Report of investigation into a fatal electrocution accident onboard the Hong Kong registered bulk carrier "*COSCO WUYISHAN*" at sea on 15 August 2022

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

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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

A fatal accident happened on board the Hong Kong registered bulk carrier "COSCO WUYISHAN" (*the vessel*) during cargo hold cleaning at 2030 hours on 15 August 2022 when she was drifting in the waters off the coast of Veracruz, Mexico.

At 1310 hours on 15 August 2022, the crew of *the vessel* started cleaning cargo holds (*the cleaning operation*) in the waters off the coast of Veracruz, Mexico, to prepare for the next loading of steel cargo. At 1900 hours, *the cleaning operation* was completed except for the tank top of the No. 1 cargo hold (*the hold*). One able seaman (the AB), carpenter, and bosun entered *the hold* to clean the tank top. At about 1952 hours, one portable cargo hold light[1] (*the light)* was installed in *the hold* for illumination. In order to check the cleanliness inside the starboard bilge well of *the hold* (*the bilge well*), the AB attempted to move *the light* by hand to illuminate *the bilge well*. At 2030 hours, the AB suddenly fell on the tank top due to an electric shock. First aid treatment was applied to the AB by the crew of *the vessel*, including Cardiopulmonary Resuscitation (CPR) operation under shore medical instructions. The CPR operation was continued until the shore doctor's arrival. Unfortunately, at 0109 hours on 16 August 2022, the AB was declared dead by the shore doctor.

The investigation revealed the contributory factors leading to the accident were that the crew failed to follow the requirements of the "Code of Safe Working Practices for Merchant Seafarers" (*the Code*)[2] to use a portable lamp with low voltage or take suitable precautions to avoid electric shock in damp or humid conditions; failed to follow the requirements of *the Code* and the shipboard safety management system (SMS) to carry out toolbox meeting properly, including risk assessment before cargo holds cleaning; lacked safety awareness of electric shock when using cargo hold light; and the shipboard SMS failed to identify using electrical equipment as one of the main risks onboard *the vessel* when working in cargo holds.

[1] A portable cargo hold light is powered by shipboard power supply system and used for illumination in the cargo hold by hanging on hatch coaming via a lanyard.

[2] *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).

1. Description of *the vessel*

Ship name	:	*COSCO WUYISHAN* (Figure 1)
Flag	:	Hong Kong, China
Port of registry	:	Hong Kong
IMO number	:	9418303
Type	:	Bulk Carrier
Year built, shipyard	:	2010, Fujian Mawei Shipbuilding Ltd., China
Gross tonnage	:	19,993
Net tonnage	:	11,046
Length overall	:	177.50 meters
Breadth	:	28.20 meters
Depth	:	14.20 meters
Engine power, type	:	6300 kW, Mitsubishi 6UEC43LS II, 1.
Classification society	:	China Classification Society
Registered owner	:	WUYISHAN MARITIME CO. LTD.
Management company	:	COSCO Shipping Specialized Carriers Co., Ltd.

Figure 1: COSCO WUYISHAN

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 - 6 hours)

3.1 At 0815 hours on 15 August 2022, the cargo of malt discharge operation was completed on board *the vessel* at Veracruz, Mexico (*the port*).

3.2 At 1224 hours, *the vessel* departed *the port* and proceeded to the international waters for drifting in order to conduct *the cleaning operation* to prepare for the next loading of steel cargo.

3.3 At 1310 hours, the crew of *the vessel* were divided into groups to carry out *the cleaning operation*. At 1900 hours, all cargo holds were cleaned except for the tank top of *the hold* (Figure 2). The AB, carpenter, and bosun were assigned to clean the tank top of *the hold*. The bosun acted as the site supervisor. The Chief Officer (C/O) and commissar rendered coordination and assistance on the main deck.

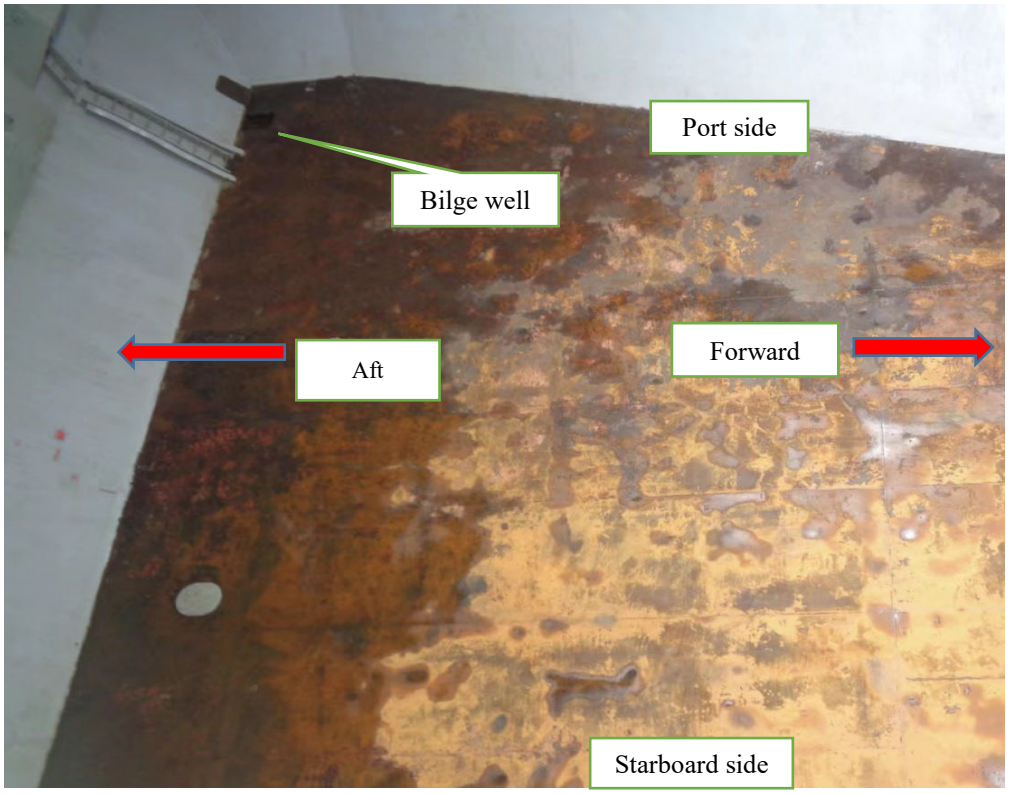

Figure 2: the tank top of *the hold* after cleaning

3.4 At 1952 hours, the sky was getting dark. The bosun requested the crew on the main deck to prepare a portable cargo light to illuminate *the hold*. Another able seaman (the AB2) visually checked the condition of *the light* and lowered it from the main deck by a lanyard to a height of about one and a half meters above the tank top of *the hold*. *The light* was powered by the ship's main of 220 volts (Figure 3).

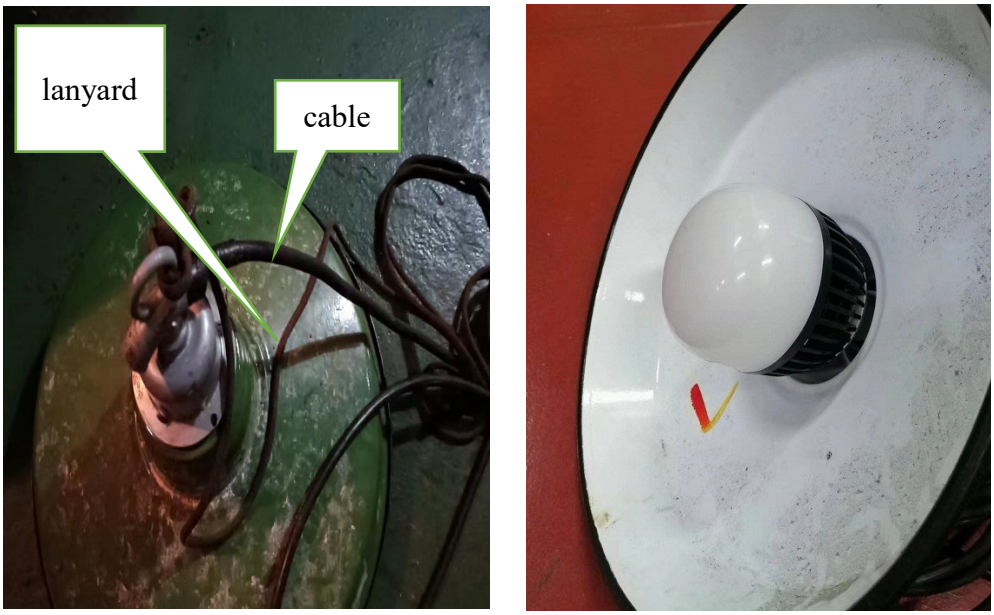

Figure 3: *The light* used in *the hold*

3.5 At 2010 hours, bilge water[3] was completely pumped out from the bilge well of *the hold.* The AB entered *the bilge well* to clean the residue left inside (i.e. the mixture of water and cargo residue).

3.6 In order to check the cleanliness inside *the bilge well*, the AB left *the bilge well* intending to move *the light* which was hanging above the tank top to illuminate *the bilge well*. In the meantime, the bosun lifted the garbage drums to the main deck by the crane of *the vessel* for preparing to leave *the hold* when the carpenter tidied up the cleaning tools in *the hold*.

3.7 At 2030 hours, when the AB held the light by hand to illuminate *the bilge well*, the bosun suddenly heard a sound and found the AB fell on the tank top. The bosun immediately realized that the AB was electric shocked and requested the crew on the main deck via

[3] The water accumulated in the bilge well after *the cleaning operation*.

walkie-talkie to cut off the power of *the light.* After the power supply of *the light* was cut off, the AB was shifted to the dry area on the tank top of *the hold* but he was unconscious with only weak breath.

3.8 At 2031 hours, the bosun checked the condition of the AB and started the Cardiopulmonary Resuscitation (CPR) operation. The C/O and commissar immediately proceeded to *the hold* to participate in the rescue operation when they received an emergency call from the carpenter.

3.9 The Master immediately initiated a contingency rescue plan to contact the local port authority and *the Company* to request emergency rescue assistance.

3.10 The Master steered *the vessel* back to the designated rendezvous position to meet the rescue boat from *the port*. The shipboard CPR operation continued under the shore medical instructions until the shore doctor arrived.

3.11 At 0100 hours on 16 August 2022, the local rescue boat arrived. The AB was shifted to a stretcher and lifted to the main deck at 0105 hours when the shore rescue team boarded *the vessel.*

3.12 At 0109 hours, the vital signs of AB were examined on board *the vessel* and was declared dead by the shore doctor.

4. Analysis

Certificates and manning

4.1 The statutory trading certificates of *the vessel* were valid and in order. *The vessel* was manned by 25 crew members, including the Master. The Minimum Safe Manning Certificate of *the vessel* was issued by the Hong Kong Marine Department (HKMD) on 21 June 2017, and the manning of *the vessel* fulfilled the requirements.

4.2 The Master joined *the vessel* on 16 March 2022. He had about 4 years of experience as a master. The Master possessed a Master Certificate of Competency issued by China, valid until 10 December 2025.

4.3 The Chief Engineer (C/E) joined *the vessel* on 16 March 2022. He had about 6 years of experience as a chief engineer. The C/E possessed a chief engineer Certificate of Competency issued by China, valid until 9 January 2025.

4.4 The C/O joined *the vessel* on 15 June 2022. He had about 2 months of experience as a chief officer. The C/O possessed a chief officer Certificate of Competency issued by China, valid until 17 August 2023.

4.5 The Second Officer (2/O) joined *the vessel* on 16 March 2022. He had about 2 years of experience as a second officer. He possessed a chief officer Certificate of Competency issued by China, valid until 22 July 2027.

4.6 The Third Officer (3/O) joined *the vessel* on 16 March 2022. He had about 14 years of experience as a third officer. He possessed a second officer Certificate of Competency (Deck Officer) issued by China, valid until 5 November 2024

4.7 The bosun joined *the vessel* on 16 March 2022. He had about 11 years of experience as a bosun.

4.8 The carpenter joined *the vessel* on 15 June 2022. He had 2 months of experience as a carpenter.

4.9 The AB joined *the vessel* on 17 May 2022. He had 12 months of experience as an able seaman.

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

Fatigue, alcohol and drugs abuse

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

Weather and sea conditions

4.12 On the day of the accident, the weather was cloudy with southerly wind of Beaufort wind scale Force 3. The sea was smooth, and the visibility was good. The weather and the sea conditions were not considered to be the contributory factors to the accident.

Cause of death

4.13 The death certificate issued by the Health Secretary of the port authority stated that the death was caused by cardiac arrest by electrocution.

Safe lighting on board

4.14 Section 11.5.8 of *the Code* states that a portable lamp used in damp or humid conditions should be of low voltage, preferably 12 volts, or other suitable precautions to avoid risks of electric shock from mains voltage.

4.15 The investigation found that *the light* was being supplied with 220 volts, and its ingress protection (IP) rating of *the light* was IP20[4] which did not protect against water; *the hold* was wet and humid after being cleaned by water, and some water accumulated on the aft part of the tank top (Figure 2). No additional suitable precautions were taken to avoid the risks of electric shock. It revealed that the crew of *the vessel* did not follow the relevant

[4] IP20 was the ingress protection rating issued by IEC (International Electro-technical Commission). It protects against solid foreign objects of diameter 12.5 mm and greater but has no protection against water. https://www.iec.ch/ip-ratings

requirements of *the Code* to avoid electric shock under damp or humid conditions when using a portable lamp.

Risk assessment and toolbox meeting

4.16 Section 1.2.5, "Risk awareness and risk assessment" of *the Code,* states that all persons involved in work should have a clear understanding and awareness of any hazards and their associated risks through a toolbox talk or meeting before the work commences.

4.17 Sections 4.1.2 and 4.4 of the "Regulations for safe shipboard operation and work team management" (i.e., Part CI-05-020) (*the manual*) of the shipboard SMS state that a toolbox meeting should be carried out before daily work, including assessment of all risks related to the operation of daily work, and taking preventive measures.

4.18 According to the shipboard toolbox meeting and risk assessment records, the toolbox meeting and risk assessment for *the cleaning operation* were carried out on board *the vessel* on 15 August 2022 before commencing work. The risk of electrical shock by using a submerged pump was identified, and its risk assessment was carried out. However, the risk of using a portable cargo hold light, including the electrical shock, was not identified and assessed in the toolbox meeting.

4.19 In addition, the AB was absent at the toolbox meeting held on the day of the accident as he was taking rest after his watch duty. There was also no evidence to show that the AB had received the related training or safety instruction on the cargo hold cleaning work and the precaution on the risk of electric shock in a damp working environment before he carried out the work.

4.20 The investigation revealed that the crew of *the vessel* did not follow the requirements of *the Code* and *the manual* of the shipboard SMS to carry out the toolbox meeting with proper risk assessment before *the cleaning operation*.

Safety awareness

4.21 According to Sections 18.17.2, 20.13.10, and 20.13.13 of *the Code*, the risk of electric shock is increased by perspiration and location that are damp, humid, or have large conductive surfaces; those working on or near live equipment should be avoided if possible unless precautions have been taken, including wearing insulated gloves where practicable; avoiding to contact with bare metal and the deck, particularly if it is wet, etc.; all seafarers should follow good practices and be aware of the potential dangers in the space in which they work.

4.22 As paragraph 3.7 mentioned, the AB held *the light* by hand to illuminate *the bilge well* after he completed the cleaning work. He did not realize that the nearly bare metal tank top of *the hold* was wet; *the hold* was damp, humid, and had large conductive surfaces; the rubber gloves used were in poor insulation as he had just completed cleaning residue in *the bilge well*; *the light* was working under the power of 220 volts without protection against water etc., which were the causes for the electric shock. Therefore, it was deduced that the AB lacked safety awareness of the danger of electric shock.

Safety Management System (SMS)

4.23 Sections 4.4 to 4.6 of the "Instructions of Risk Identification, Evaluation and Control" (*the Risk Assessment Procedure*) of the shipboard SMS state that the risk sources to be identified should include their work activities, working areas, equipment and tools that may be used, existing preventive measures, etc.; and then take risk assessment and additional preventive measures.

4.24 Sections 4.3 to 4.5 of the "Instruction of Safety management for cargo and cargo hold routine operation" (i.e., Part CI-D08-060) of the shipboard SMS state the risks with their preventative measures related to the operations in cargo holds only involving working at height, enclosed space, hot works, object falling from a height, and lack of oxygen, etc. However, the risk of using electrical equipment (i.e., the risk of electric shock) was not covered. If shipboard SMS had identified the risk of using electrical equipment during working in cargo holds according to the shipboard *Risk Assessment Procedure* thus providing a safe working guide to the

crew members, the accident might have been avoided.

5. Conclusions

5.1 A fatal accident happened on board *the vessel* during cargo hold cleaning at 2030 hours on 15 August 2022 when she was drifting in the waters off the coast of Veracruz, Mexico.

5.2 At 1310 hours on 15 August 2022, the crew of *the vessel* started *the cleaning operation* in the waters off the coast of Veracruz, Mexico, to prepare for the next loading of steel cargo. At 1900 hours, *the cleaning operation* was completed except for the tank top of *the hold*. The AB, carpenter, and bosun entered *the hold* to clean its tank top. At about 1952 hours, *the light* which was supplied with 220 volts was installed in *the hold* for illumination. In order to check the cleanliness inside *the bilge well*, the AB attempted to move *the light* by hand to illuminate *the bilge well*. At 2030 hours, the AB suddenly fell on the tank top due to an electric shock. First aid treatment was applied to the AB by the crew of *the vessel*, including Cardiopulmonary Resuscitation (CPR) operation under the shore medical instructions. The CPR operation was continued until the shore doctor arrived. Unfortunately, at 0109 hours on 16 August 2022, the AB was declared dead by the shore doctor.

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

(a) the crew failed to follow the relevant requirements of *the Code* to use a portable lamp with low voltage or take suitable precautions to avoid electric shock in damp or humid conditions;

(b) the crew failed to follow the requirements of *the Code* and the shipboard SMS to carry out the toolbox meeting properly, including risk assessment before cargo holds cleaning;

(c) the crew lacked safety awareness of electric shock when using cargo hold light; and

(d) the shipboard SMS failed to identify the risk of using electrical equipment as one of the main risks onboard *the vessel* when working in cargo holds.

6. Recommendations

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

(a) strictly follow the relevant requirements of *the Code* to use a portable lamp with low voltage or take suitable precautions to avoid electric shock in damp or humid conditions;

(b) strictly follow *the Code* and the shipboard SMS requirements to carry out toolbox meeting properly, including proper risk assessment before cargo holds cleaning; and

(c) enhance safety awareness of the crew on electric shock when using cargo hold light.

6.2 The management company should consider revising the shipboard SMS to identify the risk of using electrical equipment as one of the main risks onboard *the vessel* when working in cargo holds and conduct an internal audit on *the vessel* to ensure that the crew strictly follow the safety requirements when carrying out work in cargo holds.

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 the consultation, there was no comment received from the above-mentioned parties.