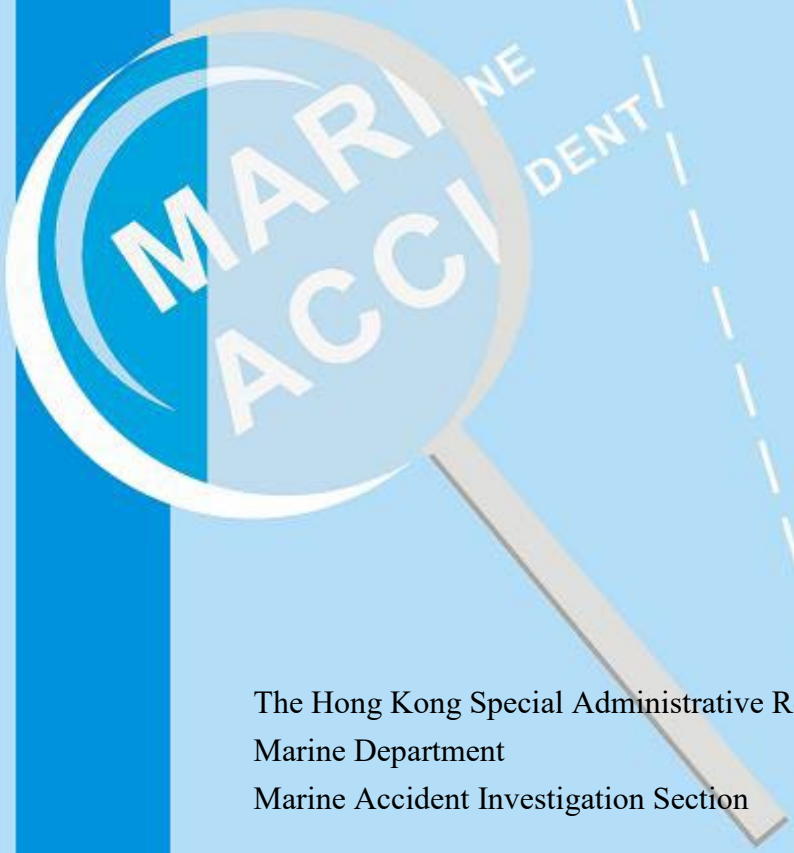
Report of investigation into the fatal accident on board the Hong Kong registered bulk carrier "*Wei He*" at Karachi, Pakistan on 9 May 2022



The Hong Kong Special Administrative Region
Marine Department
Marine Accident Investigation Section

13 December 2022

Purpose of Investigation

The purpose of this investigation, conducted by the Marine Accident Investigation Branch (MAIB) of Marine Department, is to determine the circumstances and the causes of the incident with the aim of enhancing the safety of life at sea and avoiding similar incidents in future.

It is not intended to apportion blame or liability towards any particular organization or individual except so far as necessary to achieve the said purpose.

The MAIB has no involvement in any prosecution or disciplinary action that may be taken by the Marine Department resulting from this incident.

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Summary

On 27 March 2022, the Hong Kong registered bulk carrier "Wei He" (*the vessel*) completed the cargo loading of Brazilian soya beans in bulk (*the cargo*) at Paranagua, Brazil (*the loading port*). Afterwards, a local fumigation company carried out the fumigation [1] of *the cargo* with Aluminum Phosphide (*the fumigant*). On 28 March 2022, *the vessel* departed *the loading port* for Karachi, Pakistan (*the discharging port*) and the fumigation of *the cargo* continued during the voyage.

The vessel arrived at *the discharging port* at 1212 hours on 29 April 2022. The fumigation of *the cargo* and the following ventilation of all cargo holds were carried out on board *the vessel* as required by the port authority of *the discharging port*. At 1902 hours on 9 May 2022, two stevedores were reported missing in the No.2 cargo hold (*the hold*). The search and rescue operation was carried out by the stevedore rescue team, the police, and the shore first aid team. Two stevedores were rescued from the Australia ladder[2] space (*the ladder space*) in the early morning of 10 May 2022. At 0433 hours, the first aid team evacuated the two stevedores ashore for medical treatment. Unfortunately, they were confirmed dead later.

The investigation revealed that the main contributory factors leading to the accident were: (a) the crew failed to follow the requirements of the "Code of Safe Working Practices for Merchant Seafarers" (*the Code*[3]) relevant to the dangerous space entry; (b) the crew failed to follow the requirements of the shipboard safety management system (SMS) on entering the cargo hold loaded with the fumigated cargo; (c) the crew failed to control or monitor the access to *the vessel* according to International Ship and Port Security (ISPS) Code[4]; and (d) the shipboard SMS failed to cover the safety procedures of the fumigation of the grain cargo in port and in transit. Paragraph 5.3 of this report contains the details of the contributory factors.

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[1] Fumigation is the introduction of poison into space to suffocate any insects or pests within.

[2] The Australia ladder is a spiral ladder with intermediate platforms between the tank top and the deck.

[3] The Code is a publication required to be carried onboard Hong Kong ships pursuant to the Merchant Shipping (Seafarers) (Code of Safe Working Practices) Regulation (Cap. 478M).

[4] ISPS Code means the International Ship and Port Facility Security Code adopted by the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea, 1974 on 12 December 2002 to enhance security of ships and port facilities.

1. Description of the vessel

Ship name	:	*Wei He* (Figure 1)
Flag	:	Hong Kong, China
Port of registry	:	Hong Kong
IMO number	:	9601091
Type	:	Bulk Carrier
Year built, shipyard	:	2012, Zhoushan Jinhaiwan Shipyard
Gross tonnage	:	43,550
Net tonnage	:	27,579
Length overall	:	229 meters
Breadth	:	32.26 meters
Depth	:	20.25 meters
Engine power, type	:	11900 kW, MAN B&W 5S60 MC-C
Classification society	:	Nippon Kaiji Kyokai
Registered owner	:	Fastlink Shipping Limited
Management company	:	Wei Fong Shipping Co., Ltd.

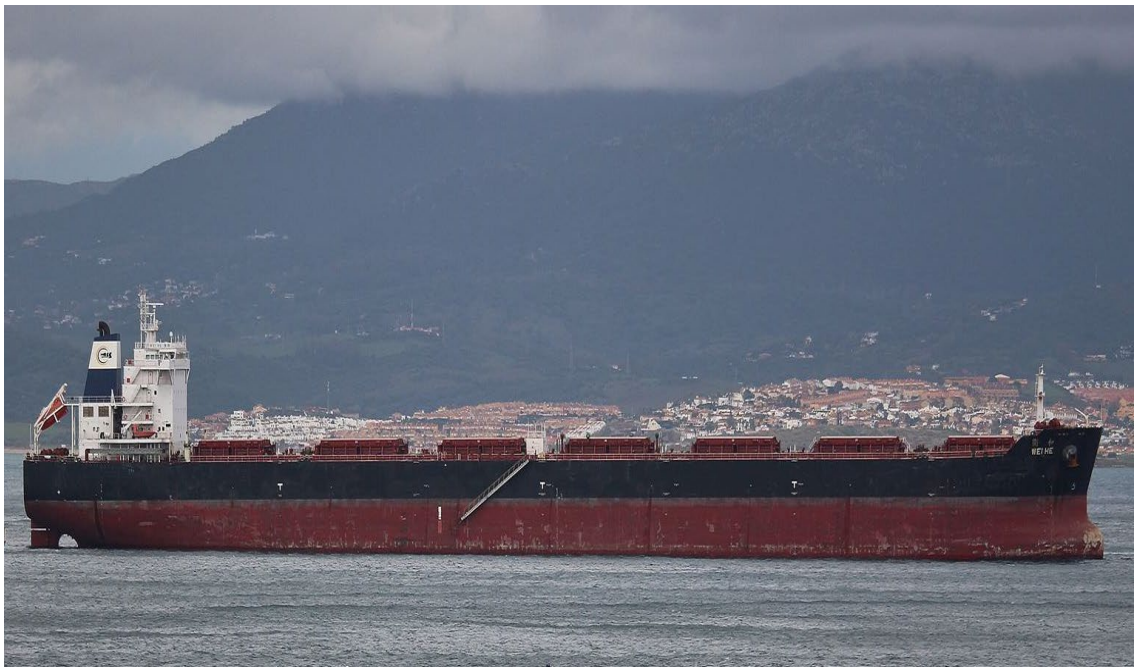

Figure 1: *Wei He*

2. Sources of evidence

2.1 Information provided by the Master, the crew and the management company (*the Company*) of *the vessel*.

3. Outline of events

(All times were local time UTC + 5 hours)

3.1 On 27 March 2022, a local fumigation company carried out the fumigation of *the cargo* on board *the vessel* after completing the cargo loading at *the loading port*.

3.2 On 28 March 2022, *the vessel* departed *the loading port* to *the discharging port* via Port Elizabeth, South Africa with the fumigation continued onboard during the voyage. *The vessel* arrived at *the discharging port* at 1212 hours on 29 April 2022.

3.3 Before discharging *the cargo*, the Chief Officer (C/O) and a shore foreman completed the "Ship/Shore Safety Checklist", including confirming the atmosphere which would be safe for access in the holds and enclosed spaces, the identification of the fumigated cargo, the agreement to have the need for monitoring of atmosphere.

3.4 From 0000 to 0300 hours on 30 April 2022, the shore fumigation team of *the discharge port* prepared for cargo fumigation as required by the authority of the Karachi port. The fumigation commenced from 0300 hours on 30 April 2022 and lasted for 24 hours.

3.5 At *the discharge port*, the visitors to *the vessel* were registered at the gangway access point except the stevedores. The stevedores were only managed by two local watchmen who were on duty onboard every 8 hours.

3.6 On the daytime of 1 May 2022, all cargo holds' hatch covers of *the vessel* were opened for ventilation, and the covers of all cargo hold entrances were kept closed, locked by handles. The unloading facilities were installed by stevedores on the starboard side main deck (Figure 2).

3.7 At 2030 hours on 1 May 2022, *the vessel* commenced discharging *the cargo* from the No.1 and No.3 holds. A stevedore was assigned to stay inside the cargo holds to assist the cargo operation by using a hoe (Figure 3) in the cargo holds near the suction pipe of the

unloading facilities.

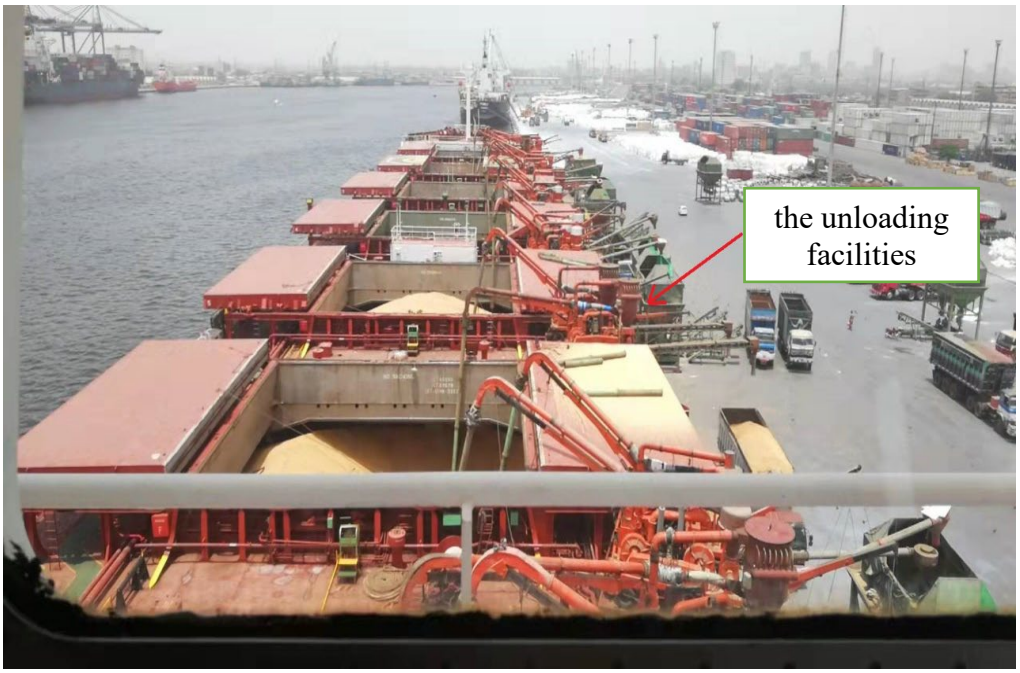

Figure 2: the unloading facilities

Figure 3: A hoe used by the stevedore

3.8 At 1900 hours on 6 May 2022, *the vessel* commenced discharging *the cargo* from the No. 2 cargo hold *(the hold)*.

3.9 At 1800 hours on 9 May 2022, the stevedores suspended the cargo discharging to take an hour's break. At 1902 hours, a foreman reported to the watchmen that 2 stevedores were missing in *the hold*.

The duty Third Officer (3/O) immediately reported the incident to the C/O and the Master.

3.10 At 1905 hours, the foreman arrived at the aft hold entrance of *the hold* with the 3/O. He reported to the 3/O that the two stevedores were missing in *the ladder space* of *the hold*.

3.11 At 1915 hours, the stevedore rescue team wearing SCBA sets entered *the ladder space* of *the hold* with the assistance of the crew *of the vessel* to search for the missing stevedores (Figure 4).

Figure 4: the Australia ladder with the protective casing of *the hold*

3.12 At 1920 hours, the stevedore rescue team came out of *the ladder space* and reported that the two stevedores were found unconscious inside *the ladder space*.

3.13 At 1922 hours, the foreman reported the accident to the police and the rescue center for assistance. Afterwards, the police and the shore first aid team arrived at the accident scene.

3.14 Due to the spiral construction of the ladder which was located in a narrow space, and the problem in verbal communication between the crew and shore rescue team as they spoke different languages, the rescue of the two stevedores was tough. The two unconscious stevedores were finally rescued to the main deck of *the vessel* from *the ladder space* at 0005 hours and 0033 hours on 10 May 2022 respectively.

3.15 At 0433 hours, the first aid team evacuated the two stevedores to shore. Unfortunately, they were confirmed dead later.

4. Analysis

Certificates and manning

4.1 The statutory certificates of *the vessel* were valid and in order. *The vessel* was manned by 21 crew members, including the Master. The Minimum Safe Manning Certificate of *the vessel* was issued by the Hong Kong Marine Department (HKMD) on 26 January 2017, and the manning of *the vessel* fulfilled the requirements.

4.2 The Master joined *the vessel* on 13 October 2021. He had 7 months of experience as a master. The Master possessed a Master Certificate of Competency issued by China, and a Class 1 License (Deck Officer) issued by the HKMD valid until 28 March 2023.

4.3 The C/O joined *the vessel* on 13 October 2021. He had 7 months of experience as a chief officer. The C/O possessed a chief officer Certificate of Competency issued by China, and a Class 2 License (Deck Officer) issued by the HKMD valid until 9 December 2024.

4.4 The 3/O joined *the vessel* on 17 December 2021. He had about 8 months of experience as a third officer. The 3/O possessed a third officer Certificate of Competency issued by China, and a Class 3 License (Deck Officer) issued by the HKMD valid until 24 November 2026.

4.5 The C/E joined *the vessel* on 13 October 2021. He had about 16 years of experience as a chief engineer. He possessed a Chief Engineer Certificate of Competency issued by China, and a Class 1 License (Marine Engineer Officer) issued by the HKMD valid until 13 January 2026.

4.6 The 2/E joined *the vessel* on 17 December 2021. He had about 6 months of experience as a second engineer. He possessed a Second Engineer Certificate of Competency issued by China, and a Class 2 License (Marine Engineer Officer) issued by the HKMD valid until 29 July 2026.

4.7 There was no abnormality with regard to the certification and qualification of the crew concerned.

Fatigue, alcohol and drugs abuse

4.8 There was no evidence to show that the crew on board suffered from either fatigue at work or abuse of alcohol and drugs.

Weather and sea conditions

4.9 On the day of the accident, the weather was cloudy with southwesterly wind of Beaufort wind scale Force 3. The sea was having large wavelets with scattered whitecaps, and the visibility was good. The weather and the sea conditions were not considered to be the contributory factors to the accident.

Enclosed space entry

4.10 *The vessel* had seven cargo holds and each hold had two fixed access ladders which were the vertical and the Australia ladders at the forward and aft respectively. The Australia ladder was covered vertically by a protective casing except for the lower part from the tank top of *the hold* with 3.055 meters in length (Figures 4, 5 and 6 refer).

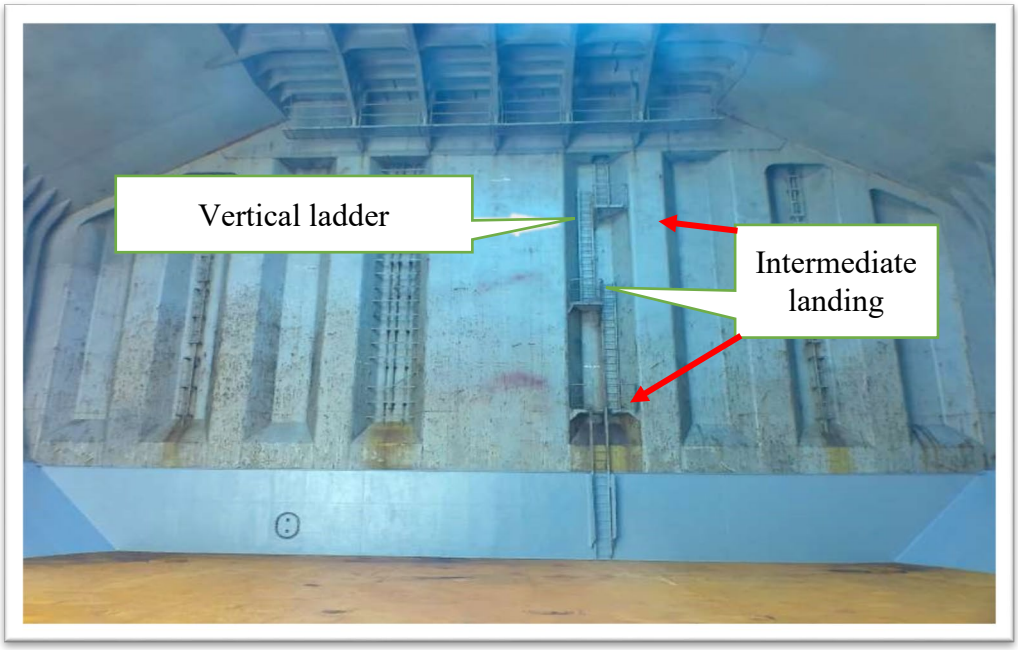

Figure 5: the forward vertical ladder of *the hold*

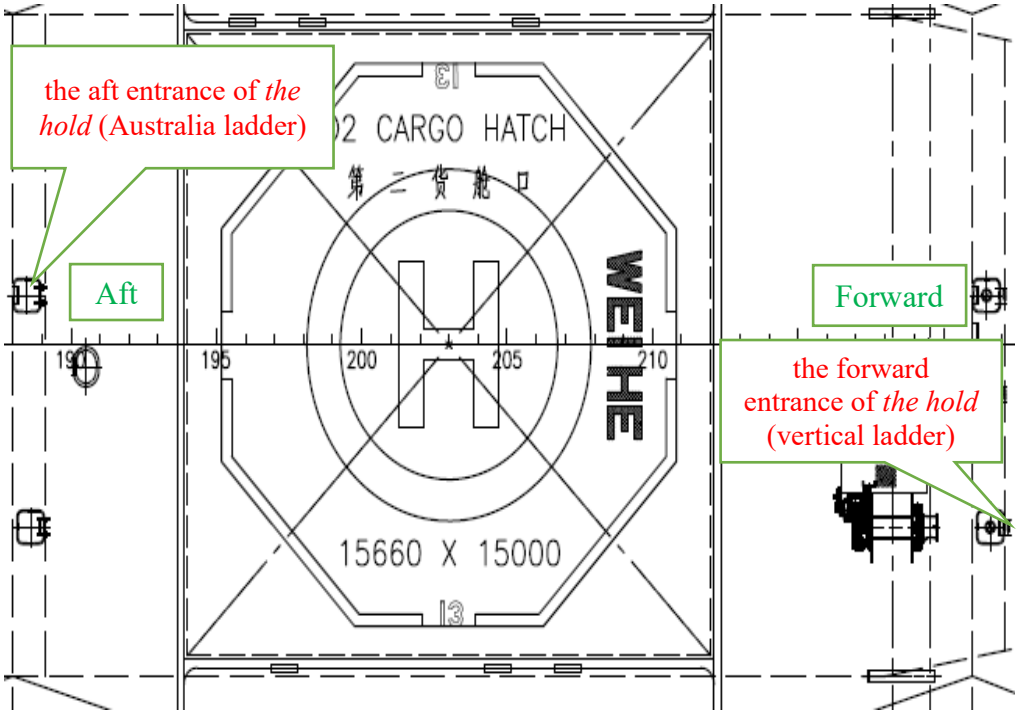

Figure 6: the forward and aft entrances of *the hold*

Figure 7: *the* condition of *the hold* at the time of the accident

Figure 8: the cover of the aft hold entrance of *the hold*

4.11 At the time of the accident, the lower exposed part of the Australia ladder of *the hold* was submerged by *the cargo* (Figure 7). With the cover of its aft hold entrance kept close (Figure 8), *the ladder space* became an enclosed space. The enclosed *ladder space* was possibly lack of oxygen due to the oxygen depleting nature of the grain and having residue poisonous gases from the post-fumigation.

4.12 Chapter 15.1.8 of *the Code* states that any hatches to readily accessible enclosed spaces should be locked or secured against entry and marked as an entrance to a dangerous space.

4.13 According to paragraph 3.9, the cargo discharge operation onboard was resumed at 1900 hours on the accident day, and the foremen reported to the watchmen that two stevedores were missing in *the hold at* 1902 hours. It could be deduced that the two stevedores might enter *the ladder space* when the foreman was on-site.

4.14 The investigation found that if the cover of the aft hold entrance to *the ladder space* had been locked, secured or marked properly, the foreman and the two stevedores might realize that it was not permitted to enter *the hold* through the aft hold entrance. As such, the crew failed to follow the requirements of *the Code* to mark the entrance to *the ladder space* as a dangerous space and locked or secured against entry accordingly, which was considered as one of

the contributory factors to the accident.

Toolbox meeting

4.15 Paragraph 4.2 of the "Stipulations of the Shipboard Safety Meeting" (Section WF-CA 05) of the shipboard SMS manual stated that a toolbox meeting should be held before starting work. The toolbox meeting should include issuing a permit to work, the work arrangement, safety precautions, protective measures, etc.

4.16 According to the information provided by *the Company*, there was no evidence to show that a toolbox meeting was held on board *the vessel* before discharging *the cargo* on the day of the accident. That said, shipboard SMS was not followed.

Shipboard Safety Management System

4.17 Paragraph 12.5 of "the safety instructions for entry into enclosed spaces" (Section WF-CA 39) (*the instruction*) of the shipboard SMS manual stated that the fumigation of *the cargo* onboard should follow the requirements of the MSC. 1/Circ. 1358[5] (*Circular 1358*). Paragraph 6.3.2 of the Annex-"Revised Recommendations on the Safe Use of Pesticides in Ships" of the *Circular 1358* stated that aeration of the treated spaces onboard should be completed and a gas-free certificate should be obtained before personnel is permitted to enter.

4.18 According to the information provided by *the Company,* the fumigation was carried out on board *the vessel* on 30 April 2022 at *the discharging port* and lasted for 24 hours before discharging *the cargo.* However, the crew did not follow the requirements of the shipboard SMS to obtain a gas-free certificate before entering *the hold* on the day of the accident.

4.19 Chapter 21.7.2 of *the Code* states that if pesticides are used in the cargo spaces of ships, safety procedures should be in accordance with the IMO MSC.1/Circ.1264[6] (*Circular 1264*) and a copy of

[5] MSC. 1/Circ. 1358 of the "Recommendations on the Safe Use of Pesticides in Ships" was adopted on 30 June 2010 by the Maritime Safety Committee (MSC) of the IMO.

[6] MSC. 1/Circ.1264 of the "Recommendations on the Safe Use of Pesticides in Ships Applicable to the Fumigation of Cargo Holds" was adopted by the MSC on 27 May 2008.

which should be retained on board and kept accessible for all crew members.

4.20 According to paragraph 3.3.2.13 of *Circular 1264*, gas concentration safety checks at all appropriate locations, such as accommodation, engine room, areas designated for use in navigation of the ship, frequently visited working areas, and store, should be continued throughout the voyage at least at eight-hour intervals. These readings should be recorded in the log book of the vessel. The investigation revealed that the crew of *the vessel* did not follow the requirement of *Circular 1264* to carry out the gas check in the above-mentioned areas throughout the voyage.

4.21 Indeed, paragraph 4.7.3 of the "Cargo handling" (i.e., Section WF-CA 64) of the shipboard SMS manual elaborated the procedures of grain cargo handling. However, it did not cover the requirements of *Circular 1264* for the fumigation of the grain cargo, such as the procedures of fumigation continued in transit, aeration of treated cargo holds in port and relevant safety precautions, etc.

Risk assessment

4.22 Paragraph 12 of *the instruction* (i.e., Section WF-CA 39) stated that cargo fumigation was identified as a risk. According to the requirements of paragraph 6 of *the instruction*, a risk assessment should be carried out before related work and the risk assessment should follow the "Risk identified, Assessment and Control procedure" (Section WF-BA17) (*the risk assessment procedure*) of the shipboard SMS manual to cover the risk of the related work, including taking account of safety precautions, preventive measures, etc.

4.23 The crew of *the vessel* did not follow the requirements of *the instruction* and *the risk assessment procedure* to carry out the risk assessment before discharging the fumigated cargo at *the discharging port*, including identifying the risk of entering *the ladder space*, testing its atmosphere, taking account of safety precautions and preventive measures.

Supervision of the stevedores

4.24 Chapter 10 of the shipboard Ship Security Plan (SSP) stated that the duty crew of *the vessel* are responsible for monitoring the ship visitors, including checking ID card, boarding pass, work order, etc.

4.25 Two appointed watchmen managed the stevedores, but the duty crew and the ship security officer failed to monitor the movement of stevedores during the cargo operation.

4.26 In case *the vessel* had taken sufficient measures to monitor the cargo hold entry through the access hatch, the two stevedores' unauthorized entry to the *ladder space* could have been avoided.

Search and Rescue onboard

4.27 Paragraph 8.7.1 of the "Emergency Response Plan", i.e. Section WF-DA 01, of the shipboard SMS manual stated that the shipboard rescue team should use the safety equipment, such as compressed air breathing apparatus, resuscitator, etc., to enter an enclosed space when a rescue is to be carried out.

4.28 According to the statement of the 3/O, the rescue of the two stevedores was carried out from 1910 hours and lasted to 0033 hours the next day by the shore rescue team with the assistance of the crew. The investigation found that neither the crew provided the resuscitator to the two fainted stevedores found by the shore rescue team nor urged the shore rescue team to immediately apply the resuscitators to the two stevedores when carrying out rescue in *the ladder space*.

4.29 According to the shipboard drills and training records, the crew conducted an emergency exercise & drill for "entering enclosed space and rescue drill" on 18 February and 16 April 2022 respectively. The quarterly training for "entering enclosed space," including using resuscitation equipment, was carried out on 16 January and 20 April 2022 respectively. However, the two stevedores were not provided with resuscitators during the rescue operation. It was deduced that the shipboard training for "entering enclosed space" to the crew was ineffective.

Probable Cause of death

4.30 The two stevedores entered the aft entrance of *the hold* to *the ladder space* for unknown reasons. Paragraph 4.11 mentioned that *the ladder space* might lack oxygen and have poisonous gas from the post-fumigation. Because no autopsy report was available to ascertain the cause of death, the investigation could only deduce that the cause of death of the two stevedores was lacking oxygen or possibly breathing in poisonous fumigant gas within *the ladder space*.

5. Conclusions

5.1 On 27 March 2022, *the vessel* completed loading *the cargo* at *the loading port*. Afterwards, a local fumigation company carried out cargo fumigation. On 28 March 2022, *the vessel* departed *the loading port* for *the discharging port*, and cargo fumigation continued during the voyage.

5.2 *The vessel* arrived at *the discharging port* at 1212 hours on 29 April 2022. The fumigation of *the cargo* and the following ventilation of all cargo holds were carried out on board *the vessel* as required by the port authority of *the discharging port*. At 1902 hours on 9 May 2022, two stevedores were reported missing in *the hold*. The search and rescue operation was carried out by the stevedore rescue team, the police, and the shore first aid team. Two stevedores were rescued from *the ladder space* in the early morning of 10 May 2022. At 0433 hours, the first aid team evacuated two stevedores ashore for medical treatment. Unfortunately, they were confirmed dead later.

5.3 The investigation revealed that the main contributory factors leading to the accident were as follows:

(a) the crew failed to follow the requirements of *the Code* to mark *the ladder space* as the entrance to a dangerous space and lock or secure it properly against unauthorized entry;

(b) the crew failed to follow the requirements of the shipboard SMS to hold a toolbox meeting and carry out risk assessment before cargo discharge as well as obtain a gas-free certificate before entering the cargo hold loaded with the fumigated cargo;

(c) the crew failed to follow the requirements of *the Code* to carry out the gas check at all appropriate locations onboard when fumigation continues in transit according to the recommendations of MSC.1/Circular 1264;

(d) the crew failed to take sufficient measures to prevent unauthorized entry to a dangerous space according to *the Cod*e and control or monitor the access to *the vessel* according to ISPS Code;

(e) the shipboard drills and training of the crew for entry into enclosed space and rescue were ineffective; and

(f) the shipboard SMS failed to cover the safety procedures of the fumigation of the grain cargo in port and in transit according to recommendations of MSC.1/Circular 1264, which was required by *the Code*.

6. Recommendations

6.1 The management company should issue circular informing all masters, officers and crew members of its fleet of the findings and lessons learnt from this accident to:

(a) strictly follow the requirements of *the Code* to mark the space as the entrance to a dangerous space and lock or secure it properly against unauthorized entry;

(b) strictly follow the requirements of the shipboard SMS to hold the toolbox meeting and risk assessment before discharging *the cargo* and obtain a gas-free certificate before entering the cargo hold loaded with the fumigated cargo;

(c) strictly follow the requirements of *the Code* to carry out the gas check at all appropriate locations onboard according to the recommendations of MSC.1/Circular 1264 when fumigation continues in transit;

(d) enhance the measures to prevent unauthorized entry to a dangerous space according to *the Code* and control or monitor the access to *the vessel* according to ISPS Code; and

(e) enhance the shipboard drill and training of the crew for entry into enclosed space and rescue.

6.2 The management company should consider revising the shipboard SMS to cover the requirements of *the Code* and *Circular 1264* and conduct internal audits on *the vessel* to ensure that the crew strictly follow the requirements of the ISPS Code at the port and the shipboard SMS when carrying the fumigated grain cargo.

6.3 A Hong Kong Merchant Shipping Information Note is to be issued to promulgate the lessons learnt from this accident.

7. Submission

7.1 The draft investigation report, in its entirety, was sent to *the Company* and the Master of *the vessel* for comments.

7.2 By the end of consultation, comments from *the Company* were received and the report had been amended as appropriate.