

Final Report

Death of a crew

Onboard

SRS Asian Triumph

At Muldwarka port

India

On 21 February 2023

TIB/MAI/CAS.140

Transport Safety Investigation Bureau
Ministry of Transport
Singapore

31 January 2024

The Transport Safety Investigation Bureau of Singapore

The Transport Safety Investigation Bureau (TSIB) is the air, marine and rail accidents and incidents investigation authority in Singapore. Its mission is to promote transport safety through the conduct of independent investigations into air, marine and rail accidents and incidents.

TSIB conducts marine safety investigations in accordance with the Casualty Investigation Code under SOLAS Regulation XI-1/6 adopted by the International Maritime Organization (IMO) Resolution MSC 255(84).

The sole objective of TSIB's marine safety investigations is the prevention of marine accidents and incidents. The safety investigations do not seek to apportion blame or liability. Accordingly, TSIB reports should not be used to assign blame or determine liability.

Table of Contents

| | |
|---|----|
| ABBREVIATIONS | v |
| SYNOPSIS | 1 |
| VIEW OF VESSEL | 2 |
| 1 Factual information | 4 |
| 1.1 Sequence of events | 4 |
| 1.2 Post occurrence | 10 |
| 1.3 Design of ship | 10 |
| 1.4 Access to the cargo hold | 13 |
| 1.5 Crew's qualification, experience and training | 16 |
| 1.6 IMO Resolution on Enclosed Spaces | 17 |
| 1.7 The Company and its SMS | 18 |
| 1.8 Entering into Enclosed Spaces (KOP-WI19) | 20 |
| 1.9 An Enclosed Space Entry Permit (KOP-FM14-1) | 21 |
| 1.10 Tool-box meeting and RA for collecting cargo samples | 22 |
| 1.11 Safety Data Sheet of Petcoke | 23 |
| 1.12 Gas detector | 24 |
| 1.13 Additional information | 25 |
| 2 Analysis | 27 |
| 2.1 The occurrence and likely cause of death | 27 |
| 2.2 Cargo sample collection process | 27 |
| 2.3 Company's SMS regarding enclosed space entry | 28 |
| 2.4 Crew experience on collection of cargo samples | 28 |
| 2.5 Rescue operation | 29 |

| | | |
|-----|------------------------|----|
| 2.6 | Enclosed space signs | 29 |
| 3 | Conclusions | 30 |
| 4 | Safety actions | 31 |
| 5 | Safety recommendations | 32 |

ABBREVIATIONS

| | |
|----------------------|--|
| ABS | American Bureau of Shipping |
| COSWP | Code of Safe Working Practice |
| CPR | Cardiopulmonary resuscitation |
| DOC | Document of Compliance |
| DNV-GL | Det Norske Veritas – Germanischer Lloyd |
| GT | Gross Tonnage ¹ |
| IMSBC | International Maritime Solid Bulk Cargoes |
| ISM | International Safety Management |
| Mt | Metric Tonne |
| O₂ | Oxygen |
| Petcoke | Petroleum Coke |
| PPE | Personal Protective Equipment |
| RA | Risk Assessment |
| RMP | Risk Management Procedure |
| SCBA | Self-contained breathing apparatus |
| SDS | Safety Data Sheet |
| SMC | Safet Management Certificate |
| SMS | Safety Management System |
| STCW | Standards of Training, Certification, and Watchkeeping for Seafarers |
| UTC | Coordinated Universal Time ² |

Table 1

¹ Gross tonnage (GT) is a measure of a ship's overall internal volume and referred to as an overall size of a ship.

² UTC is the primary time standard by which the world regulates clocks and time.

| Designation (Relevant Personnel) | Rank | Department |
|---|------------------|-------------------|
| Chief Mate | CM | Deck |
| Second Mate | 2M ³ | |
| Third Mate | 3M ⁴ | |
| Deck Cadet | DC | |
| Bosun | BSN ⁵ | |
| Able Seafarer Deck | ASD | |
| Ordinary Seaman | OS ⁶ | |
| Officer of the Watch | OOW | |
| Chief Engineer | CE | |
| Second Engineer | 2E | |
| Engine Cadet | EC | |
| Chief Cook | C-CK | Galley |

Table 2

³ 2M's cargo watch in port was from 0001-0600H, and 1200-1800H. 2M's navigation watch at sea was from 0001-0400H, and 1200-1600H.

⁴ 3M's cargo watch in port was from 0600-1200H, and 1800-2400H. 3M's navigation watch at sea was from 0800-000H and 2000-2400H.

⁵ Member of the Deck department and supervises deck crew.

⁶ Member of the Deck department and typically the starting rank for a seafarer in the deck department.

SYNOPSIS

On the morning of 21 February 2023, Asian Triumph, loaded with Petcoke, anchored off Muldwarka port in Gujarat, India, in fair weather conditions. The Cargo Surveyor and Agent requested for cargo samples from specific cargo holds of the ship. The CM instructed four deck crew members, to form two teams, to collect cargo samples from five cargo holds.

After collecting cargo samples from cargo hold #2, while ascending the vertical ladder, the OS called for help and fell from a height of 1-1.5m onto the top platform. Despite emergency rescue efforts, the OS was reported dead upon arrival at the hospital.

The Transport Safety Investigation Bureau classified the occurrence as a very serious marine casualty.

The OS' autopsy report was not available to the investigation team at the publish of the investigation report. Hence, the exact cause of death remained unclear.

It is probable that the crew onboard AT did not treat cargo holds as enclosed spaces and did not follow the correct procedures for entering enclosed spaces. The crew did not measure the atmospheric condition of the cargo holds for O₂ content or presence of toxic gases before entering and did not wear proper PPE when collecting Petcoke samples. The crew also did not measure the cargo hold atmospheric condition after the incident. Hence, the atmospheric condition of the cargo hold was unknown.

The investigation also revealed that there were no rescue and resuscitation equipment placed near the entrance of cargo hold #2 during the cargo sample collection. This had resulted in delaying the rescue operation. While the Company's SMS indicated that cargo space should be treated as enclosed space, there were no signs near the cargo holds to warn the crew of enclosed space entry.

VIEW OF SHIP



Figure 1 - Asian Triumph (Source: Marine Traffic)



Figure 2 - Asian Triumph with hatch covers in open position as circled in yellow.
Annotation by TSIB (Source: Marine Traffic)

DETAILS OF SHIP

| Asian Triumph | |
|---|--|
| IMO Number | 9474668 |
| Call Sign / Flag | 9V9803 / Singapore |
| Classification society | DNV - GL |
| Recognised Organisation issuing SMC and DOC certificate | ABS |
| Ship type | Bulk Carrier |
| Year of build | 2011 |
| Where built | COSCO (Zhou Shan) Shipyard, China. |
| Hull type/ material | Single Hull with double bottom/ Steel |
| Company ⁷ | U-Ming Marine Transport (Singapore) Pte. Ltd. |
| Gross tonnage | 33,035 |
| Length overall | 189.99m |
| Breadth / Depth | 32.26m / 18.00m |
| Summer draft | 12.8m |
| Summer deadweight | 56,535mt |
| Remarks | At the time of the occurrence, the ship was in loaded condition: Draught: Forward 11.86m and Aft 12.05m Approx. Freeboard: 5.95m (at mean draught) |

Table 3

⁷ Company means the owner of the ship or any other organisation or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the shipowner and who, on assuming such responsibility, has agreed to take over all duties and responsibility imposed by the ISM Code. Source: ISM Code.

1 FACTUAL INFORMATION

All times used in this report are Ship's Mean Time, which corresponds to Local Mean Time (5.5H ahead of UTC).

In the conduct of marine safety investigation into the circumstances surrounding this death occurrence, the investigation team reviewed information obtained from the Company.

1.1 Sequence of events

1.1.1 On 13 January 2023, the bulk carrier Asian Triumph (AT) loaded with about 49,570 Mt of Petcoke in all its five cargo holds departed Oxbow terminal dock 45, Texas city, USA, bound for India.

1.1.2 During passage, AT made a prearranged stop at Algeciras port 'D' anchorage in Spain on 1 February 2023 to take bunkers. Subsequently, the ship made another scheduled stop at Port Said, Egypt on 10 February 2023 for the purpose of conducting a crew change. Following this, AT joined the southbound convoy for the crossing of the Suez Canal on 11 February 2023.

1.1.3 On 21 February 2023 at about 0736H, AT arrived and anchored off Muldwarka port 'B' anchorage⁸, Gujarat, India, with cargo loading condition in each cargo hold as indicated in **table 4**.

| Cargo Hold | # No.5 | # No.4 | # No.3 | # No.2 | # No.1 |
|-------------------|--------|--------|--------|--------|--------|
| Weight (Mt) | 9,700 | 10,800 | 8,870 | 10,800 | 9,400 |
| Loading condition | 93% | 91% | 79% | 91% | 93% |

Table 4 - Cargo holds loading condition at the time of the occurrence. *Source:* The Company.

1.1.4 At about 1042H, in fair weather of NE wind of about 15 knots, with moderate seas and swell, the Agent, Customs' Officers and Cargo Surveyor boarded AT for arrival port formalities.

1.1.5 At about 1200H, after completing the arrival port formalities, the Cargo

⁸ Anchor Position Lat: 20-44.0N; Long: 070-39.1E

Surveyor requested the CM to collect cargo samples from cargo holds #1, #3 and #5. At the same time the Agent also requested the CM to collect cargo samples from cargo hold #2 and #4.

- 1.1.6 Upon receiving the requests, the CM used the walkie-talkie and instructed the BSN⁹ and the deck crew, comprising the ASD¹⁰-B, OS and DC, to open hatch covers and access manholes for cargo holds #1 to #5. This was done to allow for natural ventilation and facilitate the collection of cargo samples.
- 1.1.7 At approximately 1215H, the BSN informed that the covers for all the cargo hold had been opened. Following this, the CM directed the BSN to gather cargo samples from holds #1, #3, and #5, as per the Cargo Surveyor's request. The BSN subsequently divided the deck crew into two groups, assigning the OS and DC to collect samples from cargo hold #1, while accompanying the ASD-B to gather samples from holds #3 and #5.
- 1.1.8 The practice of taking cargo samples onboard involved a two-person team. One crew member would enter the cargo hold through the manhole located at the port side aft section, while the other would remain outside to provide assistance. The crew member inside the cargo hold would descend the 'Australian ladder' (referred to as the spiral ladder) to the cargo level within the protected casing (protector), while the other crew member at the manhole would be prepared to hoist the bucket filled with samples. The duration of time needed to collect the cargo samples ranged from 10 to 20 minutes, depending on the cargo level within the protector.
- 1.1.9 Following the successful collection of cargo samples from cargo holds #1 and #3 by both groups, the BSN was provided with additional instructions from the CM. These instructions, which were requested by the Agent, tasked the BSN with collecting cargo samples from cargo holds #2 and #4, a task that was then directed to the OS and DC to carry out.
- 1.1.10 The OS and DC on receiving the instructions, proceeded to cargo hold #4, while the BSN and ASD-B from cargo hold #3 continued walking aft towards cargo hold #5.
- 1.1.11 After collecting samples from cargo hold #4, the OS and DC proceeded to cargo hold #2. According to the DC, it was the OS' turn to collect cargo samples

⁹ Day work – BSN and OS.

¹⁰ Sea Watch arrangement ASD-A (0800-1200), ASD-B (1200-1600) and ASD-C (1600-2000).

at cargo hold #2. The DC further added, there was no problem with the communication¹¹.

- 1.1.12 At about 1305H, the OS entered cargo hold #2 while the DC remained outside of the manhole, standing by to hoist the samples up. In the meantime, the DC observed the BSN and ASD-B leaving the manhole of cargo hold #5.
- 1.1.13 According to the DC, like the previous cargo holds #1 and #4 there was nothing unusual about the loading condition of cargo hold #2. See **figures 3**.

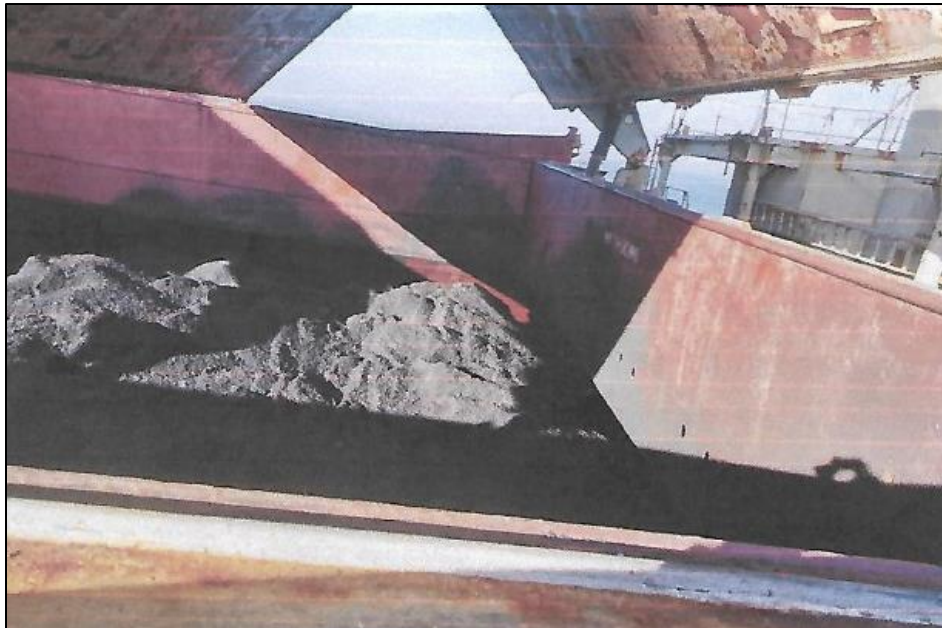


Figure 3 - Loading condition inside cargo hold #2 (hatch in open position) at the time of the occurrence. *Source: The Company.*

- 1.1.14 Upon recollection, the DC observed the OS descending the vertical ladder to the transverse beam walkway¹² space, and subsequently using the spiral ladder to collect the cargo samples. The OS displayed no difficulties during this operation, see **figure 4**.

¹¹ For communication between the team members during the collection of cargo samples, the DC and OS would call out verbally to each other.

¹² The inner space below the main (upper) deck, which extend between the ship's port and starboard side.

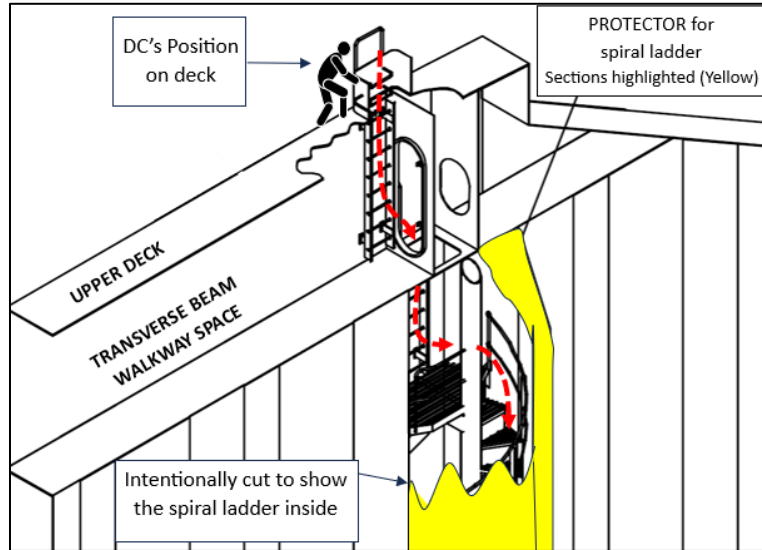


Figure 4 - Depicting the DC's position and route taken by the OS (marked red dashes). *Source:* The Company. Annotation by TSIB

- 1.1.15 After the OS collected the cargo samples, he instructed the DC to hoist the bucket up. The OS then proceeded to climb the spiral ladder followed by the vertical ladder. Upon reaching the third or fourth step of the vertical ladder from the top platform, the OS suddenly called for assistance. Subsequently, the OS fell (from height about 1-1.5m) and collapsed onto the platform, see **figure 5**.

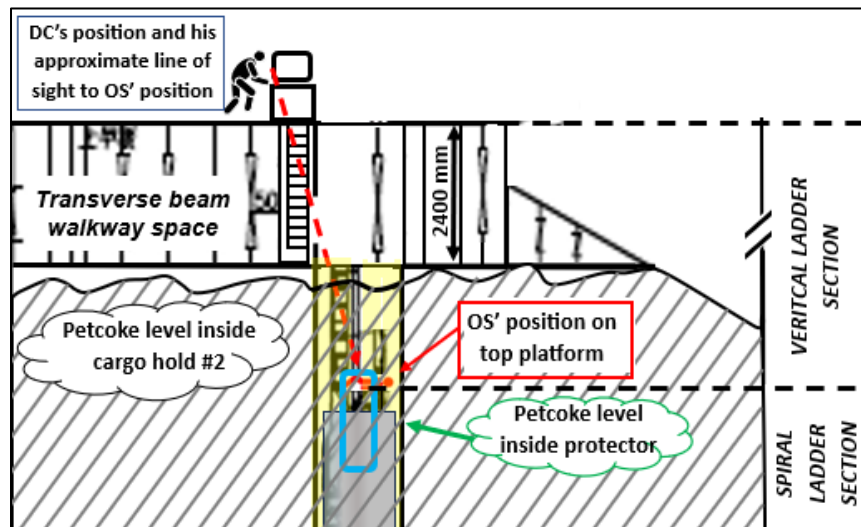


Figure 5 - Presentation of cargo level inside cargo hold #2 and inside the protector (coloured yellow). Not to scale. *Source:* The Company. Annotation by TSIB

- 1.1.16 The DC repeatedly called the OS by name. After receiving no response, the DC promptly contacted the BSN for assistance using a walkie talkie.
- 1.1.17 The 2M, who was the officer of the watch (OOW) at anchor, overheard the communication between the DC and the BSN. The OOW promptly sought clarification and broadcasted the occurrence over the Public Address system. Upon hearing the announcement, the Master arrived at the bridge and relieved the OOW to assist the deck crew. At the same time, the CM and the Cargo Surveyor left the Ship's Office for cargo hold #2.
- 1.1.18 Shortly after, the BSN and ASD-B arrived at the manhole of cargo hold #2 and called out the OS' name but received no response. Concerned about the potential lack of O₂ content or presence of toxic gases, the BSN instructed the DC and ASD-B to collect the ventilation fan and SCBA set to rescue the OS from cargo hold #2. However, the atmospheric condition of cargo hold #2 was not checked with a gas detector.
- 1.1.19 The DC ran to the deck store for the ventilation fan and its duct tubing and brought them to the incident site, while the CM and other crew members collected the SCBA set. Once the ventilation system was operational, the DC returned to the deck store to collect the full body safety harness required for the retrieval of the OS. Upon being unable to locate the safety harness¹³, the DC joined the CM and the other crew to assist the ASD-B in donning the SCBA set. Subsequently, rest of the crew arrived at the manhole to assist.
- 1.1.20 The CM assumed control of the recovery operation and directed the ASD-B to descend to the top platform. The ASD-B reported that upon reaching the bottom of the vertical ladder, he found the OS unconscious on the top platform. He attempted to revive the OS by gently shaking him and calling out his name multiple times but received no response.
- 1.1.21 The ASD-B then secured a rope¹⁴ around the OS' body, positioning it below the armpit. Once secured, the crew initiated the process of pulling the body upwards, while the ASD-B provided guidance from below to ensure the body was manoeuvred safely, clearing any obstructions up to the main deck, see **figure 6**.

¹³ Total onboard five full body safety harness. The locations and numbers as follows: engine room - two, hospital - one, bosun store – one and deck store - one. The distance from cargo hold #2 (frame 145) to deck store (frame 26) and the bosun store (frame 225) was about 100m each.

¹⁴ Manila rope of about 20mm diameter.

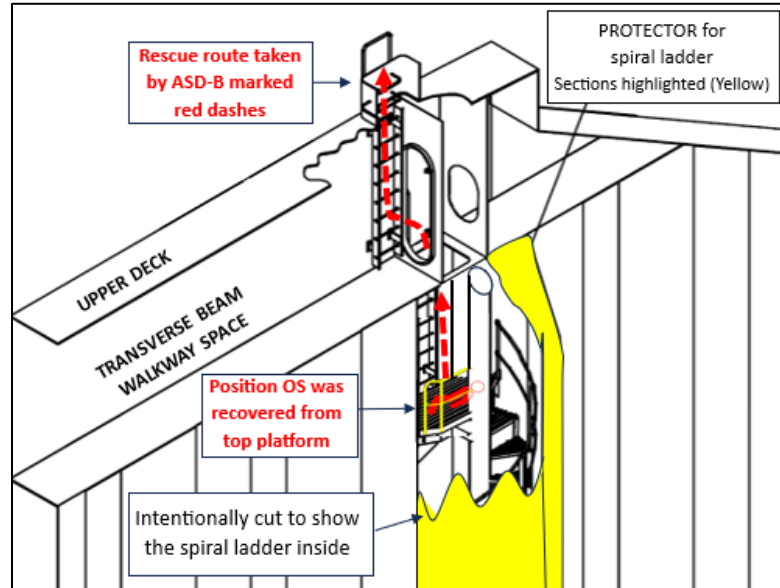


Figure 6 - Depicting the rescue route taken by the ASD-B (marked red dashes). *Source:* The Company. Annotation by TSIB

- 1.1.22 The crew successfully extracted the unconscious OS from the manhole and placed him onto the open deck.
- 1.1.23 Upon assessment, the 2M noticed that the unconscious OS had a weak pulse. Additionally, vomitus was presence in the OS' airway including the mouth and nose. The 2M cleared the airway, initiated CPR and used the ship's medical O₂ bottle to provide O₂. After approximately one minute of CPR, the OS expelled more vomitus. The 2M once again cleared the airway and continued to administer CPR until the arrival of the tug to transport the OS ashore.
- 1.1.24 The OS, accompanied by the 2M and EC-A, was transported on a stretcher to a tug for transferring to onshore hospital. The 2M and EC-A provided continuous CPR to the unconscious OS until the tug arrived at the terminal approximately twenty minutes later.
- 1.1.25 Upon arrival at the terminal, the OS was transferred to an awaiting ambulance. The 2M, assisted by ambulance personnel, provided the OS with O₂ from the ambulance. Throughout the 20-minute travel from the terminal to the hospital, the 2M and EC-A provided continuous CPR to the OS. Upon arrival at a local hospital in Kodinar, a medical examination by the doctor confirmed that the OS had passed on.

- 1.1.26 The Master received information of the OS' death from the 2M at around 1530H and reported¹⁵ the occurrence to the Company.
- 1.2 Post occurrence
- 1.2.1 From 21 February 2023, per the planned schedule AT waited at anchor for berthing instruction. On 27 February 2023, AT shifted to berth for cargo operation.
- 1.2.2 On 1 March 2023, the Government of Gujarat, Department of Health and Family Affairs, issued the OS' death certificate and thereafter the Master received notification from the Kodinar Police Station that the Authority has no objection for the ship to sail from Muldwarka Port.
- 1.2.3 On 6 March 2023 at about 1900H, AT after completed the discharge cargo of Petcoke, departed Muldwarka Port for New Mangalore Port, India.
- 1.2.4 Up to the time the report is being completed, the autopsy report was not available to the investigation team.
- 1.3 Design of ship
- 1.3.1 AT is a Supramax¹⁶ class of bulk carrier with a typical design of ship having the cargo carrying capabilities located forward of the accommodation block. The ship's design, construction requirement for structure, subdivision and stability, machinery, and electrical installations were following SOLAS, 1974, as amended.
- 1.3.2 The Supramax bulk carriers are utilised for the transportation of loose and unpackaged cargo, including ores, grains, and steel pipes. Their smaller size allows them to access smaller ports, enhancing their versatility. Additionally, four cranes strategically positioned along the ship's centreline facilitate efficient loading and unloading processes for the five cargo holds.
- 1.3.3 **Figure 7** shows the starboard side profile of the ship, also indicating the cargo hold #2 marked in yellow box – location where the incident occurred.

¹⁵ According to the Master due to poor communication signal, the report was only received by the Company around 1731H.

¹⁶ Supramax or medium sized bulk carrier with carrying capacity between 48000 and 60000 DWT.

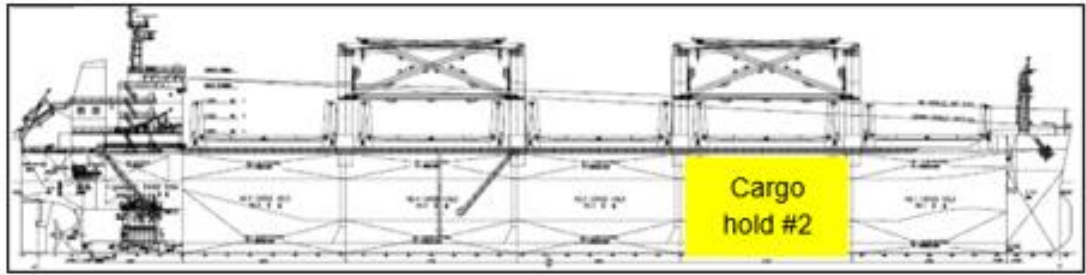


Figure 7 - Starboard side profile of the ship. *Source: The Company.*
Annotation by TSIB

1.3.4 **Figure 8** depict view from the top of cargo hold #2 with the vertical ladder at the starboard side forward section and the spiral ladder at the port side aft section.

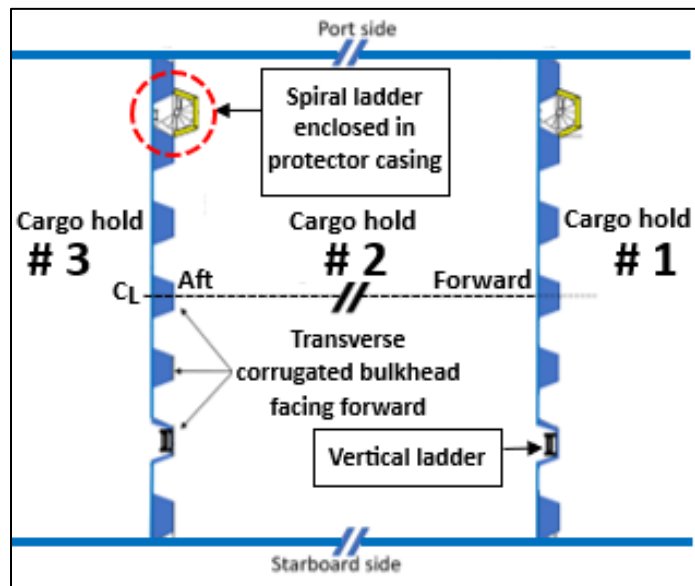


Figure 8 - Depicting cargo hold #2 showing the location of the occurrence site (circle in red dash) as viewed from the top. Not to scale *Source: The Company.* Annotation by TSIB.

1.3.5 **Table 5** indicates the manholes for means of access, as per the regulation¹⁷, to the five cargo holds onboard AT:

¹⁷ SOLAS 2005 Amend/ Chapter II-1 / Reg 3.6 requires that each cargo hold shall be provided with at least two means of access as far apart as practicable. In general, these means of access should be arranged diagonally, for example one access near the forward bulkhead on the port side, the other one near the aft bulkhead on the starboard side.

| Cargo hold | Means of access | |
|------------|--------------------------------|--------------------------------|
| | Spiral ladder with protector | Vertical ladder |
| #1 | Port side aft section | Starboard side forward section |
| #2 | Port side aft section | Starboard side forward section |
| #3 | Port side aft section | Starboard side forward section |
| #4 | Port side aft section | Starboard side forward section |
| #5 | Starboard side forward section | Port side aft section |

Table 5 - Means of access for the five cargo holds.

1.3.6 Both the ladders' designs, width and construction are accepted by the Administration¹⁸, see **figure 9** depicts both ladders inside the cargo holds.

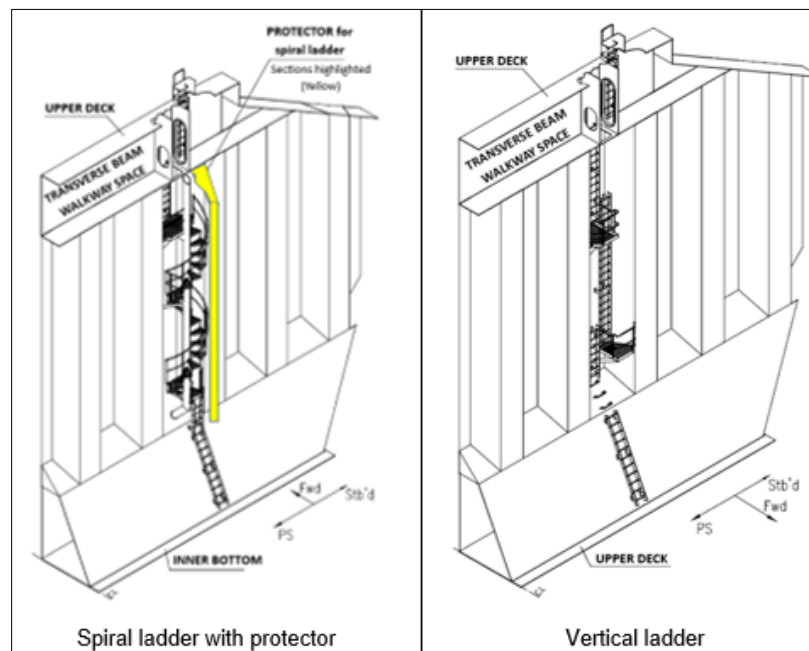


Figure 9 - Depicting the two means of access inside the cargo holds. Source: The Company. Annotation by TSIB

1.3.7 Onboard AT, each spiral ladder is enclosed in a protector (marked yellow) to

¹⁸ IMO Resolution MSC.158(78)

prevent damage by the shore crane during cargo operation. Additionally, to maximise cargo carrying capacity, the internal space of the protector is intended to be filled with cargo.

- 1.3.8 To facilitate this, each protector is fitted with two openings (W1 and W2) for cargo loading. At the time of the incident, both W1 and W2 were fully covered by cargo inside the cargo hold #2, and the cargo level within protector was roughly more than half of the W2 opening, see **figure 10**.

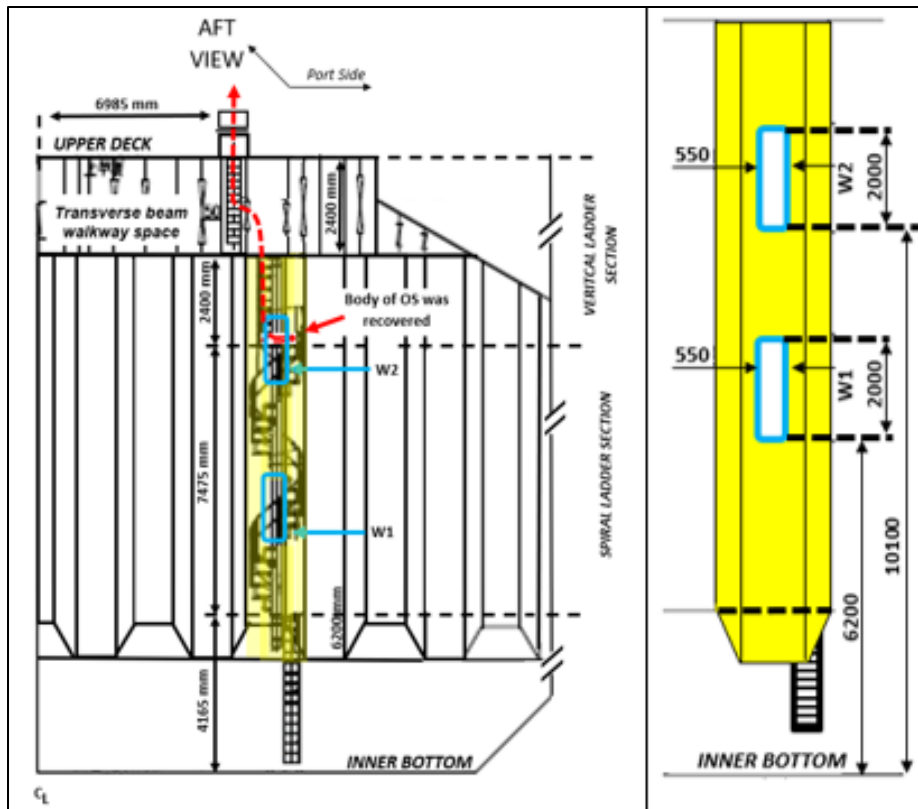


Figure 10 - Depicting the protector for the spiral ladder. Not to scale. *Source:* The Company. Annotation by TSIB

- 1.4 Access to the cargo hold
- 1.4.1 See **figure 11** for the location of the access manhole fitted with spiral ladder and located at the port side aft section of the cargo hold #2.



Figure 11 - Manhole to cargo hold #2 fitted with spiral ladder. *Source:* The Company. Annotation by TSIB.

1.4.2 **Figure 12** shows the transverse beam walkway space at the bottom of the vertical ladder, as seen from the access manhole on the main deck.



Figure 12 - showing the vertical ladder to the transverse beam walkway space. *Source:* The Company.

1.4.3 **Figure 13** depicting the position of a person standing-by on deck during the collection of cargo samples process. This was the position of the DC at the time of the occurrence.

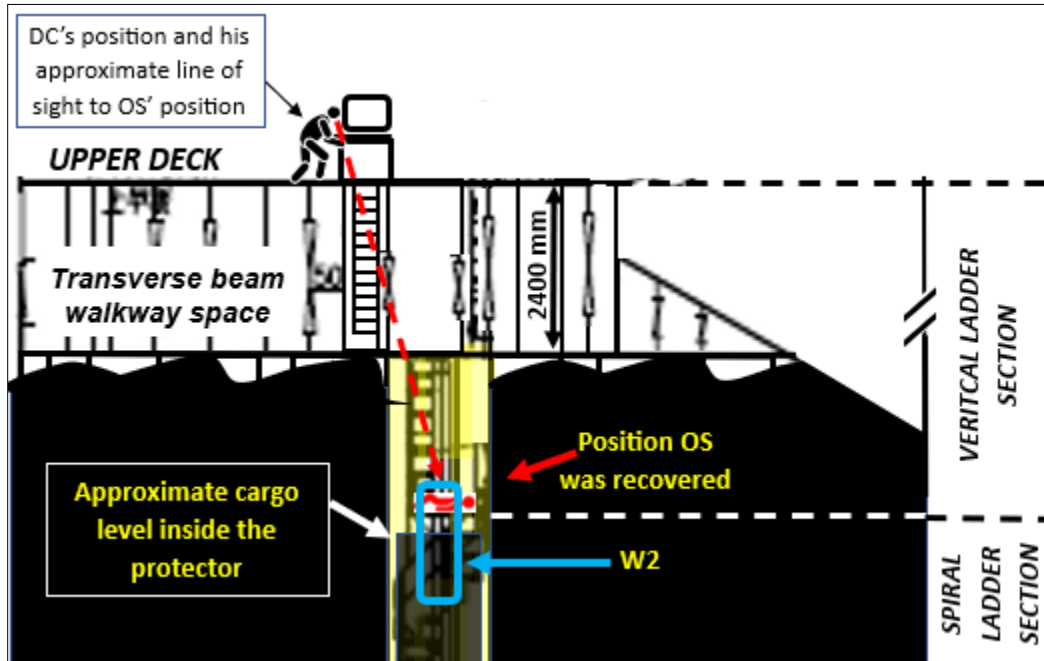


Figure 13 - Depicting the position of the DC outside the manhole and the position where the OS was recovered. Not to scale. *Source:* The Company. Annotation by TSIB.

1.4.4 The means of ventilation system for the spaces (transverse beam walkway and the protector) relied on a portable fan and ventilation duct tubing, see **figure 14**. On the day of the incident the ventilation fan was not utilised.



Figure 14 - The onboard portable fan and ventilation tubing. *Source:* The Company

1.5 Crew’s qualification, experience and training

1.5.1 At the time of the occurrence, AT had a total of 19 crew including the Master. The crew comprised nine Chinese and ten Filipino nationalities. Information relating to relevant personnel as indicated in **table 6**.

| Rank (Nationality) | Age in Year | Certification/ Issuing Authority | Experience | | Sign-on date, Country |
|--|----------------|---|-----------------|----------------------|-------------------------------------|
| | | | Year in rank | Year with Company | |
| Master (Chinese) | 45 | COC, Master, II/2, China | 1 | 18 | 27 Aug 22, Zhoushan, China. |
| CM (Chinese) | 35 | COC, Master, II/2, China | 1 | 11 | 10 Feb 23, Port Said, Egypt. |
| 2M (Chinese) | 31 | COC, Deck Officer, II/1, China | 1 | 7 | 27 Aug 22, Zhoushan, China. |
| DC (Filipino) | 21 | Mandatory Training ¹⁹ STCW Certificates | 0.5 | 0.5 | 3 Nov 22, Chittagong, Bangladesh |
| EC-A (Filipino) | 22 | Mandatory Training STCW Certificates | 0.5 | 0.5 | 3 Nov 22, Chittagong, Bangladesh |
| BSN (Filipino) | 57 | STCW II/5 for deck crew, Philippines | 25 | 8 | 10 Feb 23, Port Said, Egypt |
| ASD-B (Filipino) | 38 | STCW II/5 for deck crew, Philippines | 9 | 3 | 10 Feb 23, Port Said, Egypt |
| OS ²⁰ (Filipino) (Deceased) | 40 | STCW II/4 for deck crew, Philippines | 1.3 | 7 | 10 Feb 23, Port Said, Egypt |

Table 6 – Relevant crew matrix of AT. *Source:* The Company.

1.5.2 AT’s last crew change¹⁹, comprising 11 out of the 19 crew, was on 10 February 2023 at Port Said, Egypt.

1.5.3 All crew had undergone shipboard training, among others, included the donning of SCBA set as required by the provisions of STCW Table A-VI/1-2²⁰ and those possessing a certificate of competency had undergone relevant training under

¹⁹ The 11 newly joined crew comprised the CM, 3M, 2E, EC-B, C-Cook, BSN, Carpenter, ASD-A, ASD-B, ASD-C, and OS.

²⁰ Specification of minimum standard of competence in fire prevention and firefighting. Table A-VI/1-2 is part of Basic Safety Training for all seafaring personnel.

STCW Table A-VI/3²¹ and held appropriate certificates.

- 1.5.4 The investigation team was unable to access the work and rest hour records for the crew due to the ship being sold in May 2023. The Company informed the investigation team that, as a result of the ship's sale, the records of the work and rest hours were not obtainable.
- 1.5.5 The Master was reportedly conversant with the Company's SMS and attended the pre-joining briefing on 27 August 2022 in Zhoushan, China prior to joining AT.
- 1.5.6 The CM and the newly sign-on crew had the briefing conducted by the Company's representative on 10 February 2023 at Suez Canal, Egypt prior to joining AT.
- 1.6 IMO Resolution²² on Enclosed Spaces
 - 1.6.1 Section 2.1 of the Resolution identified "Enclosed Space" as a space which has any of the following characteristics:
 - (a) limited openings for entry and exit;
 - (b) inadequate ventilation; and
 - (c) is not designed for continuous worker occupancy.
 - 1.6.2 Section 3.1 of the Resolution provides procedure of SMS for entry into enclosed spaces as:
 - (a) Safety strategy to be adopted for preventing accidents on entry to enclosed spaces should be approached in a comprehensive manner by the company;
 - (b) The company should ensure that the procedures for entering enclosed spaces are included among the key shipboard operations concerning the safety of the personnel and the ship, in accordance with paragraph 7 of the ISM Code; and

²¹ Specification of minimum standard of competence in advanced firefighting. Table A-VI/3 is for deck and engineering officers qualifying for a Certificate of Competency.

²² A.1050 (27) Revised Recommendations for entering enclosed spaces aboard ships.

- (c) The company should elaborate a procedural implementation scheme which provides for training in the use of atmospheric testing equipment in such spaces and a schedule of regular onboard drills for crews:
- (i) Competent²³ and responsible²⁴ persons should be trained in enclosed space hazard recognition, evaluation, measurement, control and elimination, using standards acceptable to the Administration;
 - (ii) Crew members should be trained, as appropriate, in enclosed space safety, including familiarisation with onboard procedures for recognising, evaluating and controlling hazards associated with entry into enclosed spaces; and
 - (iii) Internal audits by the company and external audits by the Administration of the ship's SMS should verify that established procedures are complied with in practice and are consistent with the safety strategy referred in para 1.6.2a (Section 3 of the Resolution).

1.7 The Company and its SMS

- 1.7.1 A DOC certificate was issued to the Company by ABS on 14 October 2022 based on the verification completed on 14 October 2022 and it was valid until 22 October 2027.
- 1.7.2 A SMC was issued to AT by ABS after the external audit carried out on 19 October 2022 and it was valid until 23 December 2027.
- 1.7.3 The ship held the relevant certificates indicating compliance with the ISM Code and a functional SMS. The other documents onboard the ship included organisational policies, procedures, manuals, checklist, etc, and reference to industry common publications such as the COSWP²⁵.

²³ Competent person means a person with sufficient theoretical knowledge and practical experience to make an informed assessment of the likelihood of a dangerous atmosphere being present or subsequently arising in the space.

²⁴ Responsible person means a person authorised to permit entry into an enclosed space and having sufficient knowledge of the procedures to be established and complied with onboard, in order to ensure that the space is safe for entry.

²⁵ The COSWP published by the UK Maritime and Coastguard Agency (MCA) provides best practice guidance for improving health and safety on board ships. It is not a mandatory publication to be carried on Singapore registered ships. The Company's SMS made reference to the COSWP, and a copy of the publication was onboard AT.

- 1.7.4 From the record, AT last internal audit was carried out on 12 August 2022. From the internal audit, 12²⁶ observations/ non-conformances were noted on the shipboard SMS.
- 1.7.5 The SMS has identified that the “Enclosed Space” to have the same characteristic as Section 2.1 of IMO Resolution A.1050 (27), which includes cargo hold as an enclosed space, among others.
- 1.7.6 The SMS provided the ship with “Key Shipboard Operating Procedures” (KOP), among others, included, ‘Cargo Loading, Discharging and Ballast Handling’- KOP-WI04, ‘Entering into Enclosed Spaces’- KOP-WI19, and ‘Personal Protective Equipment’ - KOP-WI23.
- 1.7.7 Included in the KOP, the SMS provided guidance for crew ‘Safety at Work’, among others, included the following:
- (a) Each employee takes care of themselves in all activities to ensure not to put himself into unnecessary danger;
 - (b) During all activities the appropriate protective equipment²⁷ should be used; and
 - (c) Any crew has the right, responsibility and authority to cease a work or an operation without fear of retribution when he deemed that an action or an onboard operation procedure poses danger to personnel, ship and/or the environment.
- 1.7.8 In addition the Company also provided and required the crew to apply RMP for all tasks/ activities onboard, in particular, the non-routine tasks such as new activities of non-routine repairs or other potentially hazardous operations which could cause harm to people including health and hygiene, damage to environment and property or loss of process.
- 1.7.9 The RMP provided guidance on the risk assessment process to identify hazards present in a work undertaking, analyse the level of risk, consider those in danger and evaluate whether hazards were adequately controlled, considering, if any, the measures already in place.

²⁶ The Observations/ Non-Conformances noted were related to housekeeping, maintenance, fire-fighting drill training, but nothing on the entry into enclosed spaces.

²⁷ At the time of the incident the crew involved in cargo sampling was not wearing respirator with filter.

- 1.7.10 To simplify the application of the RMP, the Company adopted the "Quick Hazard Identification Guide²⁸", Tool-box meeting form (RMP-FM01) and the preliminary and detailed risk assessment form (RMP-FM02) to assist the crew in their assessment of the work activities, that would be carried out by the head of departments (CM and 2E) and reviewed by the Master and CE accordingly.
- 1.7.11 The SMS provided further guidelines for ships carrying solid bulk cargo to indicate that dangerous atmospheres may develop in cargo spaces and adjacent spaces. The dangerous atmospheres may include flammability, toxicity, O₂ depletion or self-heating, as identified in the shipper's declaration. According to the SMS, for additional information, reference should be made to the IMSBC Code.
- 1.8 Entering into Enclosed Spaces (KOP-WI19)
- 1.8.1 There was no specific "work instructions" for cargo sampling. However, to carry out cargo sampling, the crew would be required to make entry into the cargo hold, which was identified as an enclosed space and thus, the requirement to carry out a RA.
- 1.8.2 The head of department and person-in-charge were to carry out the RA for enclosed space entry with the crew involved, establish a work plan, and issue an entry permit with the approval of the Master and to ensure that the plan is adhered to.
- 1.8.3 The record of RA onboard AT for enclosed space entry included holding a toolbox meeting prior to commencing the work, the donning of appropriate PPE, the presence of communication means (a walkie-talkie) with the duty officer (including the OOW) and attaining the entry permit.
- 1.8.4 A competent person should always make a preliminary assessment of any potential hazards in the space to be entered and take into account the previous cargo carried, ventilation of the space, coating of the space and other relevant factors. The competent person's preliminary assessment should determine the potential for the presence of an O₂-deficient or toxic gases atmosphere, which included the following:

²⁸ A card that listed presence of hazards such as – Slip, trip, fall, hypoxia, explosion, toxic, fire, electric shock, etc.

- (a) Entry into enclosed spaces should be planned and carried out with the use of an entry permit system, and the use of a checklist is recommended. An Enclosed Space Entry Permit should be issued by the Master or nominated responsible person and completed by a person who enters the space, prior to entry;
- (b) That the space has been thoroughly ventilated²⁹ by natural or mechanical means to remove any toxic or flammable gases, and to ensure an adequate level of O₂ throughout the space; and
- (c) That the atmosphere of the space has been confirmed to ascertain acceptable levels of O₂ or of flammable for hot work or toxic vapors, if applicable.

1.8.5 Enclosed spaces covered by KOP-WI19 include, but are not limited to, cargo spaces, cofferdam, void spaces, inter-barrier spaces, adjacent connected spaces, etc. The list is not exhaustive and enclosed spaces should be identified and listed on a ship-by-ship basis.

1.9 An Enclosed Space Entry Permit (KOP-FM14-1)

1.9.1 This permit pertains to entry into any enclosed space onboard the ship must be approved by the master or responsible officer following checks conducted by the individual entering the space or an authorised team leader. Each section of the permit must be completed before approval is granted. Once the completed permit is reviewed and approved by the master or responsible officer, it will be released for the crew to enter the enclosed space.

1.9.2 Section 1 - Pre-entry preparation of the permit included, among others,

- (a) Has the space been thoroughly ventilated;
- (b) Has the space been tested and found safe for entry,

²⁹ If operations generate dust, fumes, gas, vapours or mist, use process enclosures, local exhaust ventilation or other engineering controls to minimise crew exposure to airborne contaminants.

- (c) Pre-entry atmosphere test readings (only gas deemed necessary to check for the space entry shall be taken): O₂³⁰, Methane (CH₄³¹), Hydrogen Sulphide (H₂S³²) and Carbon Monoxide (CO³³).
- (d) Have arrangements been made for the space to be continuously ventilated throughout the period of occupation and during work breaks;
- (e) Are access and illumination adequate; and
- (f) Are breathing apparatus, rescue and resuscitation equipment available for immediate use by the entrance to the space.

1.10 Tool-box meeting and RA for collecting cargo samples

- 1.10.1 The investigation team was provided with a completed and signed tool-box meeting form (RMP-FM01-1) dated 21 February 2023 for the works of drop anchor, connect crane grab and entry into enclosed space. The form indicated that the meeting conducted by the CM was attended by various deck crew (including the OS).
- 1.10.2 Referencing the tool-box meeting form, under the sub-heading of 'Quick Hazard Identification Guide' the attendees, among others, identified and discussed the effect of personnel being unfamiliar with the three works listed in 1.10.1 (having joined recently).
- 1.10.3 The investigation team was also made aware by the Company that for collecting cargo samples, as per the SMS on RMP, the crew discussed the RA and identified the hazards on entering enclosed space. A copy of the RA (Initialled and detailed) form for the assessment of work activity of 'Entering into Enclosed Space', dated 21 February 2023 had been completed by the CM.
- 1.10.4 The RA form identified the hazards associated with entering enclosed space and the significant risk involved, among others, included, slip, trip and falls due

³⁰ O₂ is a colourless, odourless and tasteless gas. Exposure to an O₂ deficient environment can result in hypoxia, wherein the body's tissues and cells do not receive an adequate supply of O₂ to function properly. Common symptom of mild to moderate hypoxia include shortness of breath, especially during physical exertion, headache, confusion.

³⁰ CH₄ is a colourless, odourless, and highly flammable gas. Prolong exposure to high levels of CH₄ may lead to symptoms such as vision problems, nausea and headache.

³¹ CH₄ is a colourless, odourless, and highly flammable gas. Prolong exposure to high levels of CH₄ may lead to symptoms such as vision problems, nausea and headache.

³² H₂S is a colourless gas with a strong odour of rotten eggs. Exposure to H₂S, besides irritation to the eye and respiratory system, among others, may also cause dizziness, headache, weakness, coma, etc.

³³ CO is a colourless, odourless and tasteless gas. Exposure to CO, besides loss of muscle control and consciousness, among others, may also cause headache, weakness, dizziness, shortness of breath, drowsiness, etc.

- to poorly lit and/ or restricted space, hypoxia due to lack of O₂ in the space, etc.
- 1.10.5 The RA ‘Work Process/ Action’ undertaken and ‘Existing Control’ measures to be taken had identified that, before any person enters an enclosed space, the space to be fully ventilated and the atmosphere inside the space to be tested for O₂ content or presence of toxic gases. The investigation team noted that there was no evidence to suggest that measures had been carried out for the collection of cargo samples which required the entering of cargo hold, an enclosed space identified in the Company’s SMS.
- 1.11 Safety Data Sheet³⁴ of Petcoke
- 1.11.1 The following relevant sections of the SDS were extracted for reference.
- (a) Petcoke³⁵ is ‘Not classified’ as Hazardous material according to Regulation (EC) No. 1272/2008 [CLP³⁶]; and
 - (b) Transport in bulk according to Annex II of MARPOL and the IBC Code not applicable to the carriage of Petcoke.
- 1.11.2 Symptoms after inhalation/ingestion of Petcoke
- (a) Symptoms/ effects after inhalation – irritation of the respiratory tract due to excess fume, mists or vapour exposure.
 - (b) First-aid measures after inhalation – Get medical advice/ attention if you feel unwell. Remove victim to fresh air and keep at rest in a position comfortable for breathing;
 - (c) First-aid measures after ingestion – Rinse mouth out with water. If you feel unwell, seek medical advice; and
 - (d) Symptoms/ effects after ingestion – few or no symptoms expected. If any, nausea and diarrhoea might occur.
- 1.11.3 Handling of Petcoke
- (a) Before entering and commencing any operation in the spaces that contain Petcoke, ensure that the space has been sufficiently ventilated.

³⁴ Petcoke SDS provided by the Company.

³⁵ UKP&I, International Tanker Owners Pollution Federation (ITOPF) advisory note, “*although Petcoke is described as non-hazardous, there are potential human effects relating to the small particulate matter within the powder or granules as inhaled (i.e., airborne) dust*”.

³⁶ CLP – Classification, Labelling and Packaging.

Check the atmosphere of the space for O₂ content, H₂S and flammability;

- (b) The crew to don PPE, such as, protective clothing, shoes and gloves; and
- (c) For respiratory protection, the crew to don a half or full-face respirator with filter(s) for organic vapours/ H₂S, or a SCBA can be used according to the predictable amount of exposure. If the situation cannot be completely assessed, or if an O₂ deficiency is possible, only SCBA should be used.

1.12 Gas detector

1.12.1 AT has onboard two sets of portable gas detector of type GMI, see **figure 15**. Both the units were last calibrated on 18 May 2022 and their annual calibration was due in May 2023. The investigation team was notified by the Company that the gas detector was not utilised to assess the O₂ content or presence of toxic gases within the cargo hold at the time of incident by any of the involved parties. In addition, there was no verification conducted for cargo samples, prior to rescue efforts, or following the rescue for recording purposes.

1.12.2 Per the calibration certificates the gas detectors were capable of detecting:

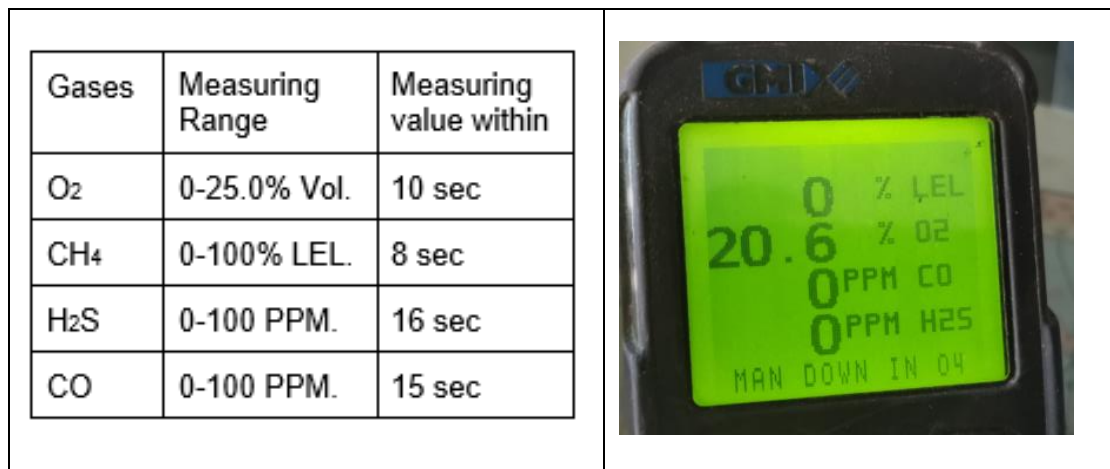


Figure 15 – Gas detector. *Source: The Company*

1.13 Additional information

1.13.1 Signs for enclosed spaces

1.13.1.1 The investigation team noted the absence of indicators prompting the crew to treat the cargo hold as an enclosed space before the incident. Additionally, there were no warnings alerting the crew to the potential hazards of entering an enclosed space near the cargo holds.

1.13.1.2 As indicated in other investigations³⁷ involving enclosed space entry fatality, the investigation team gathered that there was no standardisation of signage for enclosed spaces at the time of occurrence, and that a review of IMO Res. A.1050(27) involving entering enclosed spaces aboard was underway at the IMO.

1.13.1.3 Chapter 15 of the COSWP, “Entering Dangerous (Enclosed) Spaces”, explained that dangerous space may not necessarily be enclosed on all sides, e.g. ships’ holds may have open tops, but the nature of the cargo makes the atmosphere in the lower hold dangerous because of a change in the condition inside or in the degree of enclosure or confinement, which may occur intermittently.

1.13.1.4 The same chapter provided guidance when carrying out assessment, the competent person must take into account any cargo previously carried in the space, ventilation, the coating of the space, the degree of corrosion/ rusting³⁸ and any other relevant factors. As a result of the empty tank or other enclosed space has been closed for a time, the O₂ content may have been reduced.

1.13.1.5 The chapter further added that personnel need to exercise caution before entering any space onboard a ship that has not been open for some time. The entrances to all unattended dangerous spaces aboard a ship should be kept locked or secured against entry. Any hatches readily accessible to enclosed spaces should be marked as the entrance to a dangerous space. When the space was open for work to be carried out, an attendant should be posted, or a barrier and warning sign put in place. As far as possible, work should be arranged in such a way that no one has to enter the space.

³⁷ TIB.MAI.CAS.122 – Fatality of crew onboard the bulk carrier Nozomi in Bangka Strait, Indonesia on 1 April 2022. and TIB.MAI.CAS.133 – Fatality of Fitter onboard the Sea Prajna, at sea, on 15 November 2022.

³⁸Term corrosion and rust are frequently used interchangeably. Rust and corrosion are both effects of oxidation processes, where O₂ are absorbed from the tank atmosphere.

1.13.2 Training and Drill

1.13.2.1 Per the SMS, training and drill were to be carried out onboard for enclosed space entry and rescue drills at least once every two months. The last enclosed space entry and rescue drill was conducted on 5 December 2022.

1.13.2.2 The Company also shared with the investigation team that, in addition to the bi-monthly training and drill, the officers and crew were also required to complete sets of relevant video training programs provided by Ocean Technologies Group for the crew knowledges and awareness. It should be noted that the CM and deck crew involved in cargo sampling had only joined the ship 10 days prior to the incident.

1.13.3 Rescue Operation

1.13.3.1 At the time of incident, AT was in possession of a specialised double-fold rescue stretcher³⁹ designed for use in confined space with limited access or hatch sizes. This type of stretcher is intended for safely lowering or lifting casualties to safety in challenging or unconventional environments, allowing for the safe recovery of casualties.

1.13.3.2 In addition to the rescue stretcher, AT also possessed full body safety harness with similar function to assist in the recovery of casualties from challenging or unconventional situations.

1.13.3.3 It was observed that the stretcher or full body safety harness was not utilised during the retrieval of the unconscious OS from the cargo hold #2.

³⁹ Allows the victim to be safely evacuated from the scene and reduces the risk of further injury whilst moving.

2 ANALYSIS

2.1 The occurrence and likely cause of death

2.1.1 Based on the available evidence, the OS was deemed medically fit for duty onboard ship without any limitations or restrictions. However, due to the absence of bodily injuries and autopsy report⁴⁰, the investigation team was unable to ascertain the cause of death.

2.1.2 Nevertheless, the investigation team explored the events leading up to the occurrence, including the process of cargo sample collection as well as the rescue process, with the aim of improving the safety of personnel for shipboard operations.

2.2 Cargo sample collection process

2.2.1 There was no specific instructions established for the collection of cargo samples onboard AT. The crew would just open the hatch covers of the cargo holds for a short period of ventilation before entering the cargo holds to collect cargo samples.

2.2.2 The crew did not take measurement of the O₂ content or presence of toxic gases inside the cargo holds and did not utilise mechanical means of forced ventilation as required by KOP-WI19. Additionally, following the incident, the crew did not gather data on the O₂ content or presence of toxic gases within cargo hold #2. As a result, the investigative team was unable to determine if the atmospheric conditions of cargo hold #2 could support life.

2.2.3 In addition, the crew did not don PPE specifically the full body safety harness and respiratory protection to protect themselves when collecting samples from the cargo holds. While petcoke is not hazardous, inhaling and ingesting pekcoke would result in negative health effects.

2.2.4 The occurrence highlighted that it is desirable to have work instruction established for the collection of cargo samples. The work instruction should include the precautions to be taken by the crew and the need to conduct measurements of the atmospheric condition of the cargo hold with gas detector prior to the collection of cargo sample.

⁴⁰ Medical documentation or forensic analysis is required to conclusively determine the circumstances surrounding the individual's passing.

- 2.3 Company's SMS regarding enclosed space entry
- 2.3.1 The Company had identified cargo holds as enclosed spaces as indicated in the SMS. The collection of cargo samples required the crew to enter the cargo hold. However, the crew did not perform the requirements for enclosed space entry for the collection of cargo samples from the cargo holds, such as conducting RA for enclosed space entry, establishing a work plan and issuing an entry permit with the approval of the Master.
- 2.3.2 While the tool-box meeting form dated 21 February 2023 conducted by the CM and attended by all deck crew including the deceased OS, had identified the hazardous work activity of 'entry enclosed space' with the necessary actions to be taken to ensure the safety of the crew, it is likely that the crew were not aware that cargo hold should be treated as enclosed space.
- 2.3.3 Hence, it is desirable to have a specific work instruction for cargo sample collection, particularly for the collection of cargo sample that requires entering the cargo hold, to clearly stipulate that the requirements for entering enclosed spaces should be accorded to the entering of cargo holds.
- 2.3.4 Unfortunately, following the incident, the crew did not measure the O₂ content or the presence of toxic gases in cargo hold #2. While it was prudent for the crew to assume that cargo hold #2 was not safe to enter and had used SBGA set for the rescue operation, the investigation team opined that the atmospheric condition of cargo hold #2 should have been checked for O₂ content or the presence of toxic gases. Had this been done and deemed safe for entry, then the rescue operation could have been expediated without the need for SCBA set.
- 2.4 Crew experience on collection of cargo samples
- 2.4.1 The investigation team observed that both the Master and CM, both having approximately one year of sea time in their respective ranks, exhibited a lack of experience and safety awareness. They may have wrongly believed that the opening of hatch covers and manholes was sufficient to meet the requirements of ventilating cargo hold.
- 2.4.2 In addition, the CM and the deck crew responsible for collecting cargo samples had only joined the ship for about 10 days prior to the occurrence. Furthermore, the incident cargo operation was the first cargo operation for both the CM and

deck crew onboard AT.

2.4.3 Seafarers may have experience in collecting cargo samples while serving on other ships. However, due to the differing design of ships and onboard equipment, as well as the unique nature of different cargo, the process of collecting cargo samples may vary from ship to ship.

2.4.4 Therefore, it is crucial for the Company's SMS to have established procedures, plans, and instructions, including checklists as appropriate, for key shipboard operations such as taking cargo samples.

2.5 Rescue operation

2.5.1 Retrieving a casualty from narrow space, such as a manhole, poses great challenges. Hence, it is crucial that crew onboard ship should practise the drill of rescuing a casualty from narrow space to ensure timely and effective rescue operation.

2.5.2 In the rescue of the OS from the manhole of cargo hold #2, the crew attempted to find the safety harness from the store but could not find it and had to resort to using rope to tie below the arms of the unconscious OS.

2.5.3 If the crew treated entering the cargo space as entering enclosed space, they would have needed an entry permit. According to the requirements for the permit, breathing apparatus and rescue equipment should be available at the entrance. The rescue operation should have been faster and more efficient if the equipment was placed near the entrance of the cargo hold.

2.6 Enclosed space signs

2.6.1 The Company's SMS indicated clearly that cargo space should be treated as enclosed space. However, as mentioned in 1.13.1, there were no signs in the vicinity of the cargo holds to warn the crew that entering cargo hold should be treated as entering enclosed space.

2.6.2 While there is no standardisation of signages for enclosed spaces, it would be prudent to have signs near the cargo hold to remind crew that entering cargo hold is like entering enclosed space and necessary precautions are to be taken.

3 CONCLUSIONS

From the information gathered, the following findings are made. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- 3.1 The OS had collapsed while climbing up the vertical ladder of cargo hold #2, after collected the cargo samples of Petcoke. The OS had collected cargo sample from another cargo hold prior to the occurrence. In the absence of an autopsy report, the cause of death of the OS could not be determined.
- 3.2 There was no specific instruction established for the process of cargo sample collection onboard AT. The crew did not check the atmospheric conditions of the cargo holds prior to entering the cargo holds. The crew also did not wear PPE for the collection of Petcoke samples.
- 3.3 Following the incident, the crew did not measure the atmospheric condition of cargo hold #2 for O₂ content or the presence of toxic gases, which made it difficult to determine the atmospheric conditions of cargo hold #2.
- 3.4 It is likely that the crew onboard AT did not treat cargo hold as enclosed space and hence did not perform the requirements for enclosed space entry such as conducting risk assessment for enclosed space entry, establishing a work plan and issuing an entry permit with the approval of the Master.
- 3.5 The CM and the deck crew responsible for the cargo samples collection joined AT about 10 days prior to the occurrence and may not be familiar with the cargo samples collection process onboard AT.
- 3.6 There were no rescue and resuscitation equipment placed near the entrance to cargo hold #2 during the cargo sample collection. This had likely resulted in delayed rescue efforts.
- 3.7 The Company's SMS states that cargo space should be treated as enclosed space, however, there were no signs near the cargo holds to warn the crew of the potential hazards of entering an enclosed space.

4 SAFETY ACTIONS

Arising from discussions with the investigation team, the Company has taken the following safety action.

- 4.1 Sent a circular to the fleet, detailing the accident, its root cause, and the corrective measures. Ship masters were directed to discuss these details at their monthly ship safety committee meetings in order to prevent similar incidents, emphasising key areas for improvement.
- 4.2 Reviewed the SMS for Cargo Loading, Discharging and Ballast Handling (KOP-WI04) and included a new section for the procedure of extracting cargo samples from the cargo hold.
- 4.3 Required all masters to strictly follow the SMS procedure to complete the permit before entering enclosed spaces.
- 4.4 Incorporated this case into lessons learned during pre-joining briefings and the half-year shore leave crew training course to enhance overall awareness, completed in July 2023.
- 4.5 Directed ship masters to utilise the safety committee meeting as a platform to brief and discuss this case with all crew members to enhance their safety awareness.
- 4.6 Assessed the experience of fleet ship masters and CMs to ensure that no junior masters and CMs are on board simultaneously, completed in March 2023.
- 4.7 Completed the procurement of eight more portable O₂ content and gas detectors per ship in July 2023 and requires crew members to wear them when entering enclosed spaces.
- 4.8 To prevent and warn against unauthorised entry to an enclosed spaces, access manhole covers are to be securely locked. Furthermore, these manhole covers will be permanently marked with “Restricted Area – Authorised Personnel Only” and completed entry permit forms will be displayed at the access points. The superintendent and port captain will verify proper implementation during ship’s visit for inspections and audits.

5 SAFETY RECOMMENDATIONS

A safety recommendation is for the purpose of preventive action and shall in no case create a presumption of blame or liability.

It is recommended that the Company (U-Ming Marine Transport Pte Ltd)

- 5.1 Ensure its crew are aware that cargo holds are to be treated as enclosed space **[TSIB Recommendation RM-2024-002]**
- 5.2 Establish procedure to take and record post occurrence atmospheric condition of the cargo hold. **[TSIB Recommendation RM-2024-003]**