

MA2014-4

**MARINE ACCIDENT  
INVESTIGATION REPORT**

April 25, 2014



The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board is to determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

Norihiro Goto  
Chairman,  
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

# MARINE ACCIDENT INVESTIGATION REPORT

Vessel type and name: Cargo ship SCSC WEALTH

IMO number: 9553361

Gross tonnage: 6,550 tons

Accident type: Fatality of a stevedore

Date and time: At about 14:20, May 10, 2011 (local time, UTC + 9 hours)

Location: Public Wharf, Hibi Port, Tamano City, Okayama Prefecture  
About 255° true, 1,450m from the Inumodorihana Light Beacon located in Tamano City  
(Approximately 34°27.1' N, 133°55.7' E)

March 20, 2014

Adopted by the Japan Transport Safety Board

Chairman Norihiro Goto

Member Tetsuo Yokoyama

Member Kuniaki Shoji

Member Toshiyuki Ishikawa

Member Mina Nemoto

## SYNOPSIS

### <Summary of the Accident>

At about 14:20 on May 10, 2011, while the cargo ship SCSC WEALTH was loading copper slag at the Public Wharf in Hibi Port, Tamano City, Okayama Prefecture, tween deck hatch covers that were placed on the inner bottom plating in No.2 cargo hold moved, leading to a stevedore being caught between the hatch covers and a forward bulkhead, resulting in his death.

### <Probable Causes>

It is probable that this accident occurred for the following reasons: Five tween deck hatch covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold, during the loading of copper slag onto the SCSC WEALTH at the Public Wharf in Hibi Port; however, the safety bolts for the lowermost and second lowermost hatch covers were not inserted into the insertion holes in the inner hull plating. Due to this fact, the situation was such that it was impossible to prevent horizontal movement of the hatch covers. Furthermore, a driver entered No.2 cargo hold through a forward companionway to the inner bottom plating of No.2 cargo hold; and when the driver was passing through the space between the hatch covers and the forward bulkhead, the hatch covers moved in the direction of the bow after being pushed by the cargo, resulting in the driver being caught between the hatch covers and the forward bulkhead.

It is probable that the reason why it was impossible to prevent horizontal movement of the hatch covers is that when the hatch covers were stacked up on the bow side of the inner bottom plating in

No.2 cargo hold on the SCSC WEALTH, they were not secured as specified in the hatch cover operating manual.

It is probable that the reason why the driver entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold is that the instructions to use the designated passage route were not heeded.

#### **<Recommendations>**

##### ○ Safety recommendations

It is probable that this accident occurred for the following reasons: Five tween deck hatch covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold during the loading of copper slag onto the SCSC WEALTH at the Public Wharf in Hibi Port; however, the safety bolts for the lowermost and second lowermost hatch covers were not inserted into the insertion holes in the inner hull plating. Due to this fact, the situation was such that it was impossible to prevent horizontal movement of the hatch covers. Furthermore, a driver entered No.2 cargo hold through the forward companionway to the inner bottom plating in No.2 cargo hold; therefore, when the driver was passing through the space between the hatch covers and the forward bulkhead, the hatch covers moved after being pushed by cargo, resulting in the driver being caught between the hatch covers and the forward bulkhead.

It is probable that the reason why it was impossible to prevent horizontal movement of the hatch covers is that they were not secured as specified in the hatch cover operating manual by the SCSC WEALTH.

Based on the above, in view of the results of this accident investigation, the Japan Transport Safety Board recommends SHANGHAI CSC Line Co., Ltd. as follows for the prevention of recurrence of similar accidents.

The company should provide instructions to crew members to ensure that they comply with the hatch cover operating manual and appropriate measures to prevent movement of open hatch covers are taken.

# 1 PROCESS AND PROGRESS OF THE INVESTIGATION

## 1.1 Summary of the Accident

At about 14:20 on May 10, 2011, while the cargo ship SCSC WEALTH was loading copper slag<sup>\*1</sup> at the Public Wharf in Hibi Port, Tamano City, Okayama Prefecture, tween deck hatch covers that were placed on the inner bottom plating<sup>\*2</sup> in No.2 cargo hold moved, leading to a stevedore being caught between the hatch covers and a forward bulkhead, resulting in his death.

## 1.2 Outline of the Accident Investigation

### 1.2.1 Setup of the Investigation

On June 28, 2011, the Japan Transport Safety Board appointed an investigator-in-charge and two other investigators to investigate the accident.

### 1.2.2 Collection of Evidence

July 4, 2011, October 7, 2011, January 5, 2012, May 7, 2012, and June 26, 2013: Interviews

July 5 and 6, 2011: On-site investigations and interviews

July 12, 21, and 25, 2011, November 24, 2011, and January 17 and 26, 2012: Collection of written replies to the questionnaires

Furthermore, information materials related to the SCSC WEALTH were received from the management company through the accident investigation organization in the Hong Kong Special Administrative Region of the People's Republic of China. However, crew members' statements were unable to be obtained.

### 1.2.3 Interim Report

On May 25, 2012, the JTSB submitted an interim report to the Minister of Land, Infrastructure, Transport and Tourism, based on the facts found up until that date, and made it available to the public.

### 1.2.4 Comments from the Parties Relevant to the Cause

Comments on the draft report were invited from parties relevant to the cause of the accident.

### 1.2.5 Comments from Flag State

Comments on the draft report were invited from the flag State.

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\*1: The term "slag" signifies dross that is separated from molten metal when ore is smelted to extract refined metal. Slag is also generated during the refining of nonferrous metals such as copper and aluminum. Such slag is called copper slag or aluminum slag, as applicable.

\*2: The term "inner bottom plating" means the plate forming the top of a double-bottom structure. Inner bottom plating is also called a tank top, and serves also as the top of a tank located at the ship bottom or at the bottom of a cargo hold.

## 2 FACTUAL INFORMATION

### 2.1 Events Leading to the Accident

Events leading to the occurrence of the accident were as follows, according to statements of the safety officer, the foreman<sup>\*3</sup>, the work leader, and two workers from the Uno Marine Transportation Branch of Nippon Express Co., Ltd. (hereinafter referred to as “the Cargo Handling Company”); statements of three workers from the pertinent subcontractor; statements of two officials of the Fire Department of Tamano City; and reports such as the accident report and the cargo handling record of the Cargo Handling Company.

#### 2.1.1 Operation of the SCSC WEALTH

The SCSC WEALTH (hereinafter referred to as “the Ship” except in Chapter 6) was boarded by the master and 18 crew members (all from the People’s Republic of China). Cargoes were unloaded at Kagoshima Port, Kagoshima City, Kagoshima Prefecture. Therefore, the Ship left the port in ballast, arrived in Hibi Port at about 19:00 on May 8, 2011, and anchored. Subsequently, a Notice of Readiness<sup>\*4</sup> was issued.

The Ship hove up anchor at about 07:00 on May 9, and was berthed at about 19:45, with the port side alongside the Public Wharf in Hibi Port.

#### 2.1.2 Cargo Handling Method

##### (1) Cargo Loading

The Cargo Handling Company decided to perform cargo loading according to the following procedure.

- 1) Two truck-mounted cranes stationed at the wharf that were in the vicinity of No.1 hold and No.2 cargo hold of the Ship and also the aft crane of the Ship were used to load copper slag into both cargo holds.
- 2) Copper slag was to be carried by dump trucks to the wharf and unloaded.
- 3) Copper slag was to be grabbed by means of the grab buckets<sup>\*5</sup> of the truck-mounted cranes and of the aft crane.
- 4) Crane operators were to turn the cranes to bring the grab buckets to positions above the cargo holds. Signal persons stationed on decks were to open the grab buckets by remote control, thereby dropping the copper slag into the holds.
- 5) Cargo dropped into the holds was to be leveled with the bulldozers.

(See Figure 2.1-1, and Photos 2.1-1, 2.1-2, 2.1-3, and 2.1-4.)

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<sup>\*3</sup>: The term “foreman” signifies a person who not only hold discussions with ship companies, agencies, or cargo owners, with regard to port departure/entry dates and times, as well as work schedules, but also conducts discussions with chief officers with regard to cargo handling procedures, safe work, etc. after port entry, and supervises cargo handling work.

<sup>\*4</sup>: The term “Notice of Readiness” means an act of notifying the pertinent consignor that the pertinent ship has arrived at the cargo loading or unloading place, and that cargo handling preparation is completed.

<sup>\*5</sup>: The term “grab bucket” denotes a grabbing implement that is installed at the tip of a crane when bulk cargoes such as coal or ore are to be loaded onto a ship or unloaded therefrom. Grab buckets include those which are designed to open and close like bivalves.

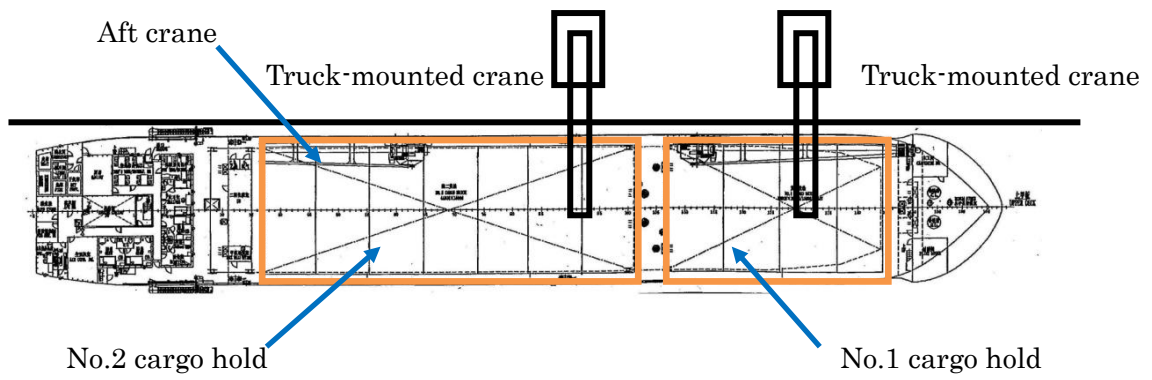


Figure 2.1-1 Arrangement Plan of Truck-mounted Cranes, etc.



Photo 2.1-1 Crane on the Ship



Photo 2.1-2 Truck-mounted crane



Photo 2.1-3 Bulldozer



Photo 2.1-4 Grab bucket

(2) Arrangement of workers engaged in cargo handling in No.2 cargo hold

The Cargo Handling Company arranged workers as follows for the purpose of loading cargo into No.2 cargo hold.

1) One bulldozer driver

One of the three drivers (hereinafter referred to as “Driver A” [accident-affected person], “Driver B,” and “Driver C,” except in Chapter 6), who were to operate No.1 cargo hold bulldozer (hereinafter referred to as “Bulldozer 1”) and No.2 cargo hold bulldozer (hereinafter referred to as “Bulldozer 2”) in approximately 2-hour rotations

2) Two crane operators

The operator of the aft crane of the Ship (hereinafter referred to as “Crane Operator A”) and the driver of the truck-mounted crane stationed at the wharf that was in the vicinity of No.2 cargo hold

3) Two signal persons

The signal person for the aft crane of the Ship and the signal person for the truck-mounted crane stationed at the wharf that was in the vicinity of No.2 cargo hold

4) One person to perform cleaning work, etc.

A worker (hereinafter referred to as “Worker A”) whose job was to perform work such as cleaning of cargo that spilled on the wharf during loading

(See Figure 2.1-1.)

### 2.1.3 Preparation for Cargo Loading Work

The foreman held discussions with the chief officer regarding places to put upper deck hatch covers\*<sup>6</sup> and about the estimated amount of cargo.

Crew members of the Ship opened the upper deck hatch covers and placed them as follows: two on the upper deck on the stern side of No.1 cargo hold; one on the upper deck on the stern side of No.2 cargo hold, and the other remaining upper deck hatch covers, totaling nine, to the wharf.

The foreman looked at the inside of both cargo holds from the upper deck and noticed that the tween deck hatch covers were opened, and that there was no remaining cargo from the previous voyage. Therefore, the foreman concluded that the Ship was in a state suitable for carrying out cargo loading work.

The foreman witnessed the following scenes: Five tween deck hatch covers (hereinafter referred to as “the Hatch Covers,” except in Chapter 6) were placed in a stacked-up state on the bow side of the inner bottom plating in No.2 cargo hold; another four tween deck hatch covers were placed in the same state on the tween deck on the bow side of No.2 cargo hold; and another five tween deck hatch covers were placed in the same state on top of the CO<sub>2</sub> room forward of the deckhouse. The foreman also heard from the chief officer that it was possible to start cargo loading work.

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\*6: The term “hatch cover” signifies a cover (made of steel plate, for example) for closing a hatch (opening) through which cargoes are brought into, and taken out of, a cargo hold.



The foreman received no explanation from the chief officer regarding how the Hatch Covers were secured.

The foreman, the work leader, and the workers for No.2 cargo hold (hereinafter referred to as “the Cargo Handling Workers”) who were engaged in cargo handling for the Ship had, up until that time, experience in performing cargo handling on ships with tween decks. However, this was the first time that the Cargo Handling Workers witnessed a situation where the hatch covers were stacked up on the inner bottom plating in a cargo hold.

(See Figure 2.1-2, Photo 2.1-5, and Photo 2.1-6.)

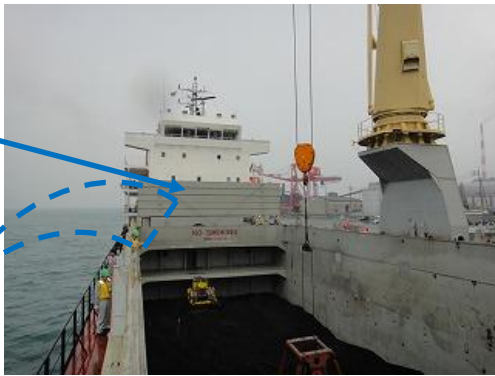


Photo 2.1-5  
Five tween deck hatch covers placed on top of the CO<sub>2</sub> room forward of the deckhouse

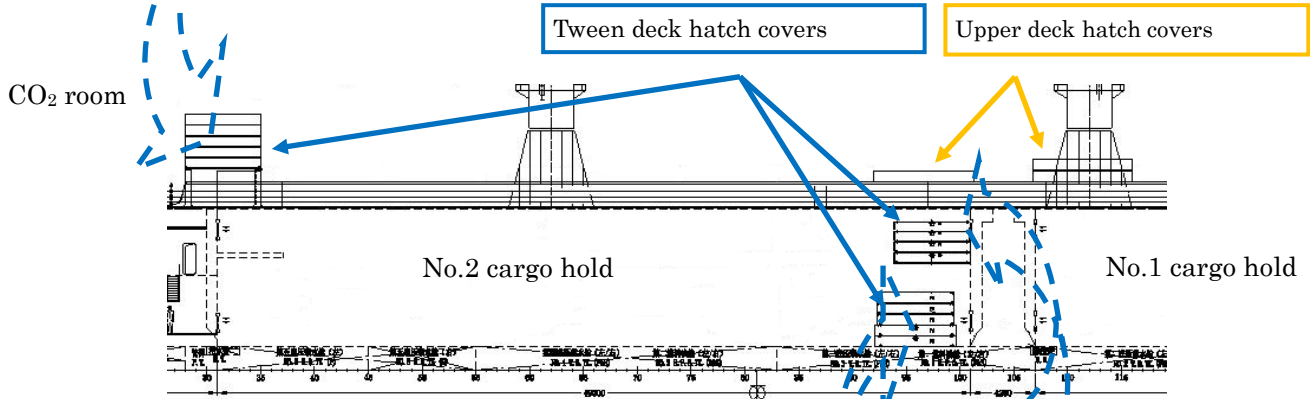


Figure 2.1-2 Location of hatch covers at the time of the start of cargo handling



Photo 2.1-6 Tween deck hatch covers that were placed on the bow side of the inner bottom plating in No.2 cargo hold (Photographed during a previous voyage, prior to the accident)

#### 2.1.4 Situation from the Start of Cargo Loading Work to the Occurrence of the Accident

In a meeting started at about 08:05 on May 9, workers of the Cargo Handling Company and of the subcontractor received an explanation from the foreman about the estimated amount of cargo to be loaded. Also, the workers were cautioned by the work leader to: use the designated companionway on the stern side when entering or leaving No.2 cargo hold, watch their steps to avoid stumbling, and not enter spaces underneath suspended cargo.

The Cargo Handling Company planned to start cargo loading for the Ship at about 10:40 and to complete the work at about 17:00 on the following day, which was May 10.

A worker for sling work<sup>\*7</sup> who was to remove slings from the bulldozer that was lowered down to the inner bottom plating of No.2 cargo hold jumped down to the inner bottom plating from the third lowermost hatch cover among the Hatch Covers in the vicinity of the starboard side inner hull plating. The foreman witnessed the scene. Since there was a risk that the worker would fall down, the foreman cautioned the worker to use the designated companionway on the stern side. Subsequently, the foreman instructed Driver A and Driver B to not pile up cargo on the inner bottom plating in the vicinity of the aft companionway, and also to enter and leave No.2 cargo hold through the aft companionway. Crane operator A also heard the contents of these instructions

Thereafter, the work leader erected a placard showing the designated companionway at the entrance to the aft companionway on the upper deck, and installed self-locks<sup>\*8</sup> to be used when going up and down on the pertinent vertical ladder.

(See Figure 2.1-3, Photo 2.1-7, and Photo 2.1-8.)

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<sup>\*7</sup>: The term “sling work” signifies a work in which wire slings (steel ropes equipped with an eye at each end) are installed on a crane hook and a heavy machinery vehicle or the like so that the heavy machinery vehicle or the like can be lifted by the crane. In the case of a heavy machinery vehicle, sling work techniques include, for example, a method in which the vehicle’s eye plates are connected to wire slings by means of fittings (shackles).

<sup>\*8</sup>: The term “self-lock” means a device whereby when a worker starts to fall, pay-out of a rope connected to the worker is instantaneously stopped, with the result that he/she is prevented from falling down.

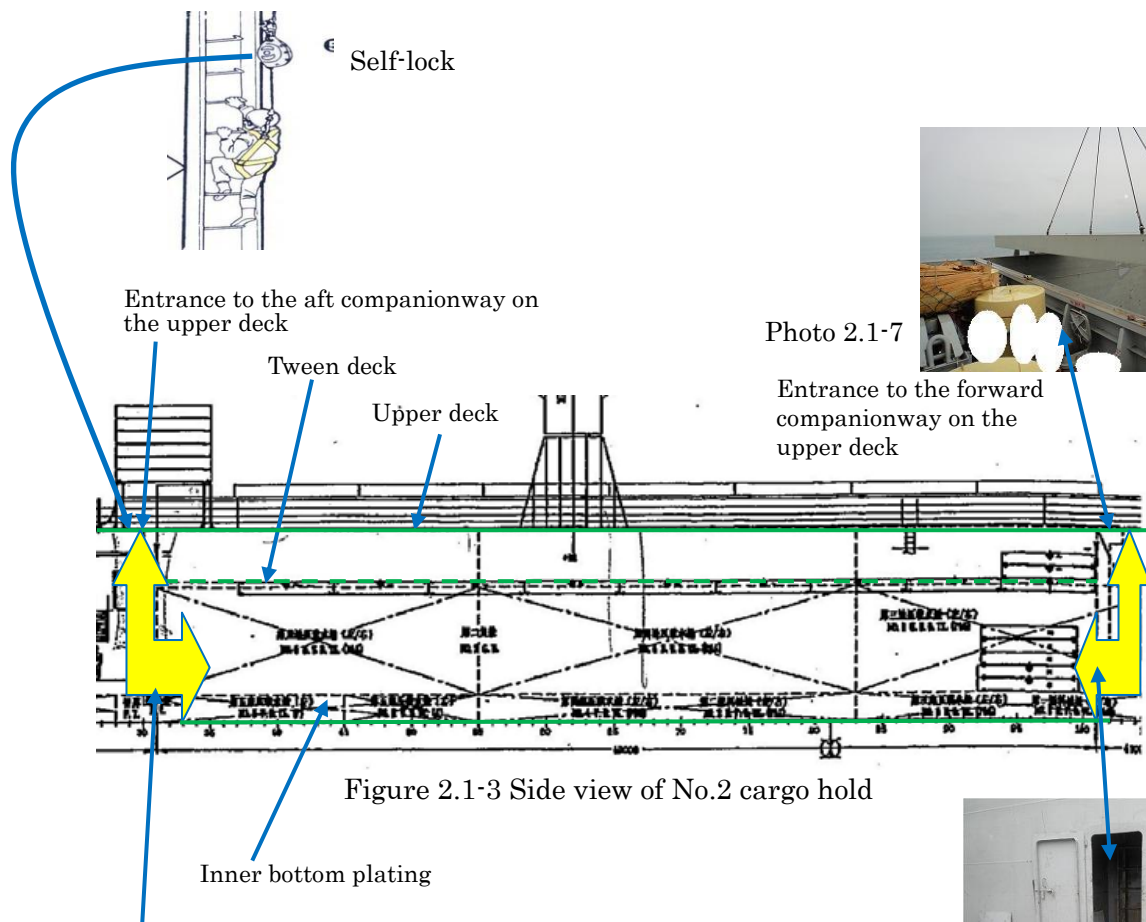


Figure 2.1-3 Side view of No.2 cargo hold



Photo 2.1-7

Entrance to the forward companionway on the upper deck



Photo 2.1-8

Entrance to the forward companionway on the inner bottom plating

Entrance to the aft companionway on the inner bottom plating

The cargo handling work on May 9 was completed at about 20:40.

In a meeting started at about 7:50 on the following day, which was May 10, workers received an explanation from the foreman regarding the remaining estimated amount of cargo to be loaded and the estimated time of completion of cargo handling. Also, the workers were cautioned by the work leader to pay attention to the fact that they were liable to stumble due to rainfall, and not to enter spaces underneath suspended cargo.

At about 08:20, Driver A and Driver C resumed cargo handling after getting into Bulldozer 1 and Bulldozer 2, respectively.

At about 10:00, Driver B entered No.2 cargo hold and drove Bulldozer 2 after relieving Driver C. In a continuation of the preceding day's practice, he intended to use the aft companionway. Therefore, he decided not to pile up cargo on the inner bottom plating in the vicinity of the aft companionway. On this basis, he started work in which cargo dropped from the grab bucket was leveled from the stern side toward the bow side.

At about 10:30, Driver B consulted with Driver A, who had come down to No.2 cargo hold, on the idea that the entrance to the aft companionway at the bottom would be blocked by piling up cargo in the vicinity of the entrance as well. This was because the amount of cargo inside the hold had increased. At that time, Driver B heard from Driver A that Driver A had used the forward

companionway to the inner bottom plating.

Using Bulldozer 2, Driver B leveled cargo loaded on the inner bottom plating in the vicinity of the aft companionway. He piled up cargo on the stern side to a height that would permit him to reach from the bulldozer seat to the tween deck. The purpose of this operation was to enable him to enter and leave No.2 cargo hold by utilizing the entrance to the aft companionway on the tween deck. At about 11:00, Driver A took over operations of Bulldozer 2 from Driver B. Subsequently, Driver B headed for the bow, passing through a gap between the side of the third lowermost hatch cover among the Hatch Covers and the inner hull plating on the starboard side. He went down to the inner bottom plating from the Hatch Covers. He passed through the space between the Hatch Covers and the forward bulkhead, entered the forward companionway from the inner bottom plating, and went up to the upper deck.

When Driver B passed through the space between the Hatch Covers and the forward bulkhead, he did not feel that it was dark. He was able to walk without turning his body sideways in such a way that neither shoulder came into contact with any of the Hatch Covers or with the forward bulkhead.

(See Figure 2.1-4.)

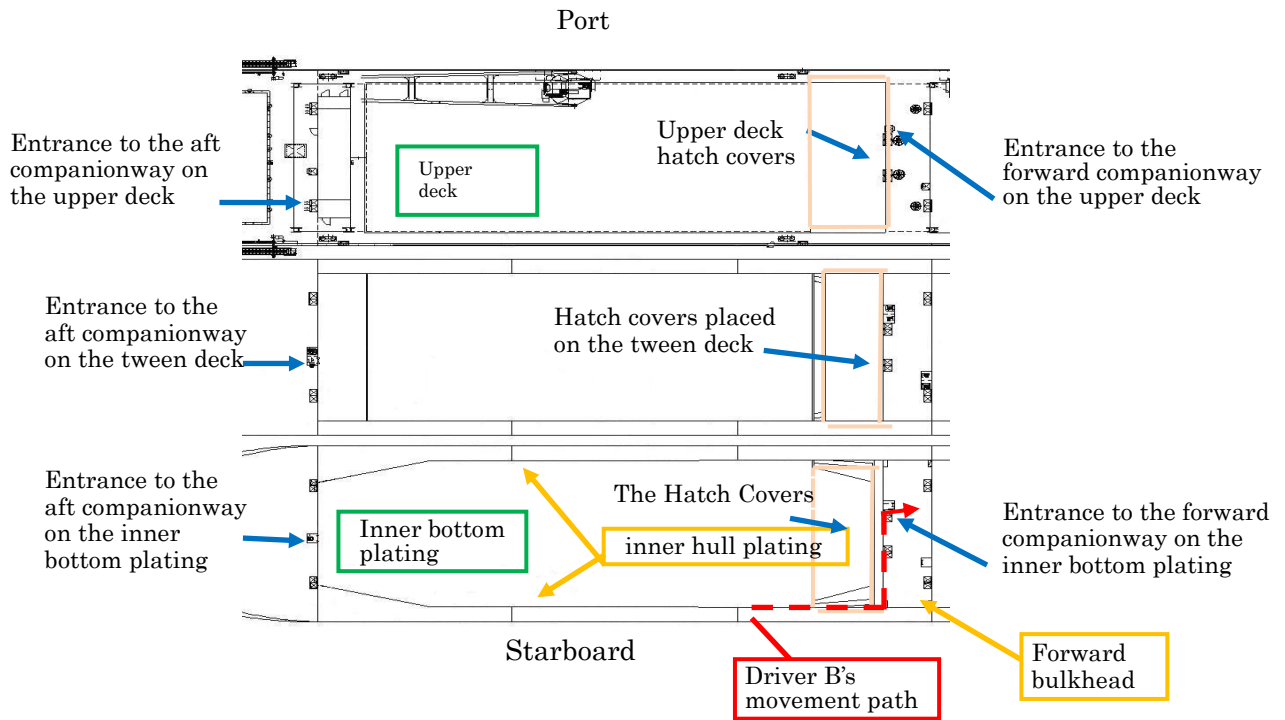


Figure 2.1-4 View of No.2 cargo hold

At about 12:45 Driver B's lunch break finished. He entered No.2 cargo hold through the forward companionway to the inner bottom plating by following the reverse path of the route he took in the morning to go up to the upper deck from No.2 cargo hold. He operated Bulldozer 2 to laterally level cargo dropped in the hold.

(See Photo 2.1-9 and Photo 2.1-10.)

### The Hatch Covers

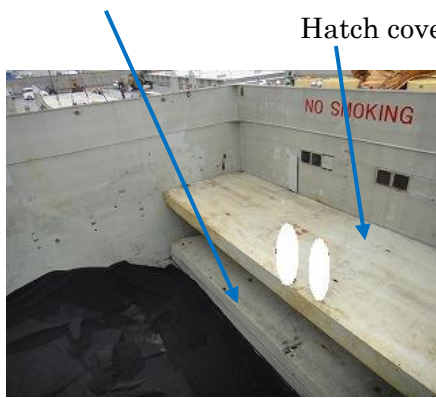


Photo 2.1-9 Bow side of No.2 cargo hold

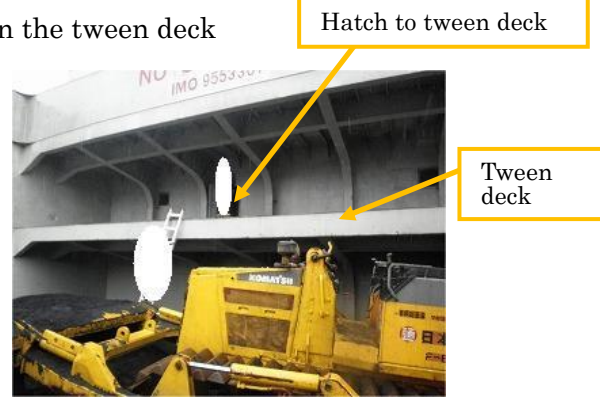


Photo 2.1-10 Stern side of No.2 cargo hold

In No.1 cargo hold, cargo handling was completed at about 14:00. Driver C, who finished operating Bulldozer 1, tried to watch the work progress at No.2 cargo hold, and moved to a location on the upper deck hatch covers that were placed on the upper deck on the bow side of No.2 cargo hold. At that moment, he saw Driver A walking toward the stern along the upper deck passageway on the port side of No.1 cargo hold. However, only Driver A's head was visible. This was because not only were there hatch coamings<sup>\*9</sup>, but between No.1 cargo hold and No.2 cargo hold, there was a partition with the same height as those of the hatch coamings.

At about 14:20, when Driver B was operating Bulldozer 2 to level cargo loaded on the stern side, he heard a loud sound from the bow side. He therefore approached the Hatch Covers and looked at them. Cargo was previously present up to a height equal to the height of the fourth lowermost hatch cover among the Hatch Covers. However, the cargo height was now found to be 70 to 80 cm lower. Consequently, he thought that the Hatch Covers had moved in the direction of the bow.

Since cargo handling was nearing an end, Driver B told Driver C that it was not necessary to take over operations of Bulldozer 2, and asked Driver C to notify Driver A accordingly.

It was decided that Worker A, who was near Driver C, should join Driver C in looking for Driver A. They went down to the inner bottom plating through the forward companionway from the upper deck to No.2 cargo hold. They looked into the inside of the cargo hold, and discovered Driver A, who was caught between the Hatch Covers and the forward bulkhead.

(See Figure 2.1-5.)

<sup>\*9</sup>: The term "hatch coaming" signifies a border member which is raised vertically around a hatch, thereby surrounding the hatch to prevent the inflow of seawater, and which also serves to support the weight of the hatch cover.

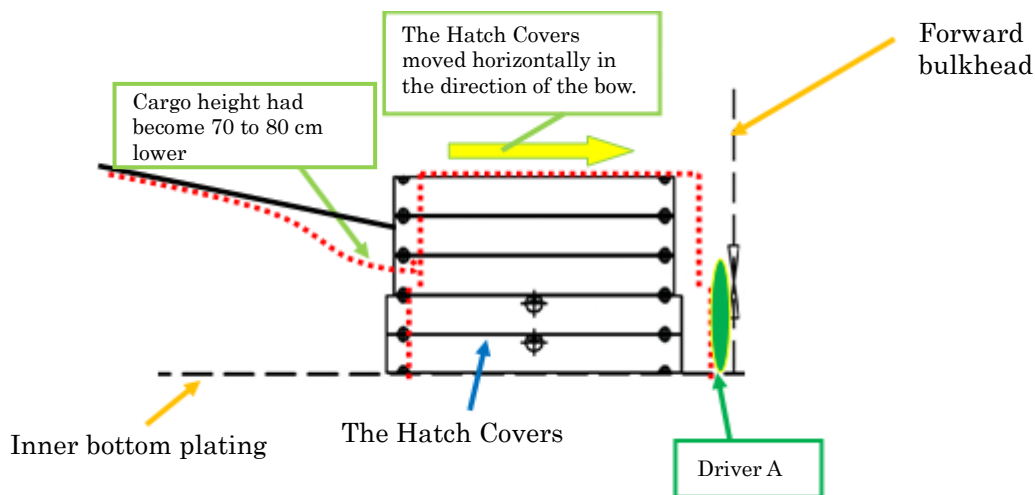


Figure 2.1-5 Illustration of the movement of the Hatch Covers

### 2.1.5 Rescue Operation after the Occurrence of the Accident

Worker A, who discovered Driver A, went up to the upper deck and reported the situation to the work leader. At about 14:30, cargo handling was suspended.

The foreman asked a tallying company\*<sup>10</sup> employee, who was present nearby, to call an ambulance. At about 14:48, an ambulance squad from the Fire Department of Tamano City arrived at the Ship, and started a rescue operation.

Crew members successively removed the following hatch covers to the wharf using the aft crane: one upper deck hatch cover located on the upper deck on the bow side of No.2 cargo hold; four tween deck hatch covers stacked up on the tween deck; and one hatch cover, which was the uppermost one among the Hatch Covers. However, regarding the remaining hatch covers to be lifted, there was a risk that the hatch covers could hit Driver A. Therefore, the crew members told the foreman that no further work would be performed by them.

(See Photo 2.1-11 and Photo 2.1-12.)

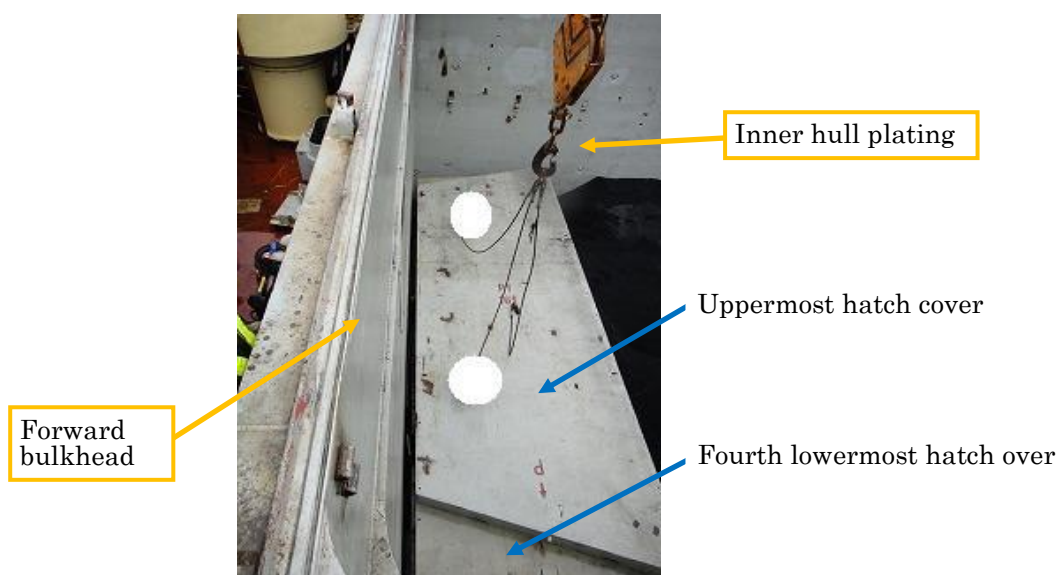


Photo 2.1-11 Removing the Hatch Covers, 1

\*<sup>10</sup>: The term “tallying company” signifies a company that tallies cargo and certifies the cargo delivery while loading or unloading of ship cargo under license by the Minister of Land, Infrastructure, Transport and Tourism. The well-known tallying companies are the Japan Cargo Tally Corporation and All Nippon Checkers Corporation.





Photo 2.1-12 The Ship, and upper deck hatch covers that were moved to the wharf

The Cargo Handling Workers used the aft crane to lift the third and fourth lowermost hatch covers among the Hatch Covers one-by-one, and moved them onto the cargo on the stern side. There were then two remaining hatch covers. Next, when lifting the upper remaining hatch cover, an attempt was made to lift it by pulling it in the stern direction by means of a truck-mounted crane. The purpose of this attempt was to prevent the upper hatch cover from hitting Driver A, who had been caught. However, the upper hatch cover was unable to be lifted. (See Photo 2.1-13.)

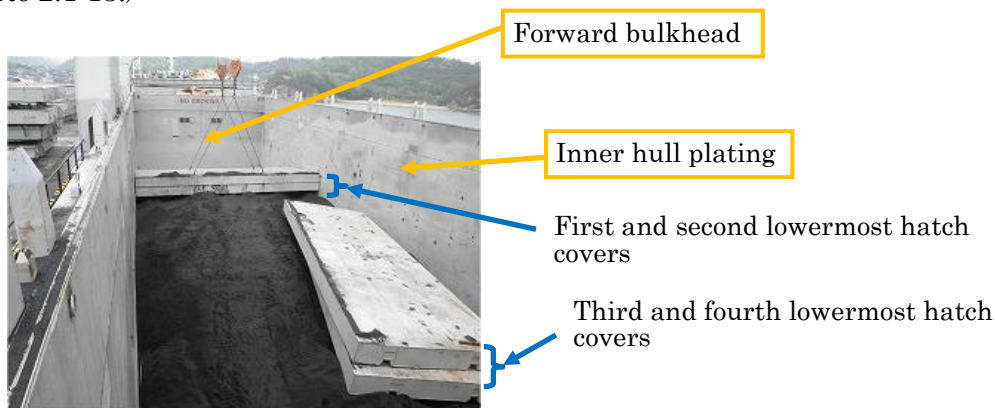


Photo 2.1-13 Removing the Hatch Covers, 2

The Cargo Handling Workers used shovels to dig down the cargo in the vicinity of the remaining two hatch covers that were on the stern side. While lifting the aforementioned two hatch covers with the aft crane, they were pulled in the stern direction by bulldozer 2. As a result, the bow side of the hatch covers was raised, and Driver A, who was caught, fell onto the inner bottom plating. Ambulance squad members and the Cargo Handling Workers lifted the second lowermost hatch cover to some extent. The situation was such that the lowermost hatch cover had adhered to the second lowermost hatch cover. If lifting had been performed in this state, and if the lowermost hatch cover had dropped, there would have been a risk of Driver A being hit. Therefore, sleepers were placed between the hatch covers and the inner bottom plating.

During the rescue operation by the Cargo Handling Workers, there was no information or advice from crew members regarding the securing of tween deck hatch covers. (See Photo 2.1-14 and Photo 2.1-15.)

Second lowermost hatch cover



Photo 2.1-14

Work performed moving the Hatch Covers, 3

Photo 2.1-15

Work performed moving the Hatch Covers, 4

The Cargo Handling Workers used the forward crane and the aft crane (for a total of two cranes) to lift the remaining two hatch covers. As a result, both hatch covers were lifted without being separated. They were placed on the cargo at the center of No.2 cargo hold.

The work leader performed sling work for the first to fourth lowermost hatch covers among the Hatch Covers. He did not see any locking devices between individual hatch covers.

At about 20:45, all Hatch Covers were removed and the death of Driver A was confirmed by ambulance squad members.

Crew members and the Cargo Handling Workers were able to lift the Hatch Covers without removing Fixing Pins or locking devices between the inner bottom plating and the lowermost hatch cover among the Hatch Covers or between the adjacent Hatch Covers.

The date and time of the occurrence of the accident was about 14:20 on May 10, 2011. The place of occurrence was the inside of No.2 cargo hold of the Ship, which was berthed alongside the Public Wharf in Hibi Port.

(See Figure 2.1-6.)

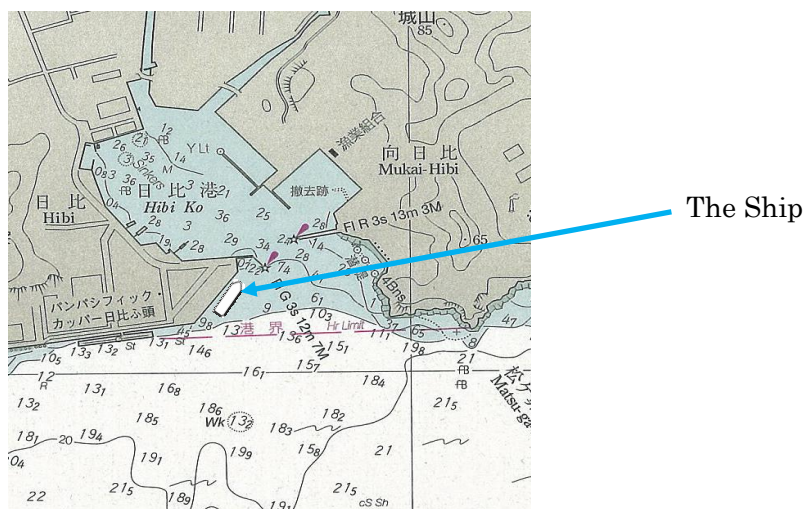


Figure 2.1-6 Berthing position of the Ship



## 2.2 Fatality/Injury to persons

According to the death certificate, the cause of the death of Driver A was heart rupture due to thoracoabdominal compression.

According to the statements of Crane Operator A and Driver C, the following situation was observed: There was an approximately 15 cm gap between the forward bulkhead and the bottom two hatch covers among the Hatch Covers; Driver A was caught in this gap; his back was in contact with the forward bulkhead; and the aforementioned two hatch covers hit Driver A's chest but did not hit his head.

## 2.3 Damage to the vessel

Damage to facilities on the Ship was unknown.

## 2.4 Information on workers

According to the report of the Cargo Handling Company; and according to the statements of the safety officer, the foreman, the work leader, and three cargo handling workers.

(1) Foreman: Male, age 38

He had a total of 15 service years at the Cargo Handling Company, with 7 to 8 years experience as a foreman.

(2) Work leader: Male, age 39

He had a total of about 8 to 9 service years at the Cargo Handling Company, with 5 to 6 years experience as a work leader.

(3) Driver A: Male, age 30

He had a total of about 5 service years at the Cargo Handling Company. Normally, he used to operate heavy machines such as bulldozers. Results of an annual medical examination and confirmation of his health condition performed on that day were satisfactory. His appearance was the same as usual on the day of the accident. At the time of the accident, he was wearing a helmet and a pair of safety shoes in addition to two-piece workwear.

## 2.5 Crew Information

(1) Gender, Age, and Certificate of Competence

Master (Nationality: People's Republic of China): Male, age 47

First grade deck officer (Certificate issued by the Government of the Hong Kong Special Administrative Region of the People's Republic of China)

Date of issue: May 18, 2011

(Valid until April 11, 2016)

Chief officer (Nationality: People's Republic of China): Male, age 28

Second grade deck officer (Certificate issued by the Government of the Hong Kong Special Administrative Region of the People's Republic of China)

Date of issue: April 15, 2011

(Valid until February 23, 2014)

(2) Main Seagoing Experience

Since no statements were able to be obtained from the crew members, it was not

possible to clarify their main seagoing experience.

## 2.6 Vessel Information

### 2.6.1 Particulars of the Ship

IMO number:	9553361
Port of registry:	Hong Kong, the Hong Kong Special Administrative Region of the People's Republic of China
Owner:	SCSC INTERNATIONAL MERCHANT & SHIPPING (HONG KONG) COMPANY LIMITED (the Hong Kong Special Administrative Region of the People's Republic of China)
Management company:	SHANGHAI CSC Line Co., Ltd. (Hereinafter referred to as "Company A" except in Chapter 6) (People's Republic of China)
Classification society:	China Classification Society (CCS)
Gross tonnage:	6,550 tons
L × B × D:	117.80 m × 18.00 m × 10.40 m
Hull material:	Steel
Engine:	One diesel engine
Output:	2,500 kW (Maximum continuous output)
Propulsion:	One fixed pitch propeller
Date of launch:	August 3, 2010
Number of crew members:	19 (Nationality: People's Republic of China)

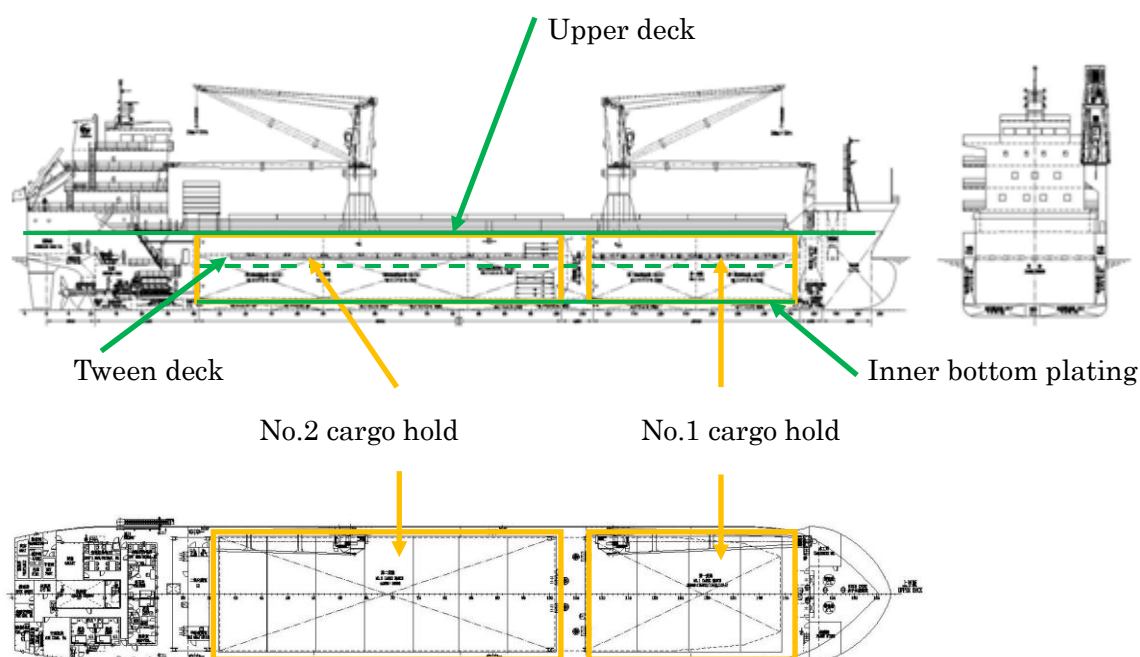


Figure 2.6-1 Excerpt from general arrangement plan

### 2.6.2 Cargo Hold Information

According to the general arrangement plan, the tween deck hatch cover arrangement plan, and the cargo handling brochure, the dimensions of the cargo holds were as follows.

#### (1) Details

Cargo hold volume:	No.1 cargo hold: 4,114 m <sup>3</sup>
	No.2 cargo hold: 7,785 m <sup>3</sup>

Upper deck hatch opening:	No.1 cargo hold: 25.9 m × 10.4 to 15.0 m No.2 cargo hold: 44.8 m × 15.0 m
Tween deck hatch opening:	No.1 cargo hold: 25.9 m × 15.0 m No.2 cargo hold: 44.8 m × 10.4 to 15.0 m
Upper deck hatch covers:	No.1 cargo hold: Four hatch covers: 6.5 m × 15.3 m; Unknown weight; Three hatch covers (Unknown length) × 10.7 m; Unknown weight; One hatch cover No.2 cargo hold: Seven hatch covers: All hatch covers: 6.5 m × 15.3 m; Unknown weight; Unknown thickness
Tween deck hatch covers:	No.1 cargo hold: Five hatch covers: Thickness of all hatch covers: 68 cm 5.0 m × 13.2 m: 16 t: One hatch cover 5.0 m × 13.4 m: 18 t: One hatch cover 5.0 m × 14.9 m: 19 t: One hatch cover 5.3 m × 14.9 m: 20 t: Two hatch covers No.2 cargo hold: Nine hatch covers: All hatch covers: 5.0 m × 14.9 m; 19 t; 68 cm thick
Cargo hold depth etc.:	Between the inner bottom plating and the tween deck: Approximately 5.8 m Between the inner bottom plating and the upper deck: Approximately 8.9 m Between the upper deck and the upper end of the hatch coaming: Approximately 1.8 m

(2) Arrangement of cargo holds and hatch covers

- 1) The Ship had two box-shaped cargo holds underneath the upper deck that was forward of the deckhouse.
- 2) The structure was such that by placing pontoon type hatch covers on the tween deck openings for No.1 cargo hold and No.2 cargo hold, it was possible to divide these cargo holds into upper and lower portions. The inner hull platings had seats for supporting hatch covers and insertion holes for inserting hatch cover safety bolts (hereinafter referred to as "Fixing Pins," except in Chapter 6) at the height of the tween deck.  
(See Figure 2.6-2, Photo 2.6-1, Photo 2.6-2, Photo 2.6-3, Photo 2.6-4, and Photo 2.6-5.)



Photo 2.6-1  
Looking at No.1 cargo hold from the stern side



Photo 2.6-2  
Looking at No.2 cargo hold from the bow side

Tween deck

Hatch covers placed on the tween deck

Insertion holes for Fixing Pins

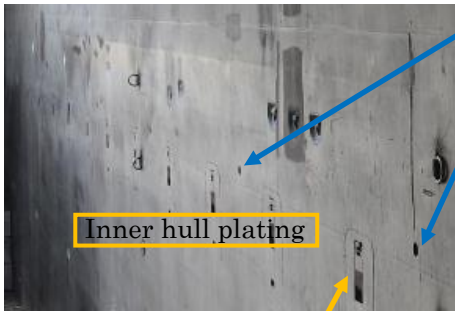


Photo 2.6-3 Seats for tween deck hatch covers and insertion holes for Fixing Pins (1)

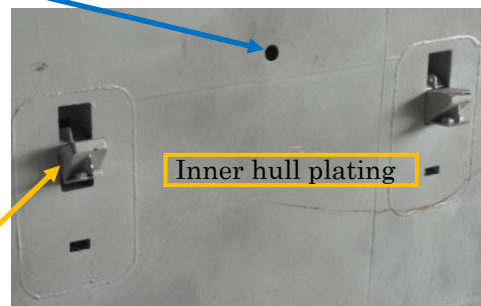


Photo 2.6-4 Seats for tween deck hatch covers and insertion holes for Fixing Pins (2)

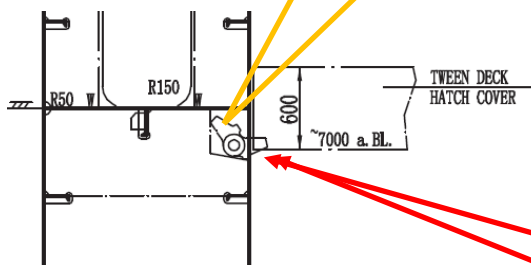


Figure 2.6-2 Seats for tween deck hatch covers

Fixing Pin (In housed state)



Photo 2.6-5 Side surface of tween deck hatch cover

(3) Companionways to No.2 cargo hold

According to the general arrangement plan and the statement of Driver B, the companionways to No.2 cargo hold were as follows: There were entrances on the bow and stern sides of the upper deck, the tween deck, and the inner bottom plating. A vertical

ladder was set up as the companionway between the upper deck and the inner bottom plating.

### 2.6.3 Places for Putting Tween Deck Hatch Covers That Were Opened

According to the tween deck hatch cover general arrangement plan, the tween deck hatch covers were placed as follows: It was arranged that five tween deck hatch covers for No.1 cargo hold would be stacked up on the bow side of the inner bottom plating in No.2 cargo hold, that three out of the nine tween deck hatch covers for No.2 hold would be stacked up on the bow side of the tween deck of No.2 cargo hold, and that the remaining six hatch covers would be stacked up on top of the CO<sub>2</sub> room located forward of the deckhouse.

The gap between the forward bulkhead and the hatch covers placed on the inner bottom plating in No.2 cargo hold was approximately 94 cm.

(See Figure 2.6.3.)

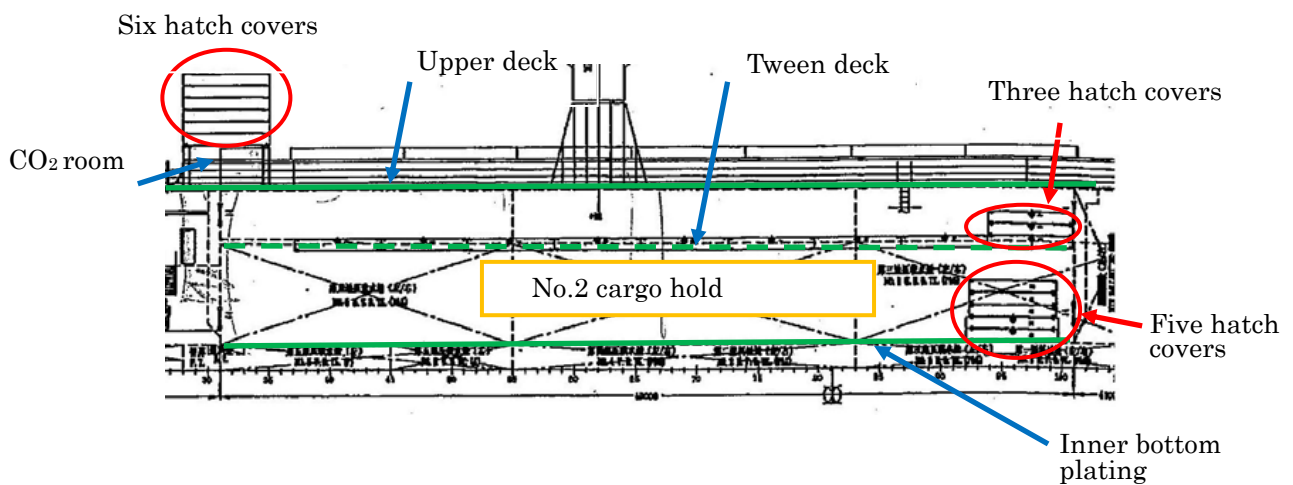


Figure 2-6.3 Places to put tween deck hatch covers that were opened

### 2.6.4 Equipment for Securing Tween Deck Hatch Covers Placed in No.2 Cargo Hold

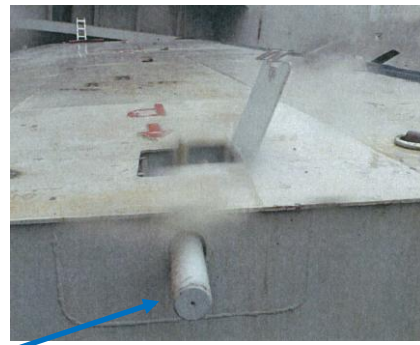
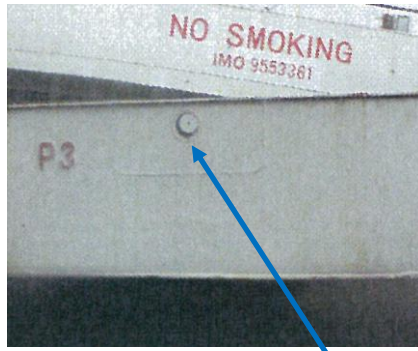
#### (1) Fixing Pins

According to the foreman's statement, the hatch cover operating manual, and photos of the tween deck hatch covers and the inside of No.2 cargo hold, the Fixing Pins were as follows.

A Fixing Pin was provided at the center of the side surface of each of the tween deck hatch covers. Specifications were such that hatch covers were to be fixed by inserting Fixing Pins into insertion holes in the inner hull plating.

On the following day of the occurrence of the accident, the foreman opened the lid on the upper surface of a hatch cover and found that a Fixing Pin was housed inside. When he pushed the Fixing Pin by hand, the pin protruded outside from the side surface of the hatch cover.

(See Figure 2.6-4, Photo 2.6-6, and Photo 2.6-7.)



Fixing Pin

Photo 2.6-6 Fixing Pin in the housed state

Photo 2.6-7 Fixing Pin in the protruded state

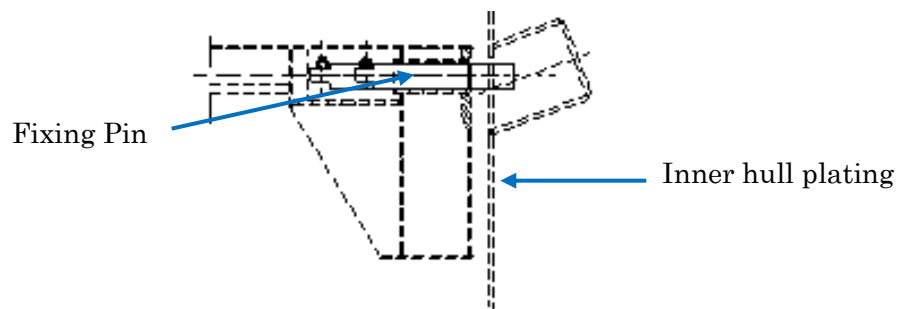


Figure 2.6-4 Fixing Pin for a tween deck hatch cover

(2) Insertion holes for securing purposes located in inner hull plating

According to the tween deck hatch cover arrangement plan and photos of the inside of No.2 cargo hold, the insertion holes were as follows.

In the inner hull plating on each of the port side and the starboard side on the bow side of No.2 cargo hold, the following insertion holes were provided: two insertion holes for Fixing Pins to fix the bottom two hatch covers among the hatch covers placed on the inner bottom plating; and three insertion holes for Fixing Pins for the hatch covers placed on the tween deck.

(See Photo 2.6-8 and Photo 2.6-9.)

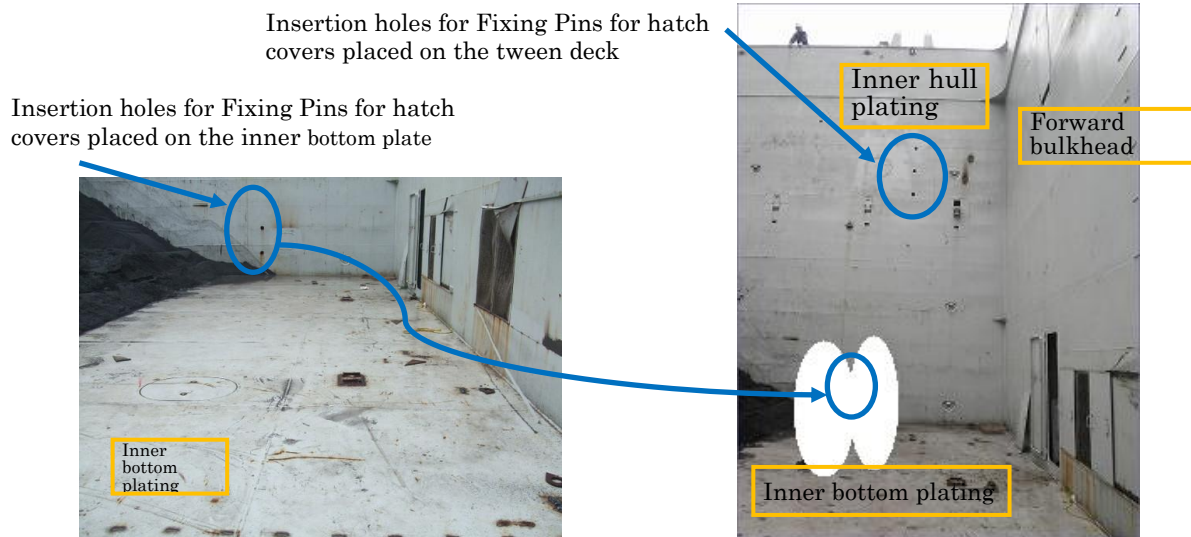


Photo 2.6-8 Fixing Pin insertion holes provided in No.2 cargo hold inner hull plating (1)

Photo 2.6-9 Fixing Pin insertion holes provided in No.2 cargo hold inner hull plating (2)

### (3) Locking devices

According to the tween deck hatch cover arrangement plan, the locking devices were as follows.

#### 1) Twist locks<sup>\*11</sup>

Regarding the five tween deck hatch covers stacked up on the inner bottom plating in No.2 cargo hold, it was so arranged that they would be fixed by a total of 12 twist locks, that is, four twist locks each between the second and third lowermost hatch covers, between the third and fourth hatch lowermost covers, and between the fourth and fifth lowermost hatch covers.

#### 2) Single stackers<sup>\*12</sup>

Regarding the five tween deck hatch covers stacked up on the inner bottom plating in No.2 cargo hold, it was so arranged that fixing would be performed using four single stackers each between the lowermost hatch cover and the inner bottom plating, and between the lowermost and the second hatch covers. Furthermore, regarding the three tween deck hatch covers placed on the tween deck of No.2 cargo hold, it was so arranged that fixing would be performed using four single stackers each between the three aforementioned hatch covers.

(See Figure 2.6-5.)

<sup>\*11</sup>: The term “twist lock” signifies a fitting that is inserted between vertically superposed containers, hatch covers, or the like, and is locked by a lever, which is an accessory, with the result that the superposed articles are fixed in such a way as to be prevented from moving horizontally or vertically.

<sup>\*12</sup>: The term “single stacker” signifies a fitting that is inserted between vertically superposed containers, hatch covers, or the like, with the result that the superposed articles are fixed in such a way as to be prevented from moving horizontally.



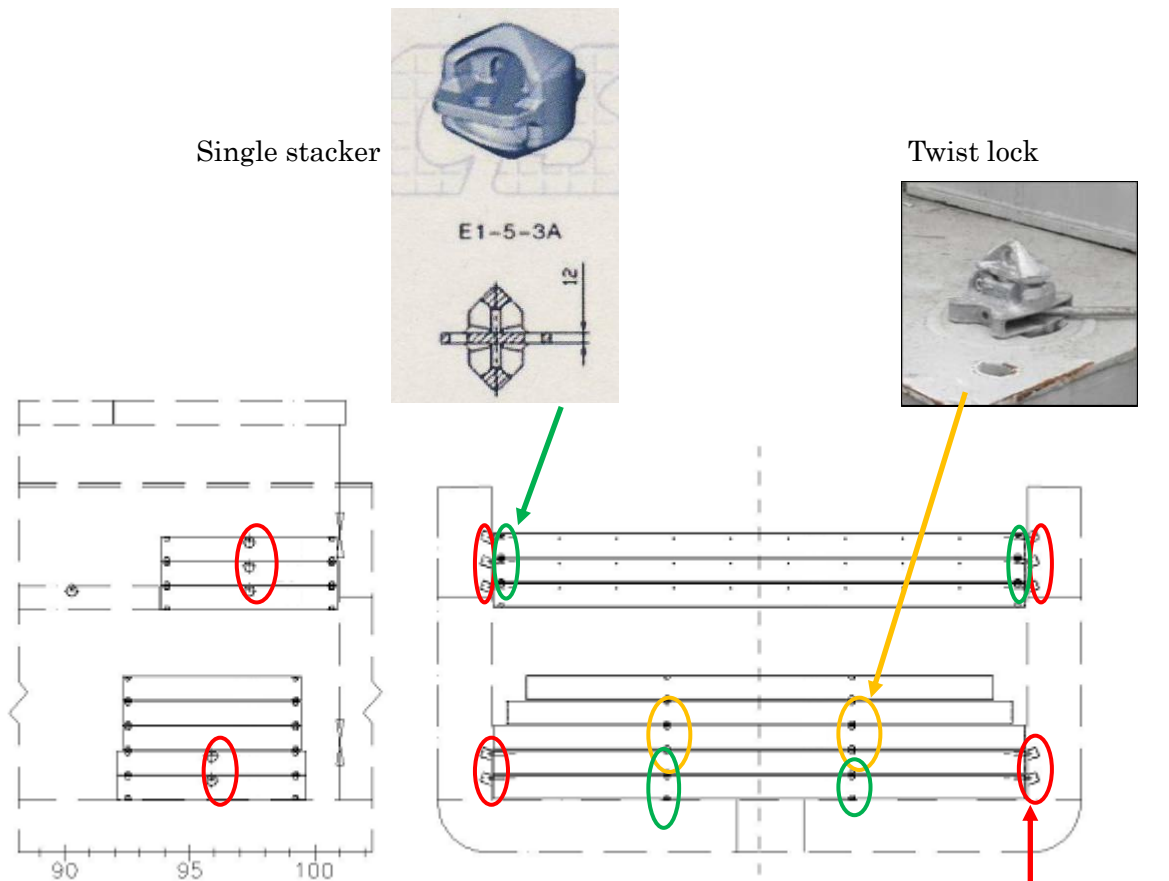


Figure 2.6-5 Side view and cross-sectional view of the bow side of No.2 cargo hold

- Fixing Pin
- Twist lock
- Single stacker



Fixing Pin

(4) Fittings installed onboard

According to photos of the inside of No.2 cargo hold, two slide shoes <sup>\*13</sup> were welded on the bow side of the inner bottom plating. It was so arranged that hatch covers would be fixed by means of slide twist locks.

(See Photo 2.6-10 and Photo 2.6-11.)

<sup>\*13</sup>: The term “slide shoe” signifies a fitting equipped with a guide for fixing a flanged locking device. This fitting is welded, for example, to the bottom of a cargo hold, and is also called a slide base.



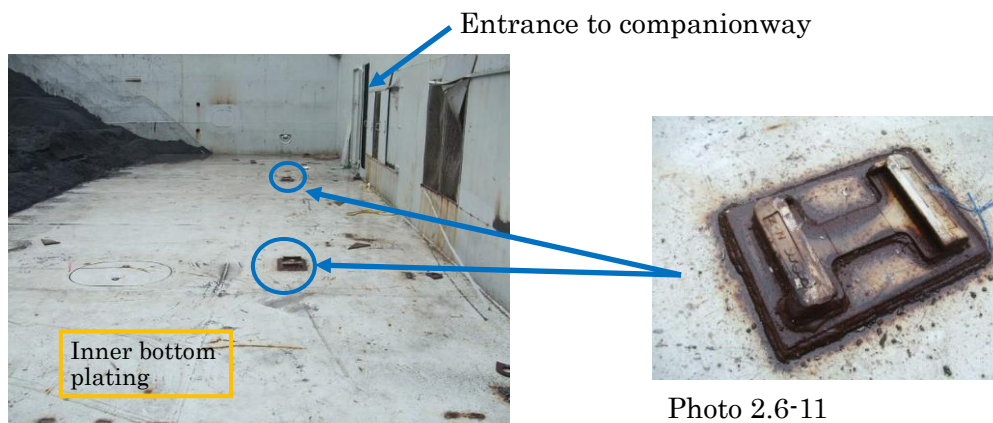


Photo 2.6-10

Installation of slide shoes

Photo 2.6-11

Slide shoe

### 2.6.5 Hatch Cover Operating Manual

According to the hatch cover operating manual, the procedure for placing and securing opened tween deck hatch covers was as follows.

- (1) Five tween deck hatch covers for No.1 cargo hold should be placed on the bow side of the inner bottom plating in No.2 cargo hold. Fixing Pins for the lowermost and second lowermost hatch covers should be inserted into the insertion holes in the inner hull platings on both the port and starboard sides. Other hatch covers should be fixed by twist locks.
- (2) Three tween deck hatch covers for No.2 cargo hold should be placed on the bow side of the tween deck of No.2 cargo hold. Fixing Pins for the aforementioned three hatch covers should be inserted into insertion holes in the inner hull platings on both port and starboard sides
- (3) The remaining six tween deck hatch covers for No.2 cargo hold should be placed on top of the CO<sub>2</sub> room. The aforementioned six hatch covers should be fixed by twist locks.

### 2.6.6 Cargo Lifting Device

According to the general arrangement plan, the cargo lifting device onboard was as follows.

The Ship was provided with two cranes on her port side of the upper deck; one on the stern side of No.1 cargo hold, and the other on the middle of No.2 cargo hold.

Both cranes had the limit load of 30 t and the turning radius of 24 m.

## 2.7 Cargo Information

### (1) Cargo name

According to the stowage plan, the cargo loaded onto the Ship was copper slag.

### (2) Stowage weight, etc. at the time of draft survey after the accident

According to the stowage amount calculation document, relevant data were as follows:

No.1 cargo hold:	2,900 tons
No.2 cargo hold:	4,373 tons
Total:	7,273 tons

Forward draft, 6.08 m; Aft draft, 7.06 m; Trim, 0.98 mB/S

Cargo handling was discontinued after the accident. The Ship left port without loading the planned amount of cargo.

(3) Loading capacity and loading capacity ratio <sup>\*14</sup>

According to the loading manual and the stowage information for solid bulk cargo, relevant data were as follows.

No.1 cargo hold: Approximately 1,160 – 1,943 m<sup>3</sup>

Loading capacity ratio: Approximately 28 – 47%

No.2 cargo hold: Approximately 1,749 – 2,930 m<sup>3</sup>

Loading capacity ratio: Approximately 22 – 38%

Values of 0.40 – 0.67 m<sup>3</sup>/t were used as the stowage factor <sup>\*15</sup> of copper slag.

(4) General description of the cargo

Copper slag is the residue that is generated from copper smelter. It is highly water-permeable, black or red-brown in color, and has either a granular or lumpy texture, with a maximum of 10 mm diameter.

(5) Trimming Procedures

The cargo shall be trimmed to ensure that the height difference between peaks and troughs does not exceed 5% of the ship's breadth and that the cargo slopes uniformly from the hatch boundaries to the bulkheads and so no shearing faces remain that may collapse during the voyage, in particular on smaller ships, i.e., 100 m in length or less.

## 2.8 Weather and Sea Conditions

(1) Meteorological observations

Observed values at the Tamano Local Meteorological Station, which is about 4 km north-northeast of the location of the accident, were as follows:

At 14:20 : Wind direction, South-southwest; Wind speed, 2.2 m/s; Atmospheric temperature: 22.3°C

(2) According to the statements of the foreman and Driver B, the weather conditions were as follows:

At the time of the accident, the weather was rainy and the wind was light.

## 2.9 Ship Safety Management

### 2.9.1 Certificate of Compliance and Safety Management Certificate

A safety management system that complies with the requirements of the International Safety Management Code <sup>\*16</sup> (ISM Code) was established. A Document of Compliance and Safety Management Certificate were issued to Company A and to the Ship, respectively.

(1) Document of Compliance

Number: 05A072

Management company: Company A

Type of ship: Other cargo ship

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<sup>\*14</sup>: The term "loading capacity ratio" signifies the ratio that the volume of a cargo bears to the total volume of a cargo hold.

<sup>\*15</sup>: The term "stowage factor" means the volume in m<sup>3</sup> that a cargo of 1 t accounts for.

<sup>\*16</sup>: The "ISM Code" (International Management Code for the Safe Operation of Ships and for Pollution Prevention) was adopted as an IMO Assembly Resolution on November 4, 1993 for the purpose of protecting the marine environment and safe navigation of vessels, and was introduced into an annex to the SOLAS Convention of 1974. Subsequently, the code took effect on July 1, 1998 after the convention was amended in 1994. The ISM Code is applied to all passenger ships and other types of ships of 500 gross tonnage and upwards engaged on international voyages.

Date of issue: January 20, 2011

Validity period: January 19, 2016

Certification Authority: China Maritime Safety Administration

(2) Safety Management Certificate

Number: BJ118932

Name of ship: the Ship

Management company: Company A

Date of issue: September 30, 2011

Validity period: June 5, 2016

Certification Authority: China Classification Society (CCS)

### 2.9.2 Safety Management Manual

According to the safety management manual, points to note regarding the cargo handling and concerning the securing method were as follows:

(1) Basic requirements for loading

It shall be arranged that the longitudinal strength of the vessels will not be degraded.

The stowage weight in all cargo holds should be correctly allocated. Loading shall be performed uniformly so that stress will not be locally concentrated.

Stowage heights shall not be locally increased or decreased.

(2) Loading of bulk cargo

Cargo shall be stowed at the bottom of holds, and stowage shall be leveled out.

(3) Stowing of cargo

1) The chief officer shall, prior to the loading of cargo, prepare a stowage plan on the basis of a loaded cargo list in accordance with the "Loading Manual" or the "Stability Calculation Manual," and shall perform appropriate stowage procedures so that the stability and strength of the vessel will fall within allowable safety limits.

2) The chief officer shall confirm that the cargo holds are clean and dry and are free of abnormal odors, insect pests, and water leakage, and shall maintain the facilities in good condition.

The boatswain shall prepare and inspect rigging and the cargo handling equipment.

### 2.10 Cargo Loading Work

The following items are contained in "Slag Handling Work on the Ship," which was specified in the safety procedure document of the Cargo Handling Company.

(1) Preparation work

1) The foreman and the work leader shall check the condition of the ship, including the inside of the holds.

2) The foreman and the work leader shall confirm the safety of passage routes and companionways, and shall erect signs for the companionways, thereby clarifying their location.

3) Pre-operation inspections and trial of cranes, bulldozers, etc. on the Ship shall be performed.

4) The foreman and the work leader shall confirm reports on inspection results.

5) Workers shall hold discussions on the contents, methods, and procedures of work to be carried out.

- 6) Before starting work, workers shall conduct a hazard prediction meeting.
- 7) Mats for preventing marine pollution (falling of cargo) shall be installed by suspending them between the ship and the wharf.
- 8) Bulldozers shall be moved into the holds.
- 9) Wire ropes for grab buckets shall be placed on crane hooks. Trial operations for opening and closing grab buckets shall be performed.
- 10) The foreman and the work leader shall confirm reports on grab bucket operation inspection.

(2) Cargo handling work

- 1) A grab bucket shall be lowered onto cargo that has been placed on the wharf. Cargo shall be grabbed and raised. The crane shall be turned to the position in the cargo hold from which the grab bucket is to be moved down. The grab bucket shall be lowered.
- 2) A signal person shall open the grab bucket by remote control.
- 3) The grab bucket shall be raised while it is closed. The crane shall be turned toward the wharf.
- 4) Steps 1) to 3) shall be repeated.
- 5) A bulldozer driver shall go down into the cargo hold through the designated entrance. A self lock shall be installed when going down the ladder.
- 6) A bulldozer shall be used to horizontally level cargo throughout the cargo hold.

## 2.11 Regulations regarding Prevention of Occupational Accidents in the Harbor Cargo Transportation Business

The following provisions are contained in the Regulations regarding Prevention of Occupational Accidents in the Harbor Cargo Transportation Business of the Japan Port Transport Industry Safety & Health Association, of which the Cargo Handling Company Is a member.

*(1) Requests to the Equipment Manager (Article 10)*

- 1) *Any member shall, when performing work by using any equipment or the like managed by any person other than the said member, shall make an inquiry to the manager of said equipment or the like about the status of safety measures regarding said equipment or the like, thereby confirming the safety thereof.*
- 2) *Any member shall, if any abnormality is noticed in the equipment or the like mentioned in the preceding paragraph or if any abnormality occurs during use of said equipment or the like, request the manager of said equipment or the like to take measures such as maintenance or repair.*

*(2) Passage on a ship (Article 17)*

- 1) *As for any passageway on a ship, or for any passage facility used for going up and down a space between an exposed deck and a hold, all members shall ensure that workers use safe passageway or facility that is designated by the person responsible for the ship.*
- 2) *Any member shall, if there is any damage to any passage facility on the ship and if therefore it is considered inappropriate to use the said passage facility, have workers use another passage facility that is deemed safe or shall provide a safe passage facility and shall have workers use the said safe passage facility.*
- 3) *As for the passage facility mentioned in the preceding two paragraphs, said member shall erect signs or the like to the effect that the pertinent passage facilities shall be used, thereby informing all workers accordingly. In addition, as for the passage facilities that*

*are prohibited from being used, said member shall take measures such as erecting signs to the effect that said passage facilities are prohibited from being used.*

*(3) Work plan (Article 29)*

*Any member shall, when stevedoring work is to be performed, formulate in advance a work plan for carrying out safe work in such a way as to be compatible with the following conditions, among others: the structure of the ship or the like in which said work is to be performed; situations of work places and equipment; and the types, shapes, and packing styles. Furthermore, said member shall carry out work in accordance with said work plan.*

*(4) Operations chief of stevedores (Article 30)*

*Any member shall, when stevedoring work is to be performed, appoint an operations chief of stevedores, and shall have said chief carry out the following.*

- 1) Prior to starting work, the following shall be performed: The environment of the work place and the condition of the cargo should be inspected; a specific work method should be established based on the work plan mentioned in the preceding article; and operation places of cargo handling machines, the operating ranges of said machines, and the passage equipment for workers shall be specified.*
- 2) Works shall be supervised directly by informing all related workers of matters required for safely in carrying out work, such as the following: work procedures; work-related signaling methods; evacuation places and evacuation methods in emergencies.*
- 3) Passage facilities, work places, cargo handling machines, work implements, protective equipment, etc. shall be inspected and maintained in good condition. The way these items are used should be monitored.*
- 4) Work coordination shall be made with other operations chiefs who are appointed for the purpose of ensuring safe work, with work leaders for vehicle-type cargo handling and conveying machines, with persons responsible for operation of relevant cargo handling machines, and with persons who give work signals. Chains of command for work shall be clearly established, and all related workers shall be informed accordingly.*
- 5) If the work of another business entity is to be carried out in the same place or in a nearby place, then contact and coordination shall be made for the purpose of carrying out said work safely.*

*(5) Inspection of hatch beams etc. (Article 56)*

*In the case where work is to be performed in which a cargo lifting device is used to hoist up a load from inside a hold or to hoist down a load into a hold, no member shall engage any worker in said work until after the following process is completed: The condition of the hatch beam or of the hatch board equipped with a hinge shall be inspected prior to starting said work; and it shall be confirmed that these parts are securely fixed.*

## 3 ANALYSIS

### 3.1 Situation of Occurrence of the Accident

#### 3.1.1 Course of Events

According to 2.1 and 2.2, it is probable that the course of events was as follows.

- (1) At about 07:45, May 9, 2011, the Ship was berthed alongside the Public Wharf in Hibi Port with the tween deck hatch covers were opened, where the Hatch Covers were stacked up at

the forward bottom of No.2 cargo hold and the other hatch covers were stacked up at the tween deck on the bow side of No.2 cargo hold.

- (2) After the Ship was berthed, crew members opened the upper deck hatch covers. Subsequently, at about 10:40, copper slag cargo loading work began. On the following day (May 10) as well, the cargo loading work was being carried out.
- (3) At about 14:20, May 10, Driver B, who was operating Bulldozer 2, heard a sound from the bow side of No.2 cargo hold. Cargo had previously reached a height equal to the height of the fourth lowermost hatch cover among the Hatch Covers. However, Driver B noticed that the cargo height was 70 to 80 cm lower.
- (4) Driver A was discovered caught between the Hatch Covers and the forward bulkhead. Although the Hatch Covers were removed successfully, he was confirmed dead by an ambulance squad.

### 3.1.2 Accident Occurrence Date, Time and Place

According to 2.1, it is probable that the date and time of the occurrence of this accident was about 14:20, May 10, 2011, and that the place of the occurrence was the inside of No.2 cargo hold of the Ship, which was berthed alongside the Public Wharf in Hibi Port.

### 3.1.3 Situation of the Deceased/Injured Person

According to 2.14 and 2.2, Driver A's chest was caught between the Hatch Covers and the forward bulkhead, resulting in his death due to the rupture of the heart caused by thoracoabdominal compression.

## 3.2 Causal Factors of the Accident

### 3.2.1 Situations of Crew Members and Workers

According to 2.4 and 2.5, it was as follows.

#### (1) Master

Although his certificate of competence was newly issued after the accident, it was not possible to clarify what certificate he held at the time of the accident.

#### (2) Chief officer

He held a legal and valid certificate of competence.

#### (2) Foreman

It is probable that he had seven to eight years of experience as a foreman.

#### (4) Work leader

It is probable that he had five to six years of experience as a work leader.

#### (5) Driver A

It is probable that he had about five years of experience in cargo handling work, and that his physical condition on the day of the accident was satisfactory.

### 3.2.2 Situations regarding the Cargo Handling Workers' Preparation for the Loading Work

According to 2.1.3 and 2.6.4(1), it is probable that the workers' awareness was as follows.

- (1) Prior to the start of cargo handling work, the foreman had a discussion with the chief officer concerning the places to put the upper deck hatch covers and about the estimated amount of stowage. After that, the foreman heard from the chief officer that it was possible to start cargo loading work. Moreover, the foreman himself looked at the inside of the cargo

holds, and noticed that no cargo remained from the previous voyage. Therefore, the foreman thought that the Ship was in a situation where it was possible to carry out cargo loading work.

- (2) The foreman received no explanation from the chief officer about how the Hatch Covers were secured.
- (3) On the following day of the occurrence of the accident, the foreman opened the lid on the upper surface of a hatch cover and discovered that a Fixing Pin was housed inside. He found that the Fixing Pin could be pushed outside the side surface of the hatch cover by hand.
- (4) The Cargo Handling Workers had experience in performing cargo handling on ships with tween decks. However, in the Ship, for the first time they saw a situation in which hatch covers were stacked up on the inner bottom plating in a cargo hold. Due to this fact and the aforementioned fact, they were not aware of the method for securing hatch covers placed on the inner bottom plating.

### 3.2.3 Situation regarding the Securing of the Hatch Covers

According to 2.1.3 to 2.1.5, 2.6.4, and 2.6.5, it is probable that the Hatch Covers were stacked as follows.

- (1) When the ship was berthed alongside the Public Wharf in Hibi Port, the Hatch covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold.
- (2) Since slide shoes were installed on the inner bottom plating, it was so arranged that the lowermost hatch cover would be fixed using slide twist locks between the lowermost hatch cover and the slide shoes. Furthermore, it was so arranged that the lowermost and second lowermost hatch covers would be fixed by inserting Fixing Pins into insertion holes in the inner hull plating.
- (3) It was so arranged that single stackers would be used between the lowermost and second lowermost hatch covers, thereby preventing horizontal movement, and that twist locks would be used between those remaining hatch covers that were adjacent to each other, thereby preventing horizontal and vertical movement.
- (4) In the state where hatch covers were stacked up, it was difficult to confirm whether locking devices were used.
- (5) In the Ship, with the aim of rescuing Driver A, crew members lifted the uppermost hatch cover with a crane, and the Cargo Handling Workers used the same crane to lift the remaining hatch covers. Regarding the Hatch Covers, the third lowermost hatch cover and above were able to be lifted one by one; however, when the second lowermost hatch cover was lifted, the lowest one was also lifted.
- (6) Prior to lifting the hatch covers, there were no crew members or the Cargo Handling Workers who removed Fixing Pins for the hatch covers, or locking devices between the inner bottom plating and the lowermost hatch cover and between adjacent hatch covers. Furthermore, the work leader, who carried out sling work for the hatch covers (with the exception of the uppermost one), did not see any locking devices between hatch covers.
- (7) According to (5) and (6) above, Fixing Pins for the hatch covers had not been inserted into the insertion holes in the inner hull plating, and no locking devices were used between the adjacent hatch covers or between the inner bottom plating and the lowermost hatch cover, except for between the lowermost and second lowermost hatch covers, which were

connected by devices for preventing vertical movement.

- (8) According to (5) to (7) above, after the tween deck hatch covers were opened, the Hatch Covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold but they were not secured as specified in the hatch cover operating manual. Therefore, the situation was such that it was impossible to prevent horizontal movement of the Hatch Covers.

#### 3.2.4 Situation regarding the Movement of the Hatch Covers

According to 2.1.4, 2.2, 2.7, and 3.2.3, it is probable that the Hatch Covers moved as follows.

- (1) The Ship was loading granular or lump cargo with a high permeability in the rain.
- (2) When Driver B was leveling cargo that had been loaded on the stern side of No.2 cargo hold, he heard a loud sound from the bow side. Therefore, he approached the Hatch Covers and looked at them. He then noticed that the cargo height in the vicinity of the Hatch Covers was 70 to 80 cm lower than before.
- (3) When Driver B passed through the space between the Hatch Covers and the forward bulkhead prior to the occurrence of the accident, he was able to walk without turning his body sideways in such a way that neither of his shoulders came into contact with any of the Hatch Covers or with the forward bulkhead. However, when Driver A was discovered caught between the Hatch Covers and the forward bulkhead, the relevant gap was approximately 15 cm.
- (4) Due to the aforementioned fact and the fact that the Hatch Covers were in a state where it was impossible to prevent horizontal movement, the Hatch Covers moved in the direction of the bow after being pushed by cargo.

#### 3.2.5 Situation regarding the Designated Passage Route to No.2 Cargo Hold

According to 2.1.4, it is probable that the passage route was designated and used as follows.

- (1) In a meeting held prior to the start of the cargo handling work, the work leader gave instructions to cargo handling workers to the effect that the aft companionway, which was the designated passage route, should be used to enter or leave No.2 cargo hold.
- (2) A worker who was to remove slings from bulldozers jumped down from the Hatch Covers to the inner bottom plating. The foreman witnessed this scene. Since there was a risk that the worker could fall down, the foreman cautioned the worker to use the designated companionway on the stern side. Furthermore, the foreman instructed Driver A and Driver B to not block the vicinity of the entrance to the aft companionway on the inner bottom plating with cargo, and also to enter and leave No.2 cargo hold through the aft companionway.

The work leader erected a placard showing the designated companionway at the entrance to the aft companionway of the upper deck that was above the stern side of No.2 cargo hold. He also installed self-locks on the vertical ladder.

- (3) At about 10:30 on May 10, Driver B consulted with Driver A, who came down to No.2 cargo hold, about an idea to pile up cargo on the inner bottom plating in the vicinity of the entrance to the aft companionway as well. This was because the amount of cargo inside No.2 cargo hold had increased. At that time, Driver B heard from Driver A that Driver A had used the forward companionway to the inner bottom plating.
- (4) At about 11:00, Driver A took over operations of Bulldozer 2 from Driver B. Subsequently,



Driver B headed for the bow. He went down to the inner bottom plating from the area of the Hatch Covers. He then passed through the space between the Hatch Covers and the forward bulkhead, entered the forward companionway from the inner bottom plating, went up to the upper deck, and took a lunch break. Thereafter, he entered No.2 cargo hold through the forward companionway to the inner bottom plating by following the reverse path of the route he took to go up to the upper deck.

- (5) At about 14:00, Driver A was seen by Driver C moving aft on an upper deck passageway on the port side of No.1 cargo hold. This occurrence means, as stated in paragraph 3.2.6, item (3), that the instructions to use the designated passage route were not heeded. As a consequence, Driver A subsequently used the forward companionway to No.2 cargo hold, entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold, and was passing through the space between the Hatch Covers and the forward bulkhead.

### 3.2.6 Situation regarding Safety Management

According to 2.1.4, 2.1.5, 2.6.4, 2.6.5, 2.9, 2.10, 3.2.2, 3.2.3, and 3.2.5, it is probable that the safety management was as follows.

- (1) Fixing Pins for the lowermost and second lowermost hatch covers were not inserted into the insertion holes in the inner hull platings. Furthermore, locking devices were not used either between the inner bottom plating and the lowermost hatch cover or between the adjacent Hatch Covers, except between the lowermost and second lowermost hatch covers. Thus, the Hatch Covers were not secured as specified in the hatch cover operating manual, resulting in a situation where it was impossible to prevent horizontal movement of the Hatch Covers.
- (2) It was specified by the provisions of the safety work procedures of the Cargo Handling Company that the foreman and the work leader shall check the condition of the ship, including the inside of the holds. However, since neither the foreman nor the work leader knew the hatch cover securing procedures, neither of them confirmed whether the Hatch Covers were secured and checked the inside of the cargo hold.
- (3) Workers were instructed by the work leader that the aft companionway, which was the designated passage route, should be used to enter or leave No.2 cargo hold. However, some workers used the forward companionway. This fact means that the instructions to use the designated passage route and to use protective equipment for preventing falls during climbing up and down the vertical ladder were not heeded.

### 3.2.7 Weather and Sea Conditions

According to 2.8, it is probable that: The weather was rainy; the wind direction was south-southwest; and the wind speed was approximately 2.2 m/s in the vicinity of the accident occurrence location.

### 3.2.8 Analysis regarding Occurrence of the Accident

According to 3.1.1, 3.1.3, and 3.2.2 to 3.2.6, it is probable that the accident occurred as follows.

- (1) After the tween deck hatch covers on the Ship were opened, the Hatch Covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold. At that time, the Fixing

Pins for the lowermost and second lowermost hatch covers were not inserted into the insertion holes in the inner hull plating and therefore the Hatch Covers were not secured as specified in the hatch cover operating manual. Consequently, at about 07:45 on May 9, the Ship was berthed alongside the Public Wharf in Hibi Port in a state where it was impossible to prevent horizontal movement of the Hatch Covers.

- (2) Since neither the foreman nor the work leader knew the hatch cover securing procedures, neither of them confirmed whether the Hatch Covers were secured and checked the inside of the cargo hold.
- (3) After the Ship was berthed, crew members opened the upper deck hatch covers. Subsequently, on May 9, copper slag cargo loading work started. On the following day (May 10) as well, the cargo loading work was being carried out.
- (4) Driver A was seen by Driver C moving aft on an upper deck passageway on the port side of No.1 cargo hold. This fact means that the instructions to use the designated passage route were not heeded. As a consequence, as with some other workers, Driver A used the forward companionway to No.2 cargo hold. That is, Driver A entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold, and was passing through the space between the Hatch Covers and the forward bulkhead.
- (5) When Driver B was leveling cargo loaded on the stern side of No.2 cargo hold, he heard a sound from the bow side. He therefore approached the Hatch Covers and looked at them, where he noticed that the cargo height in the vicinity of the Hatch Covers had become 70 to 80 cm lower as the Hatch Covers had moved in the direction of the bow after being pushed by the cargo.
- (6) Driver A entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold, where the situation was such that it was impossible to prevent horizontal movement of the Hatch Covers. When Driver A was passing through the space between the Hatch Covers and the forward bulkhead, the Hatch Covers then moved in the direction of the bow after being pushed by the cargo, which caught Driver A between the Hatch Covers and the bulkhead, resulting in his death due to heart rupture from thoracoabdominal compression.

## 4 CONCLUSIONS

### 4.1 Findings

#### (1) Course of the Events

- 1) It is probable that: After the tween deck hatch covers were opened, the Hatch Covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold. At that time, the Fixing Pins for the lowermost and second lowermost hatch covers were not inserted into the insertion holes in the inner hull plating and the Hatch Covers were not secured as specified in the hatch cover operating manual. Consequently, at about 07:45 on May 9, the Ship was berthed alongside the Public Wharf in Hibi Port in a state where it was impossible to prevent horizontal movement of the Hatch Covers. (3.1.1 (1) and 3.2.3 (7))\*<sup>16</sup>

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\*<sup>16</sup>: The numbers at the end of each paragraph in this section denote section numbers in “3 ANALYSIS” that pertain to the paragraph.

- 2) It is probable that: Driver A was seen by Driver C moving aft on an upper deck passageway on the port side of No.1 cargo hold. This fact means that the instructions to use the designated passage route were not heeded; as a consequence, as with some other workers, Driver A entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold, and was passing through the space between the Hatch Covers and the forward bulkhead. (3.2.8 (4))
- 3) It is probable that: At about 14:20 on May 10, during the loading of copper slag, the Hatch Covers moved in the direction of the bow after being pushed by cargo. Driver A was caught between the Hatch Covers and the forward bulkhead as he was passing through the space between them, resulting in his death due to the heart rupture from thoracoabdominal compression. (3.1.1(3), 3.1.3 and 3.2.8(6))

(2) Situation Pertaining to Safety Management

- 1) It is probable that: The Fixing Pins for the lowermost and second lowermost hatch covers among the Hatch Covers were not inserted into the insertion holes in the inner hull platings. Furthermore, locking devices were not used either between the inner bottom plating and the lowermost hatch cover or between the adjacent Hatch Covers, except between the lowermost and second lowermost hatch covers. Thus the Hatch Covers were not secured as specified in the hatch cover operating manual, resulting in a situation where it was impossible to prevent horizontal movement of the Hatch Covers. (3.2.6 (1))
- 2) It is probable that: Neither the foreman nor the work leader knew the hatch cover securing procedures; therefore, neither of them confirmed whether the Hatch Covers were secured. As a result, the inside of cargo hold was not checked as specified in the safe work procedures of the Cargo Handling Company. (3.2.6 (2))
- 3) It is probable that: Workers were instructed by the work leader that the aft companionway, which was the designated passage route, should be used to enter or leave No.2 cargo hold; however, some workers used the forward companionway; and this fact means that the instructions to use the designated passage route were not heeded. (3.2.6 (3)).

(3) Causal Factors of the Accident

- 1) It is probable that: The Hatch Covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold during the loading of copper slag at the Public Wharf in Hibi Port but the Fixing Pins for the lowermost and second lowermost hatch covers were not inserted into the insertion holes in the inner hull plating. Due to this fact, the situation was such that it was impossible to prevent horizontal movement of the Hatch Covers. Furthermore, Driver A entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold; therefore, when Driver A was passing through the space between the Hatch Covers and the forward bulkhead, the Hatch Covers moved in the direction of the bow after being pushed by cargo, resulting in Driver A being caught between the Hatch Covers and the forward bulkhead, leading to his death due to heart rupture from thoracoabdominal compression. (3.2.8 (1) and 3.2.8 (6))
- 2) It is probable that: When the Hatch Covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold, they were not secured as specified in the hatch cover operating manual; therefore, the situation was such that it was impossible to prevent horizontal movement of the Hatch Covers. (3.2.3 (8))
- 3) It is probable that: The instructions to use the designated passage route were not heeded.

As a consequence, as with some other workers, Driver A used the forward companionway; that is, Driver A entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold, and was passing through the space between the Hatch Covers and the forward bulkhead. (3.2.8 (4))

#### 4.2 Probable Causes

It is probable that the accident occurred as follows: The Hatch Covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold during the loading of copper slag onto the Ship at the Public Wharf in Hibi Port; however, the Fixing Pins for the lowermost and second lowermost hatch covers were not inserted into the insertion holes in the inner hull plating. Due to this fact, the situation was such that it was impossible to prevent horizontal movement of the Hatch Covers. Furthermore, Driver A entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold; therefore, when Driver A was passing through the space between the Hatch Covers and the forward bulkhead, the Hatch Covers moved in the direction of the bow after being pushed by cargo, resulting in Driver A being caught between the Hatch Covers and the forward bulkhead.

It is probable that the reason why it was impossible to prevent horizontal movement of the Hatch Covers is that when the Hatch Covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold in the Ship, they were not secured as specified in the hatch cover operating manual.

It is probable that the reason why Driver A entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold is that the instructions to use the designated passage route were not heeded.

## 5 SAFETY ACTIONS

It is probable that this accident occurred as follows: The Hatch Covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold during the loading of copper slag at the Public Wharf in Hibi Port; however, the Fixing Pins for the lowermost and second lowermost hatch covers were not inserted into the insertion holes in the inner hull plating. Due to this fact, the situation was such that it was impossible to prevent horizontal movement of the Hatch Covers. Furthermore, when Driver A was passing through the space between the Hatch Covers and the forward bulkhead, the Hatch Covers moved in the direction of the bow after being pushed by cargo, resulting in Driver A being caught between the Hatch Covers and the forward bulkhead of No.2 cargo hold.

It is probable that the reason why it was impossible to prevent horizontal movement of the Hatch Covers is that when the Hatch Covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold in the Ship, they were not secured as specified in the hatch cover operating manual.

It is probable that the reason why Driver A entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold is that the instructions to use the designated passage route were not heeded.

Therefore, it is necessary that the management company for the Ship makes sure that when the tween deck hatch covers are opened and are to be placed on the inner bottom plating of a cargo

hold, crew members secure them as specified in the hatch cover operating manual, thus ensuring that appropriate measures are taken to prevent the hatch covers from moving.

Furthermore, although the Cargo Handling Company erected a placard at the pertinent companionway, thereby clearly indicating the passage route, some workers did not use the designated passage route. Therefore, it is necessary that the Cargo Handling Company take specific measures to make sure that workers use the designated passage route.

## 5.1 Safety Actions Taken

The Cargo Handling Company took the following safety actions subsequent to the accident.

- (1) Prior to starting cargo handling, the foreman, the operations chief, and the work leader designate passage routes and companionways to the cargo holds to be used, and erect a placard at the embarkation entrance showing the passage routes.
  - 1) Regarding any companionway that should not be used, its hatch is closed and taped down not to be opened, and a placard clearly showing prohibition of use is placed..
  - 2) On passageways on decks, colored tapes are used to indicate the designated passage routes.
- (2) At the time of entry into port (prior to starting work), the foreman confirms with the Ship's officer whether the hatch covers are secured. A "Checklist Prior to Starting Work for Safe Operation" is prepared not to leave anything unchecked. By means of pre-operation hazard prediction meetings, the checklist is made known to all workers.
- (3) Radios are used as a means of communication among cargo handling workers. The operation chief, the work leader, the signal persons, and the bulldozer operators are equipped with radios at all times so that they can communicate with each other.
- (4) Risk assessment is conducted in pre-operation hazard prediction meetings with the aim of elimination of risk factors and prevention of occupational accidents. The managers conduct on-site patrols to check unsafe conditions and actions, give guidance on the spot if any, and record the results in a safety logbook. In the next round of pre-operation hazard prediction meeting, the work leader informs all workers of the results.
- (5) A person who can carry out his/her duties with a knowledge of the entire work process should be appointed as an operations chief of stevedores. If the person temporarily leaves the workplace for emergencies or the like, his/her duties are handed over to the work leader.

## 6 SAFETY RECOMMENDATIONS

It is probable that this accident occurred as follows: Five tween deck hatch covers were stacked up on the bow side of the inner bottom plating in No.2 cargo hold during the loading of copper slag onto the SCSC WEALTH at the Public Wharf in Hibi Port; however, the safety bolts for the lowermost and second lowermost hatch covers were not inserted into the insertion holes in the inner hull plating. Due to this fact, the situation was such that it was impossible to prevent horizontal movement of the hatch covers. Furthermore, a driver entered No.2 cargo hold through the forward companionway to the inner bottom plating of No.2 cargo hold; therefore, when the driver was passing through the space between the hatch covers and the forward bulkhead, the hatch covers moved in the direction of the bow after being pushed by cargo, resulting in the driver being caught between the hatch covers and the forward bulkhead.

It is probable that the reason why it was impossible to prevent horizontal movement of the hatch covers is that they were not secured as specified in the hatch cover operating manual by the SCSC WEALTH.

Based on the above, in view of the results of this accident investigation, the Japan Transport Safety Board recommends SHANGHAI CSC Line Co., Ltd. as follows for the prevention of recurrence of similar accidents.

The company should provide instructions to crew members to ensure that they comply with the hatch cover operating manual and appropriate measures to prevent movement of opened hatch covers are taken.