



REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

NO.2 OCEAN PIONEER MARINE SAFETY INVESTIGATION REPORT

Fatal Enclosed Space Entry

Strait of Hormuz | 25 August 2025

Official Number: 9910

IMO Number: 9340439



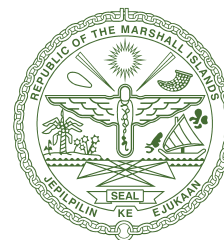
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AUTHORITY

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

°C	Degrees Celsius
2/O	Second Officer
3/O	Third Officer
A/O	Apprentice Officer
AED	Automated External Defibrillator
ASD	Able Seafarer Deck
BA	Breathing Apparatus
C/O	Chief Officer
CCR	Cargo Control Room
CCTV	Closed Circuit Television
Circ.	Circular
CPR	Cardiopulmonary Resuscitation
CT	Cargo Tank
DOC	Document of Compliance
DPA	Designated Person Ashore
EEBD	Emergency Escape Breathing Device
EU	European Union
EU-OSHA	European Agency for Safety and Health at Work
ILO	International Labour Organization
IMO	International Maritime Organization
ISM	International Safety Management
LEL	Lower Explosive Limit
m	Meter
m/s	Meter per Second
m ³	Cubic Meters
m ³ /hr	Cubic Meters per Hour
m ³ /min	Cubic Meters per Minute
m ³ /s	Cubic Meters per Second
mg/m ³	Milligrams per Cubic Meter
mm	Millimeter
MSC	Maritime Safety Committee
MT	Metric Ton

LIST OF ABBREVIATIONS AND ACRONYMS (CONTINUED)

No.	Number
OICNW	Officer in Charge of a Navigational Watch
OOW	Officer of the Watch
OS	Ordinary Seafarer
P	Port
P/S	Port and Starboard
PA	Public Address
ppm	Parts per Million
PV	Pressure Vacuum
RO	Recognized Organization
S	Starboard
SMC	Safety Management Certificate
SMS	Safety Management System
TLV-TWA	Threshold Limit Value–Time Weighted Average
UEL	Upper Explosive Limit
US NOAA	United States National Oceanographic and Atmospheric Administration
UTC	Coordinated Universal Time

DOCUMENTS CITED

COLREGs	International Regulations for Preventing Collisions at Sea
EU Directive 2004/37/EC	Directive 2004/37/EC of the European Parliament and of the Council of 29 April 2004 on the protection of workers from the risks related to exposure to carcinogens or mutagens at work
IBC Code	International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk
ISM Code	International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention
MSA No. 12-25	Marine Safety Advisory No. 12-25, Stop-work Authority
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
STCW Code	Seafarers' Training, Certification and Watchkeeping Code



PART 1: EXECUTIVE SUMMARY

On the morning of 25 August 2025, the C/O on board the Republic of the Marshall Islands-registered oil/chemical tanker NO.2 OCEAN PIONEER, managed by Heung-A Marine Co., Ltd. (the “Company”), was entering Nos. 1–3 P/S CTs to inspect them after they had been washed and gas freed following the carriage of benzene as cargo. Deck ratings then entered the cargo tanks to rinse them with de-ionized water after they had been inspected by the C/O. The C/O had reportedly tested the atmosphere inside these cargo tanks earlier that morning and had determined they were safe for entry. Neither the C/O nor the other crewmembers were wearing a personal gas detector while entering the cargo tanks.

Approximately five minutes after the C/O entered the ship’s No. 3 P CT, crewmembers who were on deck heard a noise and, after looking through the tank dome, saw the C/O lying on the tank top inside of the cargo tank. They immediately called for help and then began bringing rescue equipment to the tank dome. After arriving at the tank dome, the ship’s Master put on a BA set and entered the cargo tank to assist the C/O, who was unconscious and breathing weakly. The Master took the mask of his BA set off and held it over the C/O’s face. The Master then alternated between holding the mask on the C/O’s face and using it himself until he exited the cargo tank when two other crewmembers arrived on scene with a rescue harness. After putting on another BA set, the Master reentered the cargo tank carrying an EEBD that he put on the C/O. The C/O was then hoisted out of the cargo tank.

Once the C/O was on deck, crewmembers started to administer CPR after determining that he did not have a pulse and was not breathing. There were no visible injuries consistent with a fall from height. Despite all efforts to revive the C/O, it was subsequently determined that he was deceased.

The marine safety investigation conducted by the Republic of the Marshall Islands Maritime Administrator (the “Administrator”) determined that the gas freeing operation that had been conducted on 24–25 August 2025 was not effective, the atmosphere inside the cargo tanks had not been properly tested, and the C/O was not wearing a personal gas detector as required by the Company’s procedures. The Administrator’s marine safety investigation also identified evidence of an ineffective safety culture both at the Company level and on board the ship. Some examples include ineffective management oversight by the Company and by the ship’s Master and the Master having acted

contrary to his overall responsibility for ensuring the safety of the ship and all crewmembers by entering No. 3 P CT to assist the C/O. Other examples include that enclosed space rescue drills were likely conducted as pre-scripted exercises rather than conducted to ensure that crewmembers were prepared to respond to an actual emergency and that the crewmembers' records of work and rest hours were not accurately maintained.

The below lessons learned were identified.

- The atmosphere inside an enclosed space must be properly tested to determine if it is safe for entry.
- Gas detection equipment must be used in accordance with the manufacturer's instructions.
- Enclosed spaces should never be entered for any reason without completely implementing established shipboard procedures.
- A positive safety culture both on shore and on board a ship is essential and requires that both shore-based and sea-based staff place safety above all else.
- Enclosed space rescue drills should be conducted as if it was an actual emergency, not as pre-scripted exercises.
- Deviations from established procedures increase the risk of accidents.

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.

NO.2 OCEAN PIONEER was built with 10 pairs of cargo tanks (*see Figure 1*). The volume of the individual cargo tanks was between 603.102–1,932.982 m³. Each of the cargo tanks had a separate cargo line that could be cross connected at either the port or starboard cargo manifold. The cargo lines terminated approximately 80 mm above the tank top of each cargo tank.

SHIP PARTICULARS

Vessel Name
NO.2 OCEAN PIONEER

Registered Owner
GMF SKR No.1 S.A.

ISM Ship Management
Heung-A Marine Co., Ltd.

Flag State
Republic of the Marshall Islands

IMO No. 9340439	Official No. 9910	Call Sign V7A5325
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Year of Build 2006	Gross Tonnage 11,561
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Net Tonnage 6,052	Deadweight Tonnage 19,990
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Length x Breadth x Depth
137.9 x 23.7 x 13.4 m

Ship Type
Oil/Chemical Tanker

Document of Compliance
Recognized Organization
Korean Register

Safety Management Certificate
Recognized Organization
Korean Register

Classification Society
Korean Register

Persons on Board
23



The ship was constructed with a system for gas freeing the cargo tanks that consisted of a gas freeing fan and a gas freeing line with flange connections for connecting hoses to individual cargo tanks or to either the port or starboard side cargo manifold (see Figure 2). The capacity of the gas freeing fan was 150 m³/min.



Benzene, which was the ship's last cargo, is a highly flammable liquid with a melting point of 5.5°C and a boiling point of 80.1°C. Its LEL is 1.2%, or 12,000 ppm, and the UEL is 7.8%, or 78,000 ppm. Benzene vapors are heavier than air with a vapor density of 2.77.

1 High-velocity PV valves relieve excessive over pressure or under vacuum inside cargo tanks by automatically opening to either expel vapor when the pressure inside the cargo tank exceeds the set point of the valve or allow air to enter to prevent a vacuum inside the cargo tank.

Benzene is toxic and a known carcinogen. Exposure to benzene can cause, among other things, breathlessness, temporary incapacitation, and potentially death.² Typical means of exposure are inhalation, skin absorption, ingestion, and skin or eye contact. The TLV-TWA³ established by EU-OSHA for benzene was 0.5 ppm or 1.65 mg/m³.⁴

Narrative

NO.2 OCEAN PIONEER got underway on a ballast voyage from Jubail, Kingdom of Saudi Arabia at 0530⁵ on 24 August 2025 after discharging 17,393 MT of benzene. The ship's next load port was Salalah, Sultanate of Oman (hereinafter "Oman"), where the ship was fixed to load a cargo of methanol. The estimated date of arrival at Salalah was 28 August 2025.

At approximately 0745, the C/O conducted a daily Toolbox Talk with the Bosun, A/O (i.e., Deck Cadet), and deck ratings to review the plan for cleaning the ship's cargo tanks. The plan included flushing and gas freeing each of the cargo lines. The Toolbox Talk was completed by 0800 and the C/O, Bosun, A/O, and deck ratings went out on deck to start work. They continued working throughout the day and by 2100 had washed and steamed Nos. 1–9 P/S CTs. The wash water was transferred to Nos. 10 P/S CTs. Before stopping work for the day, the crewmembers connected a hose from the gas freeing line to the starboard side cargo manifold (see Figure 2), opened the manifold valves for Nos. 1–9 P/S CTs, and started the gas freeing fan. The cargo tank dome hatches for each of the cargo tanks that had been washed and steamed were left partially open (see Figure 3) while the cargo tanks were being gas freed.



Figure 3: Photograph of a partially open cargo tank dome hatch.

² See US NOAA, *Cameo Chemicals* (<https://cameochemicals.noaa.gov/chemical/2577>).

³ TLV-TWA is the time-weighted average concentration limit for an 8-hour workday and a 40-hour workweek to which nearly all workers may be repeatedly exposed, day-after-day, without adverse effect.

⁴ This value was in effect from 5 April 2024 until 5 April 2026, when it was decreased to 0.2 ppm or 0.66 mg/m³. See EU Directive 2004/37/EC, Annex III.

⁵ Unless stated otherwise, all times are ship's local time (UTC +3).

At 0700 on 25 August 2025, the Master and C/O met to review the planned work for the day, which included the C/O inspecting Nos. 1–9 P/S CTs before the crewmembers rinsed them with de-ionized water.⁶ It was also planned for crewmembers to start mopping each of the cleaned cargo tanks. Each of these tasks required crewmembers to enter the cargo tanks. The Master reportedly reminded the C/O to be careful since benzene was highly toxic.

After meeting with the Master, the C/O went out on deck between 0710–0740 and tested the atmosphere in Nos. 1–3 P/S CTs.⁷ The atmosphere at the top, middle, and bottom of each of these six cargo tanks was reported to contain 20.9% oxygen and no hydrocarbons, hydrogen sulfide, carbon monoxide, or toxic gases. The C/O then prepared and issued Enclosed Space Entry Permits for entering each of these cargo tanks. The Enclosed Space Entry Permits recorded the previous cargo as benzene and that the TLV-TWA was 0.5 ppm. It could not be confirmed if the gas freeing fan had been shut down while the C/O tested the atmosphere in the cargo tanks. The C/O was not accompanied by another crewmember while he was testing the atmosphere inside the cargo tanks.⁸ Five used benzene gas detector tubes and four used pre-treatment tubes were later found in the CCR.

The C/O met with the Bosun and deck ratings in the CCR at 0750 to conduct a daily Toolbox Talk to review the work planned for the day. Prior to the completion of the meeting at 0800, the C/O, Bosun, and each of the deck ratings signed the Company’s risk assessment for entering an enclosed space. Crewmembers stated that the C/O had not reviewed the risk assessment with them before he directed them to sign it.

Between approximately 0815 and 0850, the C/O inspected Nos. 1 and 2 P/S CTs and deck ratings entered Nos. 1 and 2 S CTs to rinse them with de-ionized water. The gas freeing fan was running to mechanically ventilate the cargo tanks. The deck rating who entered Nos. 1 and 2 S CTs said they assumed the cargo tanks were safe to enter because they had seen the C/O enter and exit them. None of the crewmembers who were working in Nos. 1 and 2 S CTs were wearing a personal gas detector or carrying EEBDs.⁹

The C/O entered No. 3 P CT shortly after 0850. Crewmembers who were working on deck said that the C/O was carrying a portable gas meter but could not confirm if he had carried it into the cargo tanks. They were also not aware if the C/O had checked the atmosphere immediately before he entered any of the cargo tanks.

Within five minutes from when the C/O entered No. 3 P CT, the OS1 and A/O, who were on standby next to the tank dome, heard a noise inside the cargo tank. They looked down into the cargo tank and saw the C/O lying on the tank top between the access ladder and the cargo fill line (*see Figure 4*).

⁶ De-ionized water is used to rinse off any residues that might remain after a cargo tank has been washed. The absence of ions in the water prevents unwanted chemical reactions, ensuring no spots or contaminants are left behind that could harm the tank coating.

⁷ These times are based on the Enclosed Space Entry Permits for entering these tanks on 25 August 2025.

⁸ Although there was a CCTV camera that provided imagery of the main deck forward of the Accommodations, it was not possible to recreate the C/O’s activities while he was on deck testing the atmosphere in the cargo tanks.

⁹ Per IMO MSC/Circ.849, EEBDs are intended to be used to escape from a compartment with a hazardous atmosphere. They are not to be used as a substitute for a BA set when entering a space (e.g., cargo tank) that has an oxygen deficient or toxic atmosphere. Carrying an EEBD as a piece of PPE into a cargo tank or other space that has been determined to have an atmosphere safe for entry is consistent with the guidance in the IMO circular.

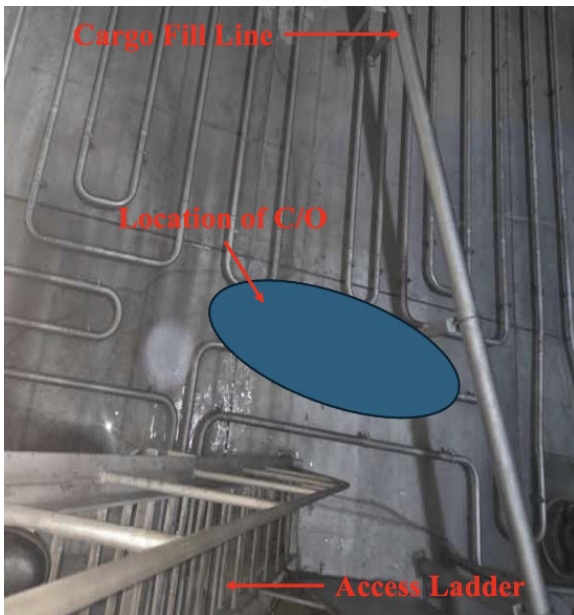


Figure 4: Inside of No. 3 P CT showing where the C/O was seen lying on the tank top.

The OS1 and A/O immediately called for help. The Bosun tried calling the OOW on the Bridge by radio but could not contact him. The Bosun then went aft to the CCR and used the ship's telephone to call the OOW. The OOW immediately informed the Master, who was working on the Bridge as the ship transited southbound through the Strait of Hormuz, sounded the general alarm, and then announced the emergency on the ship's PA.

The Master left the Bridge and proceeded directly to the No. 3 P CT tank dome. The 2/O took two EEBDs and went forward to assist as other crewmembers brought BA sets, spare oxygen bottles, and a rescue harness. The first 3/O, who had been on duty as the OOW, went forward with an AED and first aid equipment after being relieved by the second 3/O.

The Master put on a BA set and entered No. 3 P CT at 0905 to assist the C/O. The C/O was unconscious and breathing weakly when the Master reached him. The Master took his BA set mask off and put it on the C/O, who started to breathe more easily. The Master then switched the mask between him and the C/O as ASD1 and ASD2, who were both wearing BA sets, entered the cargo tank with a rescue harness. The Master, who reported having had difficulty breathing when he was not wearing the BA set mask, left the cargo tank wearing the BA set, as the ASDs put the rescue harness on the C/O, who was reported to have been gasping for breath.

Prior to re-entering the cargo tank, the Master replaced his BA set for a full bottle, and entered the cargo tank carrying an EEBD that had been brought forward by one of the ship's crewmembers. After reaching the C/O, the Master put the EEBD on the C/O. He then checked the rescue harness before crewmembers on deck hoisted the C/O out of No. 3 P CT at 0920.

The C/O was unconscious, without a detectable pulse, and not breathing when he was examined after being hoisted out of the cargo tank. Crewmembers began to administer CPR, but the C/O remained unresponsive. Crewmembers then

attempted to revive the C/O without success using an AED following the prompts on the unit's screen. As crewmembers were attempting to revive the C/O, the Master informed the Company that the C/O had fallen inside No. 3 P CT.

The C/O was found without a personal gas detector when he was removed from No. 3 P CT. Neither was a portable gas detector found inside the cargo tank after he was hoisted out.

At 1030, crewmembers carried the C/O on a stretcher to the ship's Gym. The C/O, who remained unconscious without a detectable pulse and not breathing, was bleeding from his mouth and nose, cold to the touch, and his eyes were not responsive to light. He did not have any indications of external injuries consistent with a fall from height. At 1040, the Master determined that the C/O was deceased.

After consulting with the Company, at 1155, the Master ordered the ship's course be set for Muscat, Oman, where the C/O's body was disembarked following the ship's arrival on the morning of 28 August 2025.

The death certificate issued by the public health authorities in Oman stated that the cause of the C/O's death was cardiac arrest. An autopsy report was not available.

No damage or defects were observed when the access ladder was inspected by a third-party inspector following the ship's arrival at Muscat.

Tank Cleaning

As required by the ISM Code, the Company's SMS included established procedures for routine shipboard tasks, including cleaning and gas freeing of cargo tanks. These procedures referred to a third-party tank cleaning guide, which was available on board, as the basis for preparing a plan for cleaning cargo tanks.

Based on NO.2 OCEAN PIONEER's most recent cargo (i.e., benzene), the third-party tank cleaning guide specified, in addition to flushing the cargo lines and bottoms of the cargo tanks, the following steps for cleaning the ship's cargo tanks:

1. wash with ambient sea water¹⁰ for one hour;
2. wash with sea water at 70–80°C for one and a half hours;
3. rinse with ambient temperature fresh water for 20 minutes; and
4. venting, mopping, and drying.

In contrast, the plan that was prepared by the C/O and approved by the Master for cleaning the ship's cargo tanks required: flushing the cargo lines and bottoms of the cargo tanks;

1. washing with ambient temperature fresh water for 20 minutes;
2. gas freeing; and
3. drying and mopping.

¹⁰ The sea water temperature was to be 10–15° above the melting point of cargoes with a freezing point of 0°C or higher. As previously stated, benzene is a liquid at temperatures above 5.5°C. The recorded sea water temperature at 0800 on 25 August 2025 was 28°C.

The procedure being followed by the C/O, when the cargo tank cleaning operations were conducted on 24–25 August 2025, was:

1. flushing the cargo lines and bottoms of the cargo tanks;
2. washing with ambient fresh water for 20 minutes;
3. steaming for two hours;
4. gas freeing;
5. rinsing with de-ionized water; and
6. drying and mopping.

The reason why the procedure approved by the Master omitted the wash with ambient and hot sea water specified by the third-party tank cleaning guide or why the procedure that was followed included steaming and rinsing with de-ionized water in addition to washing with ambient fresh water could not be established with certainty.

Gas Freeing¹¹

The Company's gas freeing procedures, which were included as part of its SMS, required that when gas freeing operations were being conducted, the atmosphere inside a cargo tank be changed three to five times and that toxic and flammable gases be vented from cargo tanks at an exit velocity "sufficient to carry the vapors clear of the deck." The minimum allowed exit velocity for vapors vented from a cargo tank during gas freeing operations was 30 m/s.¹² The Company's procedures also required that no cargo vapors be vented at deck level until the atmosphere inside the cargo tank was less than 30% of the lower flammable limit and below the relevant TLV-TWA.

The Company's procedures required that the tank dome hatch be kept closed so that there was sufficient pressure to cause the high-velocity PV valve to open and expel any cargo vapor that might be inside the cargo tanks being gas freed.

The Company's procedures permitted the use of either fixed or portable fans for gas freeing cargo tanks. These procedures required that when using a fixed fan, air should be introduced into the cargo tanks through the cargo lines. The cargo lines were required to have been drained before gas freeing operations were started to avoid blowing cargo residue into the cargo tank.

The Company's gas freeing procedures included guidance for calculating the number of cargo tanks that could be gas freed at the same time, based on the capacity of the fan and the minimum venting rate, which was a function of the area of the vent line and the minimum required exit velocity (i.e., 30 m/s) of vapor through the vent line.

Gas Detection Equipment

The gas detection equipment on board NO.2 OCEAN PIONEER included two portable multi-gas detectors capable of detecting oxygen, carbon monoxide, hydrocarbons, and hydrogen sulfide and two portable gas detectors capable of

¹¹ Only those provisions of the Company's gas freeing procedures that were applicable to the gas freeing operation conducted on board NO.2 OCEAN PIONEER on 24–25 August 2025 are addressed in this report.

¹² This is the minimum exit velocity required by the IBC Code, Regulation 8.3.5 for vapor expelled from vents that extend 3 m above the deck or catwalk.

detecting oxygen and hydrocarbons. An extension hose for the portable multi-gas meters was available on board. The ship also carried four personal multi-gas detectors capable of detecting oxygen, carbon monoxide, hydrocarbons, and hydrogen sulfide. Each of the portable and personal multi-gas detectors had last been tested and calibrated by a certified third-party on 25 January 2025. Records of when they had last been tested on board against span gas, cans of which were available on board, were not available.

The ship also carried toxic gas detector tubes for 11 different chemicals, including benzene, and two sample pumps that were both fitted with a 10 m long extension hose. Each box of gas detector tubes included a copy of the instructions for those particular tubes.

The detection range of the benzene detector tubes was 0.1–10 ppm of benzene. Each box of the benzene detector tubes contained five tubes for detecting benzene and five pre-treatment tubes. The gas detector and pre-treatment tubes could be used only once. The inventory of toxic gas detector tubes indicated that there had been 100 benzene detector tubes on board prior to the ship's arrival at Jubail. The inventory of toxic gas detector tubes had not been updated after the C/O reportedly checked the atmosphere inside of Nos. 1–3 P/S CTs on the morning of 25 August 2025.

Based on the manufacturer's instructions, the benzene detector tube was required to be used in series with a pre-treatment tube. Both tubes were supposed to be connected to the end of the extension hose (*see Figure 5*) and lowered into the space in which the atmosphere was to be tested. The manufacturer's instructions for the benzene detector tubes that were on board NO.2 OCEAN PIONEER stipulated that the sample pump be stroked five times, with two minutes between strokes so that each test required ten minutes. Per the manufacturer's instructions, no additional strokes of the sample pump or additional time between strokes was required when using a 10 m extension hose.

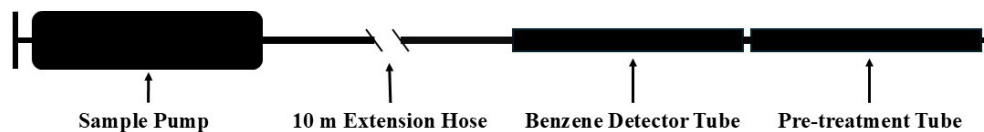


Figure 5: Schematic of the toxic gas detector sample pump, extension hose, and tubes.

The Company's procedures for testing atmospheres inside an enclosed space required that portable gas detectors be checked against span gas and that the sample pumps be inspected prior to use. These procedures also included guidance for using hand-powered sampling pumps with an extension hose when testing for toxic gases. This guidance required an additional one and a half strokes of the sample pump per meter of extension hose in addition to the number of strokes required for the toxic gas detector tube being used.

Enclosed Space Entry

The Company's SMS also included procedures for entering an enclosed space on board Company-managed ships. These procedures identified cargo tanks as enclosed spaces. These procedures required that:

1. an Enclosed Space Entry Permit be issued;
2. the risk associated with entering the enclosed space be determined; and
3. the atmosphere inside the space be tested at different levels.

The Company's procedures also required that each person entering an enclosed space carry an EEBD and that at least one of the crewmembers entering an enclosed space wear a personal multi-gas detector capable of monitoring oxygen, hydrocarbon vapor, and hydrogen sulfide. These procedures also required that a crewmember be in attendance and that a BA set, resuscitation equipment, and rescue harness with lifeline be ready for use at the entrance to the enclosed space being entered.

Consistent with the Company's procedures, the C/O issued Enclosed Space Entry Permits for entering Nos. 1–3 P/S CTs on the morning of 25 August 2025. These permits were not reviewed by the ship's Master before they were issued or before the C/O and deck ratings entered these cargo tanks. Except for the Enclosed Space Entry Permit for No. 1 P CT, which was only partially completed, all the permits indicated that the C/O had complied with all the Company's requirements. The incomplete requirements on the permit for entering No. 1 P CT were whether the cargo tank would be continuously ventilated, if at least one crewmember would carry a personal gas detector, if there was adequate lighting, and whether rescue and resuscitation equipment was available at the entrance to the space. Each of the permits, including the permit for No. 1 P CT, were signed by the C/O and crewmembers tasked with conducting a de-ionized water rinse of a given cargo tank.

The Company maintained a library of risk assessments for routine shipboard tasks, including for entering an enclosed space. This risk assessment, which had been reviewed by the C/O, identified hazards commonly associated with entering an enclosed space, including lack of oxygen and the presence of toxic and flammable gases. The identified hazards also included the use of defective equipment for testing the atmosphere inside the enclosed space. Identified controls included testing the atmosphere at different points inside the enclosed space, maintaining continuous ventilation while crewmembers were inside the space, and calibrating gas detectors in accordance with the manufacturer's instructions, which included checking/cleaning the air filter once a month and testing it against span gas every six months.

The Company's enclosed space entry procedures required that ventilation should be stopped for a minimum of 10 minutes before the atmosphere inside an enclosed space was tested. These procedures also required that the atmosphere be checked at three levels inside a tank¹³ which included the:

1. bottom of the tank, which was defined as being 5–15% of the depth of the tank;
2. middle of the tank, which was defined as being 45–55% of the depth of the tank; and
3. top of the tank, which was defined as being 85–95% of the depth of the tank.

Ventilation was required to be restarted after the atmosphere inside the tank was checked and maintained continuously while crewmembers were inside.

Each Enclosed Space Entry Permit included the results of the atmospheric testing conducted by the C/O on the morning of 25 August 2025. As previously stated, the atmosphere at the top, middle, and bottom of Nos. 1–3 P/S CTs contained 20.9% oxygen and no hydrocarbons, hydrogen sulfide, carbon monoxide, or toxic gases. It was not possible to establish whether the C/O used an extension hose with the portable multi-gas detector to check for oxygen, hydrocarbons, hydrogen sulfide, or carbon monoxide.

¹³ These procedures applied to all tank types (e.g., cargo, fuel oil, water, ballast, etc.) and voids.

The serial number and last calibration date of the portable multi-gas detector that had been used for measuring oxygen, hydrocarbons, hydrogen sulfide, and carbon monoxide in Nos. 1–3 P/S CTs was included on each of the Enclosed Space Entry Permits. The Enclosed Space Entry Permits also included the identification number of the toxic gas detector tubes used to test for benzene inside each of the cargo tanks.

Rescue

The Company had established procedures in place for conducting enclosed space rescues. These procedures required that the first action in an enclosed space rescue operation was to raise the alarm, noting that although speed was vital, a hasty or ill-prepared rescue attempt could place the rescue team into danger. These procedures also required that the officer responsible for directing the rescue operation remain outside of the enclosed space.

The Company’s enclosed space rescue procedures did not address testing the atmosphere inside an enclosed space before it was entered by a rescue team.

Enclosed Space Entry Rescue Training and Drills

Enclosed space rescue entry training and rescue drills were required to be conducted every two months in accordance with the Company’s training schedule. The dates of the three most recent drills and the scenario they were based on were:

- 1. 10 March 2025 — rescue of Bosun from No. 5 S CT;
- 2. 11 May 2025 — rescue of Bosun from the Bow Thruster Room; and
- 3. 6 July 2025 — rescue of Bosun from the Bow Thruster Room.

The record of each drill included a detailed, printed list of actions taken. The time when each action was reported to have been taken was handwritten (see Figure 6).

*상황발생 (The occurrence of situation)	
(14 30)	ABA reports to Duty officer & C/O that the BSN fall down in Bow thruster room.
(14 32)	C/O orders ABB to bring the Self Contained Breathing Apparatus(SCBA). By that time, C/O check the Oxygen & gas in bow thruster room by portable detector.
(14 34)	Duty officer reported the facts to Master. And sounded the emergency signals and announced "All crews station for the rescue response" under Master's order. C/O ordered ABB & OLR-A to wear the Self Contained Breathing Apparatus and come down with Life Line into the Bow thruster room All crews mustered at the scene with the rescue equipment.
(14 36)	Master was on the bridge and reported the accident to company and ordered C/O to wear the SCBA for supplying the oxygen to BSN in Bow thruster room. C/O ordered ABB to wear the SCBA & rescue equipments to BSN.
(14 38)	ABB supplied the oxygen in SCBA to BSN and sent the signals, lift up the BSN to deck, wearing the rescue equipment on BSN.
(14 40)	C/O ordered crews to lift up BSN using by rescue equipment from Bow thruster room to deck, ABB checked the remained pressure of SCBA and helped the rescue of BSN in order to a safe rescue.
(14 42)	After lifting up BSN to deck, C/O ordered 2/O to send back BSN on the fresh air area and check the breathing condition, the pulse and the pupil of BSN. C/O reported to Capt. that BSN was rescued from Bow thruster room.
(14 44)	C/O reported to Master, that BSN's consciousness, pulse and breathing was come to a normal condition and found out fracture on bone & scratch on skin. 2/O commence the first aid then move to the hospital. C/O report above situation.
(14 46)	Master reported the BSN's condition to company and requested the help of shore medical advise for BSN's close health examination.

Figure 6: Portion of the record for the enclosed space rescue drill reported to have been conducted on board NO.2 OCEAN PIONEER on 6 July 2025.

The training conducted in conjunction with the drill included a review of the hazards associated with enclosed spaces and a review of the Company's enclosed space entry procedures.

Of the crewmembers who were engaged in cleaning the ship's cargo tanks on 25 August 2025, only the ASD2 and ASD3 had been on board for each of the three most recent enclosed space entry rescue training and drills conducted on board the ship. The C/O and the other crewmembers who signed on board on 6 June 2025 had only been on board for the training and drill that was conducted on 6 July 2025. The records for these drills included actions taken by different crewmembers but did not include a list of the crewmembers who participated in each drill.

During the interview conducted on 9 September 2025, as part of the Administrator's marine safety investigation, crewmembers could not recall approximately when, or the space in which, the most recent enclosed space entry rescue training and drill had been conducted. One of the ship's crewmembers questioned whether enclosed space entry training and drills had been conducted.

Stop-work Authority

The Company's safe-work procedures included a "STOP CARD" system, which gave every crewmember on board a Company-managed ship the responsibility when they saw an unsafe act to tell other crewmembers to stop work. Crewmembers to whom a STOP CARD was directed were required to stop working until any required corrective actions were implemented. The crewmember who issued the STOP CARD was required to inform either the C/O or C/E of the unsafe act and action taken to correct it. Observed deviations from a work permit, such as an Enclosed Space Entry Permit, were supposed to be reported immediately to the C/O or C/E, and work was not to resume without the approval of the C/O or C/E.

The deck ratings on board NO.2 OCEAN PIONEER were aware they could stop work if they witnessed something that was not safe. There is no indication that any of them observed any act that they considered to be unsafe while they were working on deck on the morning of 25 August 2025.

Crew

NO.2 OCEAN PIONEER had a complement of 23 crewmembers, seven more than what was required by the Minimum Safe Manning Certificate issued by the Administrator. Crewmembers assigned to the deck department who were on board in excess of the required minimum safe manning included a second 3/O, an A/O, and Bosun. The duties of the second 3/O included standing watch as an OOW. The other crewmembers who were in excess of the required minimum safe manning included a Fitter and a Wiper who were assigned to the Engine Department, a Chief Cook, and a Messman.

The Master, C/O, C/E, 3/E, and A/O were Republic of Korea nationals. The ship's other officers and ratings were either Republic of Indonesia or Republic of the Union of Myanmar nationals.

Neither the C/O, the Bosun, nor the OSs were assigned any navigation watchstanding duties.

Each crewmember held the appropriate Republic of the Marshall Islands-issued seafarer documentation for their position on board NO.2 OCEAN PIONEER. The required qualifications included certification for service on board oil and chemical tankers verifying completion of the training required by STCW, Regulation V/1-1.13.

The experience of the Master, C/O, and other crewmembers who were working on deck on the morning of 25 August 2025 is shown in the following table.

RANK	TIME ON BOARD NO.2 OCEAN PIONEER	TIME IN RANK	TIME WITH COMPANY	TOTAL TIME AT SEA
Master	8 months	5 years	13.3 years	26.1 years
C/O	2.6 months	8 months	4.1 years	8 years
Bosun	2.6 months	2.4 years	6.2 years	7.3 years
A/O	2.6 months	2.6 months	2.6 months	2.6 months
ASD1	2.6 months	4.3 years	5 years	6.6 years
ASD2	7.6 months	8.8 years	7.6 months	10 years
ASD3	7.8 months	4 years	8.3 months	6.8 years
OS1	4 days	4 days	4 days	11 months
OS2	2.6 months	9 months	2.6 months	10 months

The C/O had sailed on board Company-managed oil/chemical tankers since he was promoted from A/O to 3/O in February 2020. He was promoted from 2/O to C/O on 1 October 2024 while serving on board another of the Company’s oil/chemical tankers. After being signed off after completing his first contract as C/O on 1 March 2025, he completed an advanced oil and chemical cargo operations course on 30 May 2025.¹⁴ He had not previously served on NO.2 OCEAN PIONEER before signing on board on 6 June 2025. The Master, who had not sailed with the C/O before, described him as being smart, very good at his job, and hard working.

The C/O’s most recent pre-employment medical exam had been conducted on 30 May 2025. He was reported to not be suffering from any medical condition that would likely be aggravated by or render him unfit for service at sea. He was also reported to have not been taking any prescription or non-prescription medications.

The Bosun, ASD1, OS2, and A/O all signed on board NO.2 OCEAN PIONEER on 6 June 2025. NO.2 OCEAN PIONEER was the first ship on which the A/O had worked.

The ASD3 had sailed for four years as an ASD before signing on board NO.2 OCEAN PIONEER as an OS in December 2024. He was promoted to ASD on 21 August 2025 while the ship was alongside at Jubail. The OS1, who had joined the ship on 21 August 2025, had not previously sailed as an OS. He had previously sailed as a Deck Cadet on board an oil/chemical tanker managed by another ship manager.

14 These courses met the requirements of STCW, Regulation V/1-1, paragraphs 4 and 6.

The C/O and other crewmembers who were working on deck on the morning of 25 August 2025 had completed the Company required safety familiarization training after signing on board the ship. This training included a review of the Company's enclosed space entry procedures.

Work and Rest Hours

The records of work and rest hours for the C/O, Bosun, A/O, and deck ratings indicate that they had received the amount of rest mandated by the STCW Code, Section A-VIII/1, paragraphs 2 and 3 and MLC, 2006, Regulation 2.3 during the 24-hour and seven-day periods before the C/O entered No. 3 P CT on 25 August 2025. These records also indicate that, with some exceptions related to the ship's port calls at Fujairah, United Arab Emirates for bunkering on 19 August 2025 and at Jubail to discharge cargo from 21–24 August 2025,¹⁵ these crewmembers had worked and rested on each day during the seven-day period before the C/O entered No. 3 P CT in accordance with the schedule established by NO.2 OCEAN PIONEER's Table of Shipboard Working Arrangements.¹⁶

When interviewed as part of the Administrator's marine safety investigation, the Bosun and deck ratings said they, along with the C/O, had been engaged in cargo tank cleaning operations almost continuously between 0800–2100 on 24 August 2025. They also stated that the C/O maintained their individual work and rest hour records. The recorded hours of work for the C/O and other crewmembers engaged in tank cleaning operations on 24 August 2025 are shown in the table below.

RANK	HOURS OF WORK ON 24 AUGUST 2025
C/O	0230–0630, 1300–1700
Bosun	0330–0600, 1000–1200, 1300–1700
A/O	0500–0600, 0800–1200, 2000–2400
ASD1	0500–0600, 0800–1230, 2000–2400
ASD2	0000–0400, 0500–0600, 1200–1600
ASD3	0400–0830, 1600–2030
OS1	0500–0600, 0800–1200, 1300–1700
OS2	0500–0600, 0800–1200, 1300–1700

When asked about their watchstanding duties following the ship's departure from Jubail, the ASDs stated they had been day-working on deck as part of the tank cleaning working party. In contrast, the ship's Deck Log Book indicated that an ASD had been on duty as part of the ship's navigational watch from the time NO.2 OCEAN PIONEER departed Jubail and when the C/O entered No. 3 P CT on the morning of 25 August 2025.

¹⁵ As previously stated, the ship departed Jubail at 0530 on 24 August 2025.

¹⁶ This table was based on the model format in the IMO/ILO Guidelines for the Development of Tables of Seafarers' Shipboard Working Arrangements and Formats of Records of Seafarers' Hours of Work or Hours of Rest, Appendix 3.

Additional Audits

An additional audit of the Company's implementation of its SMS was conducted by the RO that issued the Company's DOC at the Company's office on 11 November 2025. Two non-conformities related to the compliance with the Company's procedures for shipboard operations and one non-conformity related to the implementation of the Company's procedures for verifying, reviewing, and evaluating compliance with its SMS were issued. The Company identified root causes and corrective actions for these non-conformities are shown in the following table.

NON-CONFORMITY	ROOT CAUSES	CORRECTIVE ACTION
Cargo tank cleaning for change over from benzene to methanol was not done in accordance with the Company's procedure	- Lack of familiarization with SMS - Lack of safety awareness - Lack of training and monitoring related issue	- Masters conducted training for their ship's crewmembers addressing cargo tank cleaning procedures - DPA conducted training for Port Captains and Superintendents addressing procedures for reviewing and monitoring ships' cargo tank cleaning plans for compliance with the Company's procedures - Compliance with Company's procedures for cargo tank cleaning will be verified during regular internal audits
Issuance/approval of permits	- Lack of familiarization with SMS - Negligence of relevant personnel	- Masters conducted training for their ship's crewmembers addressing the Company's procedures for issuing Enclosed Space Entry Permits - Masters were instructed by the DPA to strictly comply with the Company's procedures for entering enclosed spaces and were instructed to send Enclosed Space Entry Permits to the Company for approval before crewmembers entered an enclosed space - DPA conducted training for Port Captains and Superintendents addressing procedures for reviewing and approving Enclosed Space Entry Permits before crewmembers entered an enclosed space
Conducting special internal audits	- Lack of familiarization with SMS - Negligence of relevant personnel	- DPA retrained the Company's safety management team on internal audit procedures, including those for conducting special internal audits - A special internal audit was conducted on board NO.2 OCEAN PIONEER

The RO that issued the ship's SMC conducted an additional audit of the implementation of the Company's SMS on board NO.2 OCEAN PIONEER on 16 November 2025. Four non-conformities related to the designation of a DPA,

emergency preparedness; reports and analysis of non-conformities; accidents and hazardous occurrences; and Company verification, review, and evaluation, were issued. The non-conformities identified by the RO and the root causes and corrective actions identified by the Company are shown in the following table.

NON-CONFORMITY	ROOT CAUSES	CORRECTIVE ACTION
The latest Declaration of Company had not been provided on board the ship	Negligence of relevant personnel	- The latest Declaration of Company would be immediately provided to the ship - The DPA would educate all safety management team members regarding the need to provide a company declaration
A management review was conducted only once in 2023 and 2024 and had not been conducted in 2025 whereas the Company's Quality Manual required such reviews be conducted twice a year	- Insufficient supply (support) from Company - Negligence of relevant personnel	- The Company would provide ships with management reviews conducted between 2023–2025 - The ship's Master would circulate the management reviews with crewmembers - The DPA would educate all safety management team members regarding the management review process
Enclosed Space Entry Permit was not carried out on 25 August 2025 (during incident) and the gas detection equipment was not properly calibrated prior to entry into the enclosed space	- Negligence of relevant personnel - Lack of familiarization with SMS documents - Lack of training	- The Master would train all crewmembers on the procedures for issuing an Enclosed Space Entry Permit - The Master would familiarize all crewmembers with requirements for testing atmospheres inside enclosed spaces and calibration of gas detectors before use - The Master would train the officer in charge regarding how to calibrate gas detection equipment and for maintaining records of calibration - Masters would be required to send Enclosed Space Entry Permits to the Company for review before any enclosed space entry
The incident investigation report and identified preventive measures were not distributed to Company-managed ships	- Negligence of relevant personnel - Insufficient supply by Company	- The Company would send a copy of the incident investigation report and preventive actions to Company-managed ships - Masters would review the incident investigation report and preventive actions with crewmembers - The DPA would train Superintendents and staff regarding procedures for conducting incident investigations, and for identifying and implementing preventive actions

A member of the Company's safety management team conducted a special internal audit on board NO.2 OCEAN PIONEER on 16–17 December 2025. Issues that were identified by the auditor included that:

1. the Company's SMS manual was excessively large and complex which made it difficult for crewmembers to quickly locate specific procedures;
2. Company shore staff had not provided copies of current revisions of the SMS or changes to regulations to Company-managed ships in a timely manner;
3. crewmembers expressed fear of repercussions in response to audit findings, leading to a low-trust environment and reluctance to report potential problems;
4. the current audit process was a "superficial 'tick-box' exercise that prioritized documentary evidence and that the audit process should be revised to focus on assessing the substantive implementation of the Company's SMS; and
5. although the audit was scheduled taking shipboard operations into account, crewmembers reported they found it difficult to focus on both the audit and shipboard operations that were ongoing when the audit was conducted.

PART 3: ANALYSIS

The following Analysis is based on the above Factual Information.

C/O's Entry into No. 3 P CT

The C/O entered No. 3 P CT shortly after 0850 on 25 August 2025 to inspect the interior of the cargo tank. The inspection was part of the cargo tank cleaning operation that had been conducted on board NO.2 OCEAN PIONEER on 24–25 August 2025 while the ship was underway en route to its next load port. His entry into the cargo tank was witnessed by the OS1 and A/O, both of whom were on deck next to the No. 3 P CT tank dome.

The C/O entered the cargo tank without wearing a personal gas detector or carrying a portable multi-gas detector or an EEBD, as required by the Enclosed Space Entry Permits that he had issued earlier that morning or the Company's enclosed space entry procedures. Similarly, the requirement on the Enclosed Space Entry Permits for a BA set or rescue harness with lifeline to be available at the tank dome hatch was not complied with during the C/O's entry into Nos. 1 P/S, 2 P/S, and 3 P CTs or the deck ratings entry into Nos. 1 and 2 S CTs to rinse them with de-ionized water.

Why the C/O fell approximately five minutes after he entered No. 3 P CT cannot be determined with certainty. The fact he did not have any external injuries, or other symptoms of having fallen from height, indicated that the C/O fell after reaching the tank top rather than falling from the access ladder while climbing down into the cargo tank. The C/O, who did not have any known pre-existing medical conditions, had been inside the cargo tank for approximately 10 minutes when the Master arrived on scene and found him lying unconscious on the tank top and breathing weakly.

The atmosphere inside of No. 3 P CT was not checked before the Master or other crewmembers entered the cargo tank to assist the C/O, nor are the results of any post-mortem toxicology tests that might have been conducted in Oman available to the Administrator, so the contents of the atmosphere inside the cargo tank is not known with any degree of certainty.

However, the fact that the C/O was unconscious and breathing weakly when the Master reached him indicated that the atmosphere in at least the lower portion of No. 3 P CT was oxygen deficient. This is consistent with the Master reporting that he had difficulty breathing when he was holding the BA set mask on the C/O's face.

Gas Freeing

The crewmembers had connected a hose from the gas freeing line to the starboard side cargo manifold (see Figure 2), opened the manifold valves for Nos. 1–9 P/S CTs, and then started the gas freeing fan to gas free the 18 cargo tanks that had been washed or steamed on 24 August 2025. They also left the cargo tank dome hatches partially open (see Figure 3). By the time that the C/O entered No. 3 P CT on the morning of 25 August 2025, the gas freeing fan had been running for approximately 11–12 hours.

Based on the guidance in the Company's gas freeing procedures and the rated capacity of NO.2 OCEAN PIONEER's gas freeing fan (i.e., 150 m³/min), the diameter of the cargo tank vent lines (i.e., 100 mm), and the minimum required exit velocity (i.e., 30 m/s), no more than ten cargo tanks could have been gas freed at the same time.¹⁷ These procedures also required that the tank dome hatches be kept closed so there would be sufficient pressure to cause the high-velocity PV valve to open and expel any cargo vapor that might be inside the cargo tanks.

The gas freeing fan had been running long enough for the atmosphere inside each of Nos. 1–9 P/S CTs to have been changed 3–5 times as required by the Company's gas freeing procedures.¹⁸ However, because the tank dome hatches were all partially open as air was being supplied concurrently to Nos. 1–9 P/S CTs, it is not likely that the gas freeing fan would have generated sufficient pressure inside each of these 18 cargo tanks to open the high-velocity PV valve and expel benzene vapor through the cargo tanks' vent lines.

Some benzene vapors may have been expelled through the partially open tank dome hatches. However, this would not have been as effective as the combination of air entering the cargo tanks under pressure through the cargo fill lines, mixing with the benzene vapors, and the resulting mixture being pulled out of the cargo tanks through the vent lines due to the negative pressure that would have been created as vapors were expelled at high velocity through the PV vents. It could also have resulted in creating temporary, localized concentrations of benzene vapors on deck in the vicinity of the tank domes.

Although the C/O had entered Nos. 1–2 P/S CTs without any apparent adverse effects and the crewmembers who entered Nos. 1 and 2 S CTs after him did not report any negative effects, the likelihood that the atmosphere in No. 3 P CT was oxygen deficient indicates that the gas freeing operation conducted on 24–25 August 2025 had only been partially effective.

Testing of Atmospheres in Cargo Tanks

The Enclosed Space Entry Permits that the C/O issued for entering Nos. 1–3 P/S CTs on the morning of 25 August 2025 showed that he had tested the atmosphere at the upper, middle, and lower portion of each of these six cargo tanks for oxygen, hydrogen sulfide, hydrocarbons, carbon monoxide, and benzene. Given that the depth of each cargo tank was

¹⁷ This was determined by first converting the capacity of the gas freeing fan from m³/min to mv/s (e.g., 150 m³/min to 2.5 m³/s) and the diameter of the vent line from mm to m (e.g., 100 mm to 0.1 m). The capacity of the gas freeing fan was then divided by the minimum required venting rate, which is a function of the area of vent pipe times the minimum required exit velocity (e.g., 30 m/s). The result was rounded down to the nearest whole number.

¹⁸ The total volume of Nos. 1–9 P/S CTs was 21,446 m³. Given the capacity of the gas freeing fan (e.g., 150 m³/min), 7–12 hours would have been required to change the atmosphere three to five times at the same time in all of these cargo tanks.

11.35 m, the Company's procedures required that the atmosphere in each cargo tank be tested at depths of approximately 0.5–1.7 m, 5.1–6.2 m, and 9.6–10.8 m from the top of each cargo tank.

The Enclosed Space Entry Permits issued by the C/O indicated that he spent 30 minutes testing the atmosphere in Nos. 1–3 P/S CTs on the morning of 25 August 2025. Based on the manufacturer's instructions for the benzene gas detection tubes, a minimum of 30 minutes was required to test the atmosphere at the top, middle, and bottom of any one cargo tank or three hours to test the atmosphere at the top, middle, and bottom of all six cargo tanks.¹⁹ Some additional time would have been required to change the detector and pre-treatment tubes between each test and for testing each of the cargo tanks at three levels for oxygen, hydrogen sulfide, hydrocarbons, and carbon monoxide using the portable multi-gas detector.

The implication is that the concentrations of oxygen, hydrogen sulfide, hydrocarbons, carbon monoxide, and benzene recorded on the Enclosed Space Entry Permits issued for entering Nos. 1–3 P/S CTs on the morning of 25 August 2025 were not based on proper testing of the atmospheres in each of these six cargo tanks.

As stated previously, five used benzene detector tubes and four used pre-treatment tubes were found in the ship's CCR sometime after the C/O entered No. 3 P CT. Each of the benzene detector tubes showed 0 ppm. There is insufficient information available to determine if these tubes had been used on the morning of 25 August 2025. If they had been used, they most likely had not have been used in accordance with the manufacturer's instructions given that five tests would have required at least 50 minutes to complete whereas the C/O reported spending a total of 30 minutes testing the atmosphere in Nos. 1–3 P/S CTs.

It is noted that the guidance in the Company's procedures requiring an additional one and a half strokes of the sample pump per meter of extension hose when testing for toxic gases is not consistent with the manufacturer's instructions for the sample pumps that were on board NO.2 OCEAN PIONEER.

Rescue

Consistent with the Company's enclosed space rescue procedures, the OS1 and A/O immediately raised the alarm when they saw that the C/O had fallen inside of No. 3 P CT. Additionally, neither they, nor any of the other crewmembers who were working on deck in the vicinity of No. 3 P CT, tried to immediately enter the cargo tank to assist the C/O. Rather, they instead started to bring BA sets, spare oxygen bottles, and rescue equipment to the tank dome.

After arriving at the No. 3 P CT tank dome, NO.2 OCEAN PIONEER's Master did not remain on deck as the responsible officer to direct the rescue operation as required by the Company's enclosed space rescue procedures. Instead, he immediately put on a BA set and entered the cargo tank to assist the C/O. After determining that the C/O was breathing weakly, the Master took his mask off and held it on the C/O's face. The Master then alternated between using it himself and holding it on the C/O's face until he exited the cargo tank after ASD1 and ASD2 arrived on scene with a rescue harness and began putting it on the C/O. Although other crewmembers were on deck, the Master reentered the cargo tank after changing BA sets and took an EEBD to the C/O.

¹⁹ As stated previously, the time to complete a single test for benzene is 10 minutes.

The Master's concern for the C/O is understood. However, the Master's entry into No. 3 P CT was contrary to his overall responsibility to ensure the safety of the ship, which at the time was transiting the Strait of Hormuz, the rest of the ship's crew, and to remain on deck and direct the rescue operation as the senior officer on scene. Further, by taking off the BA set mask and holding it on the C/O's face, he directly threatened his own personal safety, that of the ship, and its crew in the event he too became incapacitated. That action also increased the possibility that he, too, might have needed to be rescued.

The entry of the ASD1 and ASD2, who were both wearing BA sets and did not remove their masks while they were in No. 3 P CT to put a rescue harness on the C/O, and the subsequent removal of the C/O from the cargo tank were conducted without incident.

The Company's procedures for conducting enclosed space rescues did not address testing the atmosphere inside the space prior to entry during a rescue operation.

Onboard Enclosed Space Rescue Training and Drills

Enclosed space rescue training and drills were reported to have been conducted on board every two months. The drills in May and July 2025 were based on the same scenario (e.g., rescue of Bosun from the Bow Thruster Room). The drill in March 2025 differed slightly in that it involved the rescue of the Bosun from a cargo tank. Additionally, the records of the drills that were reported to have been conducted were effectively a log of what was done rather than a checklist for ensuring that all required actions were taken.

The lack of variation in the drill scenarios, for example none involved an entry into a fuel oil or bilge tank by one of the ship's engineers, and that the actions taken were printed whereas the times that they were reported to have been taken were handwritten (*see Figure 6*) suggests these drills were pre-scripted exercises conducted to fulfill a requirement rather than conducted as exercises to ensure that the ship's crewmembers were prepared to respond to an actual emergency.

Stop-work Authority

Stop-work authority can prevent marine casualties by allowing crewmembers, regardless of their position on board, to manage safety in real time by giving them the responsibility, obligation, and right to stop work that poses or creates an imminent danger to themselves, others, the ship and cargo, or the environment. For stop-work authority to be effective, it is not enough for crewmembers to be aware that they have this authority. They must also have sufficient situational awareness to recognize when an unsafe act or condition exists and then have the confidence that they can exercise stop-work authority without fear of repercussion.

The deck ratings on board NO.2 OCEAN PIONEER were aware they had stop-work authority. The available information suggests that they had not recognized what they thought to be unsafe acts or conditions while working on deck on the morning of 25 August 2025. However, it is also not clear whether crewmembers who had seen an act or condition they perceived as unsafe had the confidence to exercise stop-work authority without fear of repercussion. This is supported by the observations made during the Company's special internal audit conducted on 16–17 December 2025.

Company Procedures and Management Oversight

The Company's procedures for cleaning cargo tanks, gas freeing enclosed spaces, entering enclosed spaces, and exercising stop-work authority are examples of administrative controls. These controls provide clear written instructions for performing tasks or activities safely and, in doing so, reducing crewmembers' exposure to potential hazards and occurrence of preventable accidents. Administrative controls do not establish physical barriers and are only effective when they are properly followed and implemented by the ships' crews and regularly reviewed by the Company's shore staff.

Management oversight, both by the Company's shore staff and by ships' Masters, is critical for ensuring shipboard operations are conducted in accordance with established procedures. Management oversight is not micromanaging or second-guessing decisions made by others but is a means of establishing clear expectations for crewmembers, regardless of their position on board, and to encourage them to follow established procedures.

Effective management oversight contributes to safety by reinforcing the importance of established procedures and promoting a robust, positive workplace safety culture from top down. It also contributes to safety by providing a means of facilitating feedback from shore staff and ships' crews regarding any impractical or challenging provisions of established procedures. Regular review of the Company's SMS is crucial for assessing the effectiveness of existing procedures and fostering collaboration among the Company's shore staff and ships' crews.

Several of the non-conformities identified during the additional audits conducted in the Company's office and on board NO.2 OCEAN PIONEER indicated there was either ineffective or insufficient management oversight by both the Company and the ship's Master. This is further supported by the Master's limited engagement with, and oversight of, the C/O on the morning of 25 August 2025 regarding testing the atmosphere in each of the cargo tanks and safety measures that were required by the Company's enclosed space entry requirements to be in place during the C/O's and deck ratings' planned entry into the cargo tanks.

Lookout

Per COLREGs Rule 5, "every vessel shall at all times maintain a proper look-out." Therefore, with the exception of daylight hours when the principles of navigation watchstanding in the STCW Code, section A-VIII, part 4-1 conditionally permit an OICNW to serve as a ship's Lookout,²⁰ a ship's navigational watch will, at a minimum, consist of an OICNW as the OOW and a deck rating as the designated Lookout.

The information available to the Administrator indicated that a designated Lookout likely was not on duty on board NO.2 OCEAN PIONEER during non-daylight hours or at times when the existing conditions might not have been appropriate for the OOW to serve as Lookout while the ship was underway in the Persian Gulf or transiting the Strait of Hormuz on 24–25 August 2025.

Onboard Safety Culture

"An effective safety culture will support a shipboard environment that encourages and requires all on board to proactively consider their own and others' safety."²¹ An effective safety culture requires commitment from senior management. It

²⁰ Factors required to be considered when determining if an OICNW may serve as a ship's Lookout are listed in STCW Code, section A-VIII, part 4-1, paragraph 16.

²¹ International Chamber of Shipping and International Shipping Federation, Guidelines on the Application of the IMO International Safety Management Code, 4th ed (2010), p. 86.

also requires that both shore-based and sea staff at all levels “believe in safety, think safety, and be fully committed to safety.”²²

There were several indications that there was not an effective safety culture both within the Company and on board NO.2 OCEAN PIONEER. These included:

1. ineffective management oversight by the Company and by the ship’s Master;
2. root causes and corrective actions identified by the Company for several of the non-conformities issued during the additional audits of the implementation of the Company’s SMS by the Company and on board NO.2 OCEAN PIONEER were focused on:
 - (a) attributing the identified non-conformity to staff performance rather than on identifying systemic oversight gaps regarding work processes or gaps in how the Company’s shore staff and Masters of Company-managed ships exercised their oversight duties; and
 - (b) relying on either the DPA or ship’s Master to deliver additional training to shore and ship-board staff without identifying systematic changes to ensure compliance with the Company’s procedures;
3. the internal auditor’s observation that crewmembers expressed fear of repercussions in response to audit findings, resulting in a low-trust environment and reluctance to report potential problems;
4. the Master having acted contrary to his overall responsibility for ensuring the safety of the ship and all crewmembers by entering No. 3 P CT to assist the C/O;
5. multiple deviations from the Company’s established procedures, including those for:
 - (a) cleaning the cargo tanks;
 - (b) gas freeing the cargo tanks;
 - (c) checking the calibration of the multi-gas detector before use and testing the atmosphere inside an enclosed space;
 - (d) non-compliance with the requirements of the Enclosed Space Entry Permits that were issued for entering Nos. 1–3 P/S CTs on 25 August 2025; and
 - (e) conducting enclosed space rescues;
6. the records of work and rest hours for the C/O and deck ratings were based on the ship’s Table of Shipboard Working Arrangements and did not accurately report the hours they worked on 24–25 August 2025; and
7. the apparent prioritization of cleaning the ship’s cargo tanks over maintaining a proper lookout.

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.

²² *Ibid.*, p. 88. See also, ISM Code, Preamble.

1. Causal factors that contributed to this very serious marine casualty included:
 - (a) the gas freeing operation that was conducted on board the ship on 24–25 August 2025 was not effective;
 - (b) the atmosphere in Nos. 1–3 P/S CTs was not tested on the morning of 25 August 2025 as required by the Company’s procedures;
 - (c) the C/O was not wearing a personal gas detector when he entered No. 3 P CT;
 - (d) ineffective management and oversight by the Master of the cargo tank cleaning and gas freeing operations that were conducted on 24–25 August 2025 and of the enclosed space entry on 25 August 2025; and
 - (e) an ineffective safety culture both within the Company and on board NO.2 OCEAN PIONEER.
2. Additional causal factors that may have contributed to this very serious marine casualty included:
 - (a) the deck ratings on board NO.2 OCEAN PIONEER may not have had adequate awareness to recognize the existence of an unsafe act or condition prior to the C/O entering No. 3 P CT or the confidence to exercise stop-work authority.
3. Actions or events that reduced the adverse consequences of this very serious marine casualty included the:
 - (a) fact that none of the crewmembers who were working on deck entered No. 3 P CT to assist the C/O, but instead immediately called for help and then gathered and brought rescue equipment to the No. 3 P CT tank dome; and
 - (b) crewmembers who entered No. 3 P CT to put a rescue harness on the C/O did not remove their BA set masks to assist the C/O while they were inside the cargo tank.
4. Additional issues that were identified but that did not contribute to this very serious marine casualty included:
 - (a) onboard enclosed space rescue drills were likely conducted as pre-scripted exercises rather than conducted to ensure that crewmembers were prepared to respond to an actual emergency;
 - (b) the procedure for cleaning the ship’s cargo tanks on 24–25 August 2025 was not in accordance with the Company’s established procedures;
 - (c) the guidance in the Company’s procedures for using a toxic gas detector sample pump with an extension hose was not consistent with the manufacturer’s instructions; and
 - (d) a dedicated Lookout was likely not on duty during hours of darkness or when the existing conditions might not have been appropriate for the OOW to serve as NO.2 OCEAN PIONEER’s only Lookout while the ship was underway in the Persian Gulf and transiting the Strait of Hormuz on 24–25 August 2025.

PART 5: PREVENTIVE ACTIONS

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

1. Sent a safety bulletin to all ships in the Company-managed fleet emphasizing the importance of following established enclosed space entry procedures when entering cargo tanks or other confined spaces and that the Master must maintain command during rescue operations and to not enter an enclosed space during a rescue operation.

The Administrator has taken the following Preventive Actions.

1. Issued MSA No. 12-25 addressing how stop-work authority can contribute to preventing marine casualties by allowing seafarers, regardless of their position on board, to manage safety in real time by giving them the responsibility, obligation, and right to stop work that poses or creates an imminent danger to themselves, others, the ship and cargo, or the environment. MSA No. 12-25 includes several recommendations for improving the implementation of stop-work authority on board Republic of the Marshall Islands-registered ships.

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) undertake a systematic review of and, as necessary, revise the Company's procedures for:
 - (i) cleaning and gas freeing cargo tanks to require that cargo tank cleaning plans include:
 - (1) the work schedules for the officers and ratings who will be engaged in the planned cargo tank cleaning operations;
 - (2) the approximate time required to test the atmosphere inside each cargo tank at three different levels based on the manufacturer's instructions for any toxic gas detector tubes that might be required based on the ship's last cargo(s); and
 - (3) a requirement that any deviation, including the reason for the deviation, from the approved cargo tank cleaning and gas freeing plan be documented in writing and approved by the Master; and
 - (ii) conducting enclosed space entry rescues to address testing of the atmosphere inside the space;
 - (b) review and, as necessary, revise its onboard training requirements to ensure all onboard drills are conducted as if they were real emergencies;
 - (c) review and, as necessary, revise all relevant procedures and onboard training addressing the Company's "STOP CARD" system taking the recommendations in MSA 12-25 into account;
 - (d) undertake a safety campaign on board Company-managed ships focused on establishing a positive safety culture both within the Company's office and on board Company-managed ships; and
 - (e) review the lessons learned from this very serious marine casualty with Masters and management level officers during on-signing briefings.

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