

MA2016-10

**MARINE ACCIDENT
INVESTIGATION REPORT**

October 27, 2016



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.

Kazuhiro Nakahashi
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.


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October 6, 2016

Adopted by the Japan Transport Safety Board

Chairman Kazuhiro Nakahashi
Member Kuniaki Shoji
Member Satoshi Kosuda
Member Toshiyuki Ishikawa
Member Mina Nemoto

Accident type	Fatality of a grain inspector
Date and time	Around 08:50 on October 19, 2015 (local time, UTC+9 hours)
Location	Kobe Section 2 Grain Wharf, Hanshin Port Around 050° true bearing, 2,610m from Kobe No.5 Breakwater East Lighthouse (approximately 34° 42.10' N, 135° 15.70' E)
Summary of the Accident	At around 08:50 on October 19, 2015, while the cargo ship TRITON SWAN was engaged in cargo handling work at Kobe Section 2 Grain Wharf, Hanshin Port, a grain inspector died inside the No. 3 cargo hold where there was an oxygen deficiency hazard.
Process and Progress of the Investigation	(1) Set up of the Investigation The Japan Transport Safety Board appointed an investigator-in-charge and one other marine accident investigator to investigate this accident on October 19, 2015. Three accident investigators from the Kobe Office also took part in the investigation of this accident. (2) Collection of Evidence October 19 and 20: On-site investigations and interviews October 21 and 22, December 25, 2015, February 19 and 23, April 27, 2016: Interviews December 20 and 21, 2015, January 7 and April 7, 2016: Collection of questionnaire February 18, 2016: Interviews and collection of questionnaire (3) Comments from Parties Relevant to the Cause Comments on the draft report were invited from parties relevant to the cause of accident. (4) Comments from the Flag State Comments on the draft report were invited from the Flag State of the TRITON SWAN.

<p>Factual Information</p> <p>Vessel type and name Gross tonnage Vessel number Owner, etc. Management company L×B×D, Hull material Engine, Output Date of launch, etc.</p>	<p>Cargo ship TRITON SWAN (registered in the Republic of Panama) 34,800 tonnes 9632985 (IMO No.) TRITON NAVIGATION B.V. FLEET MANAGEMENT LIMITED 199.98m x 32.24m x 18.60m, steel Diesel engine, 8,450kW August 23, 2012 (See Photo 1)</p>  <p style="text-align: center;">Photo 1 TRITON SWAN</p>
<p>Information on the cargo hold and others</p>	<p>(1) The TRITON SWAN (hereinafter referred to as “the vessel”) had five cargo holds numbered 1 to 5 arranged in order from the bow. The approximate dimensions of the No. 3 cargo hold were 32.0m in length, 32.2m in width and 16.8m in depth.</p> <p>(2) The No. 3 cargo hold had a hatch that could be opened and closed for the purpose of loading and unloading cargoes, as well as one access hatch*¹ on the port bow side and one on the starboard stern side.</p> <p>(3) The ‘access hatch’ on the starboard stern side of the No. 3 cargo hold (hereinafter referred to as “this hatch”) had a structure whereby crew members could go down to the bottom of the hold by means of a vertical ladder and spiral staircase.</p> <p>(4) Normally, after cargoes had been loaded at the loading site and the access hatch had been closed, the hatch would be sealed by crew members using security plastic tags, and would then be unsealed by crew members at the unloading site.</p> <p>(See Photos 2 to 6)</p>

*¹ “Access hatch” refers to a hatch installed to access the inside of the cargo hold on a general cargo ship, bulk carrier or other vessel. A ladder or similar is also installed as a means of accessing the hold.



Photo 2 This hatch



Photo 3 Vertical ladder



Photo 4 Spiral staircase



Photo 5 No.4 cargo hold when empty



Photo 6 Security tag

Crew Information

Master A (Nationality: Republic of India), male, 37 years old
 Endorsement attesting the recognition of certificate under STCW regulation I/10 Master (issued by the Republic of Panama)
 Date of issue: October 10, 2012 (valid until December 31, 2016)
 Grain inspector (hereinafter referred to as “this inspector”), male, 52 years old
 Joined the Japan Grain Inspection Association (hereinafter referred to as “Association A”) in April 1982 and worked as a grain inspector. Since April 2010, had been office manager of the Kansai Kobe Branch, giving guidance on the hazardous nature of oxygen deficiency in cargo holds loaded with grains or similar cargoes, through daily operations, to grain inspectors employed by the office to which he was affiliated.
 At that time of this accident, he appeared to be in good health.
 Cargo handling manager, male, 26 years old
 Joined the cargo handling company (hereinafter referred to as “Company B”) in April 2013, obtained a certificate of completion of a

	<p>skill training course for oxygen deficiency and hydrogen sulfide hazardous operations chiefs*² on October 24, 2014, and had served as a cargo handling manager since November 2014.</p> <p>At that time of this accident, he was in good health.</p>
Injuries to Persons	Fatality One person (this inspector)
Damage to Vessel (or Other Facilities)	None
Weather and Sea Conditions	<p>Weather: Weather – clear; Wind direction – ESE, Wind force - about 2.7 m/s, Temperature: about 19.6°C</p> <p>Sea conditions: Sea – calm</p>
Events Leading to the Accident	<p>(1) Movements of the vessel</p> <p>After loading about 51,394 tons of maize at Gramercy Port in the USA on September 3, 2015 (local time), the vessel, with the master and 21 other crew members (all nationals of the Republic of India) on board, called at Hachinohe Port in Hachinohe, Aomori Prefecture, on October 7 (Japan time, UTC+9 hours; same applies below) and Kinuura Port in Aichi Prefecture on October 13, respectively, where it unloaded the whole of the No.1 cargo hold, the No.2 cargo hold and the No.5 cargo hold and most of the No.4 cargo hold, respectively, then headed for the grain wharf in Kobe Section 2 of Hanshin Port (hereinafter referred to as “this wharf”), where the whole content of the No. 3 cargo hold totaling about 5,572 tons and the remainder of the No.4 cargo hold content totaling about 218 tons were to be unloaded.</p> <p>(2) Movements of this inspector</p> <p>Two other grain inspectors (hereinafter referred to as “Inspector A” and “Inspector B”) were also engaged in inspection work*³ with regard to cargoes off the vessel. After this inspection work, this inspector informed Inspector A at around 07:30 on October 19, in the office to which he was affiliated, that he would head for this wharf in time for the docking of the vessel, this inspector headed for this wharf, in a separate works vehicle from Inspector A and Inspector B, because he had other work to do in the afternoon.</p> <p>(3) Course of events leading to the accident</p> <p>At around 07:55, Inspector A and Inspector B both arrived at this</p>

*² “Skill training course for oxygen deficiency and hydrogen sulfide hazardous operations chiefs” is a skill training course in which managers are trained to make correct decisions on working methods and to inspect ventilation equipment when operators work in locations where there is a risk of succumbing to oxygen deficiency or hydrogen sulfide poisoning, such as in enclosed tunnels or sewer construction, based on the provisions of Article 14 of the Industrial Safety and Health Act (Law No. 57 of 1972). The Act stipulates that operations chiefs are to be appointed by businesses engaged in work where there is a risk of anoxia.

*³ “Inspection work” refers to the processes of gauging grain temperature and confirming quality when unloading imported feed grain, grain for food products and others, as well as certifying the weight of the grain.

wharf and headed for the silo building at the side of this wharf, where Inspector A made preparations for inspection and other work at the waiting area on the 3rd floor and Inspector B on the 5th floor, respectively.

At around 08:24 on October 19, the vessel berthed to the starboard side at this wharf.

At around 08:30, Inspector B witnessed this inspector leaving the waiting area while making a gesture to Inspector B to indicate that he would take the rod-shaped grain thermometer probe.

At around 08:30, the cargo handling manager boarded the vessel together with more than ten cargo handlers by crossing a gangplank that had been put out to the vessel.

On the vessel, after the hatches of the No. 3 and No.4 cargo holds had been opened under instruction from the chief officer, the cargo handling equipment was set in the No. 3 cargo hold by the cargo handlers, and at around 08:35 unloading from the No. 3 cargo hold was started.

At around 08:35 to 08:40, the cargo handling manager measured the oxygen concentration inside the No.4 cargo hold and access hatch, confirmed that the oxygen concentration was about 21%, and hung up a tag saying "Inspected OK", but was then called by the chief officer and went to the office of the vessel for a discussion concerning the cargo handling work.

At around 08:40, a representative from the Company B Kobe Branch witnessed this inspector going to the vessel alone by ascending the stairs attached to the terrestrial cargo handling equipment that was put across to the vessel.

At around 08:50 to 08:55, while one of the cargo handlers was engaged in remote control of the cargo handling equipment near the port side center of the hatch of the No. 3 cargo hold, he noticed this inspector lying prone on top of the maize at the bottom of the starboard stern side spiral staircase of the No. 3 cargo hold. (See Photo 7)

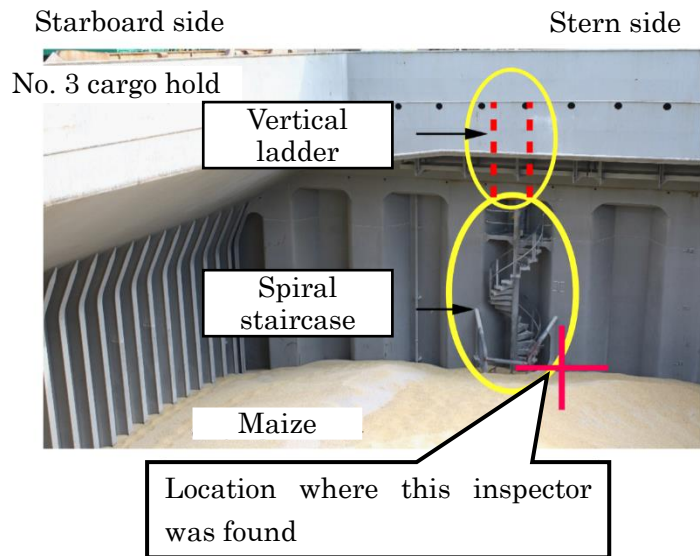


Photo 7 Situation of the No. 3 cargo hold at that time of this accident

At around 09:00, the representative from the Company B Kobe Branch made a 119 call to the fire department to report the occurrence of this accident.

At around 09:00, the cargo handling manager measured the oxygen concentration near the bottom of the vertical ladder of this hatch and confirmed that it was about 11–12%.

At around 09:05, the deputy second officer was informed of the occurrence of this accident and confirmed the accident site from the deck, then reported to the master via the chief officer, and the master instructed the crew members via on-board broadcast to go to their respective rescue positions.

At around 09:14, the chief officer measured the oxygen concentration in the No. 3 cargo hold and confirmed that it was about 20.8%, then assigned two able seamen to undertake the rescue operation.

Each of the two able seaman put on self-contained breathing apparatus and entered the No. 3 cargo hold from this hatch while holding an ‘Emergency Escape Breathing Device’*4 (EEBD), then fitted the EE BD on this inspector and performed cardiac massage.

Although life-saving treatment was performed by the fire department rescue team once it had arrived, at around 10:22 the doctor confirmed that this inspector was dead, and on the following

*4 The “Emergency Escape Breathing Device” (EEBD) is a breathing device that combines a face piece with a container supplying compressed oxygen or air in order to avoid inhaling poisonous gases.

	<p>day, the cause of death was certified as asphyxiation due to oxygen deficiency (tentative) and the time of death as 08:50 (tentative). (See Fig. 1 Sketch map of the accident location, Fig. 2 Sketch of the accident situation)</p>
<p>Other Matters</p>	<p>(1) The No. 3 cargo hold had been locked and this hatch had been sealed using a security tag from the time when the vessel left port in the USA until it docked at this wharf and the hatch was opened.</p> <p>(2) Upon request from the cargo owner, Association A was planning to have this inspector, Inspector A and Inspector B inspect the maize loaded on the vessel from the morning of October 19.</p> <p>(3) Although inspection work is normally carried out after staff of the Ministry of Agriculture, Forestry and Fisheries have undertaken plant quarantine, Association A sometimes carried out quality checks to confirm that there was no damage or other defect in the grain before plant quarantine, as part of this inspection work.</p> <p>(4) When its employees were to enter hazardous locations where there was a risk of oxygen deficiency when carrying out inspection work such as gauging grain temperature or sampling, Association A required them to enter only after asking the cargo handling manager for the result of oxygen concentration measurement and confirming safety, irrespective of whether before or after plant quarantine had been carried out.</p> <p>(5) Caution notices announcing “AUTHORISED ENTRY ONLY” (in English, red letters on a yellow background)” and “LACK OF O₂ (in English, black letters)” were permanently displayed on the top of the access hatch of the vessel.</p> <p>(6) If, after opening the access hatch and measuring the oxygen concentration in the cargo hold, it was judged safe to enter the hold, the cargo handling manager would display a sign marked “検査済み OK” (“Inspected OK”) in Japanese, and if the oxygen concentration was low, the sign would read “酸欠” (“Oxygen low”). (See Photos 8 and 9)</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p style="text-align: center;">Photo 8 Caution notice on the top Photo 9 Sign permitting hold entry</p>

- (7) After this accident, the cargo handling manager acknowledged that this hatch had been opened. Moreover, crew members discovered that the security tag had been cut and had fallen on the deck beside this hatch.
- (8) The chief officer had not instructed crew members to unseal the security tag of this hatch, because entry into the No. 3 cargo hold was not yet scheduled at that time of this accident.
- (9) Places with an oxygen deficiency hazard are designated as follows in the Order for Enforcement of Industrial Safety and Health Act (related to Articles 6 and 21).

Appended Table 6

(vii) Inside a silo, cellar, warehouse, hold or pit used for storing grains or livestock feed, ripening of fruits and vegetables, germinating seeds or growing mushrooms and the like

- (10) Provisions regarding operations chiefs, work that requires the appointment of operations chiefs, and work sites that require measurement of the working environment are specified as follows in the Industrial Safety and Health Act and relevant regulations.

(Operations Chief)

Article 14 For operation designated by Cabinet Order as those which require prevention control of industrial accident, such as operations within high pressure rooms, the employer shall, as provided for by the Ordinance of the Ministry of Health, Labour and Welfare, appoint an Operations Chief in accordance with the classification of work, from among those licensed by the Prefectural Labor Bureau, or those who have finished the skill training course conducted by one registered by the Prefectural Labor Bureau, and have the said person direct the employees engaged in the said work and handle other matters provided for by the Ordinance of the Ministry of Health, Labour and Welfare.

(Work Subject to Appoint an Operations Chief)

Article 6 The operations designated by the Cabinet Order set forth in Article 14 of the Act shall be as follows:

(xxi) Operations carried out at places with an oxygen deficiency hazard, as listed in Appended Table 6:

(Workshops Which Should Conduct Working Environment Assessments)

Article 21 The workshops prescribed by the Cabinet Order set forth in paragraph (1) of Article 65 of the Act shall be as follows:

(ix) Workshops where work is carried out in places with an oxygen deficiency hazard, as listed in Appended Table 6:

- (11) Association A had not previously suffered a fatal accident involving a grain inspector as a result of oxygen deficiency.
- (12) Association A had guided employees on the hazards arising during inspection work when first hired and through daily operations.
- (13) When this inspector was discovered in the No. 3 cargo hold, he was wearing top and bottom work clothes, helmet, safety shoes and gloves, and was carrying a grain thermometer probe.
- (14) Grain inspectors of the office to which this inspector belonged had hardly any experience of the oxygen concentration in a hold loaded with maize falling below the safety threshold (about 18%).

(Reference) Information on oxygen concentrations and effects on the human body

Oxygen concentration	Symptoms and others
21%	Normal oxygen concentration in air
18%	Safety threshold, requires continuous ventilation
16%	Headaches, nausea
12%	Dizziness, muscle weakness
8%	Loss of consciousness, death in 7 to 8 minutes
6%	Instant syncope, respiratory arrest, death

* Source: Ministry of Health, Labour and Welfare leaflet (“Let’s stop anoxia and hydrogen sulfide poisoning!”)
<http://www.mhlw.go.jp/new-info/kobetu/roudou/gyousei/anzen/040325-3.html>

Analysis

Involvement of crew members
 Involvement of vessel, engine, etc.
 Involvement of weather and sea conditions
 Analysis of the findings

Applicable

Not Applicable

Not Applicable

(1) Situation of fatality and injury

It is probable that this inspector died of asphyxiation as a result of oxygen deficiency (tentative).

(2) Course of events leading to the accident

1) It is probable that the vessel left port in the USA on September 3 (local time), berthed to starboard at this wharf with the No. 3 cargo hold carrying about 5,572 tons and the No.4 cargo hold about 218 tons of maize, and that at around 08:30 on October 19, the hatch

cover of the No. 3 cargo hold was opened for the first time after remaining closed for about 1.5 months after loading, and moreover that the hatch cover of the No.4 cargo hold was also opened at that time.

- 2) It is probable that the cargo handling manager and cargo handlers boarded the vessel and started preparing for cargo handling work at around 08:30, then started unloading from the No. 3 cargo hold at around 08:35.
- 3) It is probable that the cargo handling manager checked the oxygen concentration in the No.4 cargo hold and hung the “Inspected OK” tag on the access hatch of the cargo hold to indicate that the hold could be entered, but did not measure the oxygen concentration in the No. 3 cargo hold, because he was called by the chief officer and went to the vessel office for a discussion concerning the cargo handling work.
- 4) It is probable that the No. 3 cargo hold had fallen into a state of oxygen deficiency, because it had remained closed for about 1.5 months after the vessel was loaded with maize.
- 5) It is probable that this inspector was witnessed going to the vessel by ascending the stairs attached the terrestrial cargo handling equipment at around 08:40, and was discovered lying prone on top of the maize at the bottom of the stern side spiral staircase of the No. 3 cargo hold at around 08:50 to 08:55.

(3) Date and time of the accident

Considering from (2) 5) above and the fact that the time of death was certified as 08:50 (tentative), it is considered probable that the accident occurred at around 08:50 on October 19, 2015.

(4) Situation in which this inspector entered the No. 3 cargo hold

Considering from (2) 3) above, the fact that the security tag of this hatch had been cut, and the fact that the oxygen concentration at the bottom of the vertical ladder of this hatch was about 11-12% when the cargo handling manager measured it at around 09:00, it is probable that this inspector entered the No. 3 cargo hold before the oxygen concentration had been confirmed, but it has not been possible to clarify the circumstances of this.

(5) Safety management by Association A

- 1) It is probable that Association A gave guidance to its grain inspectors, through its daily operations, on the hazards arising from inspection work.
- 2) It is probable that the grain inspectors of Association A, when

	<p>entering a cargo hold, would only enter after confirming safety by asking the cargo handling manager for the result of oxygen concentration measurement.</p> <p>3) It is probable, considering from 1) and 2) above, that Association A, in its grain inspection, did not anticipate the eventuality that they would enter a hazardous location where there was a risk of oxygen deficiency before asking the cargo handling manager for the result of oxygen concentration measurement.</p> <p>4) It is somewhat likely that the fact that Association A had not drawn up a procedure for entering hazardous locations where there was a risk of oxygen deficiency when undertaking inspection work contributed to the fact that this inspector entered the No. 3 cargo hold.</p>
<p>Probable Causes</p>	<p>It is probable that this accident occurred because, while the vessel was undergoing cargo handling work at this wharf, this inspector entered the No. 3 cargo hold before the oxygen concentration had been confirmed, causing him to inhale oxygen deficient air.</p> <p>It is somewhat likely that the fact that Association A had not drawn up a procedure for entering hazardous locations where there was a risk of oxygen deficiency contributed to the fact that this inspector entered the No. 3 cargo hold before the oxygen concentration had been confirmed, although it could not be made clear from the fact that this inspector died as a result of this accident.</p> <p>It is probable that the No. 3 cargo hold had fallen into a state of oxygen deficiency because it had remained closed for about 1.5 months after the vessel was loaded with maize.</p>
<p>Safety Actions</p>	<p>The following measures are possible to prevent recurrence of similar accidents:</p> <p>(1) After this accident, Association A studied safety actions and took the following measures.</p> <p>1) Association A produced a draft “Basic Manual on Preventing Anoxia” (hereinafter referred to as “Manual”) and distributed it to the various branches, each branch then produced the Manual to suit its own local circumstances, and after reporting to the headquarters, immediately put it into practice.</p> <p>2) The Kansai Kobe Branch of Association A, in its Manual, specified the following procedure for cases when inspectors need to enter cargo holds and other hazardous locations where there is a risk of oxygen deficiency in order to confirm quality, such as when a hold has remained closed after being loaded with grain.</p> <p>a Check with the cargo handling manager whether the oxygen concentration has been measured, the result of the oxygen</p>

	<p>concentration measurement, and whether or not entry is possible.</p> <ul style="list-style-type: none">b Notify the cargo handling manager or other operators of the intention to enter.c Carry an oxygen concentration detector.d Prepare oxygen respirators. <ul style="list-style-type: none">3) Each branch of Association A familiarized all of its employees with the content of the Manual.4) Association A decided to have its office managers and employees who were engaged in port and harbor duties attend a skill training course for oxygen deficiency hazardous operations chiefs, appoint operations chiefs from amongst them, and have these continuously give guidance on oxygen deficiency to the employees under their authority.5) Association A decided to have the managers of its branches report to headquarters on the status of guidance on preventing oxygen deficiency accidents in each branch, and to instruct improvements if problems arose.6) Association A conducted a revision of the provisions related to health and safety. <p>(2) The following measures are possible to prevent recurrence of similar accidents:</p> <ul style="list-style-type: none">1) Association A should familiarize grain inspectors with the content of the Manual and rigorously enforce their compliance with it.2) The procedure mentioned above and a system of planned and sustainable guidance designed to prevent oxygen deficiency accidents should be created for grain inspectors, and steps should be taken to improve the awareness of grain inspectors.
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Fig. 1 Sketch map of the accident location

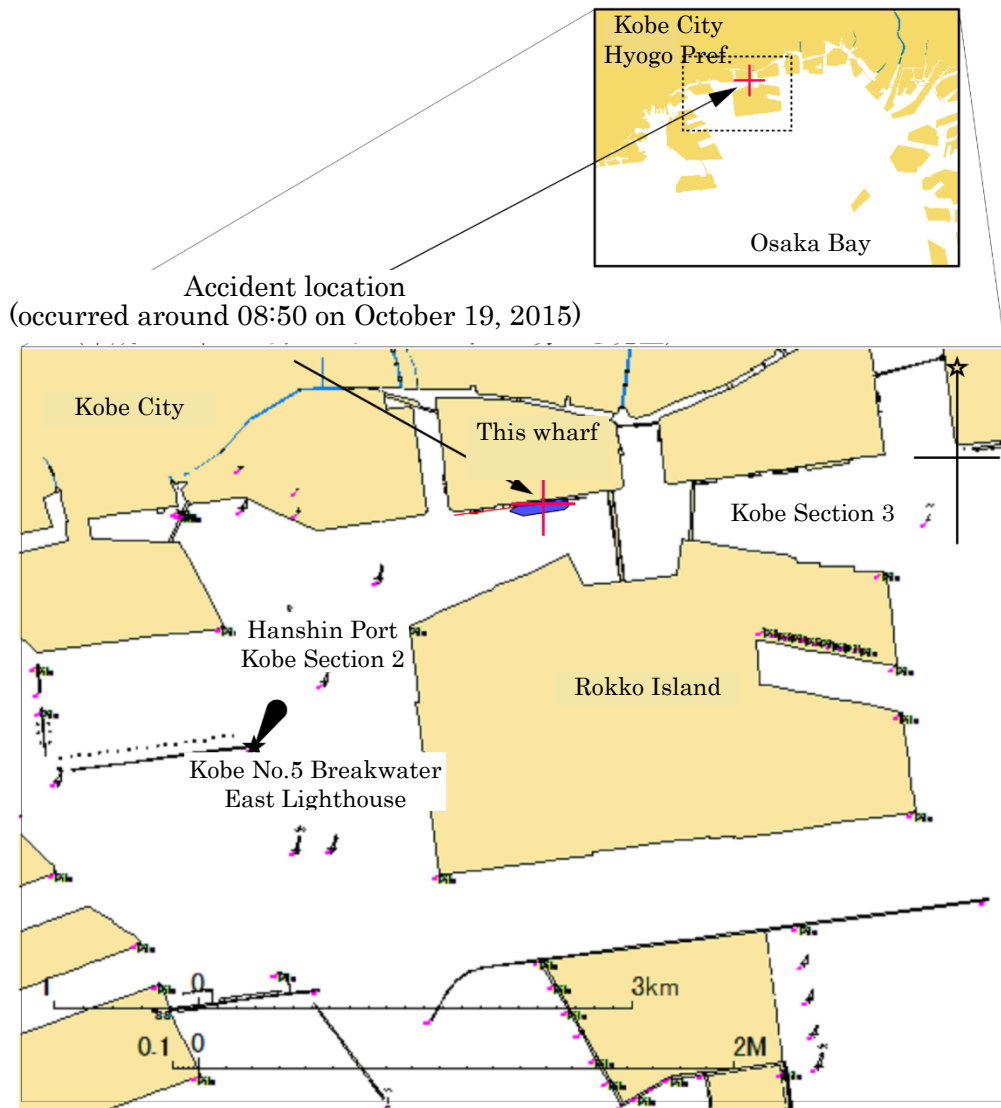


Fig. 2 Sketch of the accident situation

