



**KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIK INDONESIA**

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Marine Casualty Investigation Report

Fatality on Board

MARINER (IMO 9433559)

Muara Berau Waters, East Kalimantan

Republic of Indonesia

21 January 2018

2024

The report is based upon the investigation carried out by the Komite Nasional Keselamatan Transportasi (KNKT) in accordance with IMO Resolution MSC.255(84) and Government Regulation Number 62 of 2013 on Transport Accident Investigation.

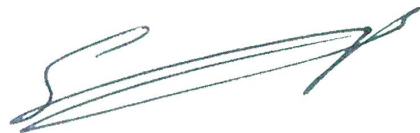
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Jakarta, December 2024

KOMITE NASIONAL
KESELAMATAN TRANSPORTASI
CHAIRMAN



SOERJANTO TJAHJONO

The report is published by the National Transportation Safety Committee (KNKT), 3rd Fl. Transportation Building, Ministry of Transportation, Jln. Medan Merdeka Timur No 5, JKT 10110, Indonesia, in 2024.

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SYNOPSIS

On 21 January 2018, an able-bodied seaman (AB 1) was crushed between the grab and the side of the hatch coaming on the Bahamas-registered bulk carrier *Mariner* at the Muara Berau anchorage, Indonesia. The *Mariner* was loading a bulk cargo of coal from barges using its onboard crane. When the coal on the barge was depleted, the crane operator rested the grab on the port side deck, which had previously been agreed upon as an area to remain free of work equipment. The crane operator was working alone without supervision of head of the working group or a designated signaler.

The AB 1 attempted to instruct the crane operator to move the grab to the starboard deck by signaling with a flashlight, positioning himself within the crane's work radius. As the crane operator lifted the grab, it swung and crushed the AB 1. The AB 1 was taken to the hospital and later pronounced dead.

The investigation by the National Transportation Safety Committee (KNKT) identified the following contributing factors:

1. AB 1 was within the radius of the crane's work zone next to the grab and was facing away from the grab when the grab was lifted so AB 1 did not realize the grab was lifting and swinging towards him.
2. Safety information regarding one of the decks free from work equipment was not passed on to the next work group resulting in the crane operator not knowing the provisions for placing work equipment on the deck.
3. There is a lack of clarity regarding the levels and methods of communication between the ship's crew and the crane operator on duty.

The KNKT investigation provided the following recommendations:

- Regulators and port authorities should emphasize the implementation of the BLU Code and BLU Manual for foreign vessels.
- Ship operators should improve safety procedures for loading and unloading operations.
- Stevedoring companies and the labor provider were advised to adhere to the BLU Code and BLU Manual and enhance operational safety procedures.

FACTUAL INFORMATION

The Accident

On 18 January 2018 at 21.24 LT¹, a Bahamian bulk carrier *Mariner* anchored off Muara Berau waters, East Kalimantan after sailing from the Philippines. *Mariner* was planned to load coal off Muara Berau waters by ship to ship (STS) from barges using *Mariner's* cranes.

On 19 January 2018, the coal loading was carried out after documents were complete. At 16.30 LT, a group of loading and unloading workers (TKBM) of the Samudera Sejahtera Cooperative (Komura) from Samarinda arrived at *Mariner* (hereinafter referred to as Group 1). After Group 1 arrived on the ship, a meeting was held before the loading activity which was attended by the Master, Chief Officer, Foreman as a representative from the Loading and Unloading Company (PBM) PT Putra Lintas Mandiritama (PLM), and the foreman as the head of the Group 1 working group (Kapokja Group 1). One of the discussions at the meeting was the arrangement and procedures that would be followed before loading coal onto the *Mariner*. The Chief Officer and the Foreman also fill out the ship/shore safety checklist for coal loading.



Figure 1: Location of the Mariner Anchorage

The meeting also agreed that one side of the deck should be sterilized from work equipment and activities related to loading operations for the sake of ensuring the crew and workers safety while walking on the deck during loading activities.

After the meeting, Kapokja Group 1 informed the Group 1 members about the results of the meeting and ordered them to set up a tent for workers to cook and rest near the foundation of Crane No. 3.

At around 20.00 LT, a landing craft ship docked on *Mariner's* port side carrying 4 dozers and 4 drums of fuel oil. After unloading its cargo, the landing craft left the *Mariner*.

At around 21.15 LT, the first barge arrived at the STS location with a coal cargo of 7,707 MT. After completing berthing of the barge, loading activities on the *Mariner* began. Three of the four *Mariner* cranes were operated by workers or crane operators from TKBM Komura. Loading was carried out using only three cranes because one crane grab was out of order. Loading was carried out 24 hours non-stop with the distribution of crane operator shifts arranged by the kapokja.

On 21 January 2018, 11 new crew members (on signers) *Mariner* boarded to replace 11 crew members whose service had expired (off signers).

At around 16.30 LT, 24 workers from the new TKBM working group (hereinafter referred to as Group 2) boarded the *Mariner* to replace Group 1 which had loaded around 20,300 metric tons of coal. Group 1 immediately got off the *Mariner* without a formal handover of duties between the Kapokja Group 1 and Kapokja Group 2.

At 18.00 LT, the *Mariner* deck watch duty was prepared on the port side deck. The Third Officer (III/O) was on duty at the bridge, while the AB 1, AB 2 and the Ordinary Seaman (OS) were on duty at the watch station on the port side deck. Loading activities at Hold No. 1, 3 and 5 using Cranes No. 1, 3 and 4 were stopped because the TKBM workers took a dinner break.

At 18.25 LT, after TKBM workers had finished resting, loading activities continued at Hold No. 1, 3 and 5 using the Cranes No. 1, 3 and 4.

¹ Local time is Central Indonesian Time (UTC +08.00)

At 20.00 LT, there was a shift change for crane operators. Crane Operator No. 1 began work on loading coal from the barge into Hold No. 1.

At 23.25 LT, Crane Operator No. 1 lifted the last bucket from the barge into Hold No. 1. After unloading the last bucket, Crane Operator No. 1 placed the grab (A grab or grip is a tool used to load and unload bulk cargo in the form of a clamshell or bucket) crane with the closed position on the port side deck near the Hatch No. 2 (Figure 4) while waiting for the next barge. The position of the operator's cab was facing the port side of the vessel and the grab steel wire rope is slightly slack. Seeing the Crane Operator No. 1 placing his grab on the port side deck, the AB 1 from the watch station gave a signal using a flashlight to the operator's cabin of the Crane No. 1 with the intention of asking the crane operator to move the grab to the starboard deck.



Figure 2: The illustration of AB 1 orders the OS to stop

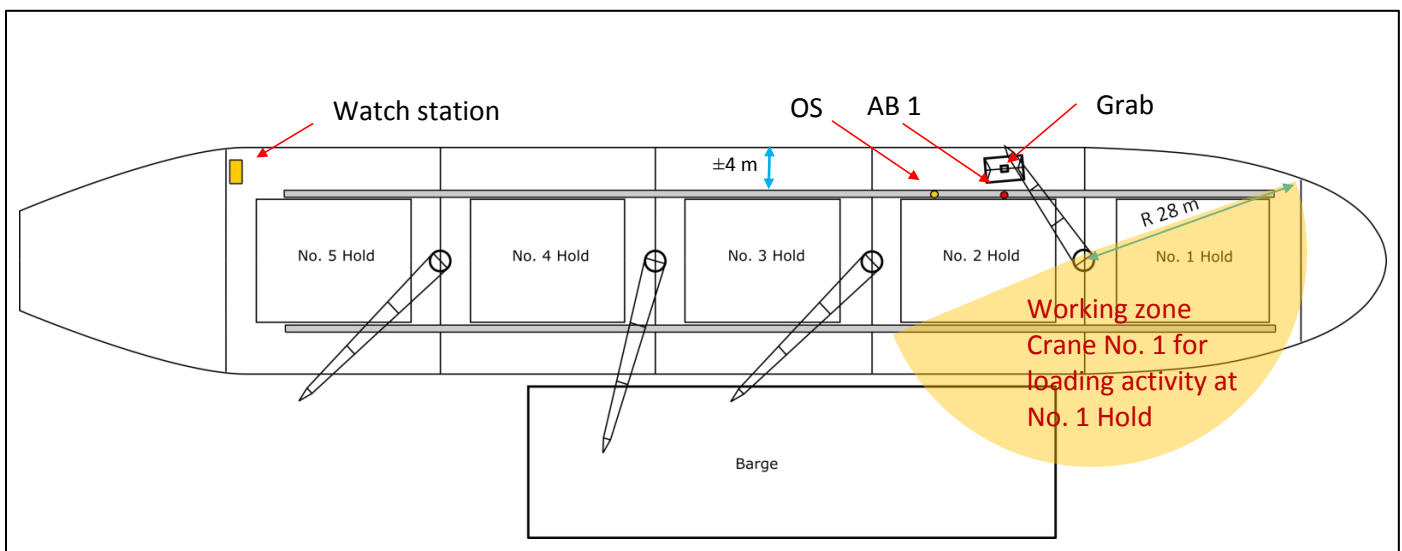


Figure 3: The illustration of the AB 1 position's

Because there was no response from the crane operator, AB 1 asked the OS to walk on the port side deck catwalk and approach Crane No. 1 until near Hatch No. 2 while continuing to signal the flashlight towards the operator's cabin. After near Hatch No. 2, AB 1 gave orders to the OS to stop and not to follow him. Then AB 1 continued to walk forward while still pointing the flashlight at the operator's cabin of the Crane No. 1.

At around 23.35 LT, when AB 1 was near the port side of Hatch No. 2 facing the crane and pointing his flashlight at the operator's cabin, Crane Operator No. 1 who got the flashlight signal decided to lift the grab. The grab moved up then swung to the port side hitting the ship's fence then swung to the starboard side crushing AB 1's back against

the side hatch coaming. The AB 1 then turned his body and the grab swung back again, crushing AB 1's chest against the side hatch coaming. Crane Operator No. 1 continued to lift the grab and placed the grab on the Hatch Cover No.2. After that, the Crane Operator No. 1 switched off the crane and went down to the port deck. At that time, the Kapokja Group 2 did not know what had happened because he was at the stern deck.

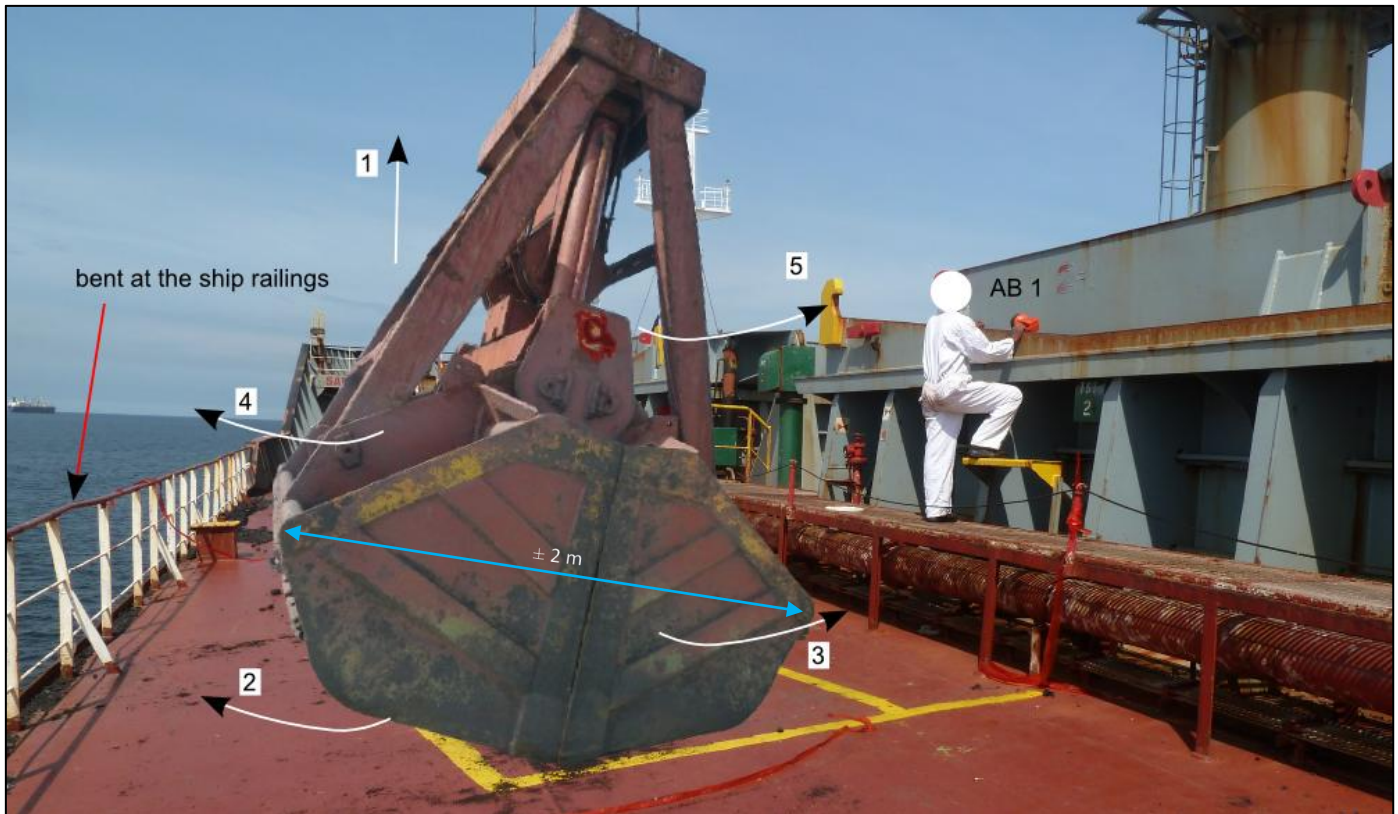


Figure 4: Marks (yellow paint lines on the deck) Grab position in inclined position and AB 1 position with back to grab and illustration of grab movement sequence

After being hit by the grab, AB 1 fell from the catwalk and laid face down on the deck. At that time, the OS immediately tried to help AB 1, who looked in pain. The OS then reported the incident to the other crew. Not long after, the Chief Officer and some other crew members came to help. AB 1 was then evacuated to the ship's hospital. The 2nd Officer as the health officer checked AB 1's condition, but there was no response from his body.

At around 23.55 LT, the Master informed the Ship Agent and asked the medical team to immediately come onboard to the ship.

At around 03.30 LT, Samarinda police officers arrived at *Mariner* to investigate the accident.

At 06.55 LT, police officers got off the *Mariner* carrying AB 1's body, which was then taken to a hospital in Samarinda.

The Consequences

As a result of this incident AB 1 died.

There was no significant damage to the ship in this incident. The ship's port side railing that was hit by the grab looks slightly bent and scratched.

Ship Information

Mariner (ex-Mandarin Harvest) IMO No. 9433559 and call sign C6BG9 is a Bahamas-flagged bulk carrier ship built in 2009 at Jiangsu Hantong Ship Heavy Industry Co., Ltd., China. At the time of the incident, *Mariner* was classed at Nippon Kyaji Kyokai (NK).

This ship has 189.9 m length overall, 32.26 m breadth and a tropical freeboard of 4,957 mm. Gross tonnage (GT) is 32,957 and net tonnage (NT) is 19,231.

Mariner was registered in Nassau, Bahamas. At the time of the incident, this ship was owned by Mariner Shipping Investment Inc. and operated by Minerva Ship Management Inc. This ship was designed to have five hatches and four ship cranes located in between the hatches. The engine room construction is at the aft of the ship under the accommodation.

Mariner is equipped with an STX-MAN B&W 6S50MC-C main engine with a power of 9480 kWt at 127 rpm.

The four *Mariner* cranes are IHI Mark II type SS360200-280B and have an NK classification certificate which was issued in July 2014, the last annual class inspection was carried out in May 2017. Each *Mariner* crane is equipped with a wireless remote control clamshell grab type.

The hoisting load grab is 28 tons. Maximum slewing radius 28 meters and minimum slewing radius 3,4 meter, slewing angle 360° (endless), hoisting speed 28 T x 20 m/min and slewing speed 0,35 rpm.

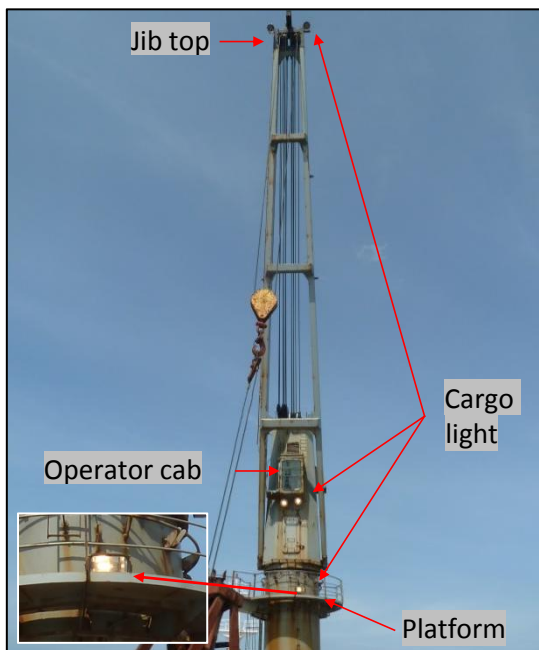


Figure 5: Lights on the Crane No. 1 (insert: Light Blocked by the Platform)

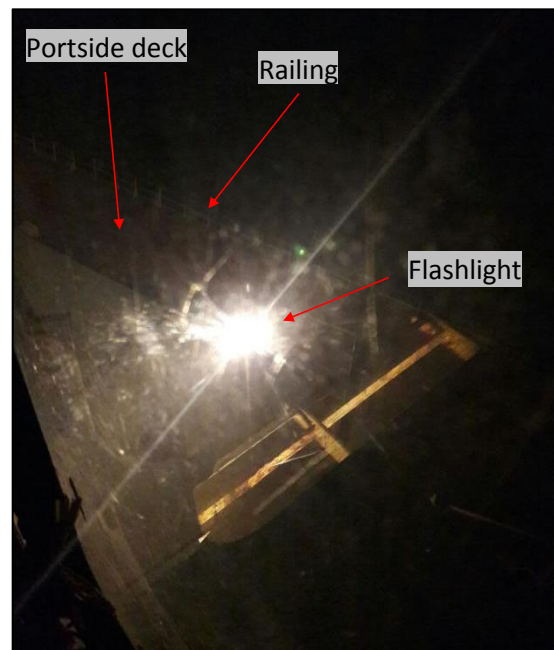


Figure 6: Visual from inside the operator's cabin to the port side left deck at night

The operator's cabin is positioned at the front of the crane house to provide the crane operator with a clear view of the area in front of the cabin. The cabin is designed to be watertight and features windows with reinforced glass for durability. Inside, it is equipped with essential controls, including a control handle, control box, room heater and electric fan. The crane operator uses a wireless remote control to manage the hydraulic grab system for opening and closing the grab shell. This system is powered by battery-operated solenoid valve.

The *Mariner* crane is outfitted with cargo lightings to facilitate nighttime operations. Specifically, two 500 watt halogen lamps are installed under the crane cab and two additional 500 watt halogen lamps are positioned at the top of the jib. However, during investigation, the team discovered that two lights at the jib top were not functioning.

Lighting on the port side deck, near the incident area, is provided by several sources: a port-side deck light located on the side of the Hatch No. 2 coaming, a light near the slewing bearing of Crane No. 1, and two cargo lights beneath the crane housing. However, the crane platform obstructs lighting from the slewing bearing light, preventing it from illuminating the area beneath the crane (Figure 5).

During nighttime operations, the port side deck area around Hatch No. 2 remains dimly lit due to the lack of additional lighting sources in the anchored waters, aside from the ship's own lights. KNKT investigators captured

visual images from inside the operator's cabin looking toward the port side deck. When a flashlight was aimed at the cabin, the operator could clearly see the beam of the light but struggled to identify the person holding the flashlight or view the surrounding area clearly (Figure 6).

Cargo

According to the loading plan, 53,350 MT of coal would be loaded onto *Mariner*.

Weather information

On the night of the incident, the weather conditions in the waters of Muara Berau were clear and the sea waves were slight.

Ship crew and crane operator

At the time of the incident, the *Mariner* was manned by 20 crew consisting of 7 Ukrainians, 8 Pakistanis and 5 Sri Lankan nationals.

The master held a Certificate of Competency in accordance with STCW II/2 regulations and had been serving aboard the *Mariner* since August 2017.

AB 1 (Able Seaman 1) had a Navigation Watchkeeping certificate (rating) and also joined the *Mariner* in August 2017.

On the morning of 21 January 2018, eleven replacement crew members boarded the *Mariner* to replace the departing crew. Among these replacements were AB 2 and an OS who were on duty alongside AB 1 on the night of the incident. Between 21:14--22:40 LT, AB 1 made a call to his family in Pakistan. According to his fellow crew members, he appeared normal after the call and even prepared food for his two colleagues.

Crane Operator No. 1 held a Class II Floating Ship Crane Operator OHS Lift and Transport Gear license, issued by the Ministry of Manpower of the Republic of Indonesia in March 2016, which was valid until 25 March 2021. He joined Komura in 2015.

On the day of the incident, Crane Operator No. 1 woke up at 05:00 LT and prepared to join Group 2, which was assigned to work on the *Mariner*. They departed from Samarinda around 12:00 LT on a longboat for a 4-hour journey to the *Mariner*, arriving at 16:30 LT. During the journey, Crane Operator No. 1 did not sleep. Upon arrival, Group 2 prepared for their stay onboard, while three members replaced Crane Operator Group 1 to continued loading coal. Crane Operator No. 1 was on duty from 20:00 to 24:00 LT. Members of the work group who were off duty rested in a designated area near the crane foundation, as arranged by the *Mariner* crew.

Port information

Muara Berau, where the ship-to-ship (STS) loading and unloading activities took place, is located approximately 40 nautical miles east of Samarinda Harbor, in East Kalimantan Province. The waters in this area have a depth of 30-50 meters, making them suitable for STS operations for coal commodities, as the shallower waters of Samarinda Harbor are not accessible to large vessels with deep drafts. Unlike dockside operations, where loading and unloading can only facilitated from one side, STS operations at sea allow loading from the starboard and port sides of the mothership.

The safety authority responsible for overseeing the safety and security of shipping in these waters is the Samarinda Harbormaster and Port Authority (KSOP).

Loading and unloading activities at Muara Berau involve a stevedoring company (PBM) and loading/unloading workers (TKBM). The coal is transported using barges and transferred to the mothership by cranes onboard the mothership.

At the time of the incident, there was no available port information for STS operations at Muara Berau, as required by IMO Resolution A.862(20), which pertains to the Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code).

Organizational information

The International Maritime Solid Bulk Cargoes (IMSBC) Code, Section 3, regarding the Safety of Personnel and Ships, states: "Prior to and during loading, carriage, and discharge of a solid bulk cargo, all necessary safety precautions shall be observed." Similarly, the Occupational Safety and Health Administration (OSHA), in its guidelines on safety and health in port operations, emphasizes that "all personnel not directly involved in the lifting operation should be kept clear of the area."

The IMO Resolution A.862(20), also known as the BLU Code, was established to provide guidance for masters, bulk carriers, terminal operators, and other relevant parties regarding the safe handling of bulk cargo during loading and unloading. The BLU Code introduces the role of the Terminal Representative, who is appointed by the terminal or facility to oversee and ensure the safe execution of these operations.

Indonesia has yet to implement specific regulations based on the BLU Code or the MSC Circular 1160 Manual on Loading and Unloading of Solid Bulk Cargoes for Terminal Representatives (BLU Manual). The Ministry of Transportation Regulation No. 6 of 2021, concerning Procedures for Handling Solid Bulk Cargo at Ports was issued in 2021 referring to the IMSBC Code. Article 4 of this regulation stipulates that "the shipper must carry out each stage of solid bulk cargo handling in accordance with the provisions of the safe code of practice for loading and unloading solid bulk cargoes and its amendments."

The BLU Code also mandates that terminal personnel receive training related to the safe loading and unloading of bulk carriers. It stresses the importance of familiarizing personnel with the general hazards of handling bulk cargo and the potential risks associated with improper operations. Additionally, terminal operators are responsible for ensuring that personnel are well-rested to prevent fatigue. Section 2.3.3 of the BLU Manual emphasizes that terminal personnel must understand how to safely access and work on bulk carriers in line with their responsibilities.

The BLU Manual provides further guidelines on the training required for terminal workers in Appendix 4 and outlines the hazards associated with loading and unloading activities in Appendix 5. The Ship/Shore Safety Checklist for Loading or Unloading Dry Bulk Cargo Carriers, filled out by the First Officer and Foreman, states that communication between the ship's crew and the Foreman is conducted via VHF radio on Channel 75.

The *Mariner* holds a Safety Management Certificate, and its operator, Minerva Ship Management, possesses a Document of Compliance, both of which were issued by NK and were valid at the time of the incident. Minerva Ship Management has a Safety Management Manual that defines the duties and responsibilities of personnel onboard. The company also establishes duty watch procedures, both in port and at sea, which are well understood by the crew.

The *Mariner's* master implemented a safety rule, which was not documented in the Ship/Shore Safety Checklist, requiring that one side of the deck remain free from loading activities, including the placement of support equipment and grabs. This area was designated as a safe zone for crew members to walk without interfering with operations. It was also outside the crane's swing radius, ensuring a clear boundary for safe movement. According to the crew, when not in use, the grab is placed on the same side as the barge or on the starboard deck of the *Mariner*.

Coal loading at the *Mariner* was managed by PT Putra Lintas Mandiritama (PLM) in collaboration with the TKBM Komura Cooperative, the sole provider of labor at Samarinda Port. PLM submitted a loading and unloading plan to KSOP Samarinda, which included a team led by the Foreman responsible for supervising and organizing TKBM workers and reporting to the shipper. The Foreman also served as the liaison between the ship and TKBM Komura.

The TKBM Komura Cooperative, established in 1985, provides loading and unloading labor services and is overseen by a cooperative chairman. The cooperative operates under joint instructions from the Ministry of Transportation and Ministry of Manpower, dated January 14th, 1989, and further supported by additional instructions issued on June 1, 1989. As of 2018, the cooperative had 1,149 members, divided into local and Indonesian groups. The Indonesian group, which serves imported and exported goods including STS operations, comprises 847 members across 34 working units.

For the *Mariner*, three working groups were assigned, with Group 1 handling 20,000 metric tons, Group 2 handling 20,000 metric tons, and Group 3 handling 12,000 metric tons. Only members with crane operator certificates were

allowed to operate the mothership crane. However, the KNKT Investigation Team was unable to obtain specific data on the number of certified crane operators or the validity of their certificates. The management of TKBM Komura stated that all workers were equipped with personal protective equipment (PPE) and tools for loading operations.

Despite these provisions, TKBM Komura does not have a formal safety management system or standard operating procedures (SOPs) for loading and unloading. Each kapokja (work unit leader) independently organizes coordination between the Foreman, crane operators, and workers, as well as work/rest hours and activity supervision. These arrangements vary by group, and shifts are determined upon arrival at the mothership.

At the time of the incident, PLM and TKBM Komura workers did not have identity cards or uniforms and lacked radio communication systems. Communication between the crane operator and kapokja was conducted via cell phones, and face-to-face communication was used between the Foreman and kapokja. The Foreman used a ship-provided radio to communicate with the crew. During operations, the crane operator worked independently without a signaler when grabbing and placing coal.

At the time of the incident, Minister of Transportation Regulation No. 152 of 2016, concerning the organizing and carrying out of loading and unloading of cargoes to and from ships, was in effect. According to Article 17 of this regulation: "Procedures for ship services and cargo handling at the port are determined by the local port authority, which must establish Standard Operating Procedures (SOP) and ship/cargo service performance standards. These standards should be based on the principles of justice, equality, coexistence, and service effectiveness, ensuring mutual benefit among port business actors."

However, at the time of the incident, no SOPs or ship service performance standards based on PM 152/2016 were available for the loading and unloading of solid bulk cargoes. This included procedures for KSOP Samarinda and the PBMs (stevedoring companies) responsible for these services. In 2018, KSOP Samarinda planned to conduct a study to develop operational standards and SOPs as required under PM 152/2016 Article 17. By the time this report was published, PM 152/2016 had been revoked and replaced by Minister of Transportation Regulation No. 59 of 2021, which also includes provisions on SOPs and performance standards in Article 8.

Regulations concerning cranes and lifting/transport equipment in Indonesia were originally governed by Law No. 1 of 1970 on work safety, Minister of Manpower Regulation Per-05/MEN/1985 on lifting and transport equipment, and Minister of Manpower and Transmigration Regulation Per-09/MEN/VII/2010 on operators and officers of lifting and transport equipment.

By the time this report was published, the two ministerial regulations mentioned above had been revoked. They were deemed outdated and no longer aligned with legal developments and occupational safety and health requirements. These were replaced by the Minister of Manpower and Transmigration Regulation No. 8 of 2020, which governs Occupational Safety and Health of Lifting and Transport Equipment. This new regulation has broader provisions, covering a wider range of lifting and transport equipment, including ship cranes, compared to the previous regulations.

Post-accident Inspection

Based on the examination conducted after the incident, it was found that AB 1 was wearing safety shoes, orange work clothes, and a safety helmet at the time of the incident. However, neither the work clothes nor the helmet had reflective elements. Additionally, the flashlight used by AB 1 was damaged and not functioning, as it had fallen during the incident.

The position of Grab Crane No. 1 on the port deck was identified by police officers, who marked the trace with yellow paint, based on the coal remnants left on the deck. The investigation team also observed that the ship's port-side railing, near the marked grab position, was bent and the paint on the railing had peeled off. This damage likely indicates that the railing was struck by the grab during the incident.

ANALYSIS**Possible cause of the accident**

At the time of the accident, AB 1 was crushed between the grab and the side of the hatch coaming. Before the incident, the grab in its closed position had been placed by Crane Operator No. 1 on the port side deck. Shortly before the accident, Crane Operator No. 1 lifted the grab without realizing that it was unstable. The grab hit the ship's railing and swung toward AB 1, who was subsequently crushed twice—once on the back and once on the chest. AB 1 was unaware that the grab had been lifted, as he was facing toward the crane operator's cabin with his back turned to the grab.

Danger Zone

During the loading process from the barge to Hold No. 1, the working zone of Crane No. 1 was primarily on the starboard side of the ship, covering the area from Hold No. 1, the starboard deck, and extending to the barge (see Figure 2). When the coal in the barge was depleted, Crane Operator No. 1 rested the grab by placing it on the port side deck. This action effectively expanded the crane's working zone (Figure 6). When AB 1 and the Ordinary Seaman (OS) approached Crane Operator No. 1 to request that the grab be moved to the starboard side, they unknowingly entered the crane's extended working zone, which had a radius of 28 meters. Although AB 1 instructed the OS not to follow him, AB 1 positioned himself directly under the jib, between the grab and Hatch No. 2, with his back turned to the grab, unaware that it was being lifted and swinging toward him.

Crane operations were conducted independently by TKBM crane operators, without a designated signaler. At the time of the accident, Kapokja of Group 2, who was responsible for overseeing the loading process, was located at the stern of the ship and did not supervise the situation on the port side deck. Without a signaler or supervision from Kapokja, the crane operator was solely responsible for ensuring the safety of the surrounding environment.

Person in the crane's working zone need to be aware of the risks involved. Being within the crane's operating radius during loading and unloading activities significantly increases the potential for accidents. It is essential for all personnel in the area to stay vigilant, remain aware of the crane's work zone, and maintain a safe distance from it at all times.

The limited lighting on the port side deck around Hatch No. 2 during night operations also contributed to the accident. Loading operations were conducted without external lighting, relying solely on the ship's lights. Two of the cargo lights at the end of Crane No. 1's jib were not functioning, and the cargo light under the crane housing was obstructed by the crane platform. In addition, AB 1's flashlight, which was directed toward the operator's cabin, may have further reduced visibility. These factors likely made it difficult for Crane Operator No. 1 to clearly see AB 1 on the port side deck from inside the cabin.

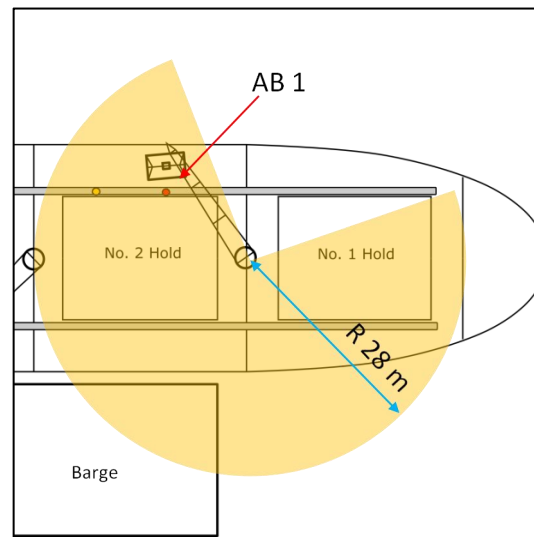


Figure 7 Crane work zone No. 1 becomes wider than before

Information and communication

Prior to loading activities, an agreement between the *Mariner* crew and the shore party stipulated that one side of the deck would remain free from equipment and loading activities. However, this information was not communicated to Kapokja Group 2 when the work groups changed. The crane operators from Group 2 also did not receive information from Group 1 regarding where the grab had been placed, as permitted by the ship's crew. The handover of cargo-handling duties between Group 1 and Group 2 was disorganized and lacked proper written

documentation between the kapokja. Additionally, the Foreman, acting as the loading and unloading representative, did not inform Kapokja Group 2 of the established rules for placing work equipment on the deck. This information should have been recorded in the ship/shore safety checklist and relayed to the next work group, ensuring a smooth transition between shifts.

The loading process on the *Mariner* was overseen by the Chief Officer under the supervision of the Master. The Chief Officer communicated verbally with the Foreman about rules, schedules, plans, and cargo placement in the ship's hold. The Foreman, in turn, relayed this information to the kapokja to be passed on to their team members, including the crane operator. However, the rules, schedules, and work plans were conveyed verbally and not documented or signed by the responsible parties. This practice increased the risk of miscommunication and incomplete information, as evidenced by the grab being placed on the port side deck, which had previously been agreed upon as an equipment-free zone.

Another contributing factor to the incident was the inadequate communication between the ship's crew and the shore workers. Although the signed ship/shore safety checklist indicated that communication between the ship and shore would occur via VHF Channel 75, and the crew had provided a radio for the Foreman, the method of communication between the kapokja, crane operator, and the ship's crew was not specified. Neither the kapokja nor the crane operator had radio communication, and the checklist did not outline clear communication protocols between these parties during loading activities.

At the time of the incident, AB 1 attempted to communicate directly with Crane Operator No. 1 by using a flashlight signal, as Crane Operator No. 1 did not have a radio. AB 1 did not report the grab's position on the port side deck to the 3rd Officer on the bridge before taking action. If a formal communication protocol had been established, AB 1 could have informed the 3rd Officer, who would then relay the message to the Foreman and Kapokja Group 2. This would have allowed Crane Operator No. 1 to move the grab from the port side deck without AB 1 needing to enter the crane's work zone.

Safety management

By placing the grab on the deck with the shell closed there is a risk that the grab will swing to one side when lifted. Taking into account the free area on the *Mariner* deck and the size of the grab being long enough if the shell had to be opened on the port deck, Crane Operator No. 1 decided to place the grab in the closed position on the deck. However, in this position the grab will tilt and sit on the deck on only one side of the shell. This position will make the grab unstable (swing) when lifted because the wire rope is not perpendicular between the grab and the tip of the jib. The correct position to be placed to avoid instability of the grab when lifted is with the shell fully open position.

The system of loading coal on ships using stevedoring workers in Muara Berau has been going on for quite a long time. The TKBM Komura Cooperative itself, as a labor provider, does not yet have guidelines or operational standards for safety procedures for grab operations, this is because there is no guidance and supervision from the relevant authorities for both PBM and TKBM in loading and unloading operations for solid bulk cargoes. Although the crane operator has a OHS license for lifting and transporting equipment, the training obtained is for lifting and transporting equipment in general and is not specific to cranes with grab equipment. In fact, in the field, there are various types of loading and unloading crane equipment other than grabs, such as clamps, magnetics, cargo slings, hooks, etc. according to the cargo requirements. The grab operation safety guidance is important to understand the risks that may arise from grab operations, including the safety procedure for resting or placing the grab.

On the other hand, the work shift schedule was not given from the beginning of departure from Samarinda by the Kapokja Group 2. The Crane Operator No. 1 started to wake up at dawn on the day of the incident and left Samarinda with the Group 2 at around 12.00 LT. During the long boat trip from Samarinda to *Mariner*, the Crane Operator No. 1 also didn't sleep. Upon arrival at the *Mariner*, the Group 2 members set up tents and equipment around the crane foundation and the Crane Operator No. 1 starts working at 20.00 LT. Up to the time of the incident, the Crane Operator No. 1 had been awake for about 18 hours. Shift assignments that were not prepared from departure or were only decided upon arrival at *Mariner* resulted in the crane operators not knowing when they would start work so during the journey from Samarinda many of the crane operators did not take a break, including the Crane Operator No. 1. This condition can cause fatigue which can impact the crane operator's concentration.

Meanwhile, the resting place for crane operators who are off duty is just a simple place around the *Mariner* crane foundation in the form of a tent and tarpaulin. The rest area around the hatch is noisy due to loading operations and hot during the day, this condition could not provide adequate quality rest for workers.

Safety management must be in place to ensure that general safety procedures and rules relating to crane operations are followed. Some things that need to be considered in safety management are related to work schedule plans that have been determined since leaving Samarinda so that workers can prepare themselves or rest if time is available, safety procedures for crane operations with grabs, handover documentation, use of identification marks, work uniforms, personal protective equipment and radio communications. With the issuance of the new ministry regulations, operators operating lifting equipment must also pay attention to Permenakertrans 8/2020 concerning Occupational Safety and Health of Lifting Equipment and Transport Equipment. In addition, if the loading and unloading service is carried out on a foreign vessel, the procedures for handling the loading and unloading of bulk cargoes should also refer to the BLU Code and its manual.

CONCLUSION

Findings

Findings are statements of all significant conditions, events or circumstances in the occurrence sequence. The findings are significant steps in the occurrence sequence, but they are not always causal, or indicate deficiencies. Some findings point out the conditions that pre-existed the occurrence sequence, but they are usually essential to the understanding of the occurrence, usually in chronological order.

1. *Mariner* has a valid ship Safety Certificate and Certificate of Conformity.
2. The Crane Operator No. 1 joined the TKBM Komura Cooperative in 2015 and has a valid class II floating ship crane operator certificate.
3. The *Mariner's* crane has a Certificate of test and thorough examination of crane or hoists and their accessory gear with No. 14ZS-0365CG3 which is valid for 5 years from 20 July 2014.
4. When leaving for *Mariner* on the day of the incident, the Kapokja Group 2 had not yet determined the crane operator's work shift schedule.
5. At the time of the incident the AB 1 was wearing a helmet and work clothes that did not have reflectors.
6. The Crane Operator No. 1 put the crane grab on the port side deck which should be free from work equipment. The Kapokja Group 2 at that time was at the stern of the ship and did not know the situation on the port side deck.
7. The agreement regarding one deck being free from work equipment and loading and unloading activities is only verbal and is not documented.
8. At the time of the incident the AB 1 tried to notify the Crane Operator No. 1 with a flashlight signal to move the grab from the port side deck.
9. In the ship/shore safety checklist for loading and unloading operations, it was agreed that communication would use Channel 75 radio. The kapokja and crane operators did not have radio communication for crane operations. Communication between the kapokja and the crane operator on duty uses a cell phone.
10. Lighting in the incident area only relied on ship lights. Two load lights at the jib top of Crane No. 1 were not working and a light near the slewing bearing of Crane No. 1 was blocked by a crane platform. The combination of ship lighting and flashlights in the operator's cabin means that the incident area is less clearly visible from inside the operator's cabin.

11. PBM and TKBM cooperatives do not yet have operational standards and safety procedures for the loading and unloading of solid bulk cargoes.
12. During loading and unloading activities, PBM and TKBM workers do not wear personnel IDs and work uniforms. These workers also did not wear safety equipment such as safety shoes, masks, gloves and safety helmets.
13. The resting place for TKBM workers who are not on duty carrying out loading and unloading activities at the STS Muara Berau location is a place with tents and simple mats on the mothership.
14. There are no standard operational procedures available from the local port authority for loading and unloading companies or business entities for loading and unloading regarding the procedures and implementation of loading and unloading activities as mandated in the applicable ministerial regulations.
15. The implementation of loading and unloading activities for solid bulk cargoes at the time of the incident did not fully comply with IMO Resolution A.862(20) the Code of Practice For The Safe Loading And Unloading Of Bulk Carriers or BLU Code and IMO MSC Circular 1160 Manual on loading and unloading of solid bulk cargoes for terminal representatives.

Contributing factors²

1. AB 1 was within the radius of the crane's work zone next to the grab and was facing away from the grab when the grab was lifted so AB 1 did not realize the grab was lifting and swinging towards him.
2. Safety information regarding one of the decks free from work equipment was not passed on to the next work group resulting in the crane operator not knowing the provisions for placing work equipment on the deck.
3. There is a lack of clarity regarding the levels and methods of communication between the ship's crew and the crane operator on duty.

RECOMMENDATIONS

The KNKT acknowledged the safety action taken by the related parties and considered the actions were relevant to improve safety, however, there remain safety issues that need to be considered. Therefore, the KNKT issues the following safety recommendations addressed to related parties.

Directorate General Sea Transportation

1. Ensure standard loading and unloading practices at each port/terminal for loading and unloading activities of solid bulk cargoes, especially those serving foreign vessels, are under the provisions of IMO Resolution A.862(20) concerning Code Of Practice For The Safe Loading And Unloading Of Bulk Carriers or BLU Code and IMO MSC Circular 1160 Manual on loading and unloading of solid bulk cargoes for terminal representatives.

Samarinda Harbour Master

1. Ensure that the parties (waters managers, terminal representatives, shippers, loading and unloading companies, and loading and unloading workers) carrying out loading and unloading activities of solid bulk cargoes on foreign vessels pay attention to their respective provisions and responsibilities under the provisions of IMO Resolution A.862 (20) the Code of Practice For The Safe Loading And Unloading Of Bulk

² Contributing factors is defined as actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident or incident occurring, or mitigated the severity of the consequences of the accident or incident.

Carriers or BLU Code and IMO MSC Circular 1160 Manual on loading and unloading of solid bulk cargoes for terminal representatives.

2. To coordinate with the East Kalimantan Provincial Manpower Service regarding the supervision of loading and unloading companies to pay attention to safety procedures for operating lifting and transport equipment by referring to the Minister of Manpower and Transmigration Regulation Number 8 of 2020 concerning Occupational Safety and Health for Lifting and Transport Equipment.

Minerva Ship Management

1. Ensure that safety procedures for loading and unloading operations take into account:
 - a. The levels and methods of communication agreed in the Ship/Shore safety checklist for loading or unloading dry bulk cargo carriers can be applied to shore workers working on board ships.
 - b. Use of crew work clothing that has high visibility or reflectors for night operations.
 - c. Deck lights relevant to cargo operations are functional and not obstructed.
 - d. Additional safety measures to any person entering the crane work zone.

PT Putra Lintas Mandiritama

1. Ensure safety information on loading and unloading activities from the mothership is conveyed and documented to the loading and unloading workers.
2. Ensure the provisions of the BLU Code and its Manual regarding the implementation of unloading activities for foreign vessels.

TKBM Komura Cooperative

1. Create relevant safety procedures regarding:
 - a. Lifting equipment operations.
 - b. Description of the duties and responsibilities of each position in the work group.
 - c. Clarity of work and rest schedule information since departure to prevent workers from experiencing fatigue.
 - d. Use of identification tags, work uniforms and other personal protective equipment during work.
 - e. Use of communication radio for workers on duty.
 - f. Written handover between working groups on board the ship.
2. Ensure that loading and unloading equipment operators working on foreign vessels have been given training referring to BLU Manual Appendix 4.

SOURCE OF INFORMATION

Samarinda Harbormaster and Port Authority;

PT Putra Lintas Mandiritama;

TKBM Komura cooperative;

Crew of *Mariner*.

Reference

IMSBC Code

BLU Code

BLU Manual

OSHA Safety and Health in Port