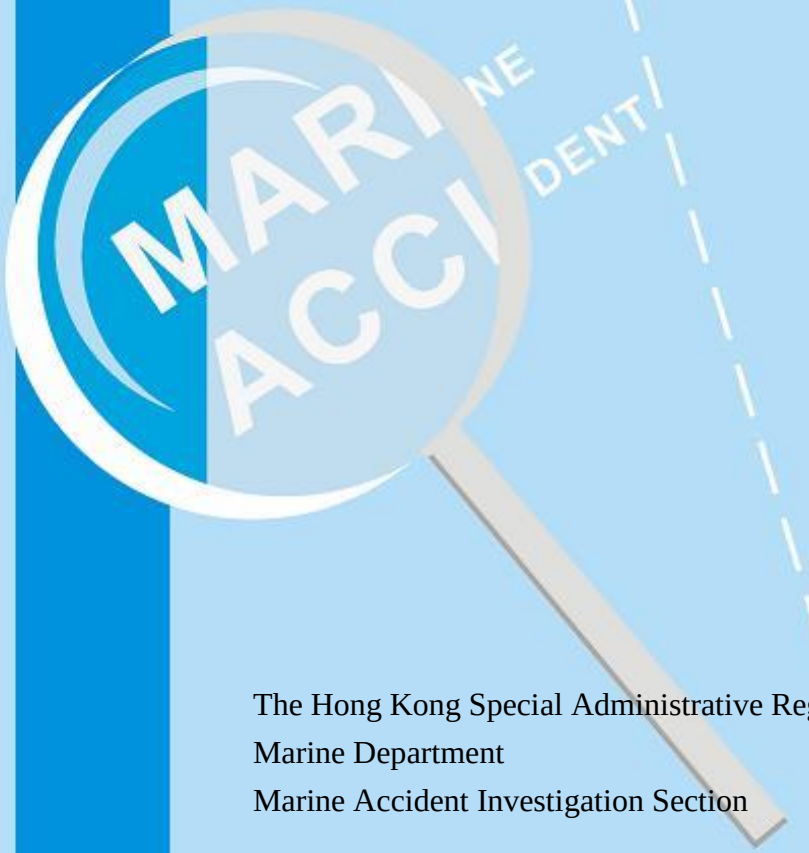
Report of investigation into the fatal accident on board the Hong Kong registered bulk carrier "*Feng Hui Hai*" at Navlakhi, India on 22 April 2018



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

03 January 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

At about 0915 hours on 22 April 2018, a fatal accident happened on board the Hong Kong registered bulk carrier "Feng Hui Hai" (*the vessel*) at Navlakhi outer anchorage, India during preparing for discharging coal cargo.

The bosun entered the No.4 cargo hold, fully loaded with coal cargo with the hatch cover opened, intending to climb to the top of the cargo pile to unlink the No.3 grab from the No.4 ship crane. Unfortunately, the bosun collapsed upon walking a few steps on the cargo pile and slipped down to the edge of it. The carpenter and steward entered the No.4 cargo hold to rescue the bosun without donning self-contained breathing apparatus (SCBA). Both of them also fainted and rolled down to the edge of the cargo pile. All of them were taken out from the No.4 cargo hold with first aid treatment applied before being evacuated to a local hospital for further treatment a few hours later. The carpenter recovered consciousness that night, but the bosun and the steward were declared dead on the same day.

The investigation had identified the following contributory factors of this accident: the crew were lack of safety awareness underestimating the risk of entering cargo hold loaded with coal cargo; the crew failed to carry out risk assessment and failed to follow the permit to work system before entering into enclosed space; the crew failed to follow the safety procedures of the Code of Safe Working Practices for Merchant Seafarers (the Code)[1] and shipboard Safety Management System (SMS) for entry into enclosed space; emergency training and drills had not been effectively carried out when handling the emergency in enclosed space as well as the safety training on the carriage of coal cargo was ineffective.

[1] Section 4 of Cap.478M "Merchant Shipping (Seafarers) (Code of Safe Working Practices) Regulation" refers.

1. Description of the vessel

Ship name	:	*Feng Hui Hai* (Figure 1)
Flag	:	Hong Kong, China
Port of registry	:	Hong Kong
IMO number	:	9727649
Type	:	Bulk carrier
Year built, shipyard	:	2017, CSSC Huangpu Wenchong Shipbuilding Co. Ltd
Gross tonnage	:	36,378
Net tonnage	:	21,646
Summer deadweight	:	36,260 tonnes
Length overall	:	199.9 metres
Breadth	:	32.26 metres
Engine power, type	:	8,050 kW, MAN B&W 5S60MC-C8.2 TII
Classification society	:	China Classification Society
Registered owner	:	Feng Hui Hai Shipping Limited
Management company	:	COSCO Bulk Carrier Co. Ltd

Figure 1 *The vessel*

2. Sources of evidence

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

3. Outline of events

(All times were local time UTC + 5:30 hours)

3.1 On 7 April 2018, *the vessel* was fully loaded with coal cargo departed from Muara Pantai, Indonesia heading to Navlakhi, India for discharging.

3.2 On 22 April 2018, *the vessel* was anchored at Navlakhi outer anchorage, India preparing for discharging coal cargo by using ship cranes and grabs.

3.3 At about 0800 hours, the bosun led two able seafarers deck (AB1 and AB2) to prepare the work for discharging cargo, including opening all cargo hold hatch covers and linking the grabs to the ship cranes.

3.4 At about 0830 hours, all cargo hold hatch covers were opened, the bosun, AB1 and AB2 then prepared to link the grabs to the ship cranes.

3.5 *The vessel* was fitted with 4 pieces of grabs. Nos.1 and 2 grabs were stowed on top of the deckhouse between Nos. 1 and 2 cargo holds. Nos.3 and 4 grabs were stowed on top of the deckhouse between Nos.4 and 5 cargo holds (*aft deckhouse*) (Figure 2).

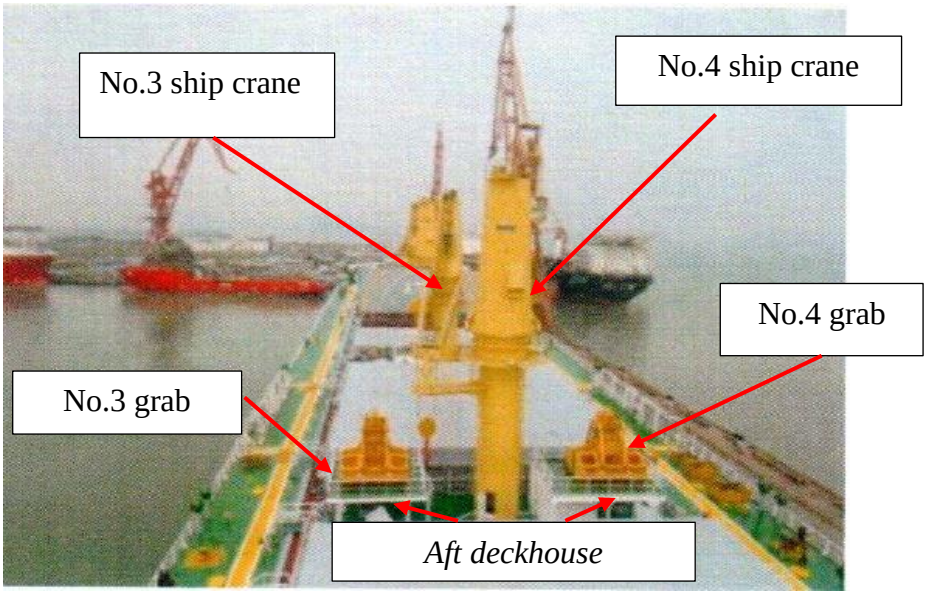

Figure 2 The overview of the Nos. 3 and 4 ship cranes as well as Nos.3 and 4 grabs.

3.6 For connecting No.3 ship crane with No.3 grab which was stowed on top of the *aft deckhouse*, the No. 3 grab must have to be moved forward to a distance reachable by the No. 3 ship crane with the assistance of the No. 4 ship crane. The procedures were to firstly shift the No. 3 grab to the No. 4 cargo hold by using the No. 4 ship crane, and then let the No. 3 ship crane to link with the grab upon the grab delinked from the No. 4 ship crane. The bosun assigned AB1 to operate the No.4 ship crane and transfer No.3 grab onto the top of the cargo pile in the No.4 cargo hold. The bosun also assigned the AB2 to operate the No.3 ship crane to pick up No.3 grab after it was landed on the top of the cargo pile in the No.4 cargo hold.

3.7 The AB1 lowered the hook of the No.4 ship crane on top of the No.3 grab, and then the bosun climbed to the *aft deckhouse* to link the No.3 grab to the hook of the No.4 ship crane. Afterwards, the bosun entered No.4 cargo hold through the aft access trunk of the No.4 cargo hold (*aft access trunk*).

3.8 At about 0915 hours, the bosun arrived at the edge of the cargo pile in No.4 cargo hold intending to climb to the top of the cargo pile to disconnect No.3 grab from the hook of No.4 ship crane. Unfortunately, the bosun collapsed upon walking a few steps on the cargo pile and slipped down to the edge (Figure 3).

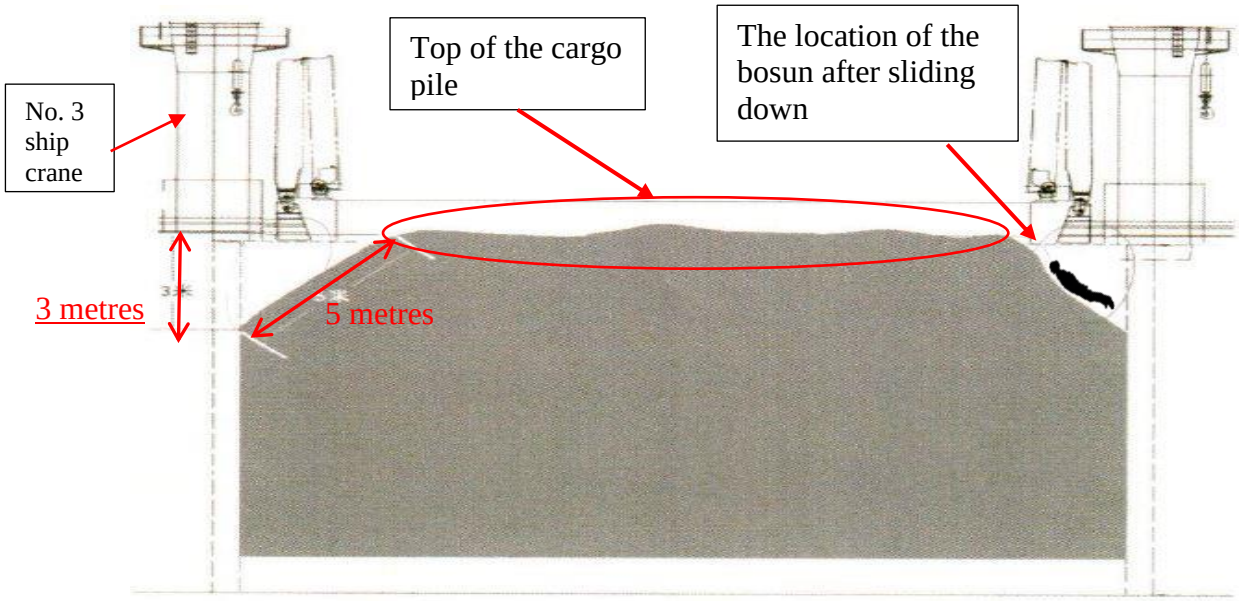

Figure 3 The diagram showing the condition of No.4 cargo hold from the view of the port side

3.9 The AB2 inside the No.3 ship crane control cabin noticed the incident and informed the AB1 immediately by shouting. The AB1 then alerted other crew members about the falling of the bosun in the No.4 cargo hold via his portable radio.

3.10 The third officer (3/O) proceeded to the No.4 cargo hold from the gangway to assess the condition of the bosun. From the starboard side hatch coaming of the No.4 cargo hold (*hatch coaming*), the 3/O saw the bosun fainted at the edge of the cargo pile beside the Australian ladder. In the meantime, the master broadcasted the incident and mustered crew members for emergency rescue operation through the public address system. He also contacted the local port authority seeking medical assistance.

3.11 To prepare for the rescue operation, the 3/O entered No.4 cargo hold through the *aft access trunk* after donning the SCBA. Meanwhile, the AB1 and AB2 arrived at the entrance of the *aft access trunk*, but they did not enter the No.4 cargo hold since they didn't have SCBA. They then took an aluminum ladder to the *hatch coaming* to facilitate other crew members access to the cargo pile in the No.4 cargo hold. The chief engineer and the chief cook also arrived at the main deck beside the No.4 cargo hold to render assistance.

3.12 While the 3/O was halfway in pulling the bosun to the top of the cargo pile in No.4 cargo hold, the carpenter and steward without donning SCBA came to assist him. The carpenter and steward lifted the bosun's legs and the 3/O pulled the bosun's shoulder. Soon after, the carpenter and steward fell and rolled to the edge of the cargo pile about 2 metres away from the top of the cargo pile. Meanwhile, the 3/O also exhausted and failed to shift the bosun to the top of the cargo pile by himself (Figure 4).

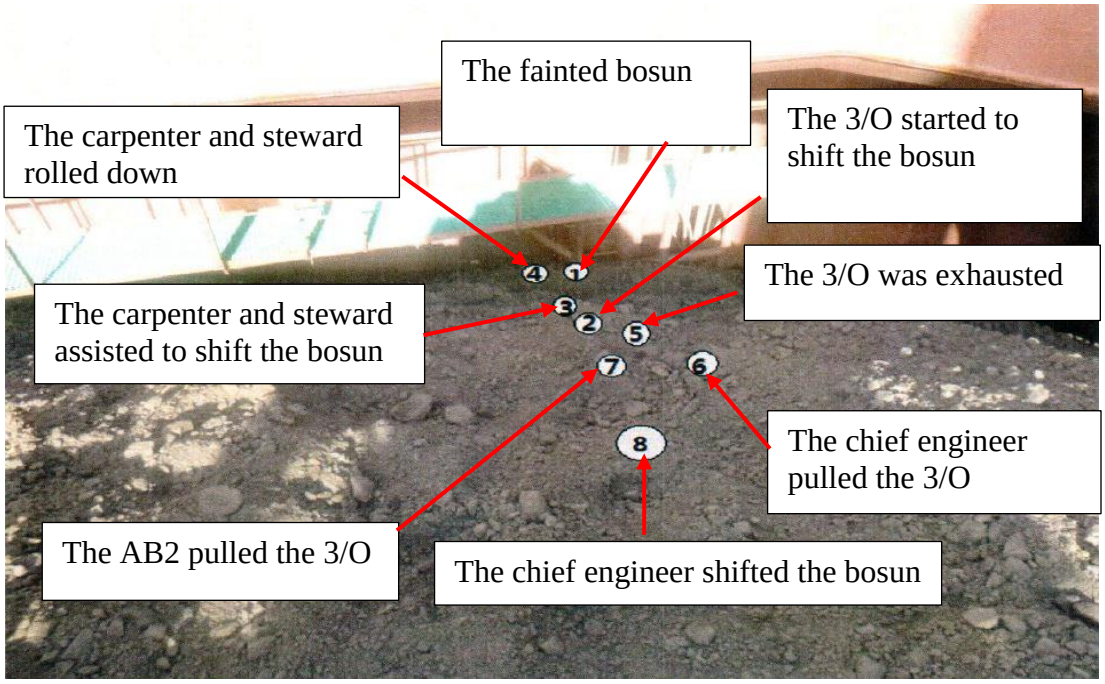

Figure 4 The location of the crew members on the cargo pile in the No.4 cargo hold during the rescue operation

3.13 The chief engineer, AB1, AB2 and chief cook arrived at the top of the cargo pile through the aluminum ladder. They walked down about 2 metres from the top of the cargo pile and pulled the 3/O to the top. While they were pulling the bosun to the top of the cargo pile, the 3/O informed the crew members on site that the carpenter and steward were collapsed and rolled to the edge of the cargo pile.

3.14 Upon a crew member bringing a SCBA to No.4 cargo hold, the AB2 immediately donned the SCBA to rescue the carpenter and the steward. The chief officer (C/O) also arrived at the top of the cargo pile and applied resuscitation to the bosun.

3.15 The AB2 walked to the edge of the cargo pile and secured the carpenter with a rope, and the crew members at the top of the cargo pile pulled and shifted the carpenter. In applying the similar method, the steward was also shifted to the top of the cargo pile. Both the carpenter and steward were applied first aid treatment on site as well.

3.16 Despite the crew members applied resuscitation for the bosun, carpenter and steward on site, only the carpenter successfully recovered his breathing. However, the bosun and steward were still unconscious and not able to breathe. At about 0945 hours, all of them were transferred to the main deck for further first aid treatment.

3.17 In the meantime, the master contacted the local port authority and agent for urgent evacuation of the casualties for treatment ashore. They confirmed that there was no helicopter rescue available. Correspondingly, a rescue tug was arranged. At about 1130 hours, the rescue tug came alongside *the vessel* and the casualties were then evacuated for emergency medical treatment.

3.18 At about 1501 hours, the casualties arrived at a local hospital. Unfortunately, at about 1645 hours, the bosun and steward were declared dead. The carpenter recovered in consciousness at about 2248 hours.

4. Analysis

The vessel's certificates and manning

4.1 The statutory trading certificates of *the vessel* were valid and in order. *The vessel* was manned by 22 crew members, including the master. The manning scale complied with the Minimum Safe Manning Certificate of *the vessel*.

4.2 The master had worked in *the Company* for about 14 years and joined *the vessel* on 21 October 2017. He had about 1 year of experience as a master. He possessed a Class I Certificate of Competency issued by China valid until 29 October 2020.

4.3 The C/O had worked in *the Company* for about 9 years and joined *the vessel* on 28 February 2018. He had about 1 year of experience as a chief officer. He possessed a Class II Certificate of Competency issued by China valid until 18 September 2019.

4.4 The 3/O had worked in *the Company* for about 3 years and joined *the vessel* on 21 October 2017. He had about 9 months of experience as a third officer. He possessed a Class III Certificate of Competency issued by China valid until 14 June 2021.

4.5 The bosun had worked in *the Company* for about 17 years and joined *the vessel* on 21 October 2017. He had about 7 years of experience as a bosun.

4.6 The carpenter had worked in *the Company* for about 11 years and joined *the vessel* on 21 October 2017. He had about 1 year of experience as a carpenter.

4.7 The steward had worked in *the Company* for about 6 years and joined *the vessel* on 20 December 2017. He had about 6 years of experience as a steward.

4.8 There was no abnormality noted with regard to the certification and experience of the crew members concerned.

Fatigue, alcohol, and drugs abuse

4.9 There was no evidence to show that any crew member on board

suffered from either fatigue at work or abuse of alcohol and drugs.

Weather and sea conditions

4.10 On the day of the accident, *the vessel* was anchored at Navlakhi, India. The weather was fine with northerly wind of Beaufort Wind Scale force 3. The sea was calm and had a visibility of 5 nautical miles. The weather and the sea conditions were not considered to be the contributory factors to the accident.

Cause of death

4.11 According to the death certificate issued by the local hospital, the cause of the death of both the bosun and steward was hypoxia which was consistent with the accident.

Entry into enclosed space

4.12 In accordance with the International Maritime Solid Bulk Cargoes Code (*the IMSBC Code*), coal is classified as "Materials hazardous only in bulk" which means that these materials present a significant risk when carried in bulk and require special precautions. Appendix 1 to the Schedule of *the IMSBC Code* on the properties and characteristics of coal stated that coals may be subject to oxidation, leading to depletion of oxygen and an increase in carbon dioxide or carbon monoxide concentrations in the cargo space. Cargo monoxide is an odourless gas, slightly lighter than air and has flammable limits in an air of 12% to 75% by volume. It is toxic by inhalation, with an affinity for blood hemoglobin over 200 times that of oxygen.

4.13 The atmospheric testing in the No.4 cargo hold was carried out daily during the voyage and the oxygen level was recorded between 4% to 15.6% which was lower than the normal oxygen level of 20.9% in the atmosphere. The oxygen level at or below 16% will not sustain life.

4.14 The nature of coal causes oxygen depletion and an increase of carbon monoxide atmosphere. Preventive measures and extra care should be taken before entering into the cargo hold carrying coal cargo.

4.15 Section 14.1.1 of Chapter 14 of the Code "Permit to Work Systems" mentioned that permits to work are formal records to confirm that control measures are in place when particular operations are being carried out. Its Annex 14.1.1 on entry into dangerous (enclosed) spaces shows that safety measures should be implemented before the work commences. Section 15.1.5 of Chapter 15 "Entering Dangerous (Enclosed) Spaces" of the Code stated that a dangerous space may not necessarily be enclosed on all sides, e.g., ship's hold may have open tops but the nature of the cargo makes the atmosphere in the lower hold dangerous. Section 15.7.1 of Chapter 15 also mentioned that entry into a dangerous space should be planned in advance and should be made of a permit to work system. In this circumstance, the No.4 cargo hold should be considered as enclosed space even the hatch cover was opened. All necessary preventive measures should be taken before entering the enclosed spaces. However, neither the risk assessment was carried out nor a permit to work was issued before crew members entering into the hold resulting in the accident.

4.16 In accordance with IMS-MI-E04, "Notice of Transportation for Coal Cargo" Section 2.2.11, Safety Management System (SMS) of *the vessel*, the crew should be equipped with SCBA to enter the cargo hold being carried coal cargo; and section 15.1.5 of Chapter 15 of the Code stated that personnel must exercise caution before entering any space on board a ship that has not been opened for some time. However, the bosun was lack of safety awareness and underestimated the risk of entry into this area without taking any safety measures such as donning SCBA.

4.17 It was revealed that the responsible officer of *the vessel* failed to follow the safety procedures of the Code and the SMS of the requirements of issuing a permit to work, carrying a risk assessment, and requiring the crew members to equip SCBA before entering the enclosed space. The accident might have been avoided if a proper risk assessment had been carried out to identify the risks of the No.4 cargo hold.

Emergency Rescue Operation

4.18 In accordance with regulation 19.3.3 "Emergency training and drills" of Chapter III of the International Convention for the Safety of Life at Sea (SOLAS), crew members with enclosed space entry or rescue responsibility shall participate in an enclosed space entry and rescue drill to be held on board the ship at least once every two months.

4.19 Before the accident, the enclosed space entry and rescue drills were carried out on 30 March 2018 and 4 April 2018 respectively. However, the crew members failed to respond to the rescue operation correctly upon the emergency announcement was made by the master through the public address system. The rescue operation was chaotic and lack of coordination. The 3/O wore the SCBA to enter the enclosed space without any rescue plan as well as the carpenter and steward recklessly entered the enclosed space without donning SCBA as required. It indicated that the crew members were not effectively trained at the routine emergency training and drills to handle the emergency in an enclosed space.

4.20 With reference to Sections 15.14.3 and 15.14.5 of the Code as extracted below, the emergency rescue arrangements should be, inter alia:

(a) In the event of an alarm being raised, no one should enter any dangerous space to attempt a rescue without taking suitable precautions for their safety.

(b) Once help has arrived, the situation should be evaluated and the rescue plan should be implemented. An attendant should remain outside the space at all times to ensure the safety of those entering the space to undertake the rescue.

4.21 In accordance with Section 3.2, IMS-OSHA03 "Operation in Enclosed Space", the SMS of *the vessel*, mentioned that none of the crew members was allowed to enter enclosed space for rescue operation before assessing the enclosed space was safe to enter. The crew members should be well trained and equipped with proper equipment before entering for a rescue operation.

4.22 In the accident, none of the above requirements of the Code and SMS were followed as listed below:

(a) The carpenter and steward did not assess the condition of the cargo hold before entering it. The proper way to ensure safe entry into the cargo hold for rescue operation was either measuring the atmosphere inside the cargo hold or donning the SCBA.

(b) The AB1 and AB2 arrived at *the aft access trunk* and considered that the cargo hold was unsafe to enter without SCBA. However, none of them stayed at the *aft access trunk* to remind other crew members of the hazards of the cargo hold at that moment.

4.23 The fatal accident happened to the steward might be avoided if the crew members strictly followed the Code and SMS to execute the enclosed space rescue operation.

Training on carriage of coal cargo

4.24 From the SMS training records on board, pieces of training were conducted for the deck crew members on the procedures and safety precautions of carriage of coal cargo and working in enclosed space of the SMS on 26 March 2018 and 3 April 2018.

4.25 Before the accident, the C/O was busy carrying out the port clearance. As such, neither toolbox meeting nor risk assessment was conducted by the C/O to the crew members involved in opening the cargo hold hatch covers and linking the grabs to the ship crane. No safety instructions or guidelines were provided for them to follow. The bosun briefed the job arrangement to AB1 and AB2 at the gangway, but no record showed that any safety issues were discussed.

4.26 The operation of transferring the No.3 grab to the No.3 ship crane had been carried out a few times previously. The No.3 grab would normally be placed on the passageway or hatch covers without the crew members to enter into the cargo hold to process the operation. The hatch covers and passageways were recently painted and the crew members did not want to damage them. As such, the crew

members decided to place the No.3 grab on the cargo pile in the No.4 cargo hold but failed to consider the fatal hazards of entering the enclosed space. There was no evidence to show that any safety issues had been discussed with the C/O relating to transferring the grabs by lowering onto the cargo pile inside cargo holds.

4.27 Under the SMS, the risk assessment and permit to work must be done before entering the enclosed space. However, there was no evidence to show that the SMS requirements had been followed. It indicated that the training was ineffective as it failed to convey the potential fatal hazards in enclosed space entry and the importance of strictly complying with the relevant safety operation procedures.

5. Conclusions

5.1 On 22 April 2018, *the vessel* was anchored at Navlakhi outer anchorage, India, for discharging coal cargo. The bosun entered the No.4 cargo hold fully loaded with coal cargo with the hatch cover opened intending to climb to the top of the cargo pile to unlink the No.3 grab with the No.4 ship crane. Unfortunately, the bosun collapsed upon walking a few steps on the cargo pile and slipped down to the edge of it. The carpenter and steward entered the No.4 cargo hold to rescue the bosun without donning SCBA. Both of them also fainted and rolled to the edge of the cargo pile. Afterwards, all of them were taken out from the No.4 cargo hold with first aid treatment applied onboard. They were evacuated to a local hospital for further treatment a few hours later. The carpenter recovered after treatment, but the bosun and steward were declared dead on the same day.

5.2 The investigation had identified the following contributory factors leading to this accident:

(a) the crew members were lack of safety awareness and underestimated the risk of entering cargo hold carrying coal cargo;

(b) the crew members failed to carry out a risk assessment and failed to follow the permit to work system before entering into enclosed space;

(c) the crew members failed to follow the safety procedures of the Code and SMS when entering into enclosed space; and

(d) ineffective training of enclosed space safety procedures. The emergency training and drills did not effectively train the crew members to be well prepared when handling emergency in the enclosed space; and the safety training on the carriage of coal cargo was ineffective.

6. Recommendations

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

(a) enhance safety awareness and safety culture onboard to ensure the risk assessment and permit to work system to be followed before entering into enclosed space; and

(b) enhance the training plan on enclosed space entry and the potential fatal hazards of the carriage of coal cargo.

6.2 The management company should conduct an internal audit on *the vessel* to ensure that the crew members strictly follow the safety requirements when entering the enclosed space as well as familiarize and understand their duties under SMS in emergencies.

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 management company and the Master of *the vessel* for comments.

7.2 By the end of consultation, there was no comment received from the above-mentioned parties.