aibn Accident Investigation Board Norway

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REPORT ON MARINE ACCIDENT ON BOARD BW SUEZ EVERETT 9243148/LAVK5, OCCUPATIONAL ACCIDENT IN THE INDIAN OCEAN 25 APRIL 2012

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This report has been translated into English and published by the Accident Investigation Board Norway (AIBN) to facilitate access by international readers. As accurate as the translation might be, the original Norwegian text takes precedence as the report of reference.

Photo of ferry on the Norwegian west coast: Bente Amandussen

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NOTIFICATION OF THE ACCIDENT

On 25 April 2012, the AIBN was notified by the Joint Rescue Coordination Centre (JRCC) of an occupational accident on board the NIS-registered gas tanker *BW Suez Everett* LAVK5. At 11:53 local time, a crew member had been injured by a wire during a work operation on board the vessel. He had been knocked unconscious, and his pulse was weak. The vessel had been in contact with the Indonesian rescue services and with Radio Medico in Bergen. While talking with the AIBN, the JRCC was informed that the injured person had been pronounced dead. The vessel was 300 nautical miles north-west of Banda Aceh in Indonesia at the time. According to the shipping company, the vessel would arrive in Galle in Sri Lanka on 28 April 2012. The AIBN decided to initiate an investigation of the accident and, on 27 April, two inspectors travelled to Sri Lanka to start the investigations.

Figure 1: The accident occurred on board the BW Suez Everett in the Indian Ocean. Map: AIBN

SUMMARY

Several of the mooring winches on board the gas tanker *BW Suez Everett* were to have their wires replaced en route from the Singapore Straights to the next loading port in Bal Haf in Yemen. The work of replacing the wires on the aft mooring deck started on 25 April 2012. It was in connection with this work that the ordinary seaman lost his life, probably as a result of being hit by the wire drum as it moved towards the port side of the deck. The fact that the unsecured drum moved towards the port side was probably a combined result of slack in the wire that passed outside the railings, the vessel heeling towards port and reduced friction between the drum and deck due to the drum being almost empty.

The investigation has focused on mapping how a risky work operation was planned and handled in practice seen in relation to the shipping company's management system. Areas of improvement have been found relating to the risk assessment carried out prior to starting up the work, as well as

weaknesses in the shipping company's procedure for risk assessments at the time of the accident. The AIBN investigation has also identified several challenges linked to communication amongst the crew. These are aspects that the AIBN believes have a potential for improvement and that contain elements of learning that can be transferred to other shipping companies.

A risk assessment was carried out before the work commenced, but it did not describe how the mooring wire was to be guided onto the winch, and the crew were not involved in its preparation. When the work started up, no special assessment was carried out of the risks involved in passing the new wire outside a section of the railings to achieve the best possible angle for reeling it onto the winch drum, even though one member of crew expressed concern on this point. The risk assessment was also based on the wire drum being suspended from the provisions crane while the job was bring done. However, the drums of new wire were somewhat higher than the drums that had previously been handled on board, so that the special tool that was normally used for the purpose (a steel-cross stand used as a spindle inside the core of the drum) was too short. This led the deck crew to decide that they would disconnect the drum from the crane and let it rest on deck without any extra securing, so that it would then turn around its own axis during the work operation. This change in the way the job was being performed was not reported to the chief mate, and the risk assessment was therefore not adjusted to take account of the new risks created by the change in circumstances.

BW Fleet Management reviewed its internal work procedures following the accident, and the shipping company has changed its procedures for safety meetings and risk assessments.
The AIBN does not, therefore, propose any safety recommendations as a result of this investigation.

1 FACTUAL INFORMATION

1.1 Details of the vessel and the accident

Vessel details

Name of vessel	: *BW Suez Everett*
Call signal	: LAVK5
Home port	: Stavanger
IMO number	: IMO 9243148
Trade area	: World Wide
Shipping company	: BW Gas
Company responsible for ISM	: BW Fleet management AS
Flag state	: Norway (NIS)
Classification society	: Det Norske Veritas (DNV)
Type	: LNG gas tanker
Year of build	: 2003
Shipyard	: Daewoo Shipbuilding & Marine Engineering
Construction material	: Steel
Length overall	: 277 m
Width	: 43.400 m
Draught	: 21.260 m
Gross tonnage	: 93 844 GT
Net tonnage	: 28 154 NT
Propulsion	: Turbine
Other relevant information	: Most recent class inspection: 20 April 2012.

Figure 2: BW Suez Everett Photo: BW Suez Everett

Details about the accident:

Date and time	: 25 April 2012, approximately 15:20 local time
Accident location	: En route in position N 06° 16’ E 090° 31'.
Persons on board	: 30
Injured/dead	: One crew member died

1.2 Chain of events

En route to discharge cargo in Oita in Japan, the LNG tanker *BW Suez Everett* dropped anchor off Singapore on 26 March 2012 in order to take on board provisions and various equipment, including four drums of mooring wire. The wires were lifted on board the *Suez Everett* from a barge using the vessel's provisions crane and placed aft of the superstructure on the open deck between the superstructure and the engine casing, in the area that the crew referred to as the 'Grand Canyon' (see Figure 3).

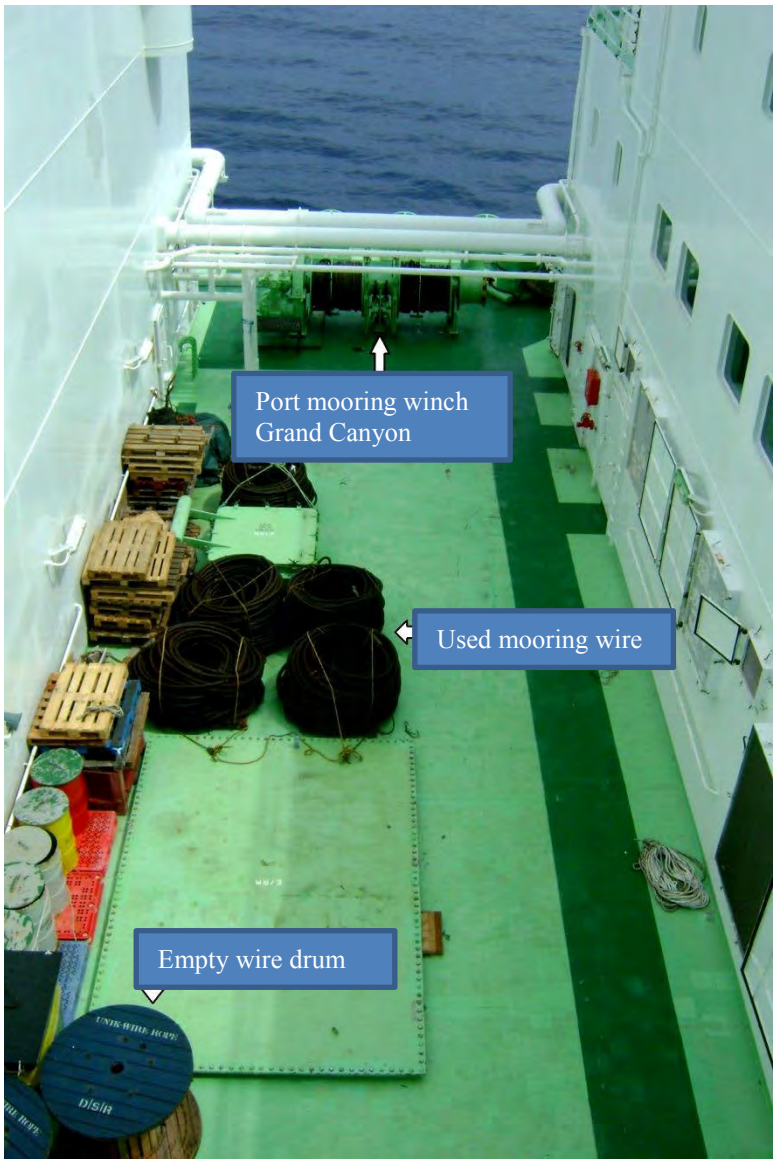

Figure 3: The 'Grand Canyon'. Photo: AIBN.

On the same day, the chief mate on board was relieved after having completed his work period. The chief mate that took over had held the same position on one of the shipping company's sister ships. No arrangements had been made for an overlapping sailing period, but the chief mate received a written report of on-going and upcoming jobs from his colleague, who signed off from the vessel later that same day. Among other things, the chief mate was instructed that a total of eight mooring wires were to be replaced in the near future, including two forward on the forecastle and three aft on the poop deck. Yet another new wire had already been placed below the poop deck aft. The chief mate

planned to replace the five wires before week 14, when the vessel was scheduled to reach its next port of discharge, Oita in Japan, on 5 April. He inspected the new wires on 27 March and, on 28 and 29 March, he prepared a risk assessment of the job to be done.

However, due to unfavourable weather conditions and other tasks imposed during the voyage, the job was postponed as it was uncertain whether it could be completed before arrival in Japan.

After leaving Japan, a total of five old wires were reeled off and stored in coils on deck in the 'Grand Canyon' (see Figure 3). This made it possible to carry out monthly maintenance routines and general maintenance of winches and the empty winch drums. Extraordinary maintenance was also being carried out on the ship's ballast tanks, and one extra bosun and two extra able seamen were on board during this period to carry out this work.

In the weekly maintenance and safety meeting in week 17 it was decided to start the job of replacing the wires. The plan for replacing the wires, including the risk assessment prepared for the job, was discussed in the safety meeting between the chief mate and bosun in the morning of 24 April. When the job started, the wire drum was placed on a steel-cross stand (see Figure 5) where it could rotate freely. The provisions crane was used to lift the drum off the deck. This was in accordance with what was specified in the risk assessment.

However, the drums of new wire proved to be somewhat higher than the drums they had previously used on board. The steel-cross stand had been made for a lower drum, and a wire sling was therefore used to connect the stand's lifting lug to the hook of the provisions crane. After a while, the crew realised that this was not an optimal solutions, and the provisions crane also sagged slightly under the load, so that it was difficult to keep the drum at a constant height. The deck crew therefore disconnected the crane and let the steel-cross rest directly on deck before completing the replacement of the wires on the forward winches. The chief mate was not informed of the change in how the job was executed.

The progress schedule for replacing the remaining wires was discussed at the safety meeting on Wednesday 25 April. The meeting was attended by the chief mate, the refrigeration engineer and the bosun. The aft winch wires were to be replaced next, and they discussed how the wire was to be guided onto the winch drums, and that it would have to be passed on the outside of the railings to be reeled onto the winch drums at the right angle. The job was based on the same risk assessment, and the bosun did not inform the chief mate that he, on the previous day, had decided to let the steel cross rest on deck.

The deck crew finished reeling new wire onto a port mooring winch on poop deck by lunchtime (12:00), and started on the next wire after the lunch break. One crew member pointed out to a colleague that it was not safe to pass such a long section of wire outside the railings, but his concern was dismissed by the rest of the crew and the bosun, and it was not communicated to the chief mate. While the work was being executed, there were four men on the aft mooring deck and two men (the deceased ordinary seaman and a colleague) at the drum in the 'Grand Canyon'. The crew stationed at the two positions were equipped with hand-held radios to communicate with each other.

Just before the coffee break at 15:00, the chief mate inspected the job on the mooring deck before everybody went inside for coffee. On his way up from the mooring deck, he observed that the wire drum on the deck in the 'Grand Canyon' that was feeding wire to the winch drum was secured with rope, but he did not reflect on this.

The work continued after the coffee break, and the ordinary seaman who lost his life was now working alone at the wire drum because his colleague had been sent to carry out the weekly cabin cleaning. The bosun was aware that the ordinary seaman was now working alone monitoring the uncoiling of wire.

Just after 15:20, a messman preparing for dinner in the mess observed the ordinary seaman outside the window. The ordinary seaman was then standing on the starboard side of the drum (the safe side) and was helping the drum to rotate to pay out wire. The messman and ordinary seaman made eye contact, and after having given the ordinary seaman the thumbs up to confirm the planned basketball game that evening, the messman returned to his duties. While standing in the galley, he felt the ship heel to port so that a rack of glasses nearly fell down. Immediately afterwards, the messman heard a loud crash from the Grand Canyon, and ran over to the mess window to see what had happened. He observed that the ordinary seaman was lying on deck on the inside of the port winch. The wire drum stood at an angle against a bollard on the port side.

The second engineer, who was under training, was in the engine room at the time, and heard some unusual noises followed by a whack on the deck above. He ran up on deck, and was the first to arrive at the scene of the accident. The messman and his assistant were also quickly on the spot in the Grand Canyon, and the second engineer asked them to notify the bridge and fetch a stretcher. After fetching the stretcher from the hospital, they ran into the chief mate and notified him of the accident. The chief mate notified the bridge and immediately proceeded to the scene of the accident. They put the ordinary seaman on the stretcher and transferred him to the hospital, where they administered oxygen and initiated life-saving first aid. They registered that his pulse was weakening and finally disappeared.

While first aid was being administered in the hospital, the captain contacted Indonesian authorities to request assistance. However, the vessel was out of helicopter range, and the captain changed course and headed for Banda Aceh. In the meantime, he contacted Radio Medico at Haukeland University Hospital in Bergen, and received assistance and advice that was conveyed to the chief mate in the hospital. The emergency response team of the shipping company was mobilized, and continuous contact with the ship and the shore side emergency resources was estbablished.

First aid was administered using oxygen, CPR and a defibrillator, but despite these efforts, his life could not be saved. The ordinary seaman was pronounced dead in consultation with a Radio Medico doctor at 17:55, approximately two and a half hours after the accident.

1.3 Crew

The crew on board *BW Suez Everett* was made up of Norwegians, Eastern Europeans and Filipinos. Most of the crew members had long experience on board the shipping company's gas tankers.

The deceased ordinary seaman had worked for the shipping company since 2009. He had most recently signed on on 9 January 2012. He had also sailed on board the *BW Suez Everett* before, and knew the vessel well. The ordinary seaman had completed the courses required by the STCW Convention, as well as company-specific shipboard training. The ordinary duration of his contracts on board was nine months.

The chief mate had been with the shipping company since 1999, since 2006 as chief mate on the company's sister ships. He held a Deck Officer Class 1 Certificate with endorsement for service on tankers (gas) of the highest grade. He had also been certified as an assessor in accordance with the STCW Convention. The chief mate had also attended a number of other courses, including in health, safety and the environment (HSE), crew resource management, investigation of incidents, risk assessment, human relations and the ISM Code.

The chief mate and bosun had never sailed on the same vessel before, and it was also the first time any of them served on board the *BW Suez Everett*. The bosun had been with the shipping company since 1993. The chief mate had a fixed rotation of ten weeks on board the vessel and ten weeks off, while the bosun was on a nine-month contract that started when he signed on in February 2012. The chief mate and the bosun had sailed together for approximately four weeks when the accident occurred.

The AIBN got the impression that the crew and officers were on good terms, and that they actively sought to maintain high HSE awareness and regular social meeting points in their free time. On 25 April, the chief mate had planned to organise a basketball tournament with the crew in the Grand Canyon after working hours.

1.4 Wire and lifting equipment

1.4.1 Wire and drum

An approximately 270-metre long 44 mm steel wire with an eye at each end was used for each mooring winch. This type of wire weighs around 7.5 kg per metre. The weight of the drum was approximately 175 kg. This gives a total weight of about 2 200 kg for each full wire drum.

After the accident, there were 15 turns of wire left on the drum from which wire was payed out. The drum had a diameter of approximately 70 cm, which gives a circumference of 2.20 m. This means that there was about 33 m of wire left on the drum after the accident.

Figure 4: Drum with 15 turns of wire left, stopped against the port bollard in the Grand Canyon. Photo: BW Suez Everett

It is assumed that there were a few more turns of wire on the drum at the time when it left its near-midship position in the Grand Canyon. There was a distance of 17 m from the drum's original position to the bollard where it stopped. Assuming that half this length was reeled off as the drum shifted across the deck, the AIBN has calculated that there was still 18 turns of wire left on the drum when the incident occurred. This means that the total weight of the wire and drum at the time of the incident was around 472 kg.

1.4.2 The wire-drum lifting equipment

The steel-cross stand had been made on board the ship and had previously been used for similar jobs. However, it proved to be a little too short for the wire drums that were taken on board on this occasion.

The lifting appliance had a lifting lug welded onto the top of a steel pipe, which was in turn welded to the centre of a steel cross. The wire drum was placed around the steel pipe so that it could rotate freely on a disc that had been slipped onto the steel pipe. The steel-cross stand holding the drum was then to be hooked onto the provisions crane, hoisted up and secured using rope (see Figures 5 and 7).

The old drums that the tool had been made for were 1.33 m high, while the new drums were 1.50 m high. The pipe on the steel cross was approximately 1.50 m high, which made it impossible to insert the provisions crane's hook directly into the lifting lug (see Figure 6).

Figure 5: Steel-cross stand for wire drums. Photo: BW Gas.

Figure 6: Steel-cross stand viewed from the top of a drum. Photo: BW Suez Everett

The deck crew therefore used a wire sling, which was hooked onto the provisions crane, and secured the arrangement against sideways movement using rope (see Figure 7).

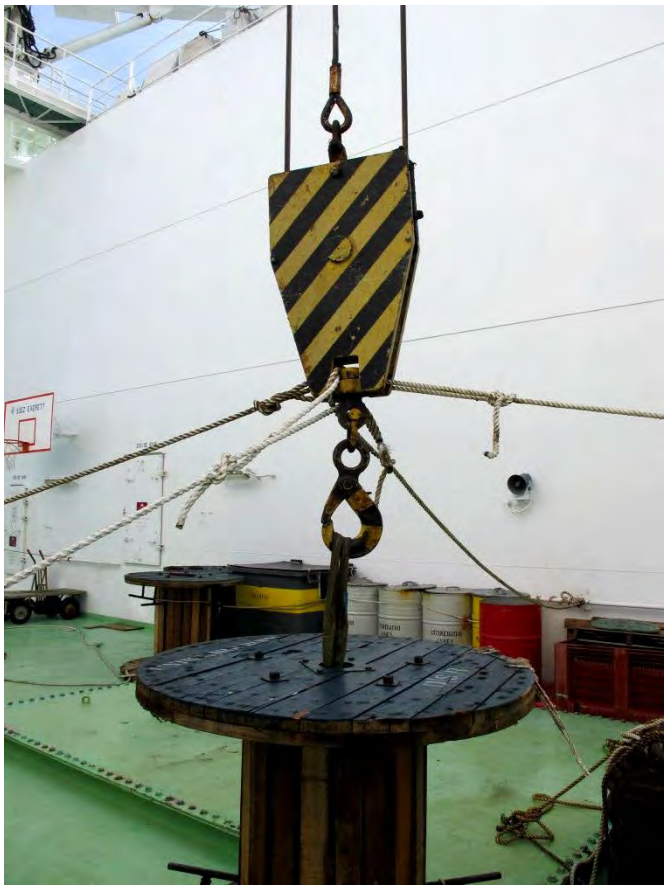

Figure 7: Drum suspended from the provisions crane. A wire sling was used, not a strap as shown in the photo. Photo: AIBN.

When the crew started to replace the wire on one of the forward mooring winches on 24 April, they rigged the equipment and attached the wire drum to the provisions crane. They were not satisfied with the way the arrangement worked in practice, however, and, after a relatively short time, the steel-cross stand holding the drum was set down on deck. The chief mate was not informed of this decision.

1.4.3 Choice of wire pulling route

The new wire drums were stored in an area known as the Grand Canyon on board the gas tanker. The replaced mooring wires were stored in the same area. The reason for this was that the plan was to use the provisions crane on the aft superstructure for the job.

The old wires from the mooring winches in question had been reeled off in early April in order to carry out general maintenance on the winches. The mooring winches in the Grand Canyon had been used to pull them to their storage location.

The routes along which the new wires would be guided onto the winches was not evaluated or documented in the risk assessment. However, it emerged during the AIBN's interviews with the deck crew that, on the day in question, they had discussed whether it would be safer and more practical to route the wires so that they would be kept on deck at all times.

Finally it was nonetheless decided to let the wires follow previously used routes. This meant that sections of wire were passed outside the railings and in through the mooring hole that provided the best angle in relation to the winch in question (see Figures 8 and 9).

Figure 8: View of the port side of the poop deck, with wire pulled through the port mooring hole aft and across the deck to the starboard mooring winch. Photo: BW Gas.

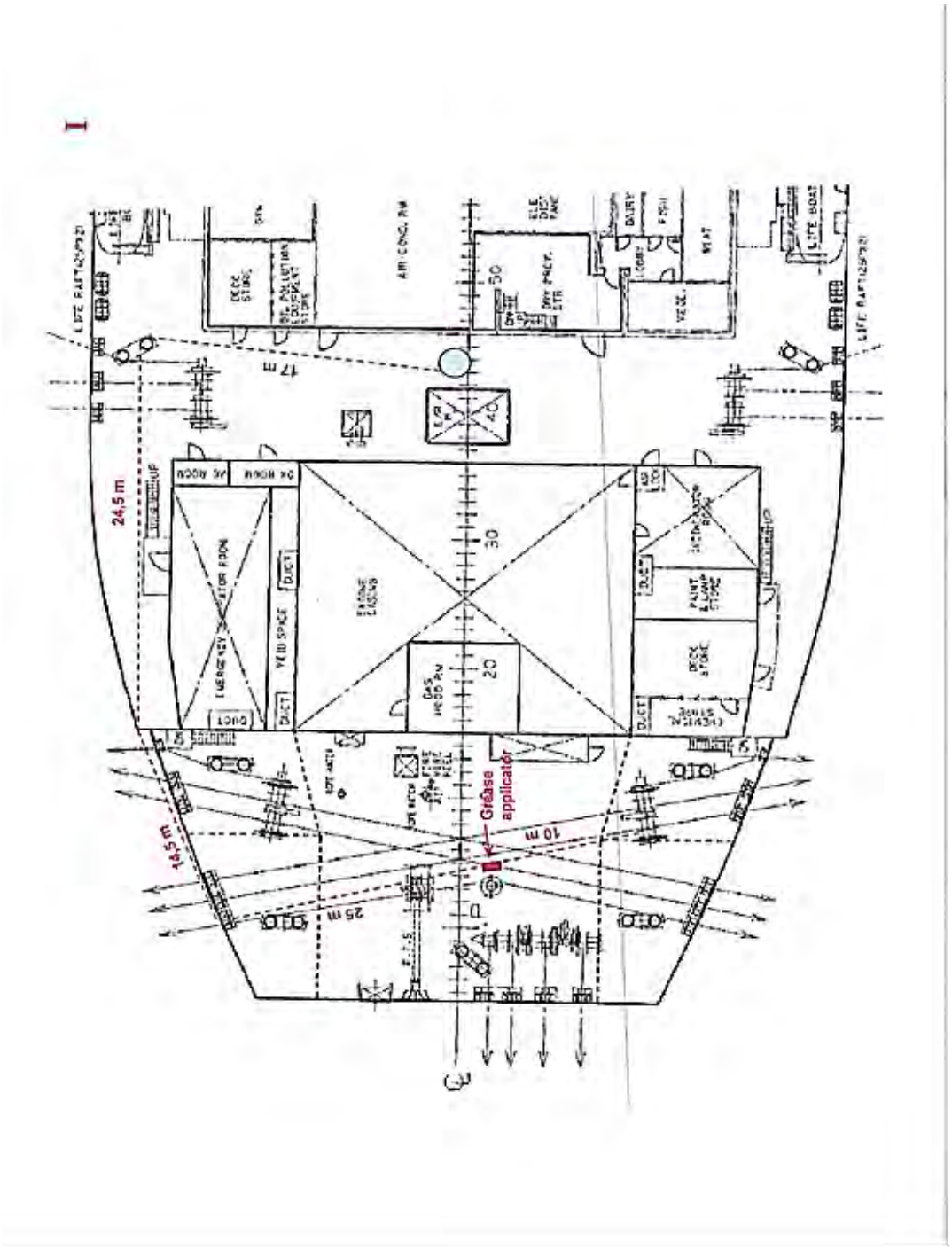

Figure 9: The wire route (red dotted line) from the winch (blue) in the Grand Canyon to the starboard winch on the poop deck. The 14.5-metre section along on the port side aft shows where the wire was passed outside the railings along the ship's side. Illustration: BW Gas.

Figure 10 shows the chosen route and the estimated length of wire that may have hung into the water in the form of a half loop as calculated by the AIBN. The distance from the drum's original position to where it was stopped by the bollard on the port side of the Grand Canyon was measured to be 17 m. The blue dotted line in Figure 10 shows the distance between the point on the deck above to which the wire was routed (in the following referred to as A) and the port mooring pipe (in the following referred to as point B), and was measured to be 14.5 m when there was no slack in the wire between the points. A half loop from point A to point B that just touches the water has been measured to be 35 m.

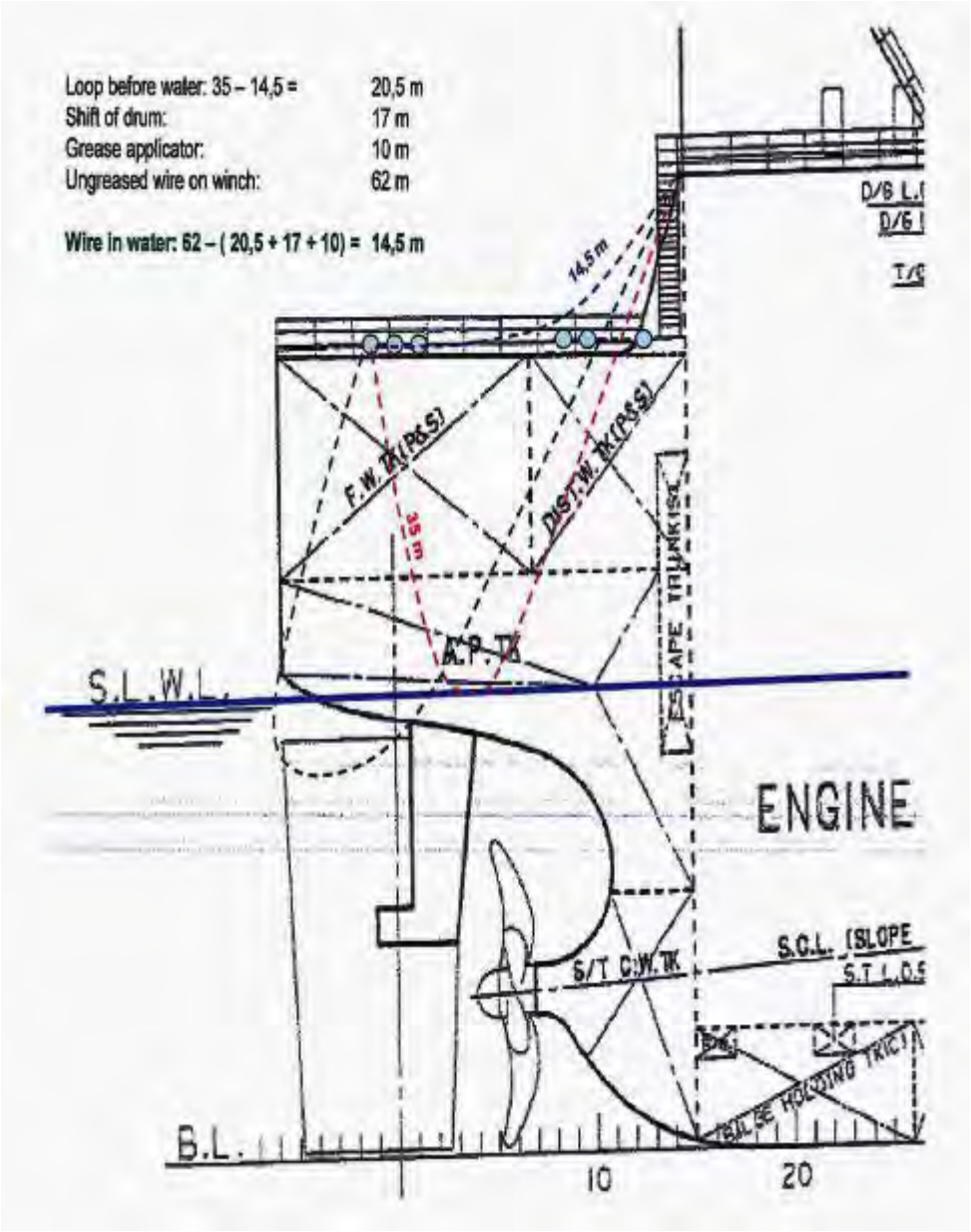

Figure 10: The line diagram shows the starboard side of the hull. The starboard side is completely identical to the port side as regards mooring pipes etc., the routing of the wire and the measurements that were subsequently carried out. Illustration: BW Gas.

The distance from the wire grease applicator (in the middle of the photo, Figure 8) to point B is 10 m. Since additional grease was applied to the wire while it was being reeled onto the mooring winch, it was possible to identify the point at which this treatment stopped and the ungreased wire began. The part of the wire that was in the water after the accident had been reeled onto the winch without grease being applied. Afterwards, the AIBN was therefore able to measure, with a high degree of accuracy, the number of metres of ungreased wire on the winch drum.

The total length of wire reeled onto the winch drum after the accident was later confirmed to be 62 m. On the basis of this, the number of metres of wire that had been in the water was subsequently calculated (see data in Figure 10, upper left corner). It was estimated that a half loop of approximately 14.5 m was in the water while the vessel was travelling at a speed of 15–17 knots and at the same time rolling slightly in the water. The AIBN

assumes that the force this represented caused the drum to shift to the port side at great speed and stop when it hit the port bollard.

1.5 Weather conditions

The weather conditions at the time of the accident were a westerly wind of 5 m/s. There was an estimated wave height of 0.5 m with some south-westerly swell. There was daylight and good visibility.

The crew described the weather conditions as fair, with no unusual movements in the ship. However, in the mess it was noticed that the ship heeled to port immediately before the accident, and one crew member reported that he noticed the bathroom door of his cabin slam shut due to the ship's movement during the same period.

1.6 Shipping company and fleet

BW Gas is part of the BW Group, which is primarily engaged in oil and gas transportation and floating offshore oil and gas production. The BW Group operates a fleet of 93 vessels.

BW Gas is a leading global player in the gas transportation market, and, as of 2012, the company had the commercial responsibility for 47 gas tankers that mostly carried LNG and LPG.

BW Fleet Management is responsible for the technical management of all BW Gas's vessels.

BW Suez Everett had been operating under a time charter for a French oil company since 16 June 2003.

1.7 The shipping company's management and control systems

1.7.1 Safety management system

The shipping company's safety management system (TQM – Total Quality Management) was a comprehensive system based on the International Safety Management Code (the ISM Code), and was intended to ensure compliance with national and international regulatory frameworks, the classification companies' rules, the oil companies' requirements and the shipping company's internal procedures.

1.7.1.1 Procedure for risk assessment

The shipping company's risk assessment procedure (SBM 06-38) contained guidelines for the types of work to be risk-assessed, for identification of risky work, for the frequency of risk assessments, risk classification, and how to reduce risk to an acceptable level so that the job in question could be executed. There were guidelines concerning how to handle risk assessments of ordinary/everyday work operations, periodic jobs, critical or special work operations, and how to proceed in connection with the introduction of new equipment or technology. The results of risk assessments were to be documented in writing in a special risk assessment form and submitted to the main office for verification. The form had fields for description of the activity, risks relating to the execution of the

job, a matrix for probability and consequence assessment, risk-reduction measures, and conclusion.

The shipping company has revised its risk assessment procedure after the accident; see section 1.11.

1.7.1.2 Procedure for safety meetings

The shipping company had prepared a procedure (SBM 06-03) for mandatory safety meetings to be held on board the vessels. A daily safety meeting was to be held every morning between the chief mate and the bosun, to ensure that safety procedures were considered before carrying out the day's work. The procedure also contained guidelines concerning weekly maintenance and safety meetings, monthly working environment and safety meetings, and quarterly crew meetings.

On the day of the accident, a morning meeting was held between the chief mate and bosun, but the changes to the way the job was being executed were not discussed. The shipping company has changed its procedure for safety meetings after the accident.

1.7.2 Maintenance system

Chapter 10 of the ISM Code requires shipping companies to introduce procedures to ensure that vessels are maintained in accordance with regulatory requirements and the shipping company's own requirements, and that such compliance is documented. In practice, this means that the shipping company must have a maintenance system.

BW Suez Everett had used the electronic maintenance system Amos W since 2006. This maintenance system was approved by the classification society. The vessel had previously used the maintenance system RAST, which was still accessible for the sake of maintenance history.

Work orders for periodic maintenance on deck were printed out by the chief mate and distributed to the right persons. After the work had been done, the history was entered and the jobs signed off. The maintenance system had no system for referring to or keeping records of risk assessment history.

The maintenance system included three work orders for mooring winches and wires: one monthly, one six-monthly and one annual.

There was no specific work order for turning the wire end to end or for replacement of the wires.

1.8 Regulations relating to risk management

1.8.1 Regulations of 14 March 2008 No 306 relating to safety management systems on Norwegian ships and mobile installations (the ISM Regulations)

The Regulations require shipping companies to have a safety management system that covers both the onshore organisation and individual vessels in accordance with the ISM Code (International Management Code for the Safe Operation of Ships and for Pollution Prevention). Among other things, the Code requires shipping companies to carry out

assessments of risks relating to their vessels, crews and the environment, and, in light of these assessments, to establish relevant barriers.

1.8.2 Regulations of 1 January 2008 No 8 relating to the working environment, health and safety (WEHS Regulations)

The WEHS Regulations regulate matters relating to personal safety. The Regulations are intended to ensure that work and leisure activities on board are arranged and organised so as to safeguard the safety and physical and mental health of employees. Section 2-2 of the Regulations sets our requirements for risk assessments, which means that hazards on board the vessel must be identified. Once a hazard has been identified, an assessment must be carried out of the risk the hazard represents, and necessary measures must be taken to eliminate or reduce the hazard. Such risk assessments are to be carried out regularly, when new work equipment or technology is introduced, and in connection with other changes in the organisation or planning of the work that may have a bearing on the health and safety of employees. The results of the safety assessments shall be documented in writing.

1.9 Risk assessment of the work operation

The chief mate prepared a risk assessment for wire replacement only a few days after he signed on the vessel. According to the procedure, such a risk assessment had to be prepared whenever a new or risky job was to be carried out. The chief mate was responsible for preparing risk assessments for the deck department. In connection with the wire job, he primarily relied on his own experience from the previous vessel he worked on, where he had taken part in corresponding operations.

The risk assessment form was stored in a separate folder in the captain's office marked 'accident prevention', while the chief mate kept a list of jobs for which risk assessments had already been prepared.

All risk assessment forms were also distributed internally between the deck and the engine department; one copy was given to the bosun and one was to be sent to the office. Risk assessments sent to the office were processed by the shipping company's maritime department. If the risk assessment was in accordance with the company's procedures, it was approved. An electronic signature was then returned to the sender (the vessel) as confirmation that the onshore organisation had no objections to the assessment. Work was not to be started before the signature had been received.

For what was considered to be routine jobs, there was no requirement for new risk assessments to be conducted each time, but the general assessment was to be evaluated every six months. If a risk assessment had previously been prepared for the same job, the existing assessment could be used without being sent to the office, provided that the prerequisites for the job had not changed. For all new jobs, or jobs deemed to be risky, a requirement applied for a risk assessment to be conducted every time, and for a copy to be submitted to the office and approved before the work could start.

The chief mate found no previous risk assessments for wire replacement, and therefore prepared a new one, dated 29 Marcy 2012. Through an oversight, this risk assessment was not forwarded to the onshore office, however. The risk assessment contained no detailed description of how the wire was to be passed from the drum to the winch. However, it did state that the provisions crane was to be used to secure the wire drums.

1.10 Supervision and certificates

BV Suez Everett had valid certificates on the day of the accident, and no official orders were outstanding.

1.11 Implemented measures

After the accident, the shipping company has changed its procedures, *inter alia*, for risk assessments and safety meetings.

The procedure for risk assessments now includes a requirement to consider alternative plans or measures to reduce potential consequences. The person responsible for monitoring/supervising the job on site must also sign the risk assessment to confirm that all risk-reduction measures are in place and implemented, that the job is carried out in accordance with the risk assessment and that a review has been carried out with all involved personnel. In addition to the person supervising the job on site, the person who conducted the risk assessment shall also monitor the job.

After the accident, the shipping company has formalized what is known as the 'tool-box safety meeting'. Such a meeting must always be held before commencing work that involves risk, and where changes are made to the planned time schedule, workforce or the execution of the job. The review shall take place at the work site and, in addition to the chief mate, everybody who will be involved in the job in question must be present when the work is reviewed on deck. Focus will be on safe work practice, precautions, previous experience and hazards associated with the job. All relevant permits and risk assessments must be reviewed to ensure that all involved personnel understand what the work entails and the potential hazards involved.

2 ANALYSIS

2.1 Introduction

The investigation has focused on mapping how a risky work operation was planned and handled in practice seen in relation to the shipping company's management system.

The AIBN has used a method based on a model developed by the Australian Transport Safety Bureau (ATSB) as an aid in its analysis. This model helped to identify several safety problems that had a direct or indirect bearing on the chain of events relating to the accident. The AIBN will review and discuss the relevant chain of events and the safety problems it identified in section 2.2.

In its further analysis, the AIBN has chosen to take a closer look at the issues relating to how the risk assessment was conducted (section 2.3) and challenges relating to communication between the crew (section 2.4). These are aspects where the AIBN believes there is a potential for improvement of safety and that contain elements of learning that can be transferred to other shipping companies.

2.2 Assessment of the chain of events

When the work of replacing the wire on the starboard winch on the aft deck started up, the new wire was passed outside a section of the railings to achieve the best possible angle for reeling it onto the mooring winch. The chief mate was aware that some wire had to be passed outside the railings, and that this practice had been used in the past, without reflecting on how much wire ran outside the railings and the risk this represented. One crew member later expressed concern to his colleagues on deck about passing the wire outside the railing, but his concern was dismissed.

The two teams involved in the work were out of sight of each other, equipped with hand-held radios for communication. While they were reeling the wire onto the winch drum, the work was occasionally stopped to ensure that the wire was sufficiently greased. This was done without notifying the crew member who was now working alone at paying out the new wire, as they considered the stops to be so short that it was unnecessary to inform him of them. However, in the AIBN's opinion, this may have resulted in the ordinary seaman in the Grand Canyon paying out more wire than the personnel on the aft deck reeled in, thereby causing the wire outside the railings to become more and more slack.

Shortly before the accident, the ordinary seaman who was monitoring the uncoiling of wire was observed on the correct (starboard) side of the drum. However, he must at some point have been at the other side, in an unsafe position between the wire drum and the port winch where he was found. The AIBN assumes that he moved into the unsafe zone to get a general overview of the situation.

The ordinary seaman was working alone monitoring the wire in the Grand Canyon. The AIBN is of the opinion that if there had been more than one person present, it would have been more likely that the crew at all times could stay in a safe area.

On the day of the accident, some swell was registered in the morning, but the sea had become calmer in the course of the day. However, it is not uncommon to see irregularities in the wave pattern from time to time, and the AIBN has been told that relatively large rolling movements were observed on board the vessel around the time of the accident.

The AIBN believes that it may have been a combination of excessive slack in the wire outside the railings and the rolling movement of the ship that caused the drum to shift towards port. There was not must wire left on the drum, and therefore little friction against the deck. The vessel made good speed through the water, and as the wire probably hit the water at the same time as the ship tilted, the AIBN assumes that the drum moved across the deck and hit the ordinary seaman in the back before stopping against a bollard on the port side.

The chief mate had conducted a risk assessment before the crew started replacing the vessel's mooring wires. However, placing the wire drum on deck removed the safety barrier represented by suspending the drum from the crane and securing it against sideways movement. Moreover, the risk assessment was no longer representative for the work that was being carried out, as the prerequisites included use of the provisions crane. The chief mate was not informed of the change that was made to the way the job was executed, and no risk assessment was made of the new safety issues that arose. The AIBN considers that there were two relevant safety issues relating to 1) risk assessments, and 2) communication, and will discuss them in more detail in the following sections.

2.3 Risk assessments and planning of work operations

2.3.1 Performance of the risk assessment

A risk assessment was prepared before the work started, but it was not sent to the onshore office for approval in accordance with procedure. The shipping company's procedures were otherwise followed. The AIBN cannot say whether the shipping company would have objected to the content of the risk assessment, but it would certainly not have known that the deck crew deviated from the prerequisite that the ship's provisions crane was to be used. The AIBN has therefore chosen not to attach importance to the fact that the risk assessment was not submitted to the shipping company, as it is deemed unlikely that it could have helped to prevent the accident.

The chief mate carried out the risk assessment for the replacement of mooring wires based on the prerequisite that the provisions crane would be used to secure the drum. However, the risk associated with passing the wire outside the railings was not taken into account or assessed, despite the fact that the chief mate was aware of this being done. The chief mate searched for previous risk assessments for the job, without success. Nor was there a description of the job in the maintenance system.

The chief mate discussed the wire replacement with both the captain and the bosun in advance, since he had no previous experience of the equipment used for replacing the wires. The risk assessment was not conducted in cooperation with other relevant crew members, however, and this may have been why he failed to register any safety-critical input from the crew. Nor did the risk assessment have the effect of making the crew aware of potential risks and what measures to implement to ensure safe operations.

2.3.2 The shipping company's procedure for risk assessment

In the AIBN's opinion the shipping company's procedure for conducting risk assessments was inadequate, as it did not state which crew members should be involved in the preparation of the risk assessments. Nor did it set out any requirement for the crew members who were to carry out the job to also take part in a review of the assessment. This made it difficult for the chief mate to register the concerns and experience of others

who had experience of corresponding jobs. Nor did the procedure describe how the crew should handle and assess risks associated with any new elements that arose as a result of changing the way in which the job was executed. A more comprehensive and structured approach to risk assessments could have improved the focus of all crew members involved on the risks that the job entailed.

BW Fleet Management reviewed its internal work procedures following the accident, and the shipping company has changed its procedures for safety meetings and risk assessments. The AIBN believes that these changes can contribute to involving the whole crew in the process of preparing risk assessments and identifying hazards associated with work operations. These changes can also help to reduce challenges associated with communication. However, sufficient training is necessary in order to achieve good implementation of procedures.

2.4 Communication

The investigation shows that several communication challenges were present in connection with the accident. The chief mate conducted the risk assessment alone, and thus lost the possibility to take into account the concerns of crew members involved in the execution of the job. The bosun did not inform the chief mate that they had decided to carry out the job in another way than planned. No importance was attached to input from one crew member who was concerned about passing the wire outside the railings, and the bosun did not inform the chief mate of this concern. Moreover, communication between the team working in the Grand Canyon and the team working on the poop deck was inadequate in that the ordinary seaman was not informed of when the poop team made stops in the reeling.

The AIBN believes that the communication challenges can be addressed by introducing good procedures for meetings and an open dialogue about safety-critical jobs. Everybody who is to participate in a given work operation must be involved and given the opportunity and encouraged to state their views on how the job should be done. Arrangements should also be made to facilitate raising matters with a bearing on safety while the work is in progress without fear of consequences or of being ignored. The AIBN considers this to be essential to building a good safety culture on board a vessel.

3 CONCLUSIONS

3.1 The chain of events, operational and technical factors

a) The new wire was pulled outside the railings in order to achieve an optimum angle for reeling the wire onto the mooring winch.

b) The drums containing the new wire were somewhat higher than the drums that had previously been handled on board, so that the special tool that was normally used for the purpose (a steel-cross stand used as a spindle inside the core of the drum) was too short.

c) The deck crew decided to disconnect the drum from the crane and let it rest on deck without any extra securing, so that it would then turn around its own axis during the work operation.

d) Placing the wire drum on deck removed the safety barrier represented by suspension from the crane and securing the drum against sideways movement.

e) The ordinary seaman was working alone monitoring the uncoiling of new wire. This may have made it necessary for him to move into the unsafe zone to obtain an overview of the situation.

f) The ordinary seaman probably lost his life as a result of being hit by the wire drum as it shifted across the deck towards the port side.

g) The fact that the unsecured drum moved towards the port side was probably a combined result of slack in the wire that passed outside the railings, the vessel heeling to port and reduced friction between the drum and deck due to the drum being almost empty.

3.2 Factors relating to risk assessment and communication

a) A risk assessment was prepared before the work started, but it was not sent to the onshore office for approval in accordance with procedure.

b) The chief mate consulted the captain and the bosun about the job, but prepared the risk assessment alone, without involving the crew members who were to take part in the job. This was according to the procedures at the time of the accident.

c) The chief mate had no previous risk assessments or other documentation to help him in this work.

d) The risk assessment did not describe how the mooring wire was to be routed.

e) When the work started up, no particular assessment was made of the risks involved in passing new wire outside the railings despite the fact that concern was expressed.

f) The risk assessment assumed that the wire drum would be suspended from the provisions crane during the work, and no longer represented the job in hand when the drum was placed on deck.

g) The change in the way the job was executed was not reported to the chief mate, and the risk assessment was therefore not adjusted to take account of the new risks that the change in circumstances involved.

h) The communication between the two teams involved in the work was inadequate.

i) The shipping company's procedure for conducting risk assessments did not state which members of crew should participate in such reviews.

4 SAFETY RECOMMENDATIONS

The AIBN does not propose any safety recommendations as a result of this investigation.

Accident Investigation Board Norway
Lillestrøm, 16 December 2013