



REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

AVRA MARINE SAFETY INVESTIGATION REPORT

Fatality During Enclosed Space Entry

Daesan Port, Republic of Korea | 25 July 2025

Official Number: 8378

IMO Number: 9859791



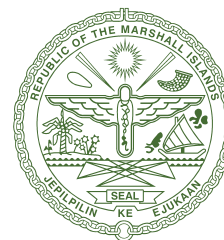
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AUTHORITY

An investigation, under the authority of the Republic of the Marshall Islands laws and regulations, including all international instruments to which the Republic of the Marshall Islands is a Party, was conducted to determine the cause of the casualty.



Maritime Administrator

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LIST OF ABBREVIATIONS AND ACRONYMS

3/O	Third Officer
ASD	Able Seafarer Deck
C/O	Chief Officer
CH	Cargo Hold
CPR	Cardiopulmonary Resuscitation
H ₂ S	Hydrogen Sulfide
IMO	International Maritime Organization
ISM	International Safety Management
m	Meter
mm	Millimeter
MSC	Maritime Safety Committee
No.	Number
OSHA	Occupational Safety & Health Administration
OEL	Occupational Exposure Limit
OOW	Officer on Watch
ppm	Parts per Million
PEL	Permissible Exposure Limits
SCBA	Self-contained Breathing Apparatus
SDS	Safety Data Sheet
SMS	Safety Management System
UTC	Coordinated Universal Time

DOCUMENTS CITED

IMO Resolution A.1050(27) ¹	Revised Recommendations for Entering Enclosed Spaces Aboard Ships
IMSBC Code	International Maritime Solid Bulk Cargoes Code
ISM Code	International Management Code for the Safe Operation of Ships and for Pollution Prevention
MLC, 2006	Maritime Labour Convention, 2006
MSA No. 03-24	Marine Safety Advisory No. 03-24, Enclosed Space Entry Incidents
SOLAS	International Convention for the Safety of Life at Sea, 1974
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978
STCW Code	Seafarers' Training, Certification and Watchkeeping Code

¹ Adopted on 30 November 2011 (in force at the time of the incident).



PART 1: EXECUTIVE SUMMARY

On 25 July 2025, the Republic of the Marshall Islands-registered bulk carrier AVRA, managed by A.M. Nomikos Transworld Maritime Agencies S.A. (the “Company”), was berthed at MB5, Daesan Port, Republic of Korea (hereinafter “Korea”).

The ship was discharging the bulk cargo of wood pellets when the Bosun was found collapsed inside the CH No. 4 aft access hatch space. At 1033,² the crew rescued the Bosun and brought him out onto the main deck, where medical first aid and CPR were immediately commenced.

At 1120, the shore emergency team arrived and transported the Bosun to the local hospital. However, at 1216, the ship received information from the local agent that the Bosun was deceased.

The Republic of the Marshall Islands Maritime Administrator’s (the “Administrator’s”) marine safety investigation determined that the Bosun had entered the CH No. 4 aft access hatch space to gain access to the CH No. 5 forward inspection platform to sweep off cargo residues on the platform without complying with the Company’s enclosed space entry procedures.

The following lessons learned were identified.

- Entering a space that is part of a fully loaded cargo hold without authorization and without following established shipboard enclosed space entry procedures is extremely hazardous and should not be attempted.
- Physical barriers and warning signs are critical for preventing unauthorized access into an enclosed space.
- Compliance with established safety procedures is paramount and should always be prioritized to ensure personal safety.

² Unless stated otherwise, all times are ship’s local time (UTC +9).

PART 2: FACTUAL INFORMATION

The following Factual Information is based on the information obtained during the Administrator's marine safety investigation.

Ship particulars at the time of the incident: *see* chart to right.

Narrative

Background Information

On the morning of 25 July 2025, the geared five-hatch, bulk carrier AVRA (*see Figure 1*) was berthed on the starboard side at MB5, Daesan Port, and was discharging the bulk cargo of wood pellets. At 1015, wood pellets were being discharged from CH Nos. 1, 3, and 5, with the hatch covers in the open position (*see Figure 2*). The hatch covers for CH Nos. 2 and 4, both fully loaded with wood pellets, remained closed. The C/O, who was in the ship's office, called the Bosun on the walkie talkie but did not receive a response. The C/O then instructed the 3/O to call the Bosun on his cabin telephone and checked with the duty ASD regarding the Bosun's whereabouts. After receiving no answer from the Bosun's cabin telephone, the 3/O made an announcement on the ship's public address, but there was no reply from the Bosun. The duty ASD reported to the C/O that he had not seen the Bosun.

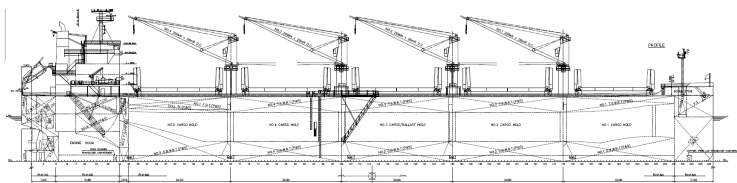


Figure 1: AVRA General Arrangement.



Figure 2: Wood pellets shown here in the cargo hold with the hatch cover opened.

SHIP PARTICULARS

Vessel Name
AVRA

Registered Owner
Benicia Trading Limited

ISM Ship Management
A.M. Nomikos Transworld
Maritime Agencies S.A.

Flag State
Republic of the Marshall Islands

IMO No. 9859791	Official No. 8378	Call Sign V7A2295
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Year of Build 2020	Gross Tonnage 34,518
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Net Tonnage 20,175	Deadweight Tonnage 61,225
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Length x Breadth x Depth
197.0 x 32.2 x 18.6 m

Ship Type
Bulk Carrier

Document of Compliance
Recognized Organization
Lloyd's Register

Safety Management Certificate
Recognized Organization
Registro Italiano Navale

Classification Society
American Bureau of Shipping

Persons on Board
20

At about 1020, the C/O proceeded to the main deck to look for the Bosun. The C/O was walking forward on the port side of the main deck when he noticed the CH No. 4 aft access hatch cover was open. The C/O looked down through the open access hatch and saw the Bosun lying inside the CH No. 4 aft access hatch space (see Figure 3).



Figure 3: CH No. 4 aft access hatch space showing where the C/O saw the Bosun lying (as illustrated).

The C/O immediately called for help on the walkie talkie. As the crew arrived, some carrying SCBAs, the C/O left to get a multi-gas detector. At 1033, the C/O returned to CH No. 4 aft access hatch space and conducted an atmosphere test. The atmosphere of the space was determined to contain 40 ppm of carbon monoxide and 16.7% oxygen.³

The C/O assessed that the access space was narrow and decided that only the 3/O, who had already donned an SCBA, would enter to rescue the Bosun. The 3/O then climbed down the access ladder carrying a rescue rope. After reaching the bottom of the access ladder, the 3/O tied the rescue rope around the Bosun's torso and signaled the crewmembers on deck to hoist the Bosun up through the access space. The Bosun was hoisted up and was placed on deck. The 3/O exited immediately after. The Bosun was unresponsive and crewmembers immediately began administering CPR.

At 1034, the Master called for shore medical emergency assistance through the agent. The shore medical emergency team arrived at 1100 and took over CPR from the crew. At 1120, the Bosun was stretchered off the ship by the shore medical emergency team and was transported in an ambulance to the local hospital.

At 1216, the Master was informed by the local agent that the Bosun did not respond to medical intervention and was deceased.

³ The duration that the access hatch cover had been opened prior to the atmosphere test conducted was not known.

Crew

On 25 July 2025, AVRA had 20 crewmembers, four more than required by the Minimum Safe Manning Certificate issued by the Administrator. Each of the crewmembers on board held the appropriate Republic of the Marshall Islands seafarer documentation issued by the Administrator required for their position on board.

The Administrator did not find any indication that the Bosun failed to receive the amount of rest mandated by the STCW Code, Section A-VIII/1, paragraphs 2 and 3, and the MLC, 2006, Regulation 2.3.

The Bosun joined AVRA on 30 November 2024 and had been on board for approximately 6.9 months at the time of the incident. He had served as a Bosun on board bulk carriers with the Company for 24 years. He reported directly to the C/O. His duties included, among others, ensuring the watertight integrity of the vessel; sounding various tanks and submitting the relevant data to the C/O; lubricating all deck machinery and lifting gear; securing, shoring, and trimming cargo to prevent shifting;⁴ operating anchors and windlasses while the vessel was at station; overseeing the routine work of the deck ratings; maintaining the cleanliness of the vessel; and carrying out maintenance of steelwork and paintwork on open decks and vessel sides. Additional responsibilities included advising the C/O on the replenishment of paints and deck stores, as well as managing the collection and segregation of all garbage generated on board.

The Bosun was qualified as a rating⁵ and was assigned to non-watchkeeping duties.⁶ According to the C/O, there was no specific work assigned for the Bosun on 25 July 2025 when the vessel was at Daesan Port during cargo discharging operation. The C/O added that during the vessel's cargo operation, the Bosun would normally carry out housekeeping⁷ by himself and assist⁸ the duty ASD when called upon. The C/O considered the Bosun to be experienced and no request was made for the Bosun to inform the C/O of his movement or work activities.

Cargo Hold Access Arrangements

The CH No. 4 aft access hatch was located on the port side of the cross deck between CH Nos. 4 and 5. It provided entry to the CH No. 4 access space, a 3.65 m long vertical compartment that led to the Australian ladder for descending to the CH No. 4 tank top. The CH Nos. 4 and 5 inspection platforms could also be accessed from this space through manholes (see Figure 4) by removing securing nuts.

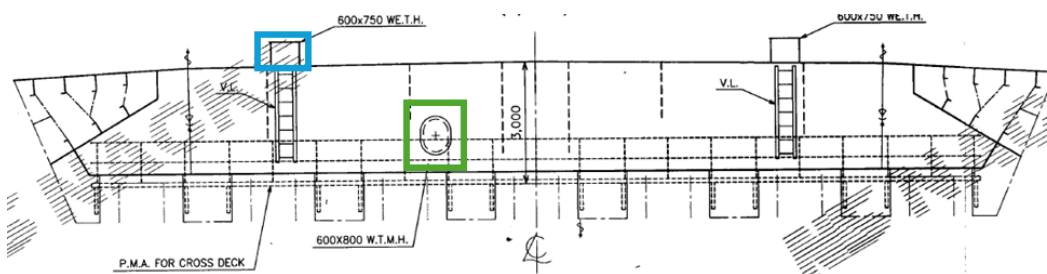


Figure 4: The cross-sectional view (viewed from aft) of the access space, the blue border indicates the CH No. 4 aft access hatch. The green border indicates the manhole for accessing the CH Nos. 4 and 5 inspection platforms.

4 This includes the rigging of shifting boards, etc., and the battening down of holds and deep tanks.

5 STCW Regulation II/5 — Mandatory minimum requirements for certification of rating as an ASD.

6 Non-watchkeeping duties were assigned from 0600–1200 and 1300–1800 for when the vessel is at sea and in port as stated in the vessel's shipboard working arrangements.

7 Tidying stores, touching up paintwork, etc.

8 Tending to the vessel's mooring lines, keeping the gangway watch, etc.

The inspection platform was positioned athwartship and was 19 m long. Every cargo hold was fitted with two inspection platforms, at the forward and aft bulkheads of the cargo hold, positioned above the cargo hold's access ladder (see Figure 5).

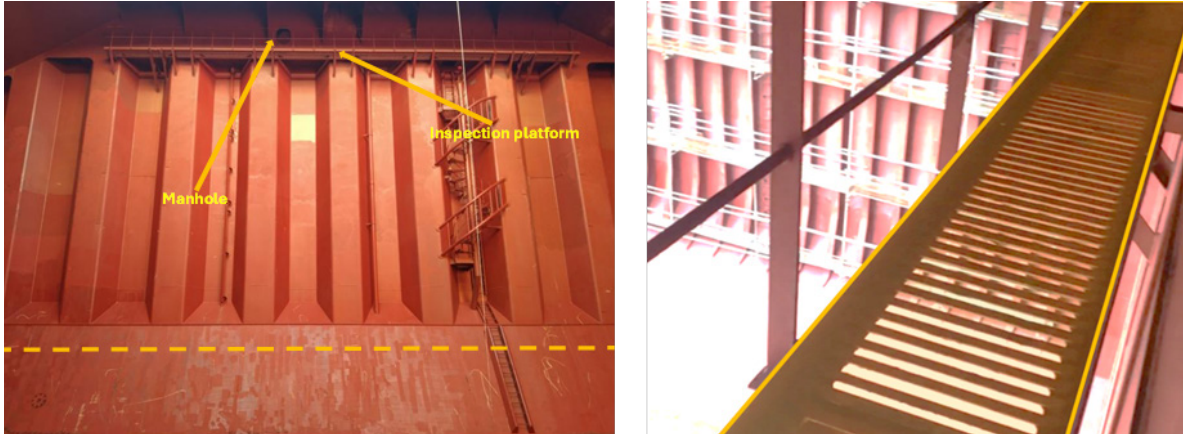


Figure 5: CH No. 5 aft bulkhead (left photo) showing the location of the inspection platform and the manhole for accessing the inspection platform from the access space. The dotted line represents the cargo level (at the bottom hopper) inside the cargo hold on the morning of 25 July 2025. The right photo shows the inspection platform with the area on the walkway where cargo residues accumulated (shaded and outlined in yellow).

The CH No. 4 aft access hatch cover was marked, “NO. 4H SP. L.” This indicated that the access hatch was the entry into CH No. 4. There was also a small metal plate with the warning: “VENTILATE BEFORE ENTRY OF CARGO HOLD” (see Figure 6). The text on the plate was worn and not easily legible.



Figure 6: CH No. 4 aft access hatch cover.

After the Bosun had been evacuated from the CH No. 4 aft access hatch space, crewmembers found a torchlight, a headlamp, a broom, a bucket containing a spanner, and about 25 securing nuts at the bottom of the access ladder (see Figure 7). The manhole cover for accessing the CH No. 5 inspection platform was found in place with the 25 securing nuts removed. The Bosun's walkie talkie was retrieved from the access space by the 3/O during the rescue.



Figure 7: Items found in CH No. 4 aft access hatch space.

Cargo Information

The cargo of wood pellets in bulk was loaded on 24 June 2025 at Prince Rupert, Canada. According to the Shipper's⁹ SDS and cargo information provided to AVRA, the cargo was described as wood pellets made of wood residues, no additives or binders. Similarly, as described in the IMSBC Code's Bulk Cargo Shipping Names — WOOD PELLETS NOT CONTAINING ANY ADDITIVES AND/OR BINDERS.

The hazards identified on the SDS and cargo information document included that wood pellets release non-condensable odorless gases such as toxic carbon monoxide, carbon dioxide, and small amounts of methane in combination with oxygen depletion.¹⁰

The document¹¹ further described the safety precautions concerning oxygen depletion. These included:

1. to ventilate all spaces to be accessed by personnel prior to entry (all spaces directly or indirectly communicating with the cargo space); and
2. to label accesses to spaces of entry with "Low Oxygen Risk Area" or equivalent.

Apart from the existing warning sign on the access hatch cover (*see Figure 6*), the Shipper's recommended safety precautions advisory to label "Low Oxygen Risk Area" was not present on the cargo hold's access hatch cover.

⁹ IMSBC Code, Section 1, General Provisions, 1.7 Definitions, definition of "Shipper".

¹⁰ Similarly, the IMSBC Code listed the following hazards for shipments of wood pellets.

1. Shipments are subject to oxidation leading to depletion of oxygen and increase of carbon monoxide and carbon dioxide in cargo and communicating spaces.
2. Swelling if exposed to moisture. Wood pellets may ferment over time if moisture content is over 15%, leading to generation of asphyxiating and flammable gases but gas concentrations do not reach flammable levels. This cargo has a low fire risk.
3. Handling of wood pellets may cause dust to develop. Risk of explosion at high dust concentration.

¹¹ See the Shipper's Shipper Cargo Information Sheet. This document was provided to the Master in accordance with the requirements of SOLAS Chapter VI, Part A, Regulation 2 - Cargo information.

A Safety Meeting was carried out on board AVRA on 30 June 2025, prior to the loading of wood pellets, to discuss the contents of the SDS and cargo information document with all crewmembers, including the Bosun. In the meeting, detailed insights into potential hazards and safety precautions, with particular emphasis on oxygen depletion risks, were discussed.

Duties During Cargo Operation

The C/O prepared a discharge plan which was made available to the Master and OOWs. The discharge plan detailed the sequence of cargoes discharged from the cargo holds. The OOWs would instruct the watchkeeping deck crew on required tasks¹² during the discharging operations.

According to AVRA's Shipboard Working Arrangement, all deck crew, except the Bosun, were on port watchkeeping duties while cargo operations were conducted in Daesan Port. The C/O stated that the Bosun kept normal daily working hours and generally worked independently during cargo operations.

It was routine shipboard practice that after every cargo discharging operation, all cargo holds would be cleaned in preparation for loading the next cargo. Also, in preparation for drydocking, all cargo holds needed to be cleaned. Cleaning the cargo holds included using a broom to sweep cargo residues¹³ that accumulated on the inspection platforms (*see Figure 5*). The C/O stated that AVRA was scheduled for drydock in Weihai, China¹⁴ after the discharge of cargo at Daesan Port and that the deck crew, including the Bosun, were aware of the scheduled drydock. Plans for cleaning the cargo holds in preparation for drydock after the discharge operation at Daesan Port had not been discussed with the ship's deck crew.

Enclosed Space Entry Procedure

The Company's SMS defined enclosed / confined spaces to include all spaces, which may be open to the atmosphere but allow gas concentrations to accumulate, as well as spaces that could suffer from lack of oxygen. The Company's SMS identified cargo holds, when the hatch covers were closed, as an enclosed space. The SMS stated that nobody should enter an enclosed space unless an entry permit had been issued by the Master or the C/O.

The shipboard MLC Crew Manual,¹⁵ included a procedure for safety and accident prevention. Similar to the Company's SMS, the MLC Crew Manual required that an Enclosed Space Entry Permit be completed before any entry into an enclosed space. The MLC Crew Manual provided a list of all enclosed spaces on board which were identified by the Company. Both the closed and opened cargo holds were classified as enclosed spaces (*see Figure 8*). According to the list, an Enclosed Space Entry Permit must be completed before entry only for cargo holds with the hatch cover closed and with cargo inside (high-risk).¹⁶ However, an Enclosed Space Entry Permit was not required to enter cargo holds which were empty and with the hatch cover open. There was also no requirement to report entry into an empty cargo hold with the hatch cover in the open position to the OOW.

¹² Monitoring of ship's mooring lines and gangways, reporting of visitors, etc.

¹³ The wood pellets product appearance, according to the Shipper, was cylindrical 6–12 mm in diameter and 3.15–40 mm long.

¹⁴ The sea distance from Daesan, Korea, to Weihai, China, is approximately 206 nautical miles, a voyage of about 18 hours at an average speed of 12 knots.

¹⁵ Crew Manual–12, a part of the SMS.

¹⁶ Risk resultant of more than 10 was categorized as high-risk in Appendix I (*see Figure 8, red highlight*).

APPENDIX I						
RISK ASSESSMENT FOR ENCLOSED SPACES IDENTIFICATION						
	AREA	SPACE TYPE	INVOLVED HAZARDS	L	S	RR
1	CARGO AREA	HOLDS & COAMINGS [open/empty]	Nos. 3/4/6/8	2	2	4
2	CARGO AREA	HOLDS & COAMINGS [closed/with cargo]	Nos. 1/3/4/5/6/8/10	5	4	20
3	TANKS	FOEDLOBE/WASTE OIL TANKS	Nos. 1/2/4/5/6/7/8	5	4	20
4	TANKS	BALLAST TANKS	Nos. 1/2/3/4/5/6/7/8/9	5	4	20
5	TANKS	FRESH WATER TANKS	Nos. 2/3/5/6/7/8	4	4	16
6	VARIOUS	SEWAGE TANK	Nos. 1/2/5/6/7/8/10	4	4	16
7	VARIOUS	VOID SPACES	Nos. 1/2/5/6/7/8	4	4	16
8	VARIOUS	DUCTS	Nos. 1/3/5/6/7/8/	4	4	16
7	DECK	CARGO GEAR CABINS	Nos. 2/3/4/6/7/8/9	2	2	4
8	DECK	OPEN	Nos. 1/2/4/6/7/8/9	2	2	4
9	DECK	CHAIN LOCKERS	Nos. 2/3/4/5/6/7/8/9	4	4	16
10	STORE/ROOMS	BOSUN STORES	Nos. 4/5/6/8/9	2	3	6
11	STORE/ROOMS	PAINT ROOMS	Nos. 1/5/8	2	3	6
12	STORE/ROOMS	EM. FIRE PUMP ROOM	Nos. 4/5/7/8	2	3	6
13	STORE/ROOMS	EM. GEN ROOM	Nos. 4/5/7/8	2	3	6
14	STORE/ROOMS	STEERING GEAR ROOM	Nos. 2/4/5/7/8	2	2	4
15	STORE/ROOMS	CO2 ROOM	Nos. 1/4/5/6/7	2	4	8
14	STORE/ROOMS	BATTERY ROOMS	Nos. 1/4/5/7/8	2	4	8
15	ACC/TION	CABINS	Nos. 5/6/7/8/9	1	2	2
16	ACC/TION	GALLEY	Nos. 2/4/5/6/7/8	2	3	6
17	ACC/TION	ALL FWAYS	Nos. 3/5/6/7	1	2	2
18	ACC/TION	PROVISION ROOMS	Nos. 2/4/5/7/8	2	4	8
19	ACC/TION	LAVATORIES	Nos. 2/5/6/8/9	2	2	4
20	ACC/TION	COMMON ROOMS	Nos. 5/6/7/8/9	1	2	2
21	ACC/TION	BRIDGE (INDOORS)	Nos. 6/7/8/9	2	2	4
22	ACC/TION	BRIDGE (OUTDOORS)	Nos. 2/4/6/7/8/9	2	2	4
23	ACC/TION	HOSPITAL	Nos. 4/5/6/7	1	3	3
24	ACC/TION	ACCOMMODATION DECKS	Nos. 2/3/4/6/7/8/9	2	2	4
25	E/R	ECR	Nos. 5/6/7/8	1	3	3
26	E/R	CRANKSHAFT SPACES	Nos. 1/2/4/5/6/7/8	3	5	15
27	E/R	SCAVENGING SPACES	Nos. 1/2/4/5/6/7/8	3	5	15
28	E/R	BOILER FURNACE	Nos. 1/4/5/6/7/8	3	5	15
29	E/R	AIR RESERVOIRS	Nos. 1/5/6/7/8/10	2	4	8
30	E/R	PURIFIER ROOMS	Nos. 2/5/6/7/8	2	2	4
31	E/R	BILGE HOLDINGTKS	Nos. 1/2/3/4/6/7/8/	4	4	16
32	E/R	E/R SURROUNDING AREAS	Nos. 2/3/4/5/6/7/8/9	2	3	6

POSSIBLE HAZARDS:

1. Lack of oxygen, possible exposure to hazardous gases.	6. Inadequate Illumination.
2. Slippery Surface.	7. Inadequate coordination/supervision/communication.
3. Structural deficiencies of the permanent means of access.	8. Fatigue/Heat-Humidity Exposure.
4. Unguarded Openings/ Obstructions/Projections.	9. Adverse Weather/Sea Condition.
5. Inadequate Ventilation.	10. Psychological Hazards (stress/fear)

ALL SPACES IDENTIFIED AS HIGH RISK (= RISK > 10 / RED HIGHLIGHTED) AN ENCLOSED SPACE ENTRY PERMIT SHOULD BE ISSUED PRIOR ENTRY

Figure 8: Cargo holds identified as an enclosed space (highlighted).

The MLC Crew Manual required that the enclosed space atmosphere be tested prior to entry and the permissible range for:

1. oxygen concentration should be at 20.9%;¹⁷ and
2. toxic gas should not exceed 50% of its OEL.¹⁸

The CH No. 4 hatch cover was closed when the Bosun was discovered inside CH No. 4 aft access space. The adjacent CH No. 5 hatch cover was opened as the cargo discharging operation in that cargo hold was ongoing. No Enclosed Space Entry Permit had been issued for the Bosun's entry into the CH No. 4 aft access space as required by the Company's enclosed space entry procedures and the shipboard MLC Crew Manual.

Prior Enclosed Space Entries

Enclosed Space Entry Permits issued prior to the incident were for entry into a cargo hold for cleaning and washing, as well as for inspection and testing of the water ingress system. Pre-entry atmosphere tests were conducted, and the results

¹⁷ Oxygen concentration permissible range was indicated at 20.8% in the Enclosed Space Entry Permit (PER-01) Form.

¹⁸ Toxic gas includes H₂S and carbon monoxide. According to OSHA, the PEL for carbon monoxide was 50 ppm average over eight hours.

recorded on these permits and each permit checklist was completed according to the described reason for entry or work to be done. The Bosun was involved in all the recorded entries on the permits sighted from 14–20 June 2025, as a responsible crewmember designated to be in constant attendance at the entrance to the space.

Enclosed space rescue drills were conducted on board AVRA once every two months in accordance with the requirements of SOLAS.¹⁹ The Bosun was involved in four enclosed space rescue drills since he joined AVRA. Two of the drills that he had participated in were rescues from the aft rope hatch compartment and the aft peak tank. The other two drills he participated in involved a rescue from the carbon dioxide room.²⁰ During these drills, the Bosun was the responsible crewmember designated to be in constant attendance at the entrance to the space.

Similar Incidents

The Administrator issued MSA No. 03-24,²¹ which reminds vessel managers of the need for continued vigilance regarding enclosed space entry and rescue training. Since 2020, 12 enclosed space entry incidents have occurred involving Republic of the Marshall Islands-registered ships, resulting in the loss of 16 lives.

PART 3: ANALYSIS

The following Analysis is based on the above Factual Information.

Bosun's Movements

On the morning of 25 July 2025, cargo was being discharged from CH Nos. 1, 3, and 5. The Bosun, who was on deck at this time, would have been aware that cargo was being discharged from these cargo holds. The hatch covers for CH Nos. 2 and 4, which were both filled with wood pellets, were closed. The Bosun would also have been aware that CH Nos. 2 and 4 were both filled and that the hatch covers were closed. At this time, the cargo of wood pellets inside CH No. 5 had already been discharged to the bottom hopper level (*see Figure 5*).

The Bosun had not reported his movements or work activities on the morning of 25 July 2025 to either the C/O or the OOW as he generally worked independently with a degree of autonomy as an experienced Bosun. C/O oversight of the Bosun was relaxed due to an assumption of competence, resulting in the absence of work-planning communication.

The Bosun, who was aware of AVRA's drydock schedule, had likely entered the CH No. 4 aft access hatch in order to reach to the CH No. 5 forward inspection platform. His intention was likely to sweep the cargo residues from the inspection platform to save time in preparing for the upcoming drydock.

Despite his experience and familiarity working on board bulk carriers, awareness that an Enclosed Space Entry Permit was required to enter an enclosed space, and that wood pellets are an oxygen-depleting cargo, there was no physical barrier present to prevent entry. The visible²² barrier warning the Bosun of the immediate danger beneath CH No. 4 aft

¹⁹ SOLAS Chapter III, Part B, Section I, Regulation 19/3 Drills.

²⁰ A compartment where fixed carbon dioxide fire extinguishing gas bottles were placed.

²¹ MSA No. 03-24 was initially published on 8 February 2024 and updated on 20 February 2026.

²² *See Figure 6* highlighting the small metal plate.

access hatch cover was not easily legible. The warning sign affixed to the CH No. 4 aft access hatch did not provide a clear and obvious warning to ventilate before entry.

The Shipper's cargo information document advised that the spaces of entry into the cargo holds be labeled with "Low Oxygen Risk Area" or equivalent as a safety precaution. This advisory was not implemented on board AVRA. A high visibility warning sign or a physical barrier securing the access hatch cover could have acted as a deterrent and prevented the Bosun from accessing the CH No. 4 aft access hatch space.

Enclosed Space Entry Procedure

The SMS and MLC Crew Manual both identified cargo holds as enclosed spaces. However, the MLC Crew Manual further distinguished between enclosed spaces that require an entry permit and those that do not. While this distinction can improve work efficiency, it also introduces an inherent risk: without proper oversight, personnel may enter an enclosed space where hazards still persist.

Since the CH No. 5 hatch cover was open and the cargo level inside the hold was low, at the bottom hopper level, the Bosun might have thought it was safe to enter CH No. 5 and that an Enclosed Space Entry Permit was not required (*see Figure 8*).

Based on the Company's enclosed space entry procedures, CH No. 4 was an enclosed space when the Bosun entered the CH No. 4 aft access space. He placed himself in a hazardous situation by entering this space without complying with the Company's enclosed space entry procedures.

Cargo Hazards

Before the Bosun was recovered, the C/O measured the atmosphere within the CH No. 4 access space and recorded readings of 40 ppm carbon monoxide and 16.7% oxygen. In accordance with AVRA's SMS requirements, these atmospheric conditions were below the minimum safe oxygen threshold and above the permissible toxic gas limit for personnel entry. Therefore, the atmosphere in the CH No. 4 access space at the time the Bosun was found was unsafe for entry.

According to the IMSBC Code, wood pellets are a cargo prone to oxidation, a process that leads to depletion of oxygen and the generation of carbon monoxide and carbon dioxide within cargo spaces and any connected²³ or communicating areas. The Shipper's SDS and accompanying cargo information further indicated that wood pellets release non-condensable, odorless gases including toxic carbon monoxide, carbon dioxide, and small quantities of methane in conjunction with oxygen depletion.

The hazards associated with oxygen depletion were also addressed during a shipboard Safety Meeting conducted prior to loading the wood pellets, which the Bosun attended. Based on this information and his participation in the briefing, the Bosun would have been aware of the oxygen depleting properties of wood pellets and the essential precautions required prior to entering any cargo hold or its connected access space.

²³ IMO Resolution A.1050(27), Annex, 2 Definitions, 2.2 Adjacent connected space means a normally unventilated space which is not used for cargo but which may share the same atmospheric characteristics with the enclosed space such as, but not limited to, a cargo space accessway.

After entering the CH No. 4 aft access hatch space and working on removing the securing nuts of the manhole, an opening (see Figure 4) that led into the CH No. 5 forward inspection platform, the Bosun had exposed himself to toxic levels of carbon monoxide and to an oxygen deficient environment.

The Bosun was found unconscious and unresponsive at the bottom of the CH No. 4 aft access hatch space, where carbon monoxide levels measured 40 ppm and the oxygen concentration was 16.7%. It was likely that, in the section of the access hatch space where the Bosun had been removing the securing nuts to the manhole, the carbon monoxide levels would have been higher and the oxygen concentration significantly lower. The Bosun would likely have felt the effects of carbon monoxide poisoning and oxygen deficiency and may have attempted to exit the access space in the vicinity of the manhole before succumbing to asphyxiation in the CH No. 4 aft access hatch space.

A death certificate from Seosan Jungang General Hospital in Korea declared the Bosun's cause of death as carbon monoxide poisoning.

PART 4: CONCLUSIONS

The following Conclusions are based on the above Factual Information and Analysis and shall in no way create a presumption of blame or apportion liability.

1. Causal factors that contributed to this very serious marine casualty included:
 - (a) the Bosun's decision to enter the CH No. 4 aft access hatch space, an adjacent connected space to CH No. 4; and
 - (b) lack of oversight by the C/O of the Bosun's movement and work activities during cargo operations in port due to the Bosun's perceived level of experience.
2. Additional causal factors that may have contributed to this very serious marine casualty included:
 - (a) there were no requirements for the reporting of personnel entry into enclosed spaces where the spaces were identified as low risk (Appendix I – MLC Crew Manual); and
 - (b) poor and/or lack of warning signs or physical barriers to prevent unauthorized entry into the cargo holds access hatch spaces.

PART 5: PREVENTIVE ACTIONS

In response to this very serious marine casualty, the Company has taken the following Preventive Actions.

1. Issued a Safety Alert to all vessels within their fleet detailing the incident, emphasizing the importance of always adhering to company procedures, particularly regarding enclosed space entry, which serves to enhance crew awareness and reinforce procedural compliance across the fleet.
2. Issued a training bulletin campaign to all vessels within the fleet regarding enclosed space entry.

3. Reviewed the vessel's training library and enhanced training topics regarding enclosed space entry.
4. Discussed the incident during the Safety Committee Meeting to analyze contributing factors, promote shared learning, and ensure all crew understand the risks and preventive measures related to enclosed space entry.
5. Circulated a fleet-wide safety campaign "Enclosed Space Identification – Cargo Holds & Connected Spaces" to the fleet, including cumulative guidance for warning signage at cargo hold access points.
6. The SMS Entry Into Enclosed Spaces procedure was revised in accordance with IMO Resolution MSC.581(110).

The Administrator has taken the following Preventive Action.

1. Updated MSA No. 03-24 addressing enclosed space entry incidents in conjunction with the Administrator's Marine Notice 7-041-1 highlighting safety precautions to be taken into consideration prior to entering an enclosed space.

PART 6: RECOMMENDATIONS

The following Recommendations are based on the above Conclusions and in consideration of the Preventive Actions taken.

1. It is recommended that the Company:
 - (a) carries out a fleet-wide safety campaign with crew engagement focusing on the safety procedures aimed at preventing casualties to crewmembers entering enclosed spaces;
 - (b) reevaluates categorization of the enclosed spaces taking into consideration the definitions contained within IMO Resolution MSC.581(110)²⁴ to address adjacent connected spaces for any assessments of risk;
 - (c) includes in its enclosed space entry procedures the requirement for reporting of personnel entering into an enclosed space where the space is identified as not high-risk;
 - (d) reviews and as necessary revise the Company's general safe work procedures to ensure the proper supervision and oversight of work activities during cargo operations in port; and
 - (e) improves the existing warning signage to indicate the hazards contained within each enclosed and connected space and add physical barriers to prevent unauthorized entry into the access hatch space of cargo holds.

The Administrator's marine safety investigation is closed. It will be reopened if additional information is received that warrants further review.

24 IMO Resolution MSC.581(110) superseded IMO Resolution A.1050(27) on 3 December 2025.