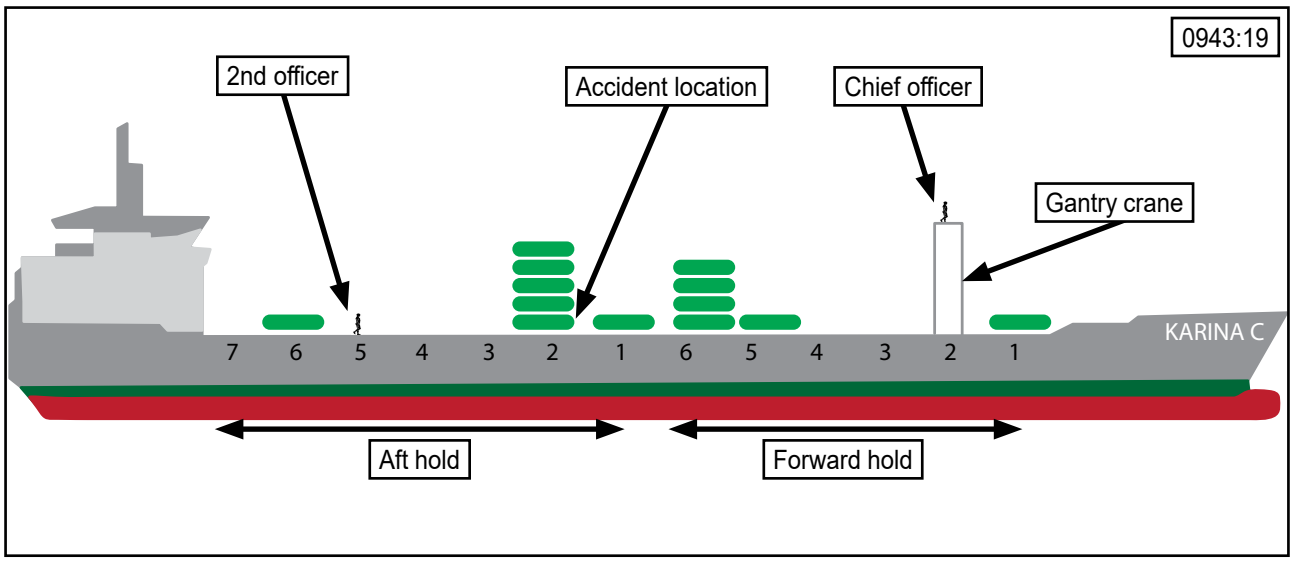


**Figure 2:** *Karina C*'s cargo hold hatch cover locations immediately before the accident

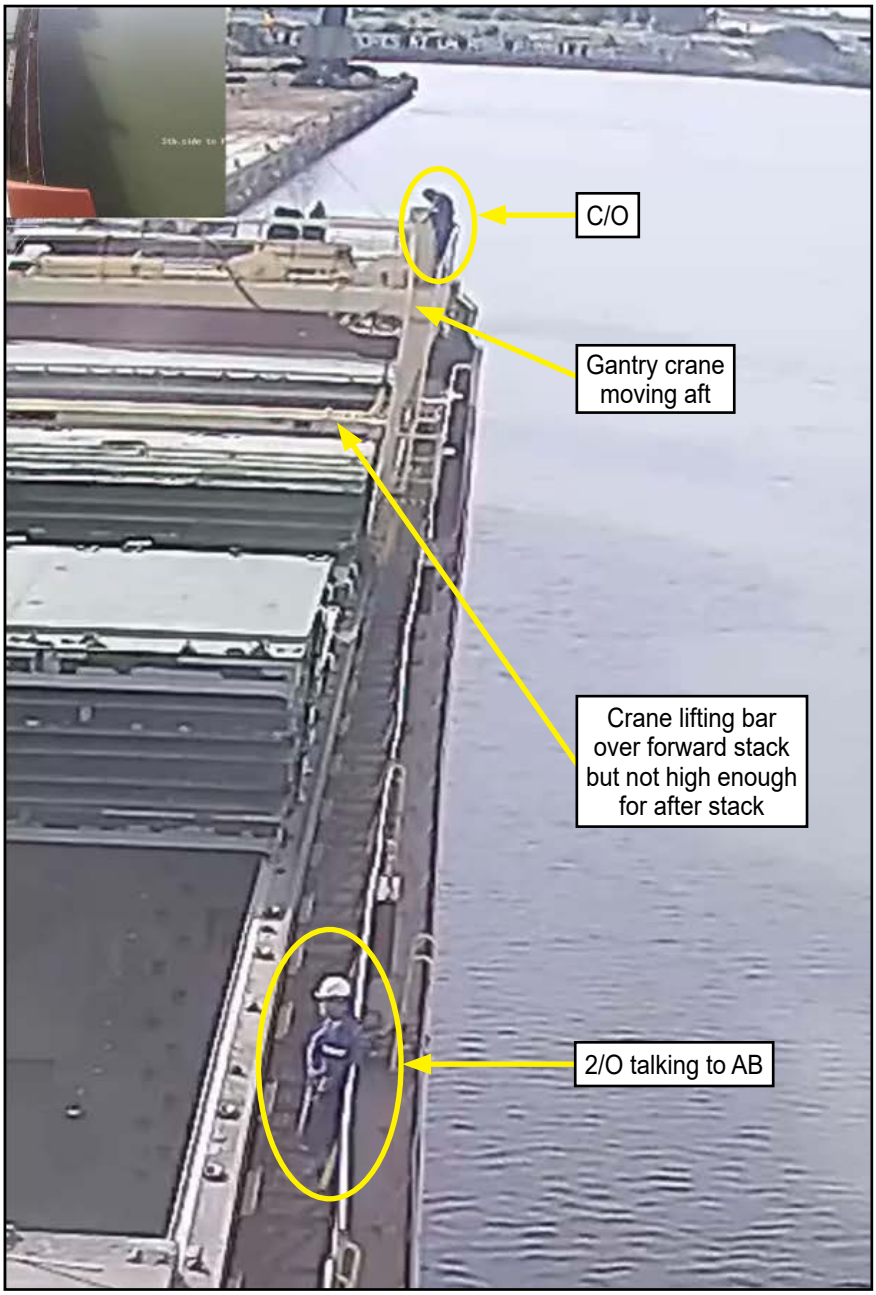


**Figure 3:** Second officer leaning on the starboard walkway guardrails while the gantry crane was being driven aft

signal was better, and called the vessel's agent. The agent alerted the emergency services. The master also called the vessel manager's, Carisbrooke Shipping Ltd (Carisbrooke), Designated Person Ashore (DPA) and told him that the 2/O had suffered a fall on deck. He then returned to the deck to check on the 2/O's condition. Realising that there was little extra he could do to assist at the scene, the master left the deck.

The C/O moved the crane further forward to make more space to treat the 2/O. At about 0949, a Spanish police team arrived on board. The crew then used a stretcher to move the 2/O to the top of the adjacent hatch cover and continued CPR, which included use of the vessel's onboard defibrillator. At about 1005, two emergency medical teams, comprising a doctor, nurse and four medical emergency technicians, arrived at the scene. The C/O told them that the 2/O had fallen from the hatch coaming onto the walkway, and they took over the resuscitation efforts. At about 1100, the doctor declared the 2/O deceased, and told the master and C/O that it was possible the 2/O had died as a result of a heart attack.

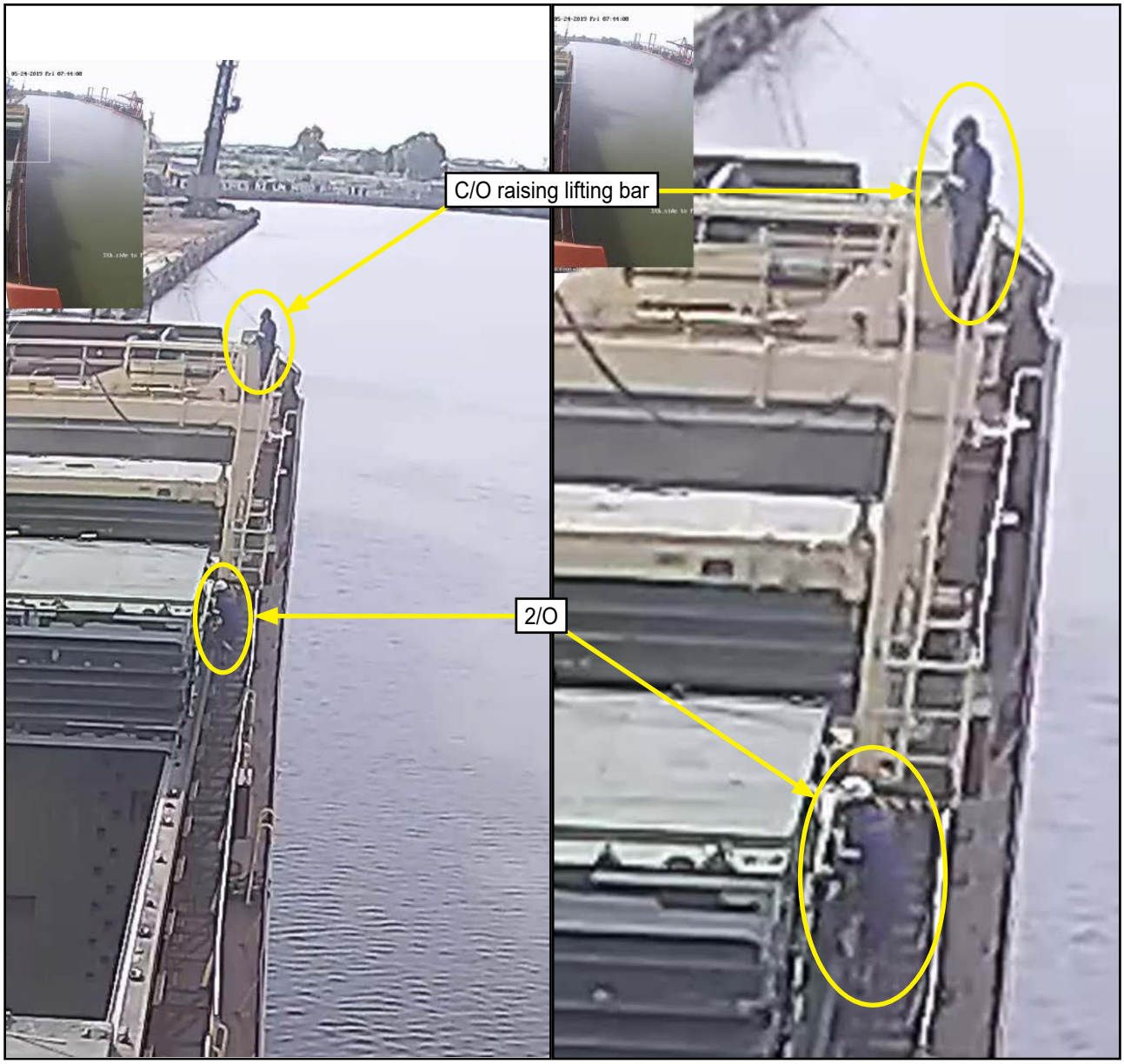


**Figure 4:** Zoomed CCTV screenshot showing the second officer climbing onto cargo hold hatch coaming at 0944:10

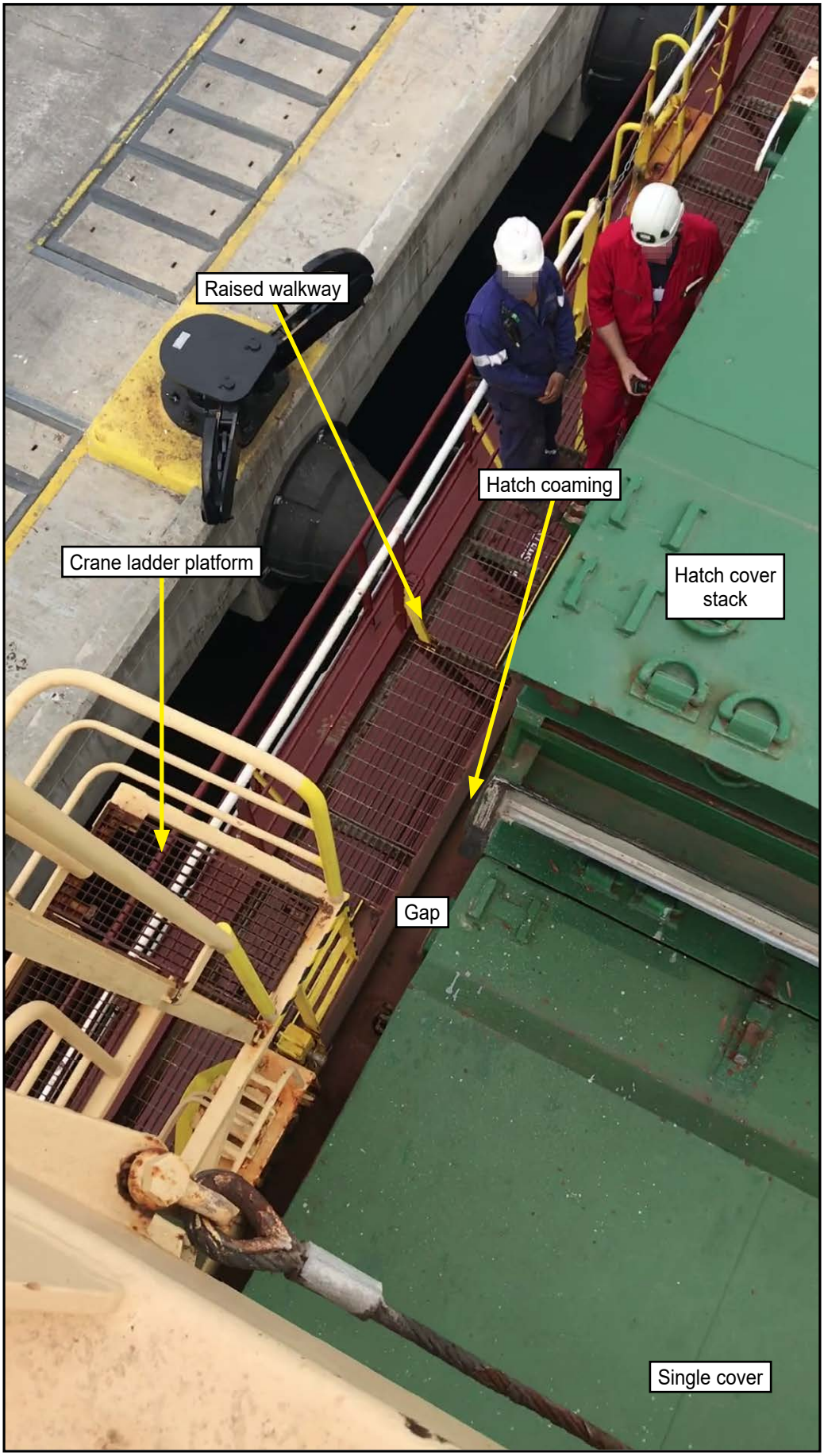


**Figure 5:** Reconstruction showing the distance between the crane ladder platform and the stack of hatch covers when the second officer climbed onto the coaming

## 1.3 POST-ACCIDENT

After the accident, the master completed an incident report form and sent it to the DPA. The report form stated:

> *Today at abt 0945 C/O informed me that 2 nd Off Reszkiewicz Maciej fell down on the walkway and lost conscious.* [sic]

The master's incident report form also advised that, according to the doctor, the cause of death was a heart attack before he fell down.

Following a request from the DPA, the master downloaded the closed-circuit television (CCTV) recording taken from *Karina C*'s starboard bridge roof camera, which was facing forward and had captured the activities along the starboard walkway and the gantry crane operations. The master examined the recording on board and expressed his concern to the C/O that it appeared to show that the crane had made contact with the 2/O. The C/O insisted that this was not the case. On 28 May, the master forwarded the CCTV recording, his statement of facts, the statements provided by the deck crew and his official logbook entries to the DPA.

On 14 June, Carisbrooke's personnel department received a message from the 2/O's son that he had received a report stating the cause of death was *haemorrhagic shock.* This is defined as:

> ***Haemorrhagic shock** is a condition of reduced tissue perfusion, resulting in the inadequate delivery of oxygen and nutrients that are necessary for cellular function.*

Haemorrhagic shock is usually caused by massive blood loss and, in the absence of external injuries, is often due to internal injuries. It is not normally associated with a heart attack.

On 17 September, the company received the 2/O's postmortem (PM) report, which was written in Spanish, and on 23 September an English translation was received. Based on the content of the PM report and following a closer review of the CCTV recording, the company reported the accident to the MAIB on 9 October 2019.

## 1.4 POSTMORTEM AND TOXICOLOGY REPORTS

The PM report concluded:

> *The history and findings of the macroscopic autopsy lead to the conclusion that the death of MACIEJ MICHAL RESZKIEWICZ was a **violent accidental death** whose main cause is haemorrhagic shock, specifically intra-cavity haemorrhage caused by visceral ruptures from blunt trauma to the thorax and abdomen **caused by falling**.*

The 2/O had suffered a broken left femur, injuries to the skin of his lower legs and multiple rib fractures, together with lacerations to both lungs and ruptures to both his liver and left kidney. He died as a result of internal bleeding due to organ rupture.

The 2/O's toxicology report stated that his blood alcohol content (BAC) was 117mg per 100ml. No other narcotic or toxic substances were detected.

Since 2011, the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended (STCW), has required the BAC for seafarers to be limited at 50mg/100ml. This is enshrined in UK law in the Railway and Transport Act 2003, as amended by the Merchant Shipping (Alcohol) (Prescribed Limits Amendment) Regulations 2015.

## 1.5 CREW

### 1.5.1 Manning

*Karina C* had a crew of nine, which comprised four Eastern European officers, a Ukrainian deck cadet, an AB from Cape Verde and three Romanian ratings: an AB, an oiler and a cook. At sea, the master and the two deck officers kept a 4 hours on/8 hours off watch system, and during cargo work in port the C/O and 2/O worked a 6 hours on/6 hours off cargo watch routine. The C/O and 2/O were the only crew members permitted to drive the gantry crane.

### 1.5.2 Second officer

The 2/O, Maciej Michal Reszkiewicz, was a 59-year-old Polish national; his birthday was on the day of the accident. He joined the company in 2012 as a 2/O and held an STCW II/1 officer of watch Certificate of Competence (CoC). He had completed ten contracts on K-class vessels, of which five were on *Karina C*. He joined *Karina C* on 3 February 2019 and was nearing the end of his current contract. He was 1.78m tall and weighed 95kg. At the time of the accident, he was wearing overalls, safety shoes and a safety helmet.

### 1.5.3 Master and chief officer

The master was a 63-year-old Polish national holding an STCW II/2 unlimited master's CoC. He had 20 years' experience in the role of master, of which 10 years were with Carisbrooke. He had worked extensively on K-class vessels, and exclusively on *Karina C* since 2015; he joined *Karina C* on 15 May 2019.

The C/O was a 56-year-old Ukrainian national holding an STCW II/2 unlimited master's CoC. He had joined Carisbrooke as 2/O in 2008, was promoted to the rank of C/O in 2011 and had worked solely on K-class vessels since 2013. He joined *Karina C* on 16 April 2019.

### 1.5.4 Hours of work and rest

In accordance with the Merchant Shipping (Maritime Labour Convention) (Hours of Work) Regulations 2018, *Karina C*'s crew were required to have 10 hours' rest in any 24-hour period, with a minimum of 6 continuous hours within these 10 hours.

According to the vessel's hours of rest records, *Karina C*'s crew members had received more than the minimum rest required by regulations during the days leading up to the accident. In the period immediately before the accident, the vessel's hours of rest records indicated that the 2/O had worked from 1200-1800, had one almost 6 hour break from 1800 to 2345, and worked again from 2345 to 0540. He was then disturbed by being called to the deck at 0915, after some 3 hours of rest.

In the previous 24 hours, the C/O had worked from 0600-1200, 1800-0130 and came on watch again at 0540. He logged a total of 10.5 hours of rest in the period.

## 1.6 *KARINA C*

### 1.6.1 General

*Karina C* was one of ten identical 6,800t vessels referred to as K-class vessels and was built for Carisbrooke in China in 2010. Operating short international trades, the general cargo vessel was also employed as a gearless mini-bulker.

### 1.6.2 Cargo holds and hatch covers

*Karina C* had two cargo holds; the forward hold had six pontoon-type hatch covers and the aft hold had seven **(Figure 6)**. Each hold had a moveable partition bulkhead, which allowed further subdivision to accommodate different cargoes, giving a total of four hold compartments. Hatch covers and partition bulkheads were moved with the gantry crane. The hatch covers were not interchangeable and had to be placed onto the hatch coaming in sequence **(Figure 7)** before cleats were used to secure them. The coamings were provided with water drain channels.

Hold access routes and ventilation ducts were located in the space between the two holds. Raised walkways, 1.67m from the main deck, ran along the length of the two holds on either side of the cargo hatch coamings **(Figure 8)**.

### 1.6.3 Gantry crane

The gantry crane was supplied by Coops and Nieborg BV, a Netherlands company, and installed by the shipbuilder in China. It had a safe working load of 19.5t and four steel legs each fitted with a steel wheel running on rail tracks along the top of the hatch coaming on either side. The wheels were chain-driven by hydraulic motors, which in turn were powered by pressurised hydraulic oil from electrically-driven pumps.

Image courtesy of GIBFRAN46 and www.marinetraffic.com

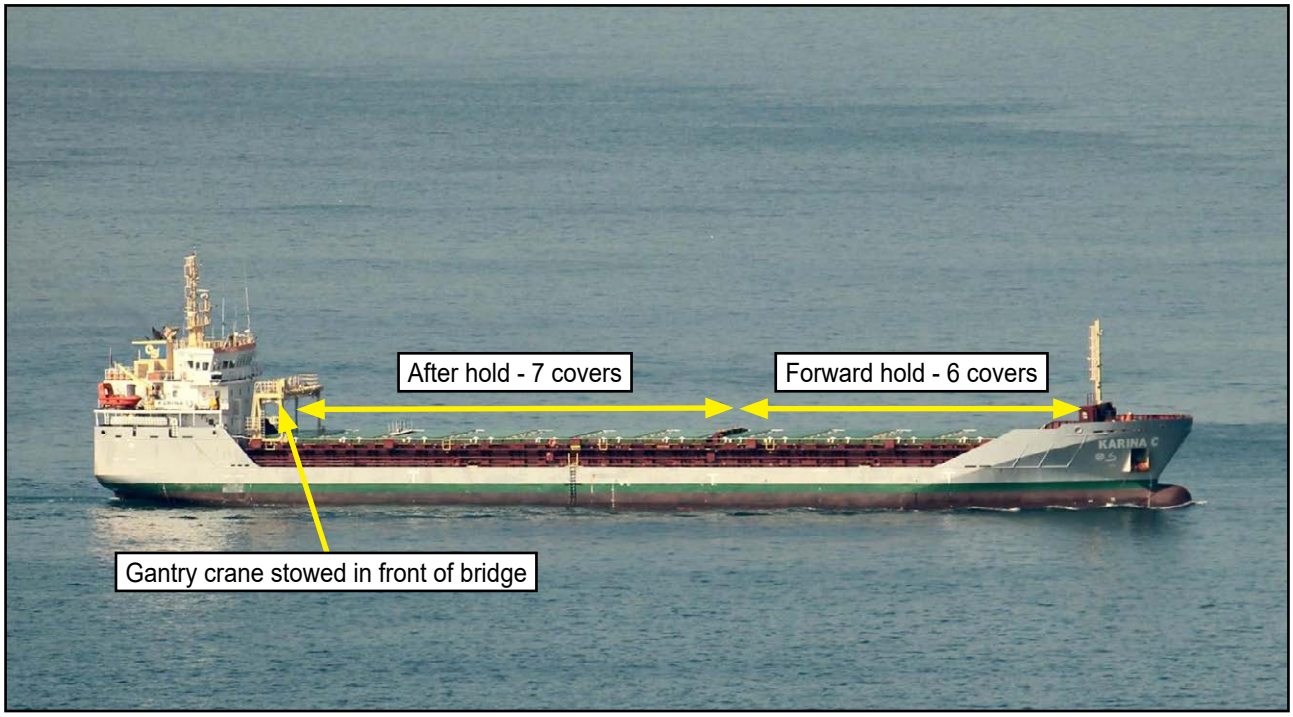


**Figure 6:** *Karina C*'s cargo hold and hatch cover arrangements

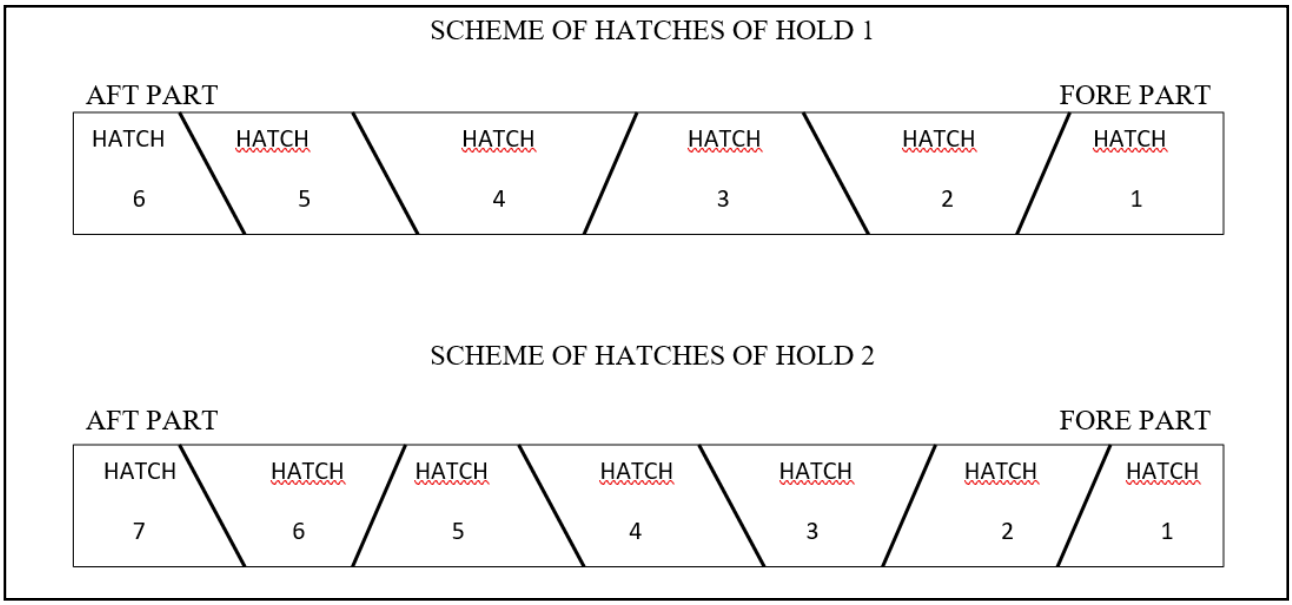


**Figure 7:** Cargo hold hatch cover scheme – all covers were unique


**Figure 8:** Starboard walkway showing stack of hatch covers and gantry crane

The operating position was located at the top of the crane on the starboard side. Access to the crane control platform was by one of two short vertical ladders (one from the starboard walkway, the other from the top of the hatch covers) to an intermediate platform, and then an inclined ladder to the top. The vertical distance between the raised walkway and the crane operator's platform was 4.75m **(Figure 9)**.

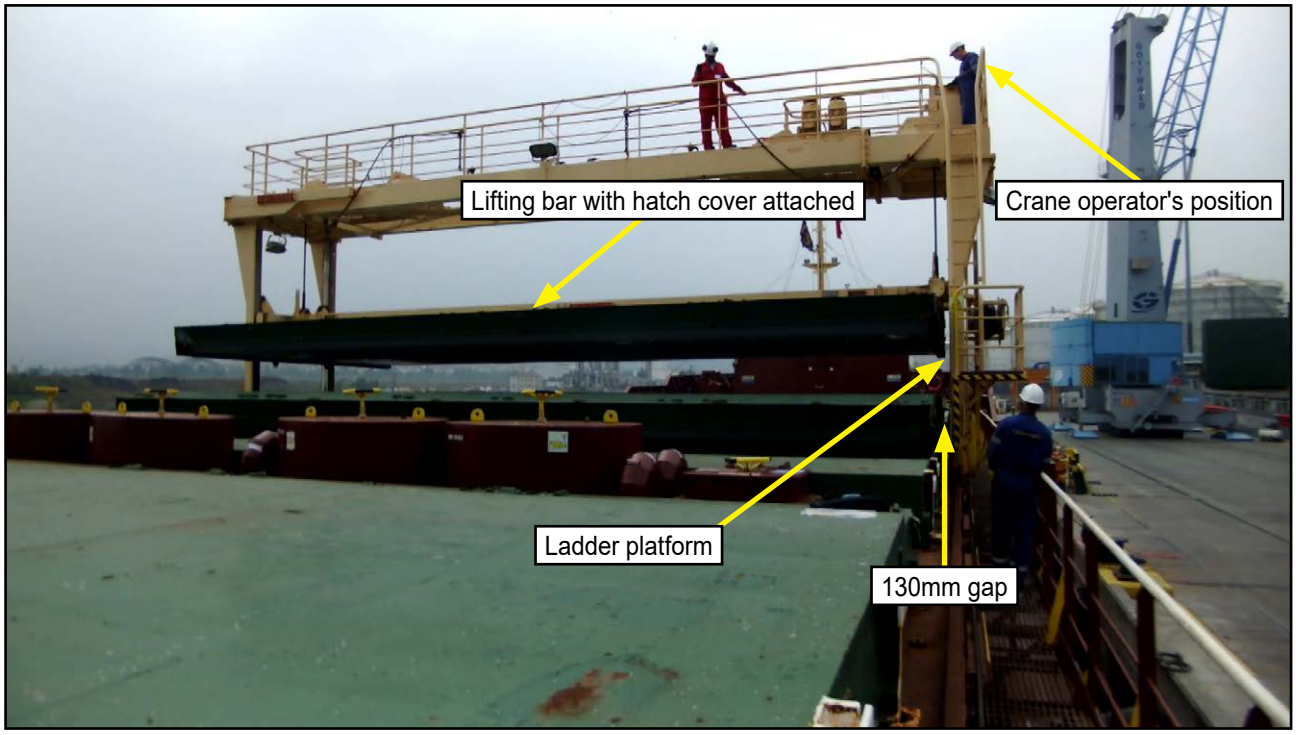


**Figure 9:** Gantry crane looking from aft

The crane had three control levers: two for operating the lifting bar through hydraulically-operated cylinders and wires, and one for driving the crane forward or aft **(Figure 10)**. The drive lever had three positions: forward, stop and reverse. The crane speed was variable depending on the position of the drive lever; at the extreme end position of the lever, the crane reached a speed of 20m/minute. Bringing the drive lever to stop applied brakes on the two forward wheels.

A loud warning bell sounded as soon as the crane started to move forward or aft on its tracks. A flashing amber warning light, positioned at the middle of the underside of the gantry, operated at the same time. There were no warning lights or audible signals when the crane was stationary and its lifting bar was being raised or lowered.

The crane had three emergency stops; two at walkway level on the outboard sides of the port and starboard aft crane legs **(Figure 11)** and one at the driving position **(Figure 10)**. To operate the port or starboard emergency stops, a crew member needed to be stationed on the outboard side of the crane between the crane and the walkway guardrail. The gap between the crane and the guardrail was about 350mm wide **(Figure 12)**.

## 1.7 CARISBROOKE SHIPPING LIMITED

Carisbrooke was based on the Isle of Wight, England, and operated 32 vessels, of which 22 were registered in the UK. Ownership of the fleet was in the form of single vessel companies, with *Karina C* owned by Carisbrooke Shipping 6250 BV, a Netherlands registered company. The vessels were all dry bulk and general cargo carriers ranging from 5,000t to 12,900t deadweight and were engaged in short international voyages.

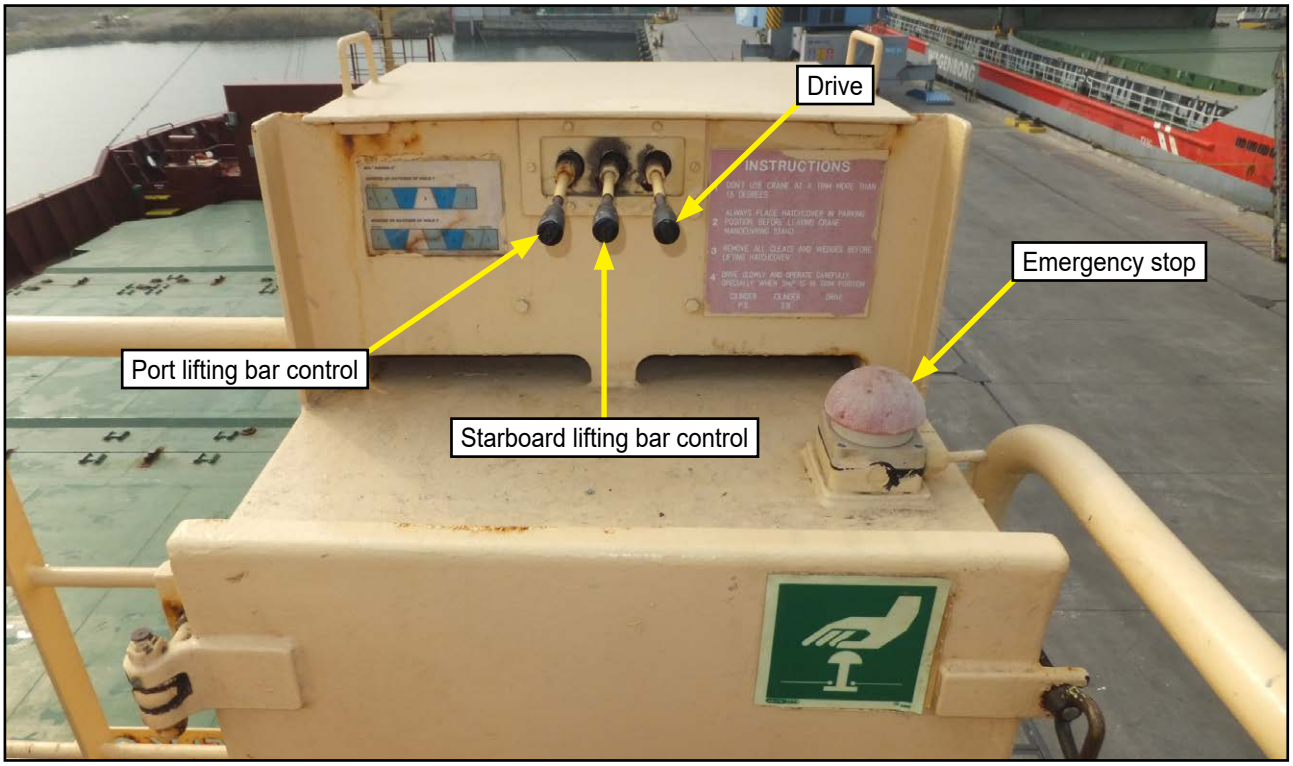


**Figure 10:** Gantry crane control panel


**Figure 11:** Gantry crane emergency stops

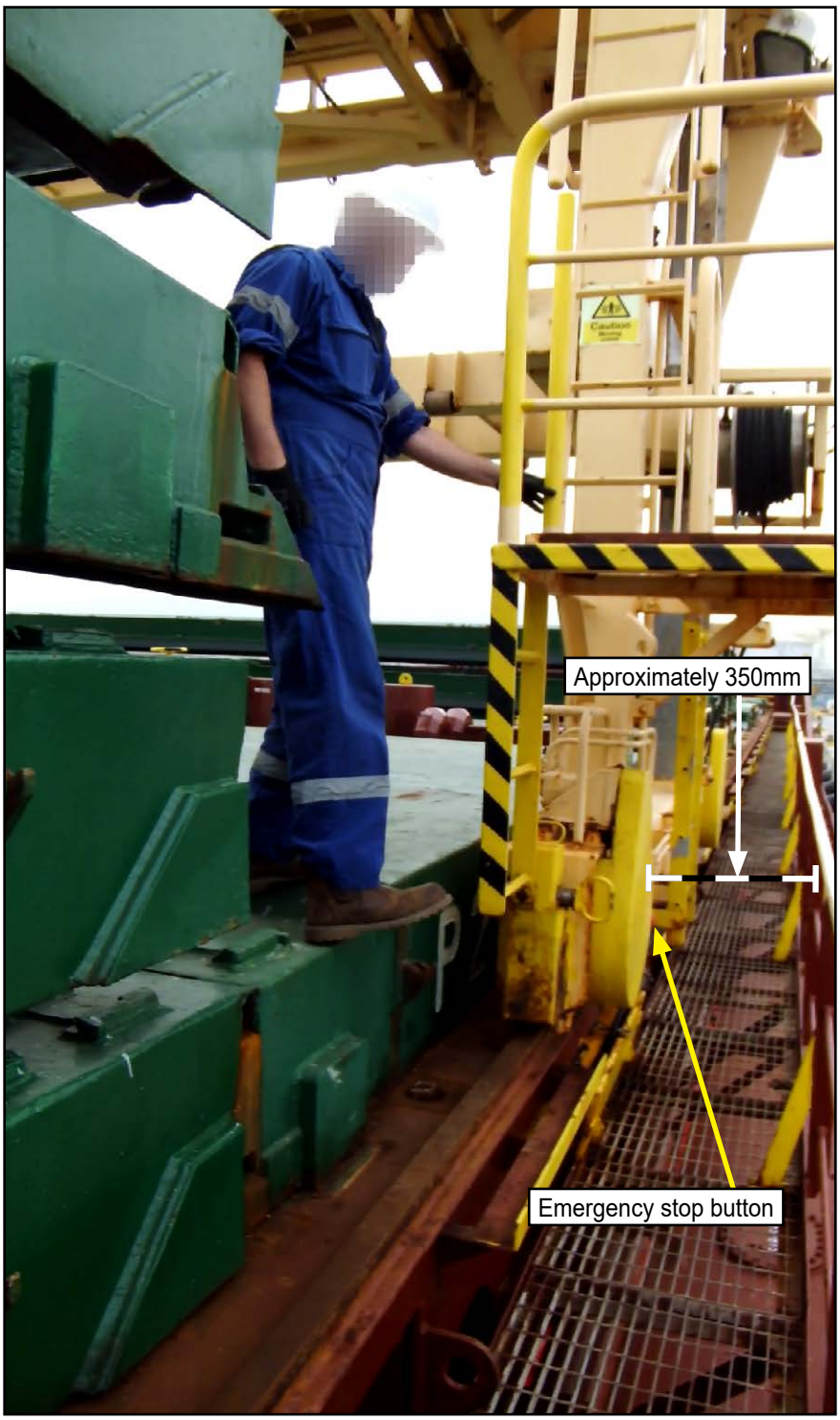


**Figure 12:** Access to starboard emergency stop

Carisbrooke employed around 750 seafarers, with departments delivering technical superintendence, personnel and human resources, and assurance for compliance with the International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code). The head of the ISM Code compliance department was the company's DPA. For convenience, Carisbrooke split its vessels into three fleets, each with its own fleet manager. *Karina C* was part of its Blue Fleet, which included all K-class vessels.

In addition to onboard audits and inspections, both internal and external, the company ran seminars in Poland and Romania, home to many of its senior seagoing personnel, to further the safety message. These were used to share

the details of accidents and incidents, and to announce changes to procedures. The circumstances of this accident and the actions taken were discussed at Carisbrooke's November 2019 seminar. The company received some opposition to the procedural changes it had introduced following the accident, with senior officers highlighting their concern that crewing levels and work patterns would not easily support the introduction of more rigorous safety precautions.

## 1.8 ONBOARD SAFETY MANAGEMENT

### 1.8.1 Safety management system overview

The core safety management system (SMS) for all K-class vessels was identical, with vessel-specific risk assessments and procedural variations produced by shore staff and developed on board by ships' crew. It was set out in a document titled *Safety Management System Manual*. The SMS manual included the company's strategic overview in Section 1:

> *The Company recognises the importance of safe and secure ship operations and endeavours to use its best efforts at all times to ensure that employees at sea and ashore and its ships are safe, secure and the environment is protected.*

The document acknowledged that this could only be achieved if all company employees shared in and contributed to that commitment.

The SMS set out the company's structure and responsibilities of both seagoing and shore-based personnel. It required all seafarers to be familiar with, and follow the documented procedures contained within it. The SMS manual contained detailed procedures for most shipboard evolutions and operation of major equipment including gantry cranes. It also contained procedures for reporting incidents, accidents and near misses, and details of management reviews and audits. This included the shipboard safety committee and procedures for reporting safety issues to shore management via a *Monthly Safety Management Update* (MSMU) report. The MSMU report was required to be completed by the master, summarising any safety issues, minutes from the vessel's safety committee meetings and any other crew welfare or safety points. The safety committee meeting agenda included a *Review of Accidents/Incidents Near Misses/Hazardous Occurrences*.

All crew members were required to complete and sign a *Shipboard Familiarisation Form* (SFF) on joining a vessel for each contract. The SFF included the operation of the gantry crane and knowledge of the vessel's SMS. Completed copies of the forms were sent to the company's offices. The 2/O and C/O had both completed and signed an SFF at the start of their contracts in February and April respectively.

The company's vessels were subject to the ISM Code, and the SMS was designed to achieve compliance. *Karina C*'s Flag State and external audits had taken place in 2018 and both were conducted by Maritime and Coastguard Agency (MCA) surveyors. No major non-conformances were identified, and minor aspects were addressed and reported via MSMUs. The vessel's most recent internal audit prior to the accident had been conducted between 11 and 14 April 2019 by one of the company's marine superintendents. One non-conformance was noted at this audit; risk assessment (RA) procedures were found not to be in accordance with company policy, with vessel-specific RAs not having been completed correctly and relevant RAs not posted at all work places. The non-conformance was noted as having been rectified in the MSMU submitted at the end of April 2019.

### 1.8.2 Deck operations

*Karina C*'s RA *D12 - Opening/Closing of Hatch Covers – Gantry Crane* **(Annex A)** identified eight hazards, including:

- *Personal Injury,*
- *Awareness – Struck by a cargo crane,*
- *Awareness – falling from height, and*
- *Obstructions.*

Risk mitigation measures for six of the eight hazards made multiple references to the gantry crane. Being crushed by the gantry crane was not identified as a specific hazard in the RA document. To reduce the risk of personal injury the RA's procedural control measures included:

> *d) Crew vigilance – Constant monitoring of the task;*
>
> *e) Ensure that the person operating the gantry crane has a clear view of the hatch covers at all times;*
>
> *f) A crew member must be placed on the opposite side to the gantry crane operator for monitoring;*
>
> *g) Any crew/personnel not directly involved in hatch cover operations should stay well clear;*

The RA was reviewed and signed by the previous master and all the deck crew who were on board at the time of the accident on 27 April 2019.

In addition to the RA, an onboard manual titled *Procedures for Safe Operation of Hatches* **(Annex B)** contained detailed gantry crane operating procedures, including the following instruction, under the heading of General Checks:

> *Establish and maintain at all times communication by voice and/or radio and line of sight between crew involved in the operation.* [sic]

Under the heading *Preparations to be taken before moving hatch covers*, the manual stated:

> *Position crewmembers to observe both sides of the hatch and to operate emergency stops if required.*

The manual did not say that the crane operator could fulfil this role for the starboard side of the deck, but this was implied later in the document when it described the procedures for removing and replacing (opening/closing) the hatch covers; which stated:

> *Ensure that a crewmember is watching the operation from the opposite side and is standing by to stop the operation immediately by using the emergency stops in case of emergency or equipment malfunction.*

The procedure also required a crew member to climb onto the hatch cover and check that the crane's lifting hooks had fully engaged before lifting and fully disengaged after lowering into position.

The master's standing orders, dated 22 August 2019, stated:

> *In no any circumstances allowed drive the Gantry if any Persons are in the vicinity of moving gantry (the walkway on the coamings have to be empty too).* [sic]

It has not been possible to verify if this particular standing order was in place at the time of the accident.

The company's *RA D15 – Loading and Discharging Dusty Cargo* **(Annex C)** required the use of suitable personal protective equipment (PPE), which included face masks and goggles. During the pre-departure cleaning operation occasional clouds of cement dust were created **(Figure 13)**. The deck cadet and two ABs were wearing face masks and eye protection; the 2/O and C/O were not.

SMS Section 5.23 *Guard Rails and Openings* stated:

> *Any opening, through which a person may fall, including open hatches should be adequately and securely fenced or otherwise guarded to prevent a person falling.*

All Carisbrooke vessels had portable guardrail systems that could be mounted on the hatch cover coaming to protect personnel on the hatch walkway. They did not have a system to protect against personnel falling from hatch covers into an open hold. The portable guardrails were not in use at the time of the accident.

### 1.8.3 Drugs and alcohol policy

Carisbrooke's drugs and alcohol policy was set out in the SMS manual **(Annex D)**. The crew were not permitted to bring alcohol or illegal drugs on board but were allowed to consume wine and beer provided by the master. The consumption of fortified wine, liquor and spirits was forbidden. The policy stated that there must be no consumption of alcohol during the 4 hours prior to duty or starting work, or while on duty or at work.

The policy reserved the company's right to carry out random alcohol testing of any employee at any time, and it required that the BAC of crew members did not exceed 50mg/100ml. The SMS made it clear that the master was responsible for ensuring compliance.

AlcoDigital alcohol level test equipment was available on board *Karina C* and it was a requirement of the SMS that within 2 hours of any accident or hazardous incident, the master, chief engineer and C/O, and all crew members involved in the accident or incident, be breath tested for alcohol. Test results, in the form of a photograph showing the equipment having just been used and the person tested, had to be sent to the company immediately, and any seafarer found under the influence of alcohol had to be relieved of all duties and investigated by the master. No record of testing after this accident was sent to Carisbrooke.

**Figure 13:** CCTV screenshot showing cement dust cloud

### 1.8.4 Accident and incident reporting and investigation

The SMS set out company policy for accident and incident reporting **(Annex E)** and referred to the *Merchant Shipping (Accident Reporting and Investigation) Regulations 2012*. It also noted the statutory requirement to report a death or major injury on board, in addition to major damage to a vessel or cargo. All reports were to be made by the master, via the DPA, to the ISM Code department and relevant fleet manager, with the master responsible for investigating the cause of the accident or incident.

Carisbrooke had a Near Miss and Hazardous Occurrence (NMHO) reporting system in place at the time of the accident. This required reporters to complete a report form and hand it to the vessel's safety officer, normally the C/O. There was also a system for crew to make confidential reports of complaints, either on board or direct to shore-based management. In the 12 months prior to the accident, 12 NMHO reports and one report on a cargo damage incident were made by *Karina C*'s crew to the company.

The death of the 2/O was recorded in the *Review of Accidents/Incidents and Near Misses/Hazardous Occurrences* section of the minutes for *Karina C*'s safety committee meeting held on 31 May 2019. The minutes stated that all crew attended the meeting and the accident was discussed. The safety committee meeting minutes were included in Section 1 of the MSMU submitted by the master for May 2019 **(Annex F)**. The crew welfare section of the MSMU stated that all deck crew members were tested for alcohol after the death of the 2/O and no alcohol was detected. This testing was not immediately reported to the company as required by the SMS and no records of the test results were found on board. The C/O was taken to the local police station to provide a statement immediately after the accident and therefore could not have been tested within 2 hours of the accident.

The MSMU was reviewed by Carisbrooke's ISM department, personnel department and fleet manager. Their responses provided on 6 June 2019 did not acknowledge the master's comments relating to the accident or alcohol testing.

## 1.9 RECONSTRUCTION

In October 2019, MAIB inspectors visited *Karina C* and reconstructed some of the circumstances that were present in the lead up to the accident. The crane positions, with the hatch covers of both forward and aft holds stacked as they were during the accident, were recreated **(Figures 14** and **15)** and the following observations were made:

- Much of the port walkway was not visible from the crane operator's position.
- The area immediately under the crane was difficult to see from the crane operator's position.
- A person approaching the crane on the starboard walkway became difficult to see once they were within approximately 2m of the crane legs.
- It was possible to get a better downward view if the crane operator moved from the driving position towards the access ladder **(Figure 16)**.
- The gap between the crane ladder platform and the stacked hatch covers was about 130mm. The crewman used in the reconstruction could not squeeze through this gap, and no average-sized adult could safely squeeze through it while the crane was moving **(Figure 15)**.
- It was impossible for the 2/O to reach the gantry crane emergency stop button **(Figure 12)** from the position in which he became trapped.
- The gantry crane's audible warning bell could be clearly heard at walkway level.
- The flashing amber warning light was visible from the walkways but was difficult to see in bright sunlight.


**Figure 14:** Climbing through the gap between the hatch covers and gantry crane (reconstruction)

**Figure 15:** Reconstruction showing size of the gap between the ladder platform and the stacked hatch covers

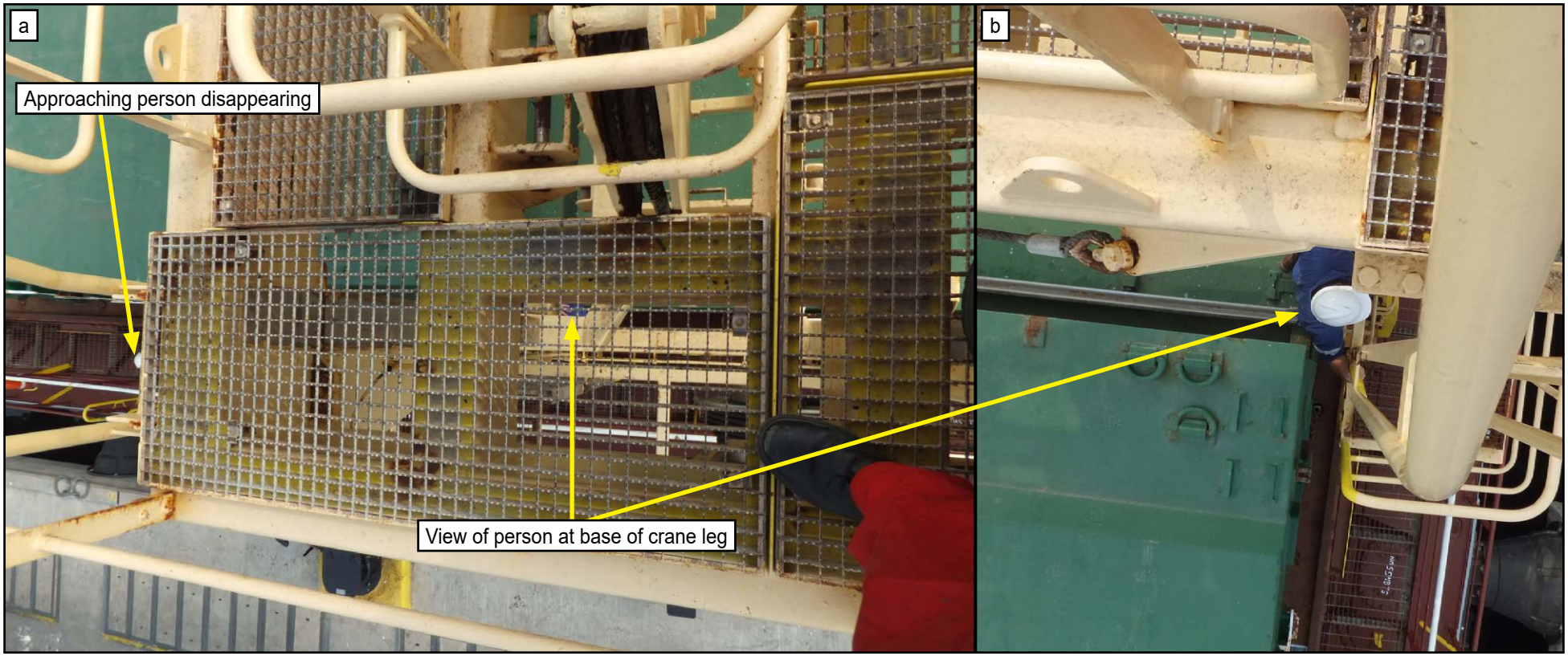


**Figure 16:** View directly below from the gantry crane operator's position **(a)** and above ladder **(b)**

## 1.10 REGULATIONS AND GUIDANCE

### 1.10.1 Lifting operations

The UK requirements for the organisation of lifting operations are set out in the Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment) Regulations 2006 (LOLER). LOLER requires that every lifting operation involving lifting equipment be properly planned, appropriately supervised, and carried out by competent persons in a safe manner.

The MCA provided guidance on the interpretation of LOLER in its Marine Guidance Note (MGN) 332 (M+F) Amendment 1 The Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment) Regulations 2006. It also provided detailed guidance and additional information on lifting equipment and operations in its Code of Safe Working Practices for Merchant Seafarers (COSWP). MGN 332 (M+F) explained that:

> *The majority of injuries to crew involving lifting equipment occur as a result of persons being struck, crushed or caught in moving parts and equipment. The cause is often attributed to incorrect practices or to errors of judgement.*

In addition, the Regulations detail the requirements for the employer to ensure safety as follows:

> *Regulation 10: (3) The employer shall ensure that adequate and effective procedures and safety measures are established to ensure the safety of workers during lifting operations, in particular –*
>
> *e) if the operator of lifting equipment cannot observe the full path of the load, either directly or by means of auxiliary devices, a responsible person has appropriate means of communication to guide the operation.*

The COSWP contained broad guidance for handling hatch covers. The main aspects were covered in *Karina C*'s SMS and gantry crane operating procedures.

Further international guidance on warning alarms for cargo handling cranes is given in the International Labour Organisation's Code of Practice titled *Safety and health in dock work (1997 edition).* While not directly applicable to ship-fitted cranes, it does suggest:

> *4.24.2 The crane should be fitted with a horn or similar warning device that can be operated separately by the driver to warn or attract the attention of any person within the operational area of the crane.*

### 1.10.2 Work at height

The UK requirements for the organisation of working at height are set out in the Merchant Shipping and Fishing Vessels (Health and Safety at Work) (Work at Height) Regulations 2010 and are summarised by the MCA in MGN 410 (M+F). The Regulations specify that 'work at height' is not limited to work on ladders or scaffolding, but also includes:

> *working alongside an open hatch or other opening in a ship's structure.*

The Regulations require an employer to properly plan and conduct work that constitutes 'work at height', and this includes the completion of appropriate RAs and the implementation of control measures to reduce risk to an acceptable level. These points are reiterated in the COSWP, which states:

> *Anyone working in a location where there is a risk of falling may be regarded as working at height. This includes undertaking work inside a tank, near an opening such as a hatch, or on a fixed stairway. Further guidance is contained in Marine Guidance Note MGN 410(M+F).*

To mitigate the risk posed by working near an open hatch Carisbrooke's SMS manual required any opening, through which a person may fall, including open hatches, be adequately and securely fenced or otherwise guarded to prevent a person falling.

### 1.10.3 Accident reporting and investigation

The Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 require all accidents involving deaths and injuries that occur in connection with the operation of a United Kingdom ship, or a ship within United Kingdom territorial waters, to be reported to the MAIB. The Regulations place an onus on the master and/or owner to report the accident by the quickest available means. The Regulations also require the master and owner to examine the circumstances of the accident and provide an investigation report.

## 1.11 PREVIOUS ACCIDENTS INVOLVING CARISBROOKE SHIPPING VESSELS

### 1.11.1 *Vectis Progress*

At 0720 on 9 March 2019, an AB on board Carisbrooke's Isle of Man registered general cargo vessel *Vectis Progress* was injured after being crushed by the vessel's moving gantry crane. The AB was assisting with monitoring the securing of the lifting cables and had been standing aft of the crane as it made its way forward. While the crane operator manoeuvred the crane to move the final hatch cover into position at the forward end of the forward cargo hold, the AB moved around the outside of the crane and was crushed between its access ladder platform and a deck fitted mushroom vent **(Figure 17)**. He suffered several broken ribs and was taken to hospital for treatment.

For the majority of the crane's path, the outboard space was unobstructed, allowing safe access past the crane. However, the forecastle area narrowed and the walkway was obstructed by the vent and other deck fittings. The AB, who had not had his minimum hours of rest in the last 24 hours, was not concentrating and misjudged the available space.

After the accident, a Carisbrooke superintendent, who was on board at the time, carried out a reconstruction and took photographs of the accident site **(Figure 17)**. He also sent the CCTV recordings of the accident to Carisbrooke. The master

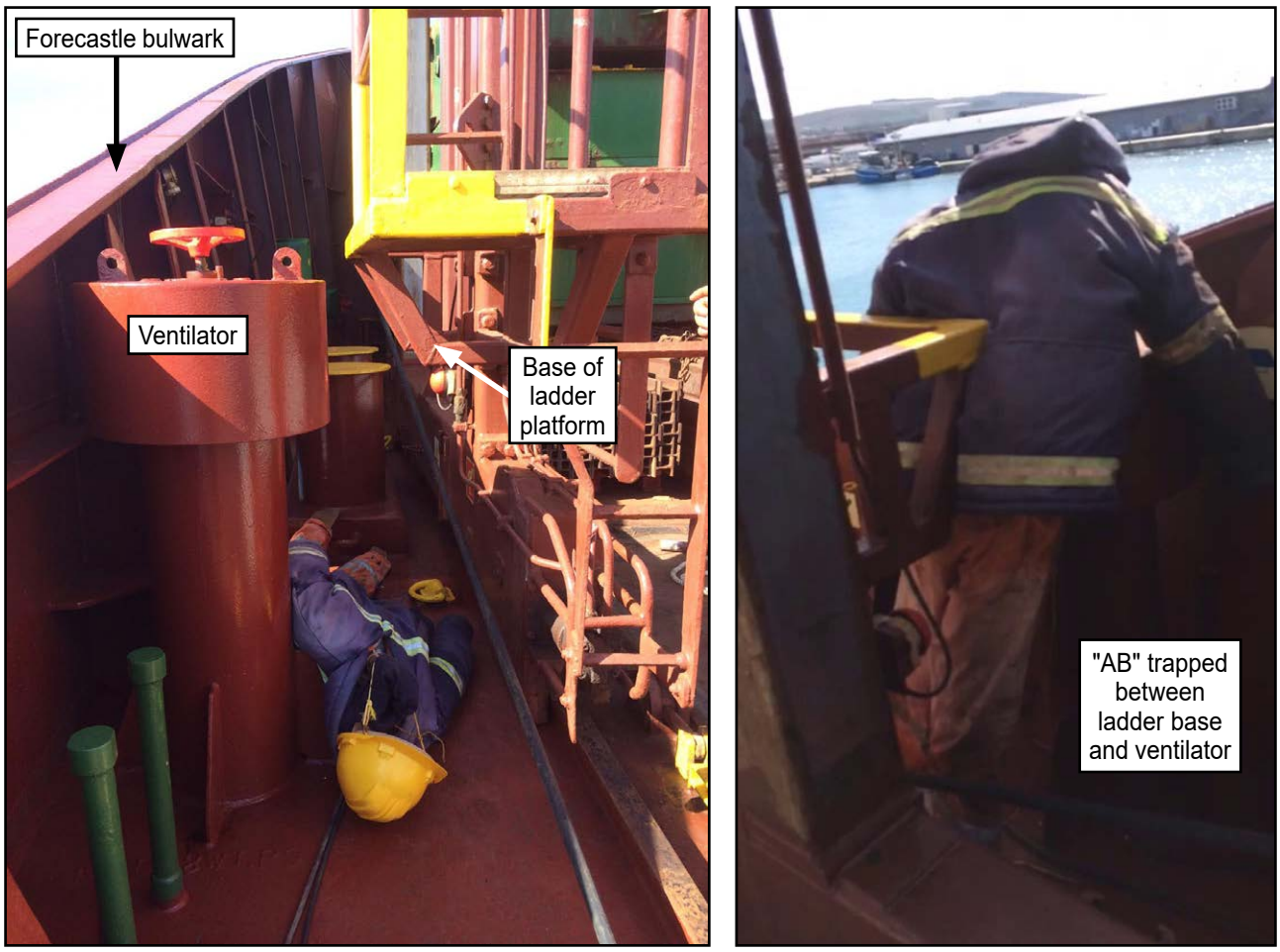


**Figure 17:** Reconstruction of gantry crane accident on board *Vectis Progress*

completed an incident report form and sent it to Carisbrooke's office. The master attributed the accident to inattention on behalf of the A/B and listed the following actions as taken:

> *Immediate corrective actions - All crew instructed to pay more attention during moving of gantry crane. Stay out from tight areas. Preventative actions – training completed with all crew and risk assessment reviewed and amended fleet wide.*

On 15 May, the office sent a response to the incident report and requested more detail about the accident from the vessel's master. At 1608 on 23 May (1708 Spanish time), the evening before the accident on board *Karina C*, the DPA sent an urgent request for action to all vessels in the Carisbrooke fleet. In the email the DPA advised all masters and safety officers of the crushing accident and instructed them to review RA D12 - *Opening/Closing of Hatch Covers – Gantry Crane.* He also instructed them to notify all crew of the accident and to conduct training.

On 31 May 2019, RA D12 was reviewed by *Karina C*'s master and signed by the whole crew, including the C/O and deck crew who were on board at the time of the accident. During the review, the hazard *Crushed by a moving gantry crane* was added. To reduce the risk posed by the hazard, the following procedural control measure was listed in the RA **(Annex G)**:

> *a) Crew must not move from clear aft of the gantry crane to in front of the gantry crane (or vice versa) while the crane is moving if there is a risk of being crushed…* [sic]

This RA review was carried out on the same day as the safety committee meeting referred to in **Section 1.8.4**, and a training exercise for "Crushed by a moving Gantry Crane" was conducted, which was recorded in the master's May MSMU report **(Annex F)**.

### 1.11.2 *Johanna C*

On 11 May 2016, *Johanna C*'s C/O suffered fatal injuries when he fell from a large steel cargo unit that was being repositioned in the forward cargo hold using the vessel's crane. The investigation report[1] concluded that it was inherently unsafe and unnecessary for the C/O to stand on top of the cargo while it was being lifted, and that the risks of standing on a load under tension had not been recognised.

The company prohibited its crews from standing on loads under tension. The MCA added a warning concerning the dangers of standing on loads being lifted in its COSWP.

### 1.11.3 *Sally Ann C*

On 13 March 2015, *Sally Ann C*'s C/O and chief engineer were killed by asphyxiation and the 2/O was seriously injured. The C/O was investigating a bilge alarm in a cargo hold when he went missing. He was found unconscious in the access space to the cargo hold, and when the vessel's chief engineer and 2/O both entered the same space, both collapsed. A team of four crew in breathing apparatus recovered all three officers, but only the 2/O survived.

The investigation report[2] found that none of the three casualties, all experienced officers, followed established shipboard practices or statutory guidelines and notices in respect of entry to an enclosed space. The company was recommended to review its guidance and introduce training and education on enclosed space entry procedures.

## 1.12 PREVIOUS SIMILAR ACCIDENTS

### 1.12.1 MAIB investigation statistics

Over the past 5 years the MAIB has investigated three accidents resulting in crush injuries or fatalities. During the same period, the MAIB investigated 12 occupational accidents where drug or alcohol consumption was considered to have been a contributing factor.

### 1.12.2 *SMN Explorer*[3]

On 1 February 2018, a crewman from the cargo vessel *SMN Explorer* was fatally crushed while working on deck when the forecastle stowage space hatch cover fell on him. The weight of the crewman climbing up the inside of the open hatch cover after its locking pins had been removed caused it to topple forward and slam shut.

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[1] MAIB Report 1/2017 dated January 2017 (https://www.gov.uk/maib-reports/accident-during-cargo-operations-on-general-cargo-vessel-johanna-c-with-loss-of-1-life).

[2] Isle of Man Ship Registry Report No.CA121 (https://www.iomshipregistry.com/media/1124/cr-sally-ann-c-enclosed-space-fatalities-and-near-fatality.pdf).

[3] MAIB Report 21/2018 dated December 2018 (https://www.gov.uk/maib-reports/crush-incident-involving-a-falling-hatch-cover-on-general-cargo-vessel-smn-explorer-with-loss-of-1-life).

The accident was the result of procedural inadequacies and a lapse of supervision. In addition, the crewman's judgment might have been affected by alcohol in his bloodstream. His BAC was 50% higher than the mandatory 50mg/100ml limit set for seafarers in the Manila amendments to STCW Regulation VIII/1 (Fitness for Duty). Given the time of the accident, it was likely that he had consumed alcohol on board that morning.

The investigation identified that the vessel's SMS was immature and that the safety culture on board was weak. RAs had not been conducted for routine tasks and a safe system of work had not been developed for opening and closing the hatch. Recommendations were made to the vessel's managers to improve the system of work for operating the hatch, to improve the safety culture on board and to improve the maintenance management of lifting appliances.

### 1.12.3 *Beauforce*[4]

On 9 June 2015, a crew member on board the Netherlands registered general cargo vessel *Beauforce* was fatally crushed by the vessel's gantry crane during cargo operations. The crew member had been working in the after hold and, to leave it, climbed up the hold access route, emerging on deck as the crane passed. He was caught by the crane and was crushed between the crane and a stack of hatch covers over the after hold. The crew member had not communicated his intentions to the crane operator and did not follow the safe systems of work in place. The crane operator was unaware of the crew member's intentions.

Recommendations from this report included stationing a second lookout on the starboard side when the crane operator had no view of the walkway due to stacked hatch covers. It also included the consideration of automatic stop mechanisms in order to prevent accidents involving running over/colliding with objects or people. The report noted that, as of 2016, no hatch cover cranes built by Coops and Nieborg BV had been equipped with automatic stop equipment.

### 1.12.4 *Toucan Arrow*[5]

On 7 October 2013, a crew member from the Bahamas registered general cargo vessel *Toucan Arrow* was fatally crushed between a hatch cover crane and the vessel's structure during preparations for cargo operations alongside in the port of Portland, Australia. Investigations concluded that it was most likely that the crew member, an electrician, was intending to repair a warning light on the crane when he was injured. It was apparent that he did not follow the designated safe systems of work in that he had not followed the permit to work procedures, did not inform the crane operator of his intentions, and did not isolate the crane's power supply before he began working on the crane.

### 1.12.5 *Cimbris*

On 14 July 2020, a stevedore working aboard the Gibraltar flagged cargo vessel *Cimbris* was fatally crushed by the vessel's moving gantry crane during cargo operations alongside in Antwerp, Belgium. The accident was still under investigation when this report was published.

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[4] Dutch Safety Board Hatch Cover Crane Entrapment report dated April 2016 (https://www.onderzoeksraad.nl/en/page/3990/hatch-cover-crane-entrapment-9-june-2015).

[5] Australian Transport safety Bureau marine occurrence investigation report 303-MO-2013-010 Crew member fatality on board *Toucan Arrow*, Portland, Victoria, 7 October 2013 (http://www.atsb.gov.au/media/4907273/mo-2013-010-_final.pdf).

# SECTION 2 - ANALYSIS

## 2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

## 2.2 OVERVIEW

*Karina C*'s 2/O was fatally injured when he was crushed between the vessel's moving gantry crane and a stack of cargo hold hatch covers. The 2/O's injuries were initially attributed to a fall following a medical event and his death was not reported as an accident.

In this section of the report, the reasons why the 2/O was crushed and the factors that contributed to the accident will be analysed. The emergency response, safe working practices on board *Karina C* and the delay in reporting the accident will also be discussed.

## 2.3 THE ACCIDENT

The 2/O arrived on deck about 15 minutes before the accident and was working at the aft end of the starboard cargo hatch walkway, sweeping cement dust from the top of the hatch coaming. At the same time, the C/O was replacing hatch covers at the forward end of the forward hold. The C/O had a good view along the whole length of the starboard walkway with the exception of the area within 2m of the crane legs.

When the 2/O finished his cement sweeping task and started to walk slowly forward along the walkway the crane was moving aft towards him. The crane's loud warning bell and flashing amber light would have been clearly apparent to the 2/O, and the 2/O would have been visible from the crane operator's position. The 2/O and the crane arrived at the hatch cover stack at the forward end of the aft cargo hold at the same time, and the warning bell and flashing light would have stopped when the crane stopped moving.

It has not been possible to determine the 2/O's intentions in attempting to pass between the stationary crane and the stack of hatch covers; however, it is most likely that he intended to walk across to the port side of the vessel. Seeing and hearing the crane stop, the 2/O must have assumed it would be stationary long enough for him to climb onto the coaming and to step through the gap. There was no evidence of any communication between him and the C/O.

The C/O was concentrating on raising the crane's lifting bar and did not notice the 2/O approach. Once he was within a couple of metres of the crane, the 2/O would not have been visible to the C/O at the control position. The C/O did not move from the control position to check the area directly below was clear and did not appear to make any visual check of the walkways before moving the crane.

Unaware that the 2/O was now under the crane and about to climb through the gap between the hatch covers and the crane, the C/O began moving the crane aft. This movement reduced the available space between the crane's ladder platform and the

hatch covers to a width of around 130mm, trapping and crushing the 2/O. Hearing the 2/O's screams, the C/O looked down towards the trapped 2/O and immediately stopped and then reversed the gantry crane, moving it forward and releasing the 2/O. It was evident from the CCTV footage that this action would have inflicted further injuries on the 2/O, but it was an instinctive thing to do and there were probably no other options available.

The 2/O was crushed because he attempted to walk between the vessel's gantry crane and a stack of cargo hold hatch covers at the same time as the C/O started to drive the crane towards him. The C/O did not know that the 2/O was under the crane or what his intentions were because he was focused on raising the crane's lifting bar and was not monitoring the walkways or communicating with the 2/O.

## 2.4 EMERGENCY RESPONSE

The crew's first-aid response was immediate. However, the 2/O had lost consciousness and stopped breathing within seconds of being crushed. CPR was carried out and external assistance was called quickly; police and medical emergency services were on board within 20 minutes.

The emergency service's medical team were told that the 2/O had fallen onto the walkway and therefore were unaware of the crushing accident. Based on the information presented to him, and his own diagnosis, the attending doctor expressed an opinion that the 2/O's death was possibly a heart attack.

Given the extent of the internal injuries he suffered, knowledge of the crush accident probably would not have increased the 2/O's chances of survival. Nevertheless, it is critical that first-aiders, paramedics and doctors are given as much information as possible about the circumstances of an accident, as this will help ensure that the most appropriate treatment is given.

## 2.5 SAFE WORKING PRACTICES

### 2.5.1 Overview

Carisbrooke had a comprehensive SMS that covered all aspects of vessel operations. It provided a generic SMS manual for its K-class vessels and vessel-specific RAs and procedures. These were produced ashore and modified as necessary by the crew on board individual vessels. Its policies and procedures were clearly articulated, but on board *Karina C*, on 24 May 2019, several of the company's documented safe working practices were not being followed.

### 2.5.2 Gantry crane operations

*Karina C*'s SMS included an RA for opening and closing the cargo hold hatch covers, and guidance and instructions for operating the gantry crane. The safety precautions listed in the RA and procedures guide included: keeping personnel who were not directly involved in hatch cover operations clear of the area; positioning crew members on both sides of the hatch to monitor walkways and operate the crane's emergency stops; and ensuring good communications between those involved. None of these safety critical control measures were put in place.

The C/O and 2/O were the only authorised operators of the crane on board, and both had signed SFFs indicating that they were familiar with the SMS and understood the gantry crane operating procedures. In addition, all the crew members on deck had reviewed and signed the RA for opening and closing the hatch covers using the gantry crane 1 month before the accident.

The reconstruction carried out on board *Karina C* in October 2019 [Section 1.9] confirmed that the C/O did not have a clear view of the port walkway from the crane operator's position. This made the use of a lookout on the opposite side of the vessel vital in ensuring the safety of personnel working on the port walkway. The reconstruction also identified that the area directly beneath and 2m aft of the gantry crane was obscured from the operator's position. This placed an onus on the crane operator, who was monitoring the starboard walkway, to ensure that area was clear before each movement commenced.

The RAs and procedures Carisbrooke had in place for operating the gantry crane could have been clearer. The RA for opening and closing the hatch covers using the gantry crane did not specifically identify the risk of crushing, and the procedure for safe operation of the hatches and bulkheads could have been more prescriptive about the monitoring of the starboard walkway. Nevertheless, a more generic 'personal injury' risk was identified, and suitable safety precautions were laid down. Had they been implemented the accident would have been avoided.

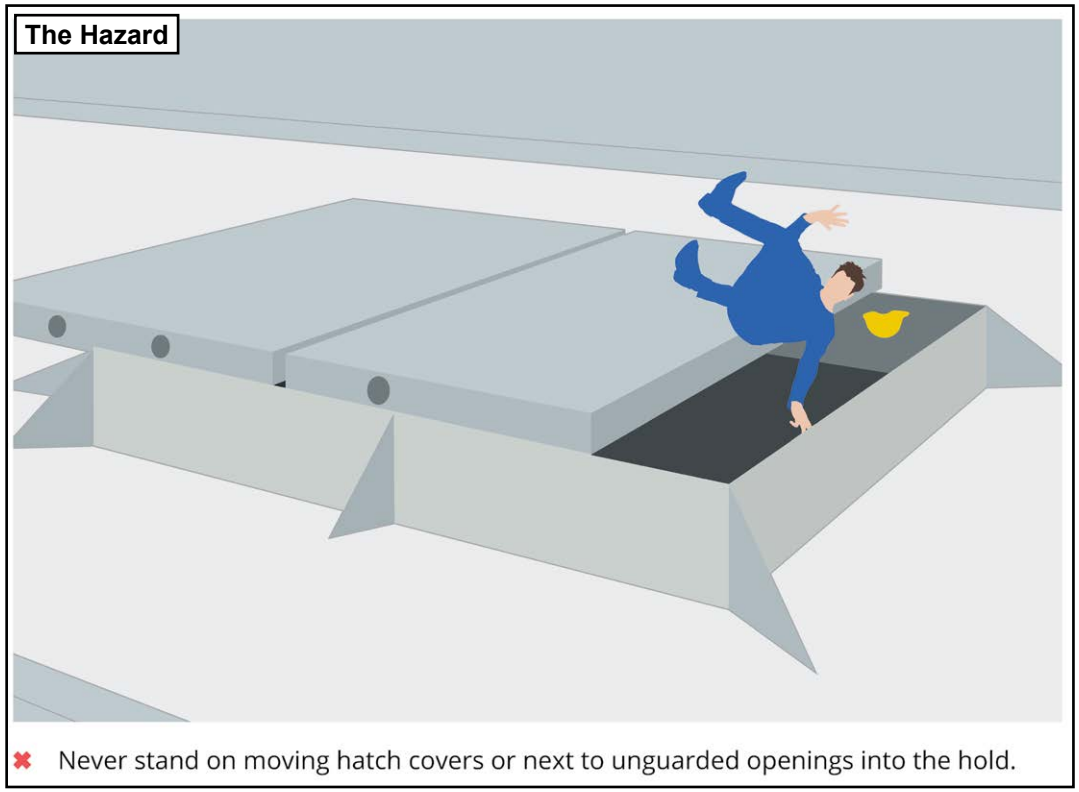
### 2.5.3 General safety on deck during cargo operations

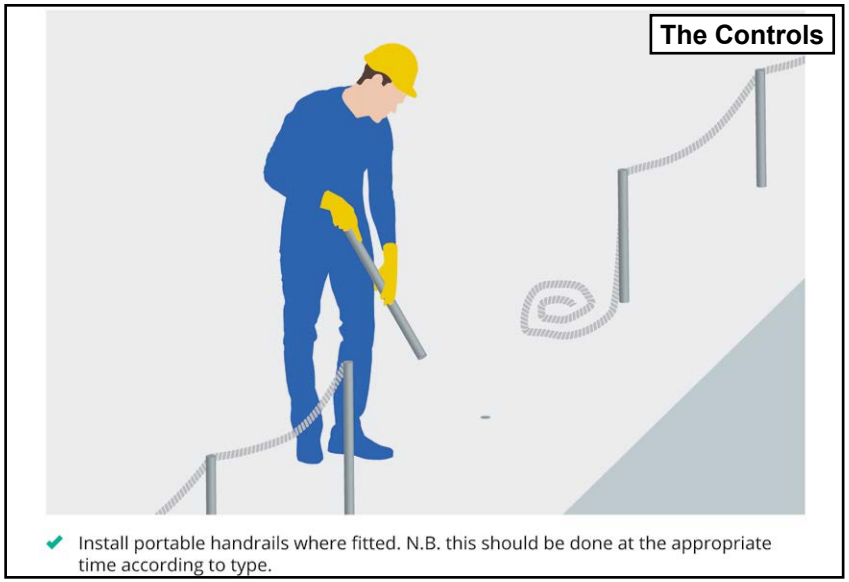
During the task of clearing the cement residue from the hatch covers and coamings, one AB was observed walking along and leaning over the unprotected edge of a hatch cover **(Figure 1)**. Working close to unprotected open hatch covers is a well-recognised hazard and the consequence of a simple slip or trip, or even a medical event, can often have fatal consequences. The UK Working at Height Regulations require personnel working in such areas to be protected, either by the rigging of temporary guardrails, or by the wearing of a safety harness and the rigging of a fall prevention system **(Figure 18)**. This requirement was repeated in Carisbrooke's SMS manual, but on the day of the accident, portable guardrails were not rigged and safety harnesses and fall prevention lanyards were not used.

It was also evident from the CCTV recordings that the crew members working on deck were being exposed to large amounts of airborne cement dust **(Figure 13)**. *Karina C*'s RA for operations in dusty environments required the use of face masks and goggles. The ABs and the deck cadet wore both, but the C/O and 2/O did not.

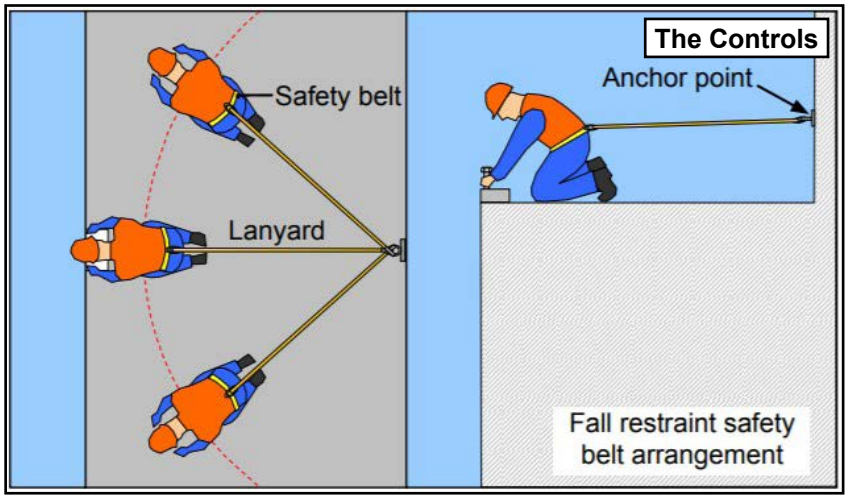
*Karina C*'s deck crew were not following the company's safe systems of work, and the tasks being undertaken on the deck were not being closely monitored or controlled. This might have been influenced by time pressures introduced when the vessel's departure time was brought forward at short notice. However, the 2/O was not demonstrating any sense of urgency and was not rushing around on deck. Furthermore, the 2/O was close to the AB, who was working on the edge of the open hatch and was in the C/O's direct line of sight when he started walking towards the moving crane, but neither he nor the C/O appeared to be concerned. This was probably because these types of deviation from the vessel's safe systems of work had become common practice and had become normalised on *Karina C.*

Illustration used by The London P&I Club in its 2020 publication 'Holds and Hatch Covers'




**Collective fall prevention**




**Personal fall prevention (Personal Protective Equipment)**

**Figure 18:** Fall prevention methods while working close to open hatches

The circumstance of the crushing accident on board *Vectis Progress* [Section 1.11.1] a couple of months earlier, and the concerns raised by senior crew members about *Carisbrooke*'s introduction of more robust safety measures following the accidents, suggest a company-wide problem.

## 2.6 GANTRY CRANE SAFETY DEVICES

*Karina C*'s gantry crane warning bell and flashing amber light were designed to alert people on deck whenever the crane was moving forward or aft along its rail tracks. The warning devices did not operate when the crane was stationary but about to move, or when the lifting beam was being raised or lowered.

There was no requirement for the rail mounted gantry crane to be equipped with a pre-movement warning device. However, such a device could save lives when strict procedural controls are not followed. An audible warning device, either automatic or manually controlled by the crane operator, that sounds for a short period before a gantry crane begins to move, would alert people who have intentionally or unwittingly strayed into a danger zone, giving them time to get clear, raise the alarm or operate an emergency stop. Alternatively, an automatic stop system, capable of detecting obstructions in the crane's path, could also achieve a higher level of safety.

The crane's deck level emergency stop buttons could only be operated from the walkways and were not within the 2/O's reach just before and after he became trapped. Furthermore, the area between the crane and the walkway guardrails where the emergency stop buttons were positioned was a dangerous place to stand when the crane was moving. To allow safe access to the emergency stops at deck level, a minimum of four emergency stop buttons needed to be provided; one on the outer face of each of the crane legs **(Figure 19)**. This would allow a lookout, or anyone caught on the walkway or hatch coaming, the chance to stop the crane in an emergency.

## 2.7 ALCOHOL

### 2.7.1 Alcohol consumption on board

The 2/O's PM toxicology report recorded that his BAC level was found to be 117mg/100ml. It was therefore evident that the 2/O's BAC was more than twice the legal limit for seafarers when he arrived on deck at 0930 and started to work. The investigation was not able to establish when and how much alcohol the 2/O had consumed, or whether he drank alone. However, the day of the accident was the 2/O's birthday, and with the vessel due to sail in the early afternoon there is a strong likelihood that he celebrated by consuming more alcohol than usual. There was also some evidence to suggest he drank with other crew members the evening before and/or during his midnight to 0600 watch.

If the 2/O did not drink alcohol during or after his watch, to still have a BAC of 117mg/100ml at 0930 he would have had to have drunk heavily the evening before the accident. It is estimated that a healthy adult will metabolize alcohol at a rate of about one unit[6] or 0.015 to 0.020ml BAC per hour once they stop drinking[7]. Using

[6] A unit of alcohol is a measure equivalent to 8g of pure ethanol, which is roughly a half-pint (250ml) of beer, a very small glass of wine (100ml) or a single measure of spirits (25ml).

[7] https://www.nhs.uk/common-health-questions/lifestyle/how-long-does-alcohol-stay-in-your-blood/

**Figure 19:** Additional emergency stops fitted to the starboard side of the gantry since the accident

the higher rate of alcohol metabolization, if the 2/O did not drink during or after his watch, he would have had to have a BAC of around 250mg/100ml when he came on watch at midnight. To achieve this, he would have had to consume at least 20 units of alcohol. If this was the case it should have been apparent to the C/O that the 2/O was heavily intoxicated and he should not have been allowed to go on duty. Again, using the higher rate of alcohol metabolization, it would have been 1330 that afternoon at the earliest before the 2/O would have been under the 50mg/100ml BAC limit required by law and thus rendering him fit for duty.

The effect of a residual BAC of 117mg/100ml is equivalent to having just consumed around five units of alcohol. This level of alcohol will impact on the part of the brain associated with judgment and decision making, causing an individual to be more reckless and uninhibited. It is also likely to make a person feel lightheaded and affect reaction time and coordination[8]. It is therefore almost certain that the consumption of alcohol was a significant contributory factor in this accident. Given the circumstances and the evidence available, it is also likely that the 2/O drank while on watch and with other crew members.

### 2.7.2 Drugs and alcohol policy

Carisbrooke had an established policy on drugs and alcohol. All illegal drug use was banned and, while it did not prohibit alcohol consumption on board, strong spirits and fortified wines were not allowed and maximum levels permitted were clearly specified. This policy allowed crew to drink in moderation provided they were always under the legal limit. There was a policy of random testing and the overall policy was generally understood by crew.

Company policy dictated that all involved crew members should be tested immediately after an accident. The only record of any post-accident alcohol testing of crew was found in the MSMU report for May 2019, which indicated all tests were negative. However, this testing was not reported to the company with photographic evidence as specified in the SMS, and might not have been conducted within 2 hours of the accident, as stipulated in the drugs and alcohol policy. This was particularly the case for the C/O, who was taken to the local police station to give a statement. As the alcohol tests recorded in the MSMU appeared to be in response to the accident, the master and chief engineer should also have been tested.

Carisbrooke's drugs and alcohol policy was clear, and it was apparent that the 2/O, and possibly other crew members, were not complying with it. There was no evidence to indicate that the master was involved or aware that the 2/O was drinking heavily that night. However, given that it was the 2/O's birthday, and with a small crew, it is unlikely that the master was completely unaware that the drugs and alcohol policy was being ignored on board.

To be effective, drugs and alcohol policies need to be strictly enforced. Carisbrooke allowed limited consumption, but on this occasion, at least one individual ignored the policy. A company's remote enforcement, of often unpopular policies, will always be difficult. Therefore, like many aspects of shipboard operation, its application must be led by senior management on board. The process of alcohol testing all crew directly or indirectly involved in accidents and incidents will identify those who might have been under the influence of alcohol and, more often than not, it will remove any doubt or speculation about their levels of intoxication. More importantly, senior officers must use the available means of testing whenever they have reason to believe the drug and alcohol policy has been breached. They must then follow this up by taking appropriate action to prevent transgressors from putting themselves or others at risk.

[8] https://www.nhs.uk/conditions/alcohol-misuse/risks/

## 2.8 FATIGUE

The 2/O's hours of rest records indicated that he had the mandated minimum 10 hours of rest in the 24 hours before he died. However, he was woken 3 hours into a rest period. This, coupled with the effect of alcohol in his bloodstream, increased the likelihood that the 2/O was tired, if not fatigued, when he arrived on deck. Therefore, tiredness and/or fatigue might also have influenced the 2/O's judgment and actions.

Although the C/O had recorded 10.5 hours of rest in the 24 hours before the incident, he only had 4.5 hours in the 16 hours before the accident. While within the mandated minimum, it is possible the C/O might have been fatigued at the time of the accident, and this might have affected his judgment and failure to apply the correct safety procedures for the operation of the gantry crane.

## 2.9 ACCIDENT REPORTING AND INVESTIGATION

The Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 required vessel masters and owners to report all accidents resulting in injuries or deaths to the MAIB, and carry out their own investigations into the circumstances. Carisbrooke was informed almost immediately that the 2/O had fallen from the hatch coaming and was very seriously injured. A short time later, the company's DPA was advised by the master that the 2/O had died, and that the emergency services' doctor had attributed his fall to a heart attack. Although the DPA asked for a copy of the CCTV footage showing the accident, Carisbrooke's managers did not investigate the circumstances of the death or report it as an accident to the MAIB. The accident was only reported once it became apparent - from the PM report - that the 2/O had suffered severe internal crush injuries.

It is almost certain that the C/O realised that the 2/O had been crushed by the crane. When he heard the 2/O's screams, the C/O stopped the crane, moved from the control position and looked down towards his trapped crewmate before reversing the crane and releasing him. It is unclear why the C/O did not report the crushing accident, and told the emergency services that the 2/O had simply fallen. It is possible that he had been traumatised by the event and was in a state of shock; however, it is more likely that he thought he might be blamed for the accident and would lose his job.

The master viewed the CCTV footage of the accident and had suspicions that the 2/O had been struck by the crane, but accepted the C/O's version of events and the opinion of the doctor at the scene that the possible cause of the 2/O's fall was a heart attack. He directed the deck crew to write statements, but did not question them individually, or conduct anything more than a cursory investigation. Taking the report from the vessel's master at face value, and even after receiving the CCTV footage, Carisbrooke treated the death as a medical event and did not conduct a company investigation.

The CCTV recording was obtained by the MAIB in October 2019. From close examination of the recording it was apparent that the crane was involved with the accident. Using commercially available software, the footage was enlarged **(Figure 20)** to make the sequence of events significantly clearer. From the zoomed images it was evident that the 2/O had been trapped by the crane and crushed between the moving crane's ladder platform and the stack of hatch covers.


**Figure 20:** CCTV snapshot of the starboard side of cargo deck (unenhanced **(a)** and enhanced **(b)**, showing significantly more detail)

A key feature of a good SMS is an open and just culture of reporting accidents and incidents. All crew members should feel able to report near misses and minor accidents, as well as more serious occurrences, either directly on board or, if they feel the need, anonymously to shore-based senior management. They should be confident that both the master and fleet management will take them seriously and that there will be no professional consequences for them as reporters. The MAIB investigation established that there was additional evidence that the 2/O had been crushed, but this was not reported to the company. Carisbrooke's confidential NMHO reporting procedure appeared to be operating effectively for relatively minor defects and incidents, but no one on board formally raised with the company the possibility of the 2/O's death being accidental rather than a medical event. There was a confidential complaints procedure and telephone line, and better promotion of this might have led to an earlier report of the probable accident.

Carisbrooke's acceptance of the reported opinion of an emergency services doctor, unverified by postmortem and the resultant slow investigation into the circumstances of the 2/O's death, is a concern. This is because the 2/O was working at the time of the accident and even had he experienced a medical event this should not have

led to him suffering significant injuries as a result of a fall from height. Similarly, Carisbrooke was slow to investigate the circumstances and causes of the gantry crane crushing accident on board *Vectis Progress* 2 months earlier. In both cases the opportunity to learn lessons and improve safety standards was delayed.

## 2.10 SAFETY CULTURE

Safety culture defines the ways in which safety is managed on board a vessel and is reflected in the shared attitudes, beliefs, perceptions and values of the crew in relation to safety. Vessel owners, managers and masters have the pivotal role of embedding and driving a strong safety culture among their crews. If they do not portray a positive approach towards safety management, then it is likely their crew will adopt similar attitudes, and a poor safety culture will result.

The strength of the prevailing safety culture within an organisation or on board a vessel can often be difficult to measure or quantify. The way people carry out work tasks when left alone or unsupervised can provide a powerful indication of both localised and widespread safety culture. Other typical indicators include accident rates, levels of procedural compliance, and the priority given to cost and time over safety.

Carisbrooke had provided a comprehensive safety management structure, which addressed ISM Code compliance and the safe operation of its vessels. This was understood by the crew; however, it was evident that the safety culture on board *Karina C* was weak. Priority was given to getting the job done, rather than implementing the vessel's documented safe working practices. This was probably influenced by time pressures and possibly by alcohol consumption.

# SECTION 3 - CONCLUSIONS

## 3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. The 2/O was crushed because he attempted to walk between the vessel's gantry crane and a stack of cargo hold hatch covers, unaware that the C/O was about to drive the crane towards him. [2.3]

2. The C/O did not know the 2/O was under the crane or what his intentions were because he was not monitoring the walkways and had not established effective communications with the crew working on deck. [2.3]

3. The safety culture on board *Karina C* was weak in that established safe systems of work were not followed, personnel were working close to moving equipment and unprotected edges, and personnel were not wearing adequate levels of PPE. [2.5.1, 2.5.2, 2.5.3, 2.10]

4. The risk assessment and procedure Carisbrooke had in place for operating the gantry crane could have been clearer; however, had the stipulated safety controls been implemented, the accident would have been avoided. [2.5.2]

5. The 2/O's judgment was probably impaired by alcohol. [2.7.1]

6. Carisbrooke's drug and alcohol policy was not being effectively enforced on *Karina C*. [2.7.2]

7. The 2/O's and C/O's actions might also have been influenced by tiredness or fatigue. [2.8]

## 3.2 SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. The master did not adequately investigate the accident, leading to incomplete information being passed to the DPA and the accident not being reported in accordance with UK Merchant Shipping regulations. [2.9]

2. The vessel did not appear to have a just culture in that the crew did not report such a serious accident to the shore-based senior management. [2.9]

3. Carisbrooke did not adequately investigate this accident when first reported, and was slow to react to the earlier incident on *Vectis Progress*. [2.9]

## 3.3 OTHER SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. The shoreside doctor and paramedics were not told the full circumstances of the 2/O's injuries, but it is unlikely that this had any impact on his chances of survival. [2.4]

2. The crane emergency stops were not easily accessible and were not within reach of the 2/O when he was trapped. [2.6]

# SECTION 4 - ACTION TAKEN

## 4.1 ACTIONS TAKEN BY OTHER ORGANISATIONS

**Carisbrooke Shipping Limited** has:

- Updated its gantry crane operating procedures and vessel-specific risk assessments to tighten operational procedures.
- Updated its SMS and company procedures to ensure all serious incidents are fully investigated until the underlying causes are established.
- Fitted additional emergency stops to all its gantry cranes.
- Improved the profile of its confidential reporting systems, accessible to all employees.
- Reviewed and amended its alcohol policy to include more frequent random testing of all crew and sanctions on masters in the event of breaches of company policy.
- Established an anchor line and harness procedure for working close to open, unguarded hatch covers.

## SECTION 5 - RECOMMENDATIONS

**Carisbrooke Shipping Limited** is recommended to:

**2020/134** Take action to improve the safety culture on its vessels. In particular, to take steps to ensure all crew on its vessels understand and adhere to agreed and established safe systems of work, aligned to the company's safety management system, and that all accidents are reported appropriately.

**2020/135** Investigate improvements to gantry crane warning systems, including pre-movement warning or automatic stop systems.

Safety recommendations shall in no case create a presumption of blame or liability

Marine Accident Report

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