Investigation report

M2013-03

M/V EGON W, death of a seaman in consequence of falling into water in the Port of Vuoksi on 26 November 2013

Translation of the original Finnish report

The purpose of the investigation of accidents is to improve safety and prevent future accidents. It is not the purpose of the investigation or the investigation report to apportion blame or to assign responsibility. Use of the report for reasons other than improvement of safety should be avoided.

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SUMMARY

M/V EGON W, DEATH OF A SEAMAN IN CONSEQUENCE OF FALLING INTO WATER IN THE PORT OF VUOKSI ON 26 NOVEMBER 2013

Course of events

A seaman who worked as a deckhand and cook on the EGON W died after he had fallen into water in the Port of Vuoksi in Imatra on 26.11.2013 at approx. 20.00. When the accident took place, the seaman was on the quay letting go of the stern line. The line had been lifted off the bollard, and the intention was not to let it get wet when pulling it onto the vessel. The man holding the line on the quay was therefore bringing it towards the vessel while the seaman working on the afterdeck was pulling it in. The line got stuck to the rugged structures of the quayside, and when the seaman working on the quay was loosening the line, he fell into water.

The seaman was not able to get a tight grip of the lifebuoy thrown to him and sank quickly under the surface of the water. The rescue department divers alarmed to the scene found the man, and he was recovered from the water approx. half an hour after he had fallen in. Resuscitation attempts gave no result. The effects of the so-called cold shock were probably a contributory factor in the drowning.

Ship and event particulars

Time:	*Tuesday 26.11.2013 at approx. 20:00*		
Place:	*Port of Vuoksi, Imatra (lat. 61°13.8' N and long. 028°49.1' E)*		
Incident:	*The death of a seaman in consequence of falling into water*		
Vessel name:	*M/V EGON W*	**Vessel type:**	*Dry cargo vessel*
Nationality:	*Antigua and Barbuda*	**Port of registry**	*St. John's*
GT / NT:	*2409 / 814*	**DWT:**	*3603*
Length / Breadth:	*82.5 m / 12.5 m*	**Max. draught**	*5.25 m*
Construction year	*2004*	**Max. speed**	*11.5 knots*
Owner and operator:	*Wieczorek Andre GmbH & Co KG, Germany*		
		Number of crew:	**Number of passengers:**
On board		*7*	*0*
Injuries to persons:	**Death:**	*1*	*0*
	Serious injury:	*0*	*0*
	Mild injury:	*0*	*0*
Damages to vessel	*No damages*		
Damages to environment	*No damages*		
Other damages:	*No other damages*		
Disruptions to vessel traffic:	*EGON W stayed in the Port of Vuoksi approx. 24 hours longer than had been planned. No significant disruptions to port operations or vessel traffic.*		

The seaman fell from the quay when he was letting go of the vessel's stern line. The photo was taken on the day after the accident, on 27.11.2013. It was dark when the accident took place. (photo: the police)

Findings of the investigation

The fact that the line got stuck to the rugged quay structures resulted in the need to work right on the edge of the quay, which played a part in the accident. Contributing factors consisted of slipperiness, darkness and shadiness and possibly also of poor pair work as both seamen handled the trapped line simultaneously.

Dangers connected to working on the quay were not anticipated in the situation, and this led to the accident. In spite of different risks, working on the quay was probably considered to be similar to deck work. Lifejackets and other floatation garments were not used.

Man over board situations in port were not taken into consideration in the safety management system of the vessel, and there was not any ready operations model for them. The vessel's lifeboat could not be used as it was on the quay-side of the vessel.

Safety actions already implemented

On the night of the accident, there was timber in front of the nearest lifebuoy and ladders, which were part of the basic rescue equipment in the Port of Vuoksi. After the safety observation made on the matter, the timber was cleared away. Amongst other things a new lifebuoy has been acquired to the scene of the accident, i.e. to the corner of the quay.

There was a wrong street address for the Port of Vuoksi in the target information of the emergency response centre data system. This was corrected immediately after the day of the accident.

Safety recommendations

In order to prevent similar accidents from happening, the Safety Investigation Authority recommends that

- The Finnish Transport Safety Agency together with the Finnish Shipowners' Association take measures to improve, both nationally and internationally, the risk management in connection with work carried out by vessel personnel in ports and to improve preparedness with regards to accidents taking place in ports. These measures are recommended because the character of such work and of possible accidents taking place in ports differs from work carried out and accidents taking place at sea.
- The Ministry of Social Affairs and Health together with Regional State Administrative Agencies, the Finnish Port Association and the Finnish Port Operators Association take measures to make port authorities and operators pay attention to the monitoring of the condition of port structures and to guide port authorities and operators in developing self-induced control regarding the safety of routes and passageways as well as moving around and working.

Safety observations

The supply of line handler services varies from port to port. There may be deficiencies in a port's own or subcontracted line handling work when it comes to skills and the use of safety equipment. The risks referred to in the first recommendation above naturally relate to all persons engaged in line handling duties in ports, both when it comes to working on a quay and to the line handling itself.

In the investigated accident, the Emergency Response Centre received basic information required for making an alert during the first 30 seconds of the emergency call, and alerting for help was commenced after the call had lasted 2 minutes 14 seconds. In urgent missions the alerting activities must be quick enough, and one must be able to direct both the caller and the discussion with the caller according to the situational requirements and principles of the task management instruction. In order to ensure this, attention must continuously be paid to the vocational skills of call centre personnel at emergency response centres and to maintaining these skills as well as to the accuracy of data in the target information.

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SYNOPSIS

The Safety Investigation Authority decided, on the basis of the Safety Investigation Act (525/2011) and the completed preliminary investigation to initiate a safety investigation on the events resulting in the death of the crew member of the EGON W in the Port of Vuoksi in Imatra on 26.11.2013. The seaman fell into water and died in a situation in which the vessel was let go in order to move it to another berth.

Master of Science in Technology Timo **Naskali** was appointed as the Team Leader of the Investigation Team and Master of Science Jukka **Seppänen** was appointed as a Member Investigator. Chief Marine Safety Investigator Risto **Haimila** was appointed as Investigator-in-Charge.

This Investigation Report describes the events before, at the time of and after the accident. In addition, it deals with alerting and rescue activities and analyses factors leading to the accident. Lastly, it presents safety recommendations, the implementation of which may reduce the likelihood of such accidents or limit their consequences. The objective of the investigation is to improve safety, and thus liability and damage issues are not considered.

The Investigation Commission visited the Port of Vuoksi twice and learnt about port management and practical arrangements. A Safety Investigator also visited the EGON W, and familiarised himself with e.g. the safety management system of the vessel.

The time used in the investigation report is Finnish wintertime (UTC+2).

This Investigation Report was sent for statements to the Ministry of Social Affairs and Health, the Finnish Transport Safety Agency, the Emergency Response Centre Administration, Antigua and Barbuda W.I. Department of Marine Services and Merchant Shipping Inspection and Investigation Division, the shipping company André Wieczorek GmbH & Co. KG, the Port of Vuoksi, Oy Saimaa Terminals Ab, Stora Enso Oyj, the Finnish Port Association, the Finnish Port Operators Association, the Finnish Shipowners' Association and to all parties concerned. All parties expressing statements have also been able to comment on the Investigation Report. A summary on the received statements can be found as an appendix to the Investigation Report. Comments and statements given by private persons are not published. The received statements and comments have been taken into consideration when finalising the Investigation Report.

Source material is filed at the Safety Investigation Authority.

The Investigation Report has been translated into English and the summary into Swedish.

This Investigation Report is also available on the Safety Investigation Authority website www.sia.fi.

1 FACTUAL INFORMATION

1.1 Ship particulars

Figure 1. EGON W photographed in Mustola on 16.12.2013 (photo: the SIAF)

Vessel name	M/V EGON W (ex ISELMAR)
Type	Dry cargo vessel, general cargo
Nationality	Antigua and Barbuda
Port of registry	St. John's
Call sign	V2CE5
IMO No.	9279018
MMSI	304520000
Construction place and year	Leda Shipyard, Croatia / Peters yard, Kampen, the Netherlands, year 2004
Length, max.	82.5 m
Breadth	12.5 m
Max. draught	5.25 m
GT	2409
NT	814
DWT	3603
Owner	Wieczorek Andre GmbH & Co KG, Germany
Operator	Wieczorek Andre GmbH & Co KG, Germany
Classification society	Bureau Veritas
Main engine	Caterpillar 3512 DI-TA
Power	1249 kW
Propulsion gear	1 rudder and 1 controllable pitch propeller, bow thruster
Max. speed	11.5 knots
Ice class	I-C
Min. number of crew	6

1.2 Voyage particulars

Ports of call	Pärnu (Estonia) – Port of Vuoksi (Finland)
Voyage type	International
Cargo information	Raw timber 2,100 m³
Manning	7 persons: Master, Chief Officer, Chief Engineer, Engineer and 3 deckhands

1.3 Incident information

Incident	Deckhand of EGON W fell into water from the quay somewhat after 20.00. The seaman in question worked as a line handler and was the only crew member present on the quay.
Date and time	Tuesday 26.11.2013 at approx. 20.00
Place	Port of Vuoksi, Imatra, lat. 61°13.8' N and long. 028°49.1'E
Weather conditions	Air temperature -4 °C, surface water temperature +4 °C, wind from south-southwest 3–6 m/s and in gusts 7–10 m/s, a thin coat of dry snow on the quay.
Vessel operation and voyage segment	Letting go of the vessel, the intention was to move the vessel to another berth. Letting go of the vessel and mooring it again was to be managed by the vessel's own crew without outside line handlers.
Place on board	The deckhand-cook was just about to let go the vessel's stern line from a bollard located in the corner of an L-shaped quay.
Personal equipment	The seaman was wearing normal work clothing used outside. He wore e.g. a coat with orange attention colour and reflectors and safety shoes but no lifejacket.
Injuries to persons	The seaman who fell into water died.
Damages to vessel	No damages
Damages to cargo	No damages
Damages to environment	No damages
Other consequences	EGON W stayed in the Port of Vuoksi approx. 24 hours longer than had been planned. No significant disruptions to port operations or vessel traffic.

1.4 Rescue activities and aftercare

The vessel's crew threw two lifebuoys to the seaman who had fallen into water. It has been told that the seaman could be seen when the first lifebuoy was thrown, but that he could not get a steady grip of the lifebuoy and sank under the surface of the water. The Master notified the ship's agent about the accident and asked him to alert for help.

A person who worked in the port at the time of the accident came to the scene (to the edge of the quay) and made the first emergency call at 20.08.37. The second emergency call was made by the ship's agent from Lappeenranta at 20.09.30.

Kuopio Emergency Response Centre received the emergency call, classified the mission as "rescuing a person from water" and initiated an urgent alert corresponding to the response at 20.10.51. The first units arrived to the scene at 20.24. Altogether six units arrived there. A rescue department diver found the seaman at 20.30, and attempts were made to resuscitate him for approx. 20 minutes without any result.

A police patrol arrived to the scene of accident when the rescue department was lifting the seaman from the sea. On the following day, the police forensic patrol started a technical investigation. The police investigated the incident as a cause of death investigation and as an occupational accident investigation. In addition, the occupational safety and health responsibility area at Regional State Administrative Agency of Southern Finland started to investigate the incident.

In the evening of the accident, the mental welfare of the crew was supported by an emergency care unit and the Stora Enso mill fire brigade. On the following day, support was given by a municipal acute unit for psychosocial support and local volunteers of the Finnish Red Cross.

2 NARRATIVE

2.1 Time and scene of events

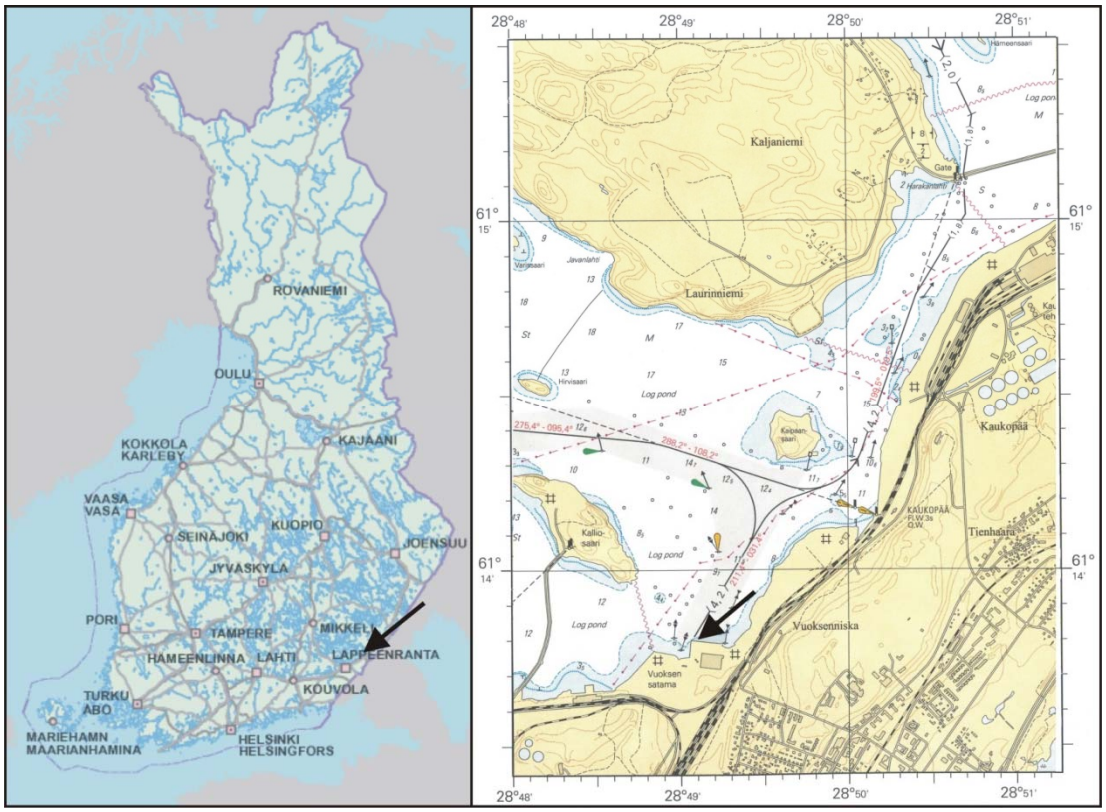

Figure 2. The accident took place in the Port of Vuoksi in Imatra. (base maps: KTJ/Ministry of Justice/National Land Survey of Finland, Finnish Transport Agency)

The accident took place on Tuesday 26.11.2013 at approx. 20.00 in the Port of Vuoksi in Imatra at the outermost (northwest) corner of an L-shaped quay, coordinates lat. 61°13.8' N and long. 028°49.1' E.

There are three berths in the Port of Vuoksi. One of them is at quay A and two at the quay B (figure 3). The berths have been numbered starting from the eastern side of the port area, i.e. berths number 1 and 2 are located at quay B and berth number 3 at quay A. The discharging of vessels transporting raw timber mainly takes place at quay A. Because the import of raw timber has increased in recent years, an agreement has been reached between the port operators that raw timber can also be discharged at quay B, at berth number 2, which is closest to the outermost edge of the quay, when it gets busy and in special situations. When the accident took place, the EGON W was moored at berth B2, and the intention was to transfer the vessel to berth A3.

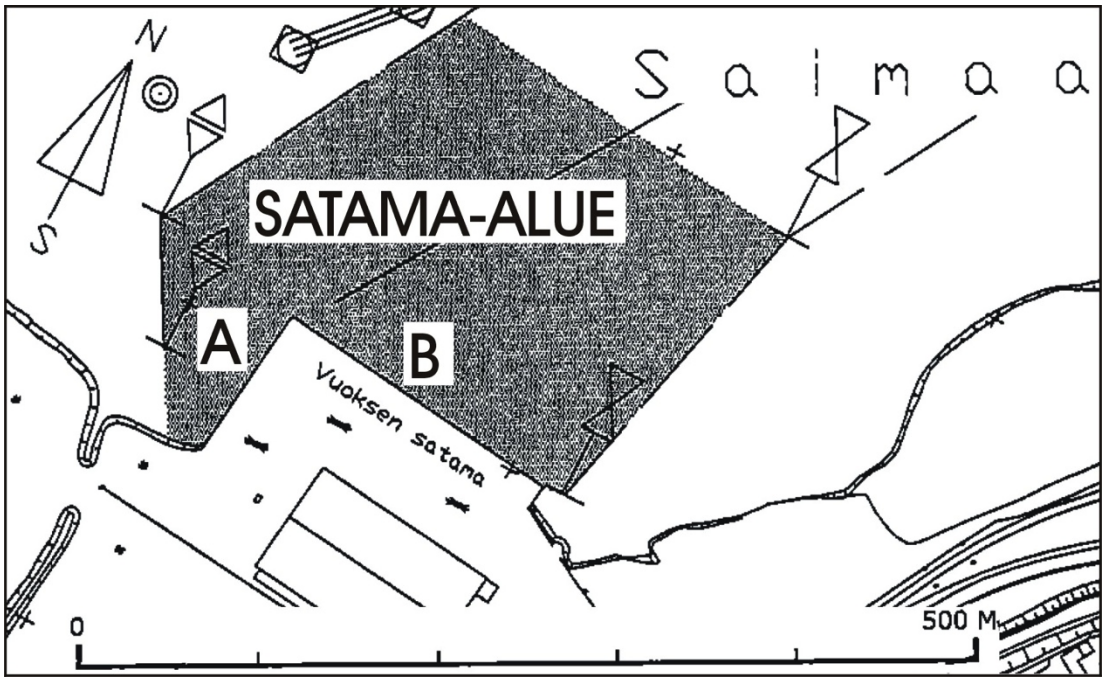

Figure 3. A drawing of the port area. Quays A and B are marked on the drawing, as well as the water area managed by the port (darker colour). (base map: Stora Enso)

Figure 4. The concrete quay top at the scene of the accident, at the west end of quay B. An edge block made of yellow metal tube, the starboard side stern corner of the EGON W and the wooden protective beams on the edge of the quay can be seen in the photo. Photo taken on 27.11.2013. (photo: the police)

2.2 Course of events

The EGON W had arrived in the Port of Vuoksi at midday with an intention to discharge its raw timber cargo and continue to Joensuu after that. When the vessel arrived at the quay, it could not immediately moor to the berth used for discharging raw timber because the berth was used by another vessel. The EGON W moored with its starboard side against the quay to the north-side of an L-shaped quay to berth B2.

2.2.1 Vessel operations and change of quays

After the other vessel had left the port at approx. 19.00 in the evening, it was decided that the EGON W was to be moved to the other side, i.e. the west-side of the L-shaped quay to berth A3, with its port side against the quay. Because of this short change of quays, a decision was made to let go of the vessel and moor it without outside line handlers by using only the vessel's own crew. The intention was first to let go of the vessel, then to reverse the vessel and then to moor it immediately again. The Master of the vessel was on the bridge and the Chief Officer was on the deck and in charge of the letting go and mooring operations. The seaman, who worked as a deckhand and cook on the vessel, was the only one to climb down to the quay by using a rope ladder. The idea was that he would be there during the transfer, i.e. also when the lines were fastened again. The seamen started to let go of the stern ropes so it would be possible to turn the stern of the vessel outwards. The intention was to keep the lines dry when pulling them onto the vessel. The first stern line was let go off the bollard, and when it was pulled onto the vessel, it got stuck to the side of the quay. The seaman (deckhand-cook) who was on the quay tried to loosen it. The seaman on the afterdeck kept pulling the line while leaning down behind the rail. The seaman who was on the quay fell into water close to the stern corner of the vessel while trying to loosen the trapped line.

Figure 5. Photo of the scene of the accident 26.11.2013. The passageway on the edge of the quay was fairly narrow because of the concrete base of the information board and the attention cones stacked next to it. The ladder seen at the edge of the quay was brought there during the rescue operations. (photo: Stora Enso mill fire brigade)

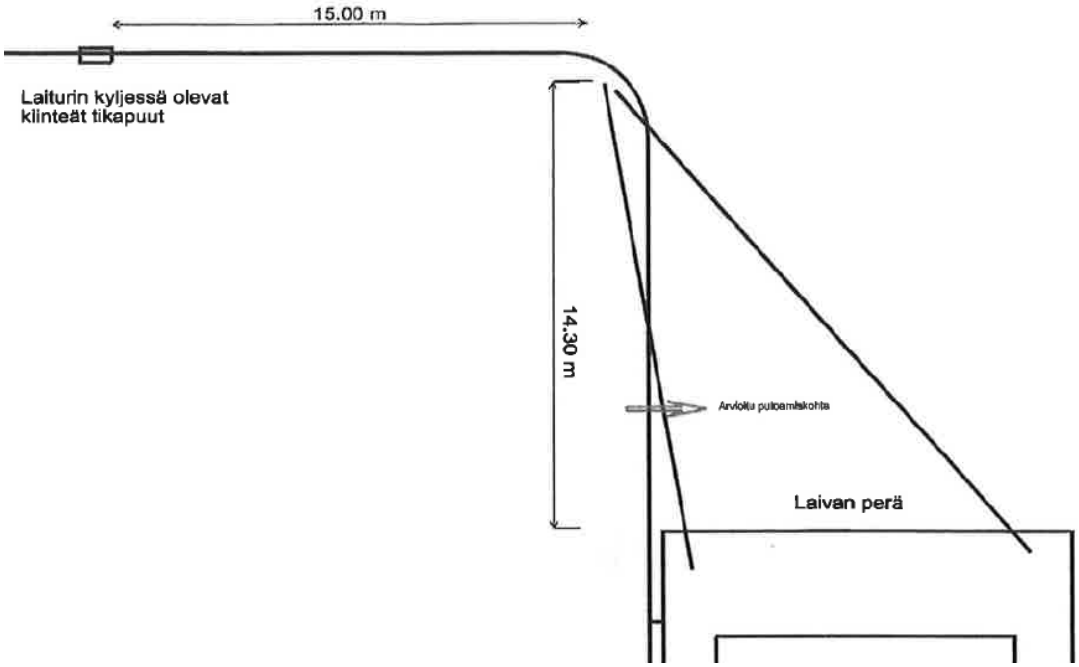

Figure 6. Scene of accident drawing compiled by the police (drawing: the police)

2.2.2 Measures after the accident

After noticing the fall, the seaman handling the line on the afterdeck threw a lifebuoy without a line into the water. The man who had fallen into the water tried to get a grip of it. Because the main engine of the vessel was running, the controllable pitch propeller caused some slipstream in the direction of the stern.[1] The slipstream and the prevailing conditions made the lifebuoy move away from the vessel, and the seaman tried to reach it. The man on the afterdeck tried to make the man in the water turn by calling out to him in order to be able to throw him another lifebuoy.

The seaman on the afterdeck used a portable radio to inform about the seaman falling into water. The men on the foredeck started to run along the vessel's deck towards the stern. The First Officer intended to jump into water, but because the seaman in the water was already quite far away and because the water was cold, he did not jump. Another lifebuoy was thrown into water. Both thrown lifebuoys were from the vessel. It was possible to emergency stop the main engine from the bridge, so the Master of the vessel who was then on the bridge stopped the main engine in order to stop the propeller.

A worker doing his shift in the port and using a car saw the seamen moving with great haste towards the stern, whereupon he drove next to vessel. After he had arrived to the scene, the Master of the vessel shouted "ambulance" thus asking him to call for help. The Master himself called the ship broker of Saimaa Terminals, i.e. the ship's agent, and asked him also to call for help.

A general alarm was not raised on the vessel, but the Master had ordered men on the deck to assist. On the other hand, almost the entire crew was in any case already engaged in duties related to the transfer of the vessel. The lifeboat could not be used in this situation because it can only be lowered on the starboard side of vessel.[2]

2.2.3 Alerting activities

The first emergency call from the accident scene at 20.08.37 was made by a person who worked in the port. The first things that the caller spontaneously told at the beginning of the emergency call, during the first 25-30 seconds, were the scene (Stora Enso mill in Kaukopää, Imatra, the Port of Vuoksi) and the basic information related to the incident, according to which somebody had supposedly fallen into the lake and that a lifebuoy had been thrown there. The scene and basic information related to the accident are exactly what the emergency response centre at least needs in order to determine the correct task class and to alert the response related to it. The address of the accident scene was noted to the emergency response centre information system 70 seconds af-

[1] It is possible that there was some pull forwards and the rudder was somewhat turned to port, which means that the side was kept along the quay by leaning onto the spring line already when letting go of the stern lines. In the course of the safety investigation it was not possible to hear the master who had worked on the bridge when the accident took place. The master of the vessel had changed immediately after the accident, and the person who had worked as master at the time of the accident did not any longer work on the vessel in question when it called Finland.

[2] The instructions on MOB situations included in the vessel's safety management system are described in Chapter 2.11.5.

ter the call had started and the task class *Rescuing a person from water*[3] 117 seconds after the call had started. Alerting for the mission was started 134 seconds and reading out the alarm notice 165 seconds after the call had started.[4] In the emergency call there were long pauses during which the duty officer did not talk to the caller. Later during the emergency call the duty officer tried to specify the accident scene[5] and asked for more detailed driving instructions. The duty officer also inquired if there was anybody who knew English there, apparently in order to get first-hand information on *what the accident had been like*. The other duty officer, who received the call made by the ship's agent (at 29.09.30), asked *whether the victim was still on the surface*. The caller could not answer the question, as he was not at the scene. Other things mentioned in the task management instructions[6] (*how many persons to rescue, do these persons have floatation devices, for how long have they been in water or drowned, what the weather conditions are like*) were not brought forward in the emergency calls.

The address and other information about the Port of Vuoksi needed for raising alert were taken from the target information of the emergency response centre information system. Target information has been entered into the system e.g. so that assistance can be alarmed quickly to targets considered carrying high risk, and so that targets, which are otherwise more difficult to locate, can be more quickly placed on the map. In the information system there was a mistake in the street address of the Port of Vuoksi, which had been defined as *Yläkuja*. This address is not located in the mill area. There had been the same mistake earlier in the files of the South-East Finland emergency response centre. In these files the mistake had been corrected. After the emergency response service moved to Kuopio, the street address had again, for some reason, turned incorrect. The street address was corrected immediately on the day after the accident.

Rescuing a person from water belongs to the task group *Accident or incident*, and as to this task group, the alarmed response does not include health care units. Therefore another task was added to the aforementioned task in the emergency response centre, i.e. *Drowning*. Alerting an emergency care unit was started with a discussion in the VIRVE network[7] with a unit then engaged in another task. The radio call was read 180 seconds after the first emergency call started, and the alarm message for task B was sent 245

[3] In the task class specific handling instructions of the emergency call, the task "Rescuing a person from water" include also a clarification text "Rescuing of a person who is supposed to be in water or drowned".
[4] The performance agreement of Emergency Response Centre Administration (Ministry of the Interior 24.1.2013, SMDno/2012/1501) defines the task types for which alarming time is monitored as one indicator of the quality of work done in emergency response centres. When it comes to rescue services, medium-size building fire and medium-size traffic accident belong to these. It is observed in the performance objectives whether the alerting takes less than 90 seconds in building fires and less than 120 seconds in traffic accidents. Rescuing a person from water is not included in the tasks defined in the performance objectives.
[5] This and the issues presented in italics are those that relate to this particular task and are mentioned in the task management instruction of the Emergency Response Centre Administration. Towards the end of the call, when it had lasted approx. 4 minutes 40 seconds, the emergency response centre duty officer who had taken the first call, asked the caller for street address.
[6] Mission classes 483 Saving a person from water and 714 Drowning
[7] VIRVE (short for "Viranomaisradioverkko", government official radio network) is the Finnish authorities' telecommunications network. It is based on the Terrestrial Trunked Radio (TETRA) standard.

seconds after the call started. A note on priority class A mentioned already in the radio call was entered into the information system 577 seconds after the call started.[8]

2.2.4 Rescue activities

The urgent alarm corresponding to the *Rescuing a person from water* response that was made by the emergency response centre comprised of eight rescue service units. The other task, i.e. *Drowning*, defined somewhat later, included an emergency care unit. Altogether six rescue service units arrived at the scene, four from the Stora Enso mill fire brigade in Imatra and two from Imatra fire station. The Emergency response centre passed the information on the task also to the police, and one police patrol arrived at the scene.

According to the Stora Enso mill fire brigade, the alarm delay from the time of the accident to the starting of the alarm call would have been approx. 4 minutes. The first unit to arrive at the scene at 20.20 was a surveillance car from the Stora Enso mill fire brigade and immediately after that, within the same minute, a rescue diving unit from the Rescue Department of South Carelia and a firefighting unit from the mill fire brigade arrived. The emergency care unit from the Rescue Department of South Carelia arrived at the scene at 20.23, after which the duty officer of the mill fire brigade (who had been hours of duty on call, waiting for possible tasks), the emergency response unit of the mill fire brigade and then at 20.26 the firefighting unit of the Rescue Department of South Carelia arrived. A diver entered the water quickly, and the victim was found at 20.30. He was found approx. 20 meters from the aft of the vessel. The victim's colourful clothing made finding him easier.

At 20.35, i.e. 5 minutes after he had been found, the victim had already been lifted on the quay and resuscitation had been started. Resuscitation was continued for approx. 20 minutes but without result. It was ended at 20.56 after a doctor had been consulted.

2.2.5 Aftercare

The personnel of the vessel were extremely shocked about what had happened. At 21.08 the manager of the rescue activities asked the emergency response centre to alarm another ambulance at the scene for the mental care of the crew. The duty officer of municipal psychosocial care was notified of the accident on the same night, and the duty officer arranged an acute care team to take care of the case. The crew was already asleep so it was decided that the acute care team would not go to the vessel till the next morning. The acute care team started a defusing discussion related to the case with the crew on Wednesday 27.11.2013 at approx. 9.00. At the same time it was found out that help was also needed pertaining to provisioning so Finnish Red Cross members were asked to the scene. The acute care team spent approx. eight hours on the vessel.

[8] According to the task management instructions used at emergency response centres, drowning is an A class mission if the person is under water and the response is under an hour. Alarming as a B mission might have been based on the idea that in unclear cases urgency is usually B. Medical care units leave immediately and drive to both the A and B missions as an emergency vehicle.

2.3 Injuries to persons

The seaman who fell into water from the quay died.

2.4 Manning

The vessel had a multinational crew consisting of 7 persons: Master, Chief Officer, Chief Engineer, Engineer and three deckhands, one of whom also worked as the cook. According to the manning certificate, the minimum number of crew was six.

The deceased seaman had worked for the same company for several years. Because the EGON W mainly operated in the Saimaa area, he was not particularly unfamiliar with conditions in Finland.

The Master of the vessel acted as the Officer of the Watch when the accident took place. The Chief Officer was in charge of the letting go operations carried out on the deck. He had worked as deck officer for four months.

2.5 Cargo

The vessel was carrying 2,100 m³ of raw timber, which was supposed to be discharged at quay A in the Port of Vuoksi. The cargo was discharged on the day following the accident at the same berth where the vessel was when the accident took place, i.e. quay B, berth 2.

2.6 Weather conditions and lighting

Two days prior to the accident, approx. 0.5 centimetres of snow fell in the Imatra area. Because the surface of the ground was still quite warm due to mild weather earlier, the snow melted away at many places. After the snowfall the weather got colder already during Sunday, and the weather was clear after that, except for the night between Sunday and Monday, when minor powder snow may have fallen from the stratus clouds.

After the weather got colder, the wind blew to the Port of Vuoksi from north-west, i.e. from the open Saimaa. Because the Saimaa was not frozen and the air temperature was a couple of degrees minus, some humidity had evaporated from the surface of the lake. Because of the clear weather during the 24 hours before the accident, the surface of the quay may have become colder also because of radiation cooling. As a result of these, some (a couple of millimetres) frost had formed on the surfaces of the various parts of the quay.

Figure 7. Photo on the estimated place of falling approx. one hour after the accident. There was a thin layer of powder snow on the quay and frost on the surfaces. The ladder seen in the foreground had been brought to the scene during the rescue operations. (photo: the police)

The weather was fair and visibility good during the accident. Temperature in the Port of Vuoksi was approx. -4 °C, wind direction south-south-west and wind speed 3-6 m/s, in gusts 7-10 m/s. Dew point was approx. -6 °C and relative humidity 88%. There were not any effective warnings for the Imatra region during the time of the accident.

It was dark when the accident took place, and the accident scene was illuminated by the lamp posts which illuminated the entire port area and by the vessel's own working lights. These lamp posts were located next to a building in the port area. Perceiving the edge of the quay may have been difficult against the dark water and because there were various shadows.

Those who were alarmed to the scene have expressed somewhat varying opinions on the slipperiness of the quay. The surface of the quay was not especially slippery, and the possible slipperiness did not hamper rescue activities. The friction values measured

by a road weather station nearby (approx. 2 km east-north-east from the port) were very good, i.e. the surface of the road was dry and the friction value according to that particular sensor was the highest possible measurement result of 0.82. Also according to the Finnish Meteorological Institute, there were normal and firm conditions for pedestrian traffic in the Imatra region on the day and evening of the accident. The Lappeenranta airport inspection record on the airport area states that the runway was entirely covered by frost or frozen dew. The inspection was carried out at the airport at 16.14 on the day of the accident. The results of the friction measurement were 0.36-0.46, i.e. according to the airport classification, the friction was better than average or even good. The measurements made at the nearest road weather station and at the Lappeenranta Airport do not, however, directly reflect the friction in the port.

The temperature of surface water in southern Saimaa was +4 °C on the day of the accident. According to approximate tables describing survival in cold water, in those conditions (0-5 °C) it takes approx. 15-30 minutes for a person to get exhausted and become unconscious and 30-90 minutes to die from hypothermia. Survival and times related to it naturally depend to a great extent on the victim's age, physical condition, build and on how used he/she is to cold. When a person suddenly falls into cold water, his/her body sometimes suffers from so-called cold shock. In that case the panic the person experiences makes him/her gasp for breath, which makes it easier for the water to enter the respiratory passages. In addition, the carbon dioxide level of blood falls quickly due to the hyperventilation, which again reduces the level of consciousness.

2.7 Navigational and communication equipment

There were portable radios on the vessel, and they were used for the communication related to letting go and mooring operations. The seaman standing in the aft of the vessel used the same walkie-talkie to report about the fall into the water.

2.8 Registration equipment

There was not a camera intended for monitoring the deck. The surveillance cameras of the port did not record the accident.

2.9 The port and port equipment and fairway equipment

The Port of Vuoksi is a private port owned by the Stora Enso Oyj. It is run by Stora Enso Forest (quay A) and Oy Saimaa Terminals Ab (quay B). There are three berths in the port and approx. 200 quay metres. Stora Enso security services are responsible for security surveillance on the area. Line handling services are taken care of by outside operators ordered by agents.

Raw timber is imported to the port, and products of Stora Enso Kaukopää mill are exported, i.e. paper and cardboard. Discharging the vessels is carried out by logistics company Mantsinen Group Ltd Oy, a subcontractor to Stora Enso Forest, and Oy Saimaa Terminals Ab is in charge of loading operations. Personnel from transport and cargo handling companies also occasionally work in the port area.

The quay top is made of concrete structure, and it is open down-under where the accident happened, i.e. north-west corner. This means that there is water surface also under the quay top. There are bollards on the edge of the quay for mooring vessels, and on the edge of quay B there is an edge block made of metal tube. On the exterior sides of the quay there are protective beams made of wood as well as quay fenders made of rubber. There are fixed yellow ladders on both quays.

2.10 Special investigations

2.10.1 Investigations onboard the accident vessel

An investigator from the SIAF visited the accident vessel on 18.12.2013 when the vessel came to Finland the following time. During this visit the vessel's safety management system, the training manual, record-keeping on drills and exercises related to emergency situations and personal floatation devices were documented and at the same time the passage of the vessel in the Saimaa Canal was monitored for approx. 1.5 hours.

2.10.2 Investigations at the scene

The Investigation Team visited the scene of the accident in the Port of Vuoksi on 14.1.2014. At the same time the letting go and mooring operations of the vessels were observed. The series of photos below illustrates the risk of falling from a quay the person working as a line handler experiences when letting go of the lines.

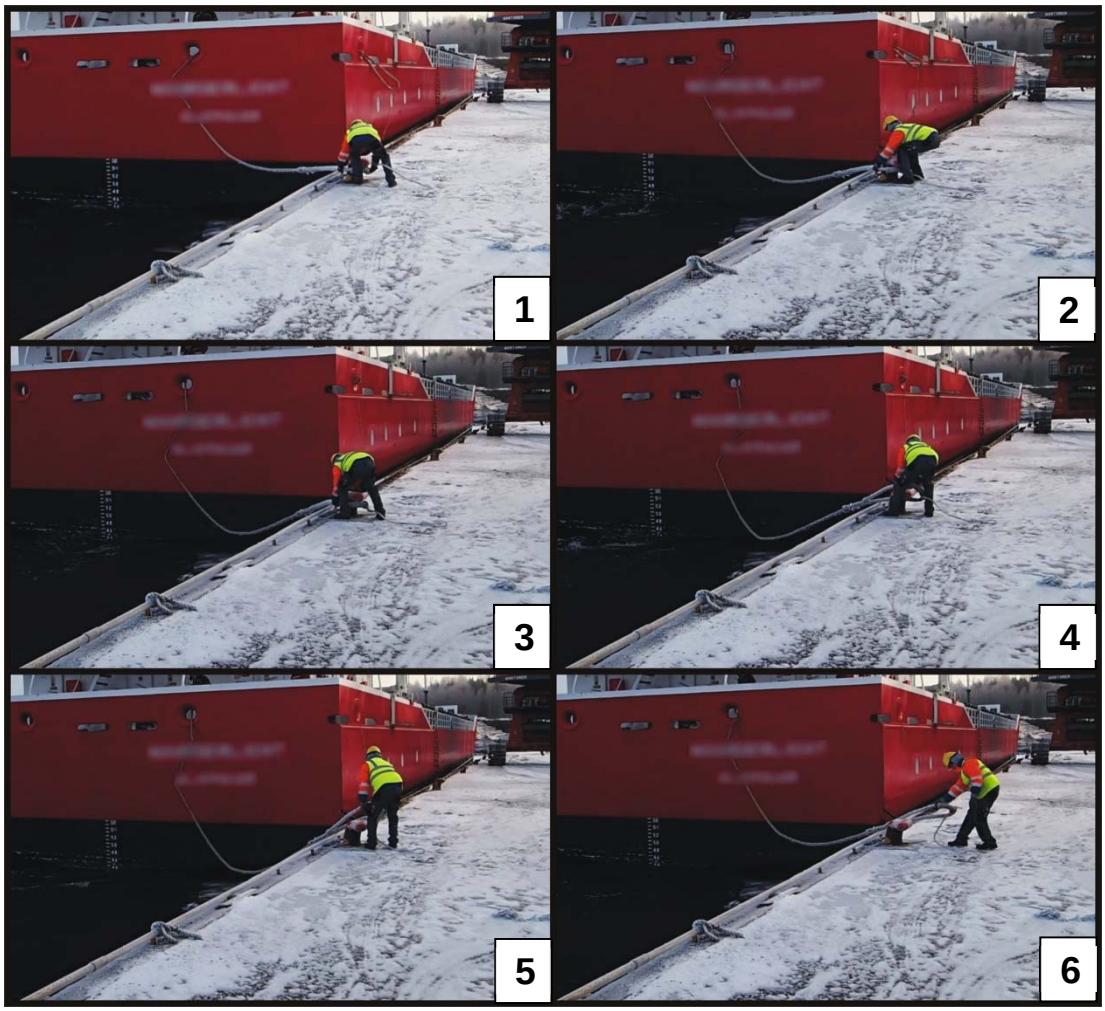

Figure 8. Series of photos portraying the actions of a line handler when letting go of a vessel similar to the accident vessel as to its size at berth number 2 in the Port of Vuoksi in winter conditions. The line handler shown in the photo had been ordered from a subcontractor, and he was not wearing a lifejacket. Photo taken on 14.1.2014. (Photos: the SIAF)

The line handler has to work very close to the edge of the quay at the same time both lifting and pulling at the rope, which means that there is a major risk of falling into water if he e.g. staggers or slips. The engines are running when the vessel is being let go as well as when it is moored. Therefore there can slipstream in the water at the stern, and bow thruster may cause flow in the bow. In winter conditions, the line is also stiffer and therefore more difficult to handle.

There were points in the port bollards and quay edges and its planking which could make it more difficult for the line handler to work if the line got stuck to them. Especially in the outer edge of the quay there were plenty of points to which the line could get stuck, protruding bolts, loosened nails, splinters of worn wooden beams, etc.

Figure 9. There were several points on the edge of the quay where the line could get stuck. Photo taken on 27.11.2013. (photos: the police)

In places the interlayered crushed stone used for sanding and other matter piled on the quay reached the level of the metal tube on the edge of the quay. After the metal tube there was a steep bevel in the concrete quay top, and crushed stone used for sanding and other matter had piled on the top of the wooden covers fastened on the side of the quay.

Figure 10. Matter piled next to the edge tube of the quay where the falling has been estimated to have taken place. (photo: the police)

On quay A in the port there is an information board in English and Russian for seamen, and it gives instructions on safety equipment needed in the port. Lifejackets are not mentioned on the board, only safety vests.

Figure 11. The English language text in the information board: "Protective equipment required in the area: Hard hat, protective goggles, safety shoes, safety vest, protective gloves." The photo to the left was taken on the morning following the accident, the one to the right on 14.1.2014. The lifebuoy seen in the photo to the right has been placed there after the accident. (photos: the police, the SIAF)

On the evening of the accident the statutory safety equipment in the port consisted of an orange lifebuoy equipped with a floating rope and a ladder equipped with a support bracket at its upper end (Decree 633/2004). They were placed approx. 60 metres from the scene (corner of the quay). There was some timber in front of them (Figure 12). An entry of *required cleaning in front of safety equipment in the Port of Vuoksi* was made to the Stora Enso Forest register of safety-related incidents and observations, and the timber in the area was removed.

Figure 12. The ladder and lifebuoy near to the accident scene, photo taken on the evening of the accident 26.11.2013. The Government Decree on the Occupational Safety in Loading and Unloading of Ships requires that there must also be a round-tipped boat hook available. (photo: Stora Enso mill fire brigade)

2.10.3 Port organization and management

In the Port Regulations of the Port of Vuoksi (2006), the tasks related to the management of the port consist of *person responsible for the administration of the port* and *port managers*. The duties of a port manager are divided to two persons according to the areas of use. One of them is responsible for quay A and the water area off the port, the other for quay B. According to Port Regulations, a vessel must be moored to a position allocated by the Port Manager and it cannot be moved to another position without his/her consent. The persons appointed for the tasks do not, however, always make these decisions, but in practice ship agents and Mantsinen's shift managers agree on matters related to departing and arriving vessels and on the use of quays.

The vessels also have no obligation to use line handlers. Transfers from one quay to another one are done based on the master's decision, and because of the practices mentioned earlier, without separately consulting the port and almost always without outside line handlers. Sometimes, weather permitting, vessels are taken to the quay and from the quay without line handlers. Agents do not automatically order a line handler, but they agree on the matter with the master of the vessel.

The Stora Enso mill fire brigade had arranged an ISPS exercise with the theme rescue from water in the Port of Vuoksi on 27.10.2010. The realization of the exercise was based on searching two victims in water and lifting them by working from the corner of the very same L-shaped quay. The immediate feedback from the drill then comprised the following observations which were to be taken notice of:

"Port structure: 1) Visibility of the lifebuoys. 2) The height of the quay is a challenge -> the ladder in the port was good, but there should be more of them and in the marked positions.

Personnel: 1) Training and schooling of personnel to help people who have fallen into water. 2) It would be a good idea to regularly go over actions required by the port personnel in different situations."

2.10.4 Other investigations and observations

During the investigation, the Investigation Team had the opportunity to make random observations on the occupational safety and safety culture on the vessels operating in the Saimaa.

When an investigator visited the EGON W, the vessel was at the same time proceeding in the Saimaa Canal: during lockings, the crew working on the deck and taking care of mooring and letting to did not wear floatation jackets or lifejackets.

When the Investigation Team visited the Port of Vuoksi, the transfer of another dry cargo vessel from quay A to quay B was observed: the transfer was realised without outside line handlers by the vessel's own crew, and the seaman working on the quay did not wear appropriate safety equipment.

Figure 13. Quay transfer of a cargo vessel in the Port of Vuoksi 14.1.2014. The seaman waiting for the bowline does not have safety equipment required in port and necessary for the safe execution of the task. The vessel and person in the photo are not related to the accident. (photo: the SIAF)

The Investigation Team visiting the Stora Enso mills was told about Stora Enso Forest's register on safety incidents and observations, in which also incidents taking place in the port are entered. During the traffic period 2013 there were almost 400 port calls, and during that period tens of entries were made on vessels and the behaviour of their crew. The majority of the entries concerned lacking personal safety equipment or the crew moving within the dangerous zone of mobile work machinery or quay during discharging and loading operations. On the basis of these observations, Stora Enso Forest goes through problems with ship agents or masters, so that there would be concrete improvements in the operations. A safety observation had been entered also on the activities of the crew of the EGON W: the loading of the vessel was interrupted on 31.12.2013 (i.e. after the accident now under investigation) because *the crew was moving on the vessel within the range of discharging machines and wearing inadequate safety equipment*.

2.11 Rules and regulations guiding the operations

2.11.1 National legislation

In the Finnish ports where extensive loading or discharging operations or other similar operations are practised, both the Occupational Safety and Health Act (738/2002) and the Government Decree on the Occupational Safety in Loading and Unloading of Ships (633/2004) are observed. The Occupational Safety and Health Act applies, in addition to all port operators, also to the shipowner, master of the vessel or any other person in trust of the vessel but only when it comes to work completed in port, ashore or on vessel when *loading or discharging* a vessel engaged in sea or inland waterway traffic or when bunkering the vessel. When performing their duties, the seamen are always the master's subordinates. All work is carried out under the responsibility of the master and complying with the legislation of the flag state and international regulations. There are few requirements pertaining to vessels on work performed in ports in the regulations mentioned above: the vessel must be appropriately moored, the mooring lines must be un-

damaged and safe to use and there must be an appropriately fixed safety net under the access route that extends a minimum of 2 metres to the both sides of the lower end of the access route.

According to the regulations pertaining to Finnish ports, the structures, materials, equipment and appliances at the work place must be safe and healthy to the workers. In this and in maintaining general occupational safety the *port holder* carries a significant responsibility. In order to co-ordinate the operations of the various work performers, the port holder has to study and assess the safety of the port area, look after general occupational safety planning and arrangements as well as the general safety and health of work conditions and environment. The port holder also has to draw safety instructions for the port. These instructions shall comprise e.g. a description of general occupational safety principles and codes of conduct for emergency and dangerous situations.

Access routes, passageways and all areas of the working places, where port workers move because of their work, must be safe. According to the Decree on ports, e.g. quays and open areas must be kept in *a condition required for safe work* and there must be a clearance of at least 1.2 metres at the edge of the quay, where no other solid structures except the equipment needed for mooring the ship to berth and a safety net may be present. According to the Occupational Safety and Health Act, workplaces shall be provided with the necessary alarm, fire safety, lifesaving and rescue systems and equipment. The Act specifically mentions workplaces in which there is a risk to life or health due to falling into water: in such workplaces there shall always be rescue equipment available in a suitable place. The workers shall also be given necessary instructions on the use of such systems and equipment, and, when necessary, exercises shall be arranged. In the Decree dealing with ports, this is specified by stating that on the quay there must be an orange lifebuoy equipped with a floating rope, a ladder equipped with a support bracket at its upper end, and a round-tipped boat hook at intervals of 100 metres or less. In addition, in the quay edge there must be several fixed ladders leading up to the quay, painted in a highly visible colour and equipped with a handle on their upper end on the quay.

According to the Finnish legislation, the employer shall acquire and provide the worker with personal protective equipment whenever the nature of the work, the working conditions or appropriate work performance require it and when it is necessary in order to avoid the risk of injury or illness. The employee shall wear them with care and according to instructions.

2.11.2 Port rescue plan and risk assessment

The rescue plan of Stora Enso Imatra mill for the Port of Vuoksi (2013) includes instructions on accidents, incidents and mishaps. In these instructions, the falling of a person or a vehicle into the dock basin has been mentioned as one of the risks. Preventive measures noted are the service and maintenance of the quay, preventing slipperiness, making clear where the rescue equipment is placed as well as service of appliances and machinery maintenance. In the instructions pertaining to the situation, the following are mentioned: use of the rescue equipment available in port to save human lives, alarming the rescue department, informing the mill's own alarm centre, warning about danger,

preventing further damage, giving first aid and taking the rescued person into shelter or warming him/her by using the blanket on the stretcher.

The port operator Saimaa Terminals has specifically assessed risks related to the handling of paper reels in the Port of Vuoksi (2004). The factors dealt with in the study included e.g. the slipperiness in the work environment caused by water and snow and careless moving around: when working on quay or vessel deck, tumbling close to the water or falling into the water may also lead to the danger of drowning. In the particular study, the risk rate[9] of work environment related dangers (slipping, falling, other traffic, etc.) was 6 on scale 1-9, i.e. intolerable risk. When calculating the risk rate, the probability of the aforementioned incident was considered possible (2) and its consequences serious (3). The related preventive measures mentioned in the study included self-induced monitoring of work environment by every employee to prevent dangerous situations, general alertness and wearing protective clothing as well as the responsibility of the work management for the tidiness and safety of work environment, e.g. ordering sanding to prevent slipperiness.

2.11.3 International Safety Management Code of seafaring

The International Safety Management Code, i.e. the ISM Code, concerns the owning shipping company of the EGON W. “The objectives of the Code are to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment and to property. Safety management objectives of the Company should, inter alia: provide for safe practices in ship operation and a safe working environment; assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards; and continuously improve safety management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection. The safety management system should ensure: compliance with mandatory rules and regulations; and that applicable codes, guidelines and standards recommended by the Organization, Administrations, classification societies and maritime industry organizations are taken into account.”

According to the ISM Code (Chapters 7-8), the company "should establish procedures, plans and instructions, including checklists as appropriate, for key shipboard operations concerning the safety of the personnel, ship and protection of the environment. The various tasks should be defined and assigned to qualified personnel. The Company should identify potential emergency shipboard situations, establish procedures to respond to them, and establish programmes for drills and exercises to prepare for emergency actions.”

[9] Risk is estimated to be the result of the seriousness of the consequences and the probability of the incident, and the extent of a risk is estimated on the basis of risk rate. Risk rate is a concept equalling with the product of the gravity of consequences and the probability of the incident, i.e. when expressed as a mathematical formula: risk (rate) = gravity of danger x probability of the incident. The scale for both of them usually consists of the same whole numbers, must commonly 1-3 or 1-5, in which case the risk rates correspondingly get values 1-9 and 1-25. The verbal interpretations of the scales may vary, but the main principle is that the higher the numerical value, the more serious the consequence, i.e. the higher the probability and total risk (i.e. risk rate).

2.11.4 Safety Management System of a shipping company

The Safety Management System of the shipping company was studied when the vessel was visited in connection with the investigation. The Code of Safe Working Practices for Merchant Seamen, the most previous edition of which is from 2010, published by the Maritime and Coastguard Agency (MCA) operating under the United Kingdom Department of Transport, has been included as the binding instruction in the shipping company safety management system.

As to the use of personal protective and safety equipment, the following is stipulated in Chapter 4 of the aforementioned Code and at the same time in the Safety Management System of the shipping company: *"Risks to the health and safety of workers must be identified and assessed. It will often not be possible to remove all risks, but attention should be given to control measures which make the working environment and working methods as safe as reasonably practicable."* It is the responsibility of the employer to ensure that workers use suitable personal protective equipment where it is needed. Where work is being carried out overside or in an exposed position where there is a reasonably foreseeable risk of falling or being washed overboard, a lifebuoy with sufficient line should be provided. In addition and as appropriate, a lifejacket or buoyancy aid should be provided. Where necessary, personnel should be provided with thermal protective clothing.

Operations related to anchoring, mooring and towing are stipulated in Chapter 25 of the Code in question. Also in this context, the importance of risk assessment is emphasized so that the safety of the personnel can be guaranteed, and it is stated, in an unambiguous manner, that all personnel participating in mooring and letting go operations must wear appropriate personal protective clothing, as described in Chapter 4.[10]

In the vessel's Safety Management System there are instructions on MOB, i.e. man over board, situations. According to these instructions, the Officer of the Watch must immediately after noticing an MOB situation e.g. launch one or both light and smoke buoys, raise lifeboat alarm, call the master, notify the engine room, bring the ship back to the scene of the accident with a suitable manoeuvre and there stop and among other things start measures to launch the lifeboat. There are no separate instructions in the Safety Management System for MOB situation taking place in port.

The risk assessment required by the Safety Management System takes into consideration the mooring and letting go of the vessel, risks connected to which have been separately assessed as to working in the bow and working in the aft. Preparing the vessel for mooring, the mooring itself, letting go and reeling in lines are mentioned as high-risk work stages when working in the aft. All risk rates related to these are average or high, and it has been calculated that 2-3 persons at time are exposed to the risks, depending on the stages of work. The catching of lines to the propeller, the catching of lines to

[10] The practical realization of the issues mentioned in the Safety Management System is illustrated by the information gained from the vessel's crew according to which there are not any specific instructions on the vessel on how to work in port, nor are there any instructions on safety measures related to this particular task, and that the crew has been instructed to use the automatically inflatable lifejacket on board when the particular task involves a risk of falling into water.

something ashore, loops and bights, i.e. twists and folds in the lines, and slips and falls have been identified as risks related to especially the letting go of the vessel. Attempts are made to control the risks connected to mooring and letting go work taking place at the aft of the vessel e.g. by familiarizing those handling the lines with their tasks, by making the operations planned and supervised, by making the workers conscious of where they step and by making them watch over each other also as a team, by ensuring that they wear appropriate safety and protective clothing and by keeping the lines straight and well stored and by e.g. trying to pull the lines onto the vessel without letting them fall into water. After these measures all residual risks have been considered very unlikely, so that their risk rates have in all cases been assessed as tolerable or average.

In the training manual of the vessel there are several instruction cards for various tasks (hot work, electrical work, climbing up to the mast, etc.) but there is no instruction card on work related to letting go or mooring. The training manual interleaf dealing with protective equipment does not mention floatation devices or lifejackets.

3 ANALYSIS

SHELL model[11] is used in the analysis of the accident, and the most important factors have been presented according to it in the figure below.

[11] The SHELL model is used to study human actions in their environment and to try to find out the impact various factors have on human performance. The objective of the model is not to concentrate on a single sector but to examine the whole and the connections between the different sectors. The name of the model derives from the following letters, i.e. sectors: Software stands e.g. for schooling, instructions, methods and orders. Hardware stands e.g. for equipment or the vessel itself, which is used by the human being. Environment stands for the operational environment. The Liveware in the middle stands for the human being, whose actions are studied, and the outer Liveware means other persons with whom the person using the device interacts.

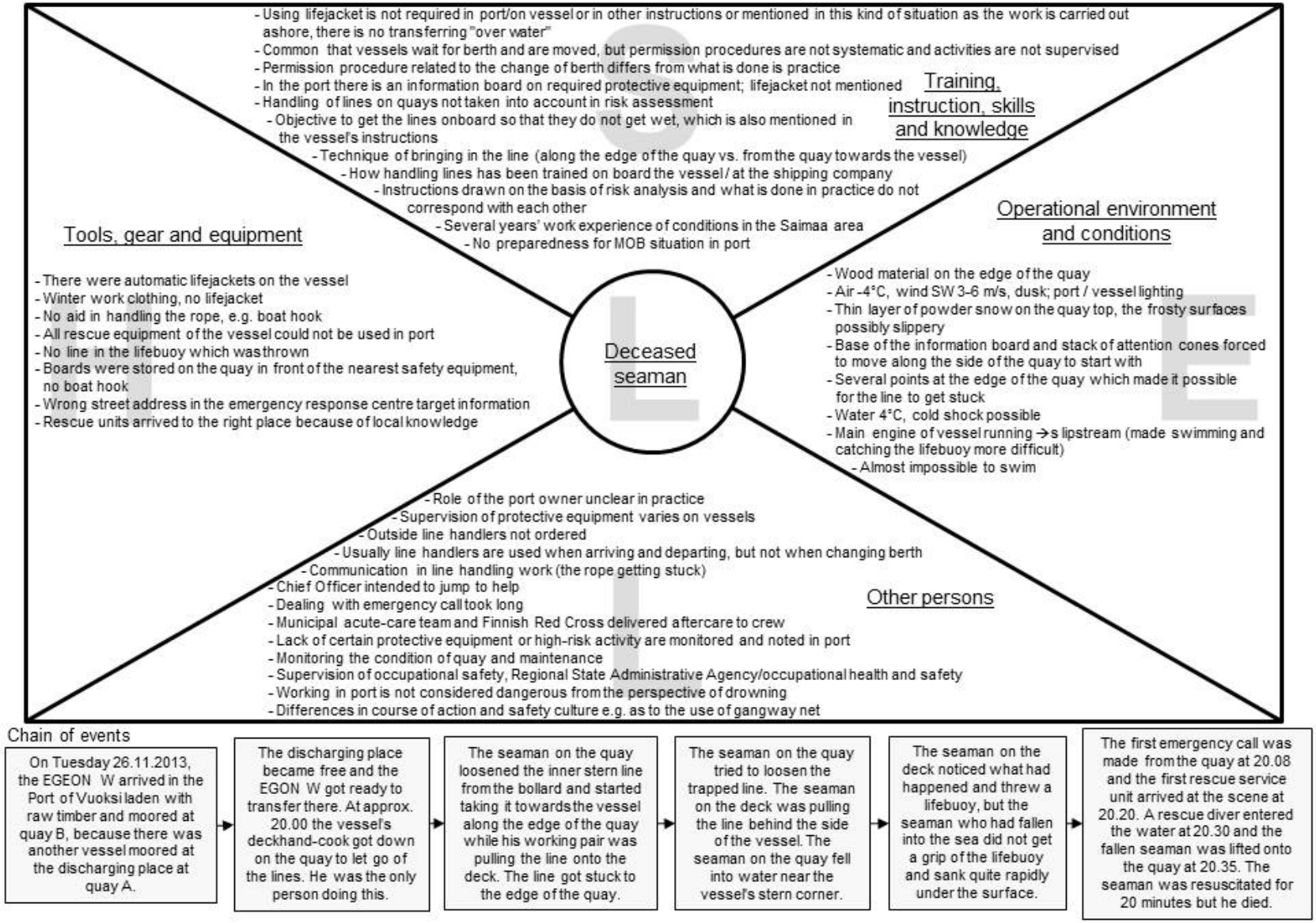

Figure 14. The SHELL graph compiled on the accident.

3.1 Actions taken by the vessel's crew, the impact of human and organizational factors

3.1.1 Line handling in port

The intention was to move the vessel by using own crew without outside line handlers from the port. The actions were logical in the particular situation because this was what had always been done in corresponding quay transfers.[12] Weather and environmental conditions did not hinder vessel operations because the vessel's own crew had experience of the task and they had at their disposal equipment corresponding with what was stipulated on the port information board on working on the quays. Using own crew also gave the opportunity to save both time and shipping company money, because using outside line handlers is not included in the berth fee in the Port of Vuoksi. Those working in the port area do not take care of line handling duties but the service is bought from a security firm acting as a subcontractor or from another service provider whose workers come to the port from elsewhere and only when they are specifically ordered. Therefore each time is also charged separately. Because all the factors mentioned above supported the idea to use the vessel's own crew, it is possible, that the master did not specifically consider the pros and cons related to using outside line handlers.

3.1.2 Making preparations for working in port

Saving time and haste or the routine-like nature of the operations may somewhat have affected the overall situation, because the vessel had already waited for several hours. On the other hand, the waiting time had offered an opportunity to rest, and based on the previous shifts, it does not look like fatigue played any role in the accident, nor did the use of alcoholic or narcotic substances.

The activities related to the letting go of the vessel were planned and they were also supervised: the Master was responsible for operating the entire vessel and the Chief Officer was in charge of the work carried out on the deck. The seamen on the deck and the one who went to the quay did not wear floatation garments or lifejackets even though there were automatic lifejackets on the vessel. The conditions and environment seemed certainly safe enough from the perspective of seamen because the vessel was in a sheltered port area. Using floatation devices in situations like this was also not part of the vessel's safety culture.[13] When considered from these perspectives it seems that the decision on not to wear floatation equipment was a so-called non-decision, i.e. the matter was not even given consideration. It is likely that from the perspective of those working on board the vessel, all seamen had headed off to take care of the same job, even though the conditions and risks were entirely different at the edge of the quay from what they were on the inside of the vessel's bulwark. The Safety Management System defines that floatation equipment shall be used if work is being carried out at an exposed position where there is a reasonably foreseeable risk of falling overboard. This risk does

[12] In the course of the investigation it came out that, weather permitting, arriving and departing vessels are also moored and let go without line handlers in the Saimaa area ports every now and then, even every week. Especially jumping and climbing over the bulwark in connection with arrivals and departures always entail considerable risks, e.g. falling onto the quay or water and getting stuck between the vessel and the quay.

[13] The safety investigator's own observation when he was visiting the EGON W in the Saimaa Canal 18.12.2013.

not necessarily materialize on the deck, but becomes without any doubt reality on the open edge of the quay. Risk identification, analysis and assessment were not active and dynamic enough, and the vessel's officers could not, with their own actions, prevent or adequately minimize the effect of the risks.

3.1.3 Falling of the seaman from the quay

Letting go of the ropes at the stern had been assigned to the seaman working on the afterdeck, and he got help from the deckhand-cook working on the quay. According to the vessel's instructions and practice, the aim was to keep the line dry when pulling it onto the vessel. The information board in the port and the cones stacked next to it forced the seaman to walk the first metres with the line close to the edge. It did not become clear during the investigation whether the vessel had an operations model related to keeping the lines dry which would have made it possible to avoid walking on the edge of the quay or any appliances which would have made handling the line easier.

The line got stuck, which generated an abnormal situation. To solve the problem both members of the work pair probably acted based on their skills, i.e. intuitively, with disentangling the line as their natural objective. Concentrating on this detail may have also meant that awareness of what can be stepped onto on the quay and/or perception of the dangers related to working on the edge of the quay has flagged at least for a moment. On the other hand, working on the edge of the vessel or the quay belongs to daily routine, and therefore risks related to it are difficult to identify. The perception most people have of the dangers connected with falling into water is based on the subconscious mental image related to swimming in warm water, and the real threat imposed by the coldness of the water is not understood. As to the height of the fall, the edge of the quay cannot visually be noted especially dangerous - at least not in the Port of Vuoksi.

The non-conformities related to mooring and letting go operations, e.g. the rope getting stuck which was mentioned in the Safety Management System, had apparently not been anticipated and there was not any ready model for working in these situations. It seems like the seamen did not stop to consider their actions and to find ways to loosen the line, but both kept handling the same trapped line at the same time. Therefore the communication during the situation may also have been inadequate. The requirements in the vessel's Safety Management System on the activities being supervised and that in this particular duty the workers must monitor each other as a team did not materialize in practice, and the work of the work pair consisted of separate work performed by two individuals.

Because there were no eyewitnesses to the falling into the water, it was not possible to find out in detail the cause of falling. The falling has been caused by tumbling, staggering, tripping, slipping, taking a wrong step, by the force generated by the movement of the line or by the combined effect of some of the aforementioned factors.

The person who fell into water had to swim in the slipstream caused by the propeller, and he was wearing work clothing for winter conditions, he did not succeed to get a grip of the lifebuoy which was thrown to him. The risk of drowning was increased by cold shock generated by falling suddenly into cold water. Therefore the only possible help in

this particular situation would have been a successful rescue operation and lifting carried out by the vessel's own crew or other port personnel.

3.1.4 Crew preparedness for man over board situations in port

The crew's own attempts to rescue the seaman who had fallen into water were started promptly. The seaman working on the afterdeck threw a lifebuoy to the seaman who had fallen into water. Later on, another lifebuoy was thrown into water. Correct measures included also the MOB alarm raised by portable radio, making sure of getting outside assistance (call to the agent and calling the port worker and stopping the main engine). For the crew a MOB situation in port was a new one, and after throwing the lifebuoy and informing about the situation, it was not possible for them to act on a skill-based manner. There were not any instructions on the vessel on how to deal with a MOB situation in port, and this kind of a situation was not taken into consideration in the vessel's Safety Management System. The MOB situation instructions on the vessel were good and practical, but it was only possible to observe them when the vessel was underway. According to these instructions the person who had fallen into water should have been lifted on the vessel's lifeboat, but as the vessel was moored with its right side against the quay, it was not possible to use the lifeboat. In this kind of a situation which evolves quickly, the crew had naturally no possibility to shift to so-called knowledge-based actions, i.e. to search for new ways to reach and realise the objective, i.e. the saving of a human life, in this hour of real need. The Chief Officer's thought of jumping to help was a spontaneous step exactly into this direction, but realising it would have required wearing a survival suit - otherwise also the rescuer might have quickly lost his ability to function in the freezing cold water before the ways to carry out a lift would have been discovered on the vessel.

There is not generally adequate preparedness in shipping for MOB situations taking place in ports. As mentioned earlier, ports are considered safer than being underway, but for the person who has fallen into water, the situation may in the worst case be quite the opposite: finding a port ladder and climbing it in wet clothing is difficult, vessel's bulwarks are high when considering high pilot ladder or lifting by manual force, and sometimes the systems intended for rescue operations cannot be used at all (placing of lifeboats, availability of hydraulics and electricity, etc.). There are also traffic-related challenges, as in busy ports other vessels and whirlpools generated by them may cause a concrete threat. On the other hand it may take surprisingly long for outside rescue equipment to arrive and be guided to the scene.

3.2 Circumstances and environment in the port

3.2.1 Condition of structures and keeping the quays clean

The uneven structures on the edge of the quay made it possible for the mooring rope to get stuck. During the technical investigation carried out by the police, the tendency of the line to get stuck was tested by taking the line from the bollard and pulling it along the quay towards the vessel. When this was done, the line got stuck at several points to the bolts, nails and an end of a plank jutting out on the edge of the quay. When investigating the scene, several observations were made on details related to the condition of the

quay structures or to keeping them clean. Some of them are presented in the photo series below (Figure 15) and in the bottom left-hand corner of Figure 13 (broken and twisted edge block).

Figure 15. On the day following the accident, wooden waste increasing risks related to moving and working on the quay could be observed on edge parts of the quay top (topmost photo). There was also an end flange which was torn from the joint and twisted at the mooring bollard at the corner of the quay as well as splinters of wood in the protective balks on the quay. Both these factors may have made line handling more difficult. (photos: the police, the SIAF)

Quays, their edges and other structures are exposed to different weather conditions and to stresses generated by both vessels and machines moving in the port and even to col-

lisions. It is clear that their condition cannot always be as good as new. Basic level for adequate condition is that those working in the port do not need to compensate problems or risks caused by poor condition by their own active measures. Adequate cleaning of quays, e.g. removing of wooden waste material and preventing slipperiness, also have major impact on workers' safety.

3.2.2 Obligations of the port holder

On the basis of the investigation it can be concluded that at least two different reasons have affected the state of affairs.

The division of responsibility related to the management and maintenance of the Port of Vuoksi is not unambiguous.[14] Even though dividing port manager duties and leaving responsibility with the operational actors have provided flexibility as to managing practicalities, the practice has been unclear with reference to the extensive responsibility of the port holder as prescribed in the aforementioned Decree. There has not been any single party responsible for or taking care of the entire port, e.g. permits for the mooring and transfer of vessels, condition of the structures and quays, elimination of detected shortcomings or taking into consideration other safety-related observations, e.g. the matters which have come up in the previous drills and exercises (see Chapter 2.10.3).

Another issue which came up in connection with the investigation was the fact that inadequate monitoring of structures and unkempt passageways (leading e.g. to mooring bollards located outside quays) are normal everyday life also in many other ports in the Saimaa area. Passageways and all areas, where port workers move because of their work, must be safe. According to the information gathered during the investigation, protective nets are not nearly always used under the vessels' own catwalks.

3.2.3 Safety culture when in port

On the basis of observations made in the Port of Vuoksi which were entered in the safety observation register of Stora Enso Forest, occupational safety thinking and culture when in port were lacking on many vessels visiting the port. Stora Enso Forest uses the safety observation register in an excellent manner by taking the observed problems in this way into discussion with ships' agents and masters.

There are significant possibilities for development in the safety information directed to seafarers and provided by ports (i.e. at its minimum in the information boards and their contents), e.g. instructions on using lifejackets and other floatation garments. Informing could also be more varied than only using information boards, and the prevailing circumstances could be better taken into account. With easy-to-understand information on occupational safety and by conveying it actively it is possible to directly affect the seafarers' safety-related thinking when in port.

[14] The division of responsibilities as to the prevention of slipperiness on the quay area, snow clearance, service and structure maintenance goes slantwise from the scene of the accident, i.e. the corner of the L quay, to the corner of the storage hall, even though in practice the whole area is entirely continuous.

3.2.4 Impact of weather and light conditions

The weather conditions and darkness during the accident have probably contributed to the accident. The frost surface which develops on asphalt, concrete and trampled snow or ice is not necessarily slippery in itself, but wind, vehicles and walking on it may smooth the frost surface so that it becomes slippery. Metal or wooden surfaces covered with frost, e.g. the yellow tube going along the edge of the quay as well as slanted wooden surfaces, may also be very slippery.

If the deceased seaman, when disentangling the line stuck to the edge of the quay, braced his leg against the metal edge tube or area outside it, there is a great possibility that he may have slipped. Darkness, the general lighting in the port, the vessel's working lights and different shadows may have made the exact perception of the edge of the quay more difficult during intensive work.

3.3 Alarming and rescue activities

Alarming outside help started soon after the accident, and the port worker, who made the first emergency call, told both the basic information about the situation and the location of the accident scene quickly and correctly during the first 30 seconds of the call. Clear situational information and using target information from the emergency centre information system should make it possible to alarm response quickly. The emergency response centre started alarming response in accordance to the mission 1 minute 45 seconds after receiving the aforementioned basic information and after the entire phone call had lasted for 134 seconds. In these kinds of situations, quick alarming for help is as important as in e.g. building fires. However, in this case the passing of time did not matter. Because of the pauses in the emergency call the duty officer’s contact with the caller was weak.

In the course of the investigation it was found out that the street address for the Port of Vuoksi, which was taken for the task from the target information of the emergency centre information system, was incorrect. In this case the duration of alarming and incorrect address[15] did not play crucial role in what happened to the victim, but in another kind of a situation prolonged alarming of response or incorrect address information might have been significant.

The rescue activities in the port passed very well, the response was correct, and the resources were adequate. It was not possible to save the victim despite the fact that he was found quickly and resuscitation was continued for a long time. It was also noteworthy that the mill fire brigade felt responsible for taking care of the crew's mental crisis and alarmed psychosocial help to the scene.

[15] Because Stora Enso is a major and well-known operator in the area, all units arrived to the scene based on their local knowledge in spite of the incorrect address received in the alarm message.

4 CONCLUSIONS

4.1 Findings

1. The EGON W carrying raw timber arrived in the Port of Vuoksi and moored to another quay to wait so that the quay used for the discharging of raw timber would be free.

2. After the discharging quay was free, it was decided that the EGON W would be transferred to the quay in question. Outside line handlers were not ordered.

3. The Master worked on the bridge and the Chief Officer was in charge of the letting go operations taking place on the deck.

4. Risks related to working on the quay different from being on the deck were probably not identified. Lifejackets and other floatation garments were not used, and this was also not part of the safety culture of the vessel when in port.

5. The vessel's deckhand-cook was working as a line handler on the quay. He was letting go of the stern line off the bollard and bringing it towards the vessel on the edge of the quay. There was another deckhand on the afterdeck, and he was pulling the line onto the vessel. According to the vessel's instructions and practice the aim was to keep the line dry when pulling it onto the vessel.

6. The information board placed at the corner of the quay and the cones stacked next to it forced the line handler to walk close to the edge of the quay.

7. The line got stuck to the structures on the edge of the quay. There were several points on the edge of the quay which made it possible for the line to get stuck.

8. The entanglement of the line made it necessary to work right on the edge of the quay.

9. The seamen tried to loosen the line and they did not observe one another nor were they aware of the dangers involved. The communication during this exceptional situation might also have been insufficient.

10. The deckhand-cook working on the quay fell into water.

11. The falling was the result of tumbling, staggering, tripping, slipping, taking a wrong step, of the force generated by the movement of the line or of the combined effect of some of the aforementioned factors. Contributing factors consisted of slipperiness, darkness and shadiness and possibly also of the lack of pair work as both seamen handled the trapped line simultaneously.

12. The seaman working on the afterdeck threw a lifebuoy to the deckhand-cook, who could not get a steady grip of it. Slipstream made catching the lifebuoy and swimming more difficult. Another lifebuoy was thrown into water later.

13. There was no preparedness on the vessel for man over board situations taking place in port, and the crew was not able to do anything else than to throw lifebuoys into water in order to save the person in water.

14. The lifeboat of the vessel could not be used as it was on the quay-side of the vessel.

15. Vessels' own systems intended for rescue operations cannot necessarily be used when in port (the placing of the lifeboats, availability of hydraulics and electricity, etc.)

16. The vessel was not adequately prepared for a MOB situation in port.

17. The seaman who had fallen into water sank fairly quickly under the surface of the water. Cold shock probably played a role in this.

18. The port worker who had made the emergency call from the quay told during the first 30 seconds of the call all basics related to the situation. The emergency response centre started to alarm for help after the call had lasted for 2 minutes 14 seconds.

19. There was a wrong street address for the port in the target data of the emergency response centre.

20. The first unit and divers were on the scene 12 minutes after the emergency call had started. The casualty was recovered quickly and he was resuscitated for a long time, but to no avail.

21. The mill fire brigade made sure that psychosocial crisis support was arranged to the crew of the vessel.

4.2 Causes leading to the accident

The fact that the line had stuck to the rugged structures resulted in the need to work right on the edge of the quay, and this had an effect on the accident. Contributing factors consist of slipperiness, darkness and shadiness and possibly also of the lack of pair work as both seamen handled the trapped line simultaneously.

Dangers connected to working on the quay were not anticipated in the situation which led to the accident. In spite of the different risks, working on the quay was probably considered to be similar to the work completed on the deck. Lifejackets and other floatation garments were not used.

Man over board situations in port were not taken into consideration in the Safety Management System of the vessel, and there was no beforehand completed operations model for them. The lifeboat of the vessel could not be used as it was on the quay-side of the vessel.

5 SAFETY ACTIONS ALREADY IMPLEMENTED

On the night of the accident, there was timber in front of the nearest lifebuoy and ladders belonging to the basic rescue equipment in the Port of Vuoksi. After the safety observation made on the matter, the timber was cleared away. A new lifebuoy has been acquired to the scene of the accident, i.e. to the corner of the quay.

There was a wrong street address for the Port of Vuoksi in the target information in the emergency response centre data system. This was corrected immediately after the day of the accident.

6 SAFETY RECOMMENDATIONS

6.1 Recommendations

Risk management related to work performed by vessel personnel in port and preparedness of shipping companies to accidents taking place in ports

Every seafarer has the right to have a safe work environment in which safety-related regulations have been taken into consideration. According to the International Safety Management Code of seafaring, the shipping company objectives related to safety management must include e.g. the safe realization of vessel operations, creating safe work environment and developing protective measures for all specified risk factors. In the course of the investigation it was observed that shipping companies do not necessarily identify or take seriously dangers related to being in port and operating there. In addition, vessel crews often regard ports as a refuge, where everything is safe. These viewpoints make risk management related to work carried out in ports and self-induced observation of individual risks more difficult.

The accident vessel did not have instructions for MOB[16] situations taking place in ports. Especially work carried out on quays and MOB measures taken in ports should be observed in more detail in the safety management of shipping companies. In the quickly evolving emergency situation the crew had no possibility to move directly to knowledge-based activity, i.e. to try to look for new ways to rescue a human life. In several successful rescue operations the help received from people nearby has been a central factor. Rescuing a person who has fallen into water is very time-critical also when it comes to falling into water in ports. It is therefore important that the vessel crew know to act correctly and are able to quickly use the rescue equipment available on the vessel.

The Finnish Transport Safety Agency improves traffic system safety, participates in international cooperation and actively influences the preparation of traffic policy. The aim of the Finnish Shipowners' Association is to improve the safety of maritime traffic and technology, and the Association is responsible for lobbying for the shipping industry via international seafaring organisations in matters related to technology and safety.

The Safety Investigation Authority recommends that

1. *The Finnish Transport Safety Agency together with the Finnish Shipowners' Association take measures to improve, both nationally and internationally, the risk management in connection with work carried out by vessel personnel in ports and to improve preparedness with regards to accidents taking place in ports. These measures are recommended because the character of such work and of possible accidents taking place in ports differs from work carried out and accidents taking place at sea.*

[16] MOB is an international acronym for Man Over Board

Improving occupational safety in ports

In the course of the investigation it was observed that there were several points in the quay located at the scene of accident where the vessel's mooring line, which was let go, could have got stuck. In addition, general information was obtained on the risk factors related to the condition and arrangements in the ports of the Saimaa area. Quays, structures, passageways and access routes must be kept in a safe working condition. Basic level for adequately safe work environment can be considered to have been achieved if there is no need to compensate problems or risks caused by port arrangements or possible shortcomings by active measures taken by the workers.

The Ministry of Social Affairs and Health prepares and develops occupational health and safety legislation and policy, is responsible for international cooperation within occupational health and safety, and governs areas of responsibility related to occupational health and safety for the Regional State Administrative Agencies. The members of the associations mentioned in the recommendation form a significant part of the owners and operators of Finnish ports. The Finnish Port Association is an expert association for municipal and private ports, and it aims to promote e.g. the flow of port-bound transportation and improve the know-how of its member ports. The Finnish Port Operators Association acts e.g. as a prominent party developing working methods as well as guides and advises its members in matters related to its field of expertise.

The Safety Investigation Authority recommends that

2. *The Ministry of Social Affairs and Health together with Regional State Administrative Agencies, the Finnish Port Association and the Finnish Port Operators Association take measures to make port authorities and operators pay attention to the monitoring of the condition of port structures and to guide port authorities and operators in developing self-induced control regarding the safety of routes and passageways as well as moving around and working.*

6.2 Other safety observations

Line handling duties in port

The supply of line handler services varies from port to port. There may be deficiencies in a port's own or subcontracted line handling work when it comes to skills and the use of safety equipment. The risks referred to in the first recommendation above naturally relate to all persons engaged in line handling duties in ports, both when it comes to working on a quay and to the line handling itself.

Speed and quality of emergency response centre activities

In the investigated accident, the Emergency Response Centre received basic information required for making an alert during the first 30 seconds of the emergency call, and alarming for help was commenced after the call had lasted 2 minutes 14 seconds.

In urgent missions the alerting activities must be quick enough, and one must be able to direct both the caller and the discussion with the caller according to the situational requirements and principles of the task management instruction. In order to ensure this,

attention must continuously paid to the vocational skills of the call centre personnel at emergency response centres and to maintaining these skills as well to the accuracy of data in target information.

DATE AND SIGNATURES

Helsinki, 29 September 2014

Timo Naskali

Jukka Seppänen

Risto Haimila

LIST OF SOURCES

The following source documents are filed at the Safety Investigation Authority:

1. Decision of the investigation M2013-03, letter 344/5M, 5.12.2013
2. Statements given on the draft version of the Investigation Report:
3. Marine casualty report to the Finnish Transport Safety Agency, EGON W, 20.12.2013
4. Port state control report, the Finnish Transport Safety Agency, 27.11.2013
5. Investigation material of the Police
6. Investigation material of the Regional State Administrative Agency
7. Material of the Port of Vuoksi
8. Material of the Stora Enso mill fire brigade
9. Alarm and accident reports related to the accident from the Pronto information system of the rescue services
10. Emergency call and radio traffic recording and mission reports related to the accident from Kuopio Emergency Response Centre
11. Weather report related to the Port of Vuoksi accident on Tuesday 26.12.2013 at 20.00 (LT), the Finnish Meteorological Institute
12. The inspection record of Lappeenranta Airport, airport area, 26.11.2014 at 14.27 UTC.

Summary of the statements received on the draft version of the investigation report

Ministry of Social Affairs and Health

In their statement the Ministry of Social Affairs and Health refers to the accident investigation performed by an occupational safety and health inspector, according to which the immediate cause of death was the fact that the seaman was not wearing life jacket when falling into water.

On recommendation number 2 of the draft investigation report the Ministry of Social Affairs and Health concludes that the legislation pertaining to the recommendation is up-to-date. According to the Ministry of Social Affairs and Health, the parties mentioned in the recommendation know and understand how dangerous mooring and letting go operations are and the risks involved in these operations. The Ministry of Social Affairs and Health reminds that the Occupational Safety and Health Act obliges employers to continuously observe the working environment. The Ministry of Social Affairs and Health notes that the occupational safety and health regulations have been drawn in consultation with the parties mentioned in the recommendation, and that The Ministry of Social Affairs and Health does not perceive the proposals for action described in the recommendation to be necessary in this case.

The Ministry of Social Affairs and Health concludes that a vessel must comply with the safety regulations of the port and that work performed in Finnish ports must not compromise workers' health and safety. The Ministry of Social Affairs and Health brings forth that port regulations can be used to define the safety regulations to be observed in a certain port.

Finnish Transport Safety Agency

The Finnish Transport Safety Agency concludes that they do not have any statements on the draft investigation report. The Finnish Transport Safety Agency will make a separate decision on possible measures to be taken on the basis of the safety recommendations.

Emergency Response Centre Administration

The Emergency Response Centre Administration concludes in their statement that the first person to make emergency call did not see the accident itself but told in the emergency call that he suspected that someone had fallen into water. This conclusion had been drawn on the basis of the actions of the ship personnel. The Emergency Response Centre Administration finds that it has therefore not been meaningful to ask the caller all risk assessment questions related to the mission. Some of the facts to be clarified had already come up when the caller told them without being asked. The objective of risk assessment questions is to get information about what has happened. According to the Emergency Response Centre Administration, it was not possible to get new information on the basis of the second emergency call.

According to the Emergency Response Centre Administration, the initial information on the mission had been unclear, which meant that it took some time for the duty officer to confirm that the case was something for the rescue services and emergency care to look into. It took approx. one minute to find out information about the accident, after which the duty officer had necessary information to raise an alert. The Emergency Response Centre Administration concludes that the duty officer had settled on a correct task type, and that a mission type had also been created for emergency care.

As to the silent moments during the emergency call, the Emergency Response Centre Administration concludes that the duty officer spent those by looking for target information in the emergency centre information system, entered information about the call, chose the correct mission type and made the alert both technically through the emergency centre information system and by speech.

Pertaining to guiding the caller, which is mentioned in the section Other safety observations, the Emergency Response Centre Administration concludes that because the caller himself had not seen the accident, additional or directing question would probably not have yielded more information about the accident.

As to the emergency missions to be observed according to the performance agreement of the Emergency Response Centre Administration, the Centre concludes that these are not official performance objectives and they are not used to determine whether the duty officer has acted correctly or incorrectly when dealing with the emergency call. Emergency calls differ greatly from one another, and it is not possible to set such universal time indicators. The Emergency Response Centre Administration concludes that as to this mission, the realised alert time of 134 seconds from receiving the call is fairly good when the certain uncertainty of the information is taken into consideration.

After the accident the incorrect street address for the Port of Vuoksi in Imatra was corrected in the emergency centre information system. The Emergency Response Centre Administration is of the opinion that the duty officer has, after getting initial information and raising alert, acted professionally and specified the scene of accident and driving instructions to get there.

Antigua & Barbuda W.I. Department of Marine Services and Merchant Shipping, Inspection & Investigation Division (ADOMS IID)

The Department of Marine Services and Merchant Shipping, Inspection & Investigation Division, Antigua and Barbuda (ADOMS IID) stresses in their statement the perspective put forth in the draft investigation report that improvements can be made with reference to vessel and occupational safety in ports, including MOB situations.

Oy Saimaa Terminals Ab

Saimaa Terminals concludes that they do not have any statements on the draft investigation report.

Stora Enso Oyj

Stora Enso / Imatra mill concludes that they do not anything to add or correct in the draft investigation report.

Finnish Port Association

In their statement the Finnish Port Association concludes that the Port of Vuoksi is not a member port of the Finnish Port Association, but because the accident relates to everyday operations in shipping and in ports, the report has been studied by the port safety work group of the member ports of the Association. In the opinion of the Finnish Port Association, the investigation report has been well and carefully drawn. The conclusions of the analysis are suggestive and they will be taken into consideration when maintaining and improving activities and safety. In their statement the Finnish Port Association underlines that mooring and letting go are tasks which require knowledge and skills and in which the importance of training on possible risks and appropriate equipment is emphasized. In addition, the importance of the maintenance of loading and discharging areas on quays and of operations culture as well as of the accuracy of target information in the emergency centre information system is noted in the statement.

Finnish Shipowners' Association

The Finnish Shipowners' Association emphasizes in their statement the importance of the safety of work. The Association wishes to participate in the improvement of the safety of vessel personnel when working in port by developing safety management systems. Howe-

ver, the Finnish Shipowners' Association concludes that promoting the first recommendation made on the basis of the investigation may be difficult in the international maritime community because the decisive cause of the accident is not known explicitly and because the prevailing circumstances are not typical globally. In addition, transferring the vessel in berth only by the crew's own measures can be regarded as a rare procedure.