



REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

LINUS P CASUALTY INVESTIGATION REPORT

Enclosed Space Fatality

Pacific Ocean | 24 November 2018

Official Number: 6808

IMO Number: 9749350



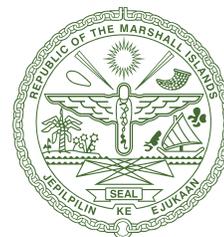
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AUTHORITY

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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PART 1: EXECUTIVE SUMMARY

The Republic of the Marshall Islands-registered oil/chemical tanker LINUS P, managed by Fleet Management Limited (the “Company”), was cleaning cargo tanks while underway off the west coast of the United States of America (USA) on 24 November 2018.

At about 0030¹, an Able Seafarer Deck (ASD) 1, together with the Pumpman, was supplying fresh water to the No. 2 Port (P) Cargo Tank using a fire hose through the open tank dome. During this work, he dropped his portable radio into the tank.

The Pumpman reported that the ASD1 told him he was going to retrieve the radio from the tank after getting a flashlight. The Pumpman also reported that he tried to stop the ASD1 from entering the tank. The ASD1 entered the inerted cargo tank to retrieve the radio without following onboard enclosed space entry procedures and the lack of oxygen quickly rendered him unconscious.

¹ Unless otherwise stated, all times are ship’s local time (UTC -8).

During the enclosed space rescue operation, the Second Officer (2/O) and ASD2, lost consciousness when they removed their self-contained breathing apparatus (SCBA) face masks while inside the cargo tank. As a result, the ASD2 fell from the second platform of the tank access ladder to the tank top.

All three individuals were subsequently removed from the tank. The 2/O and the ASD1 recovered; however, the ASD2 did not survive the injuries sustained from his fall.

The Republic of the Marshall Islands Maritime Administrator's (the "Administrator's") marine safety investigation concluded that the causal factors that contributed to the death of the ASD2 and the injury to the ASD1 were:

1. failure of the ASD1 to properly secure his radio while working on deck;
2. failure of the Pumpman to take firm actions to "Stop Work" when the ASD1 advised him that he was going to enter the tank;
3. failure of the ASD1 to comply with the Pumpman's warning;
4. failure of the ASD1 to follow enclosed space entry procedures when he climbed into the No. 2P Cargo Tank to retrieve his radio;
5. failure to follow enclosed space entry procedures when the 2/O entered the tank alone; and
6. failure to follow enclosed space rescue procedures when the 2/O and the ASD2 removed their SCBA masks while inside the enclosed space.

The causal factors that likely contributed to the fatality and injury include:

1. improper decision making by the Chief Officer (C/O) when he directed opening the domes of inerted tanks for cleaning procedures;
2. improper supervision by the Master when he failed to ensure the appropriateness and accuracy of the tank cleaning plan and the risk assessment developed by the less experienced C/O;
3. inadequate onboard implementation of pre-task risk identification, assessment, and control procedures;
4. inefficient organization and execution of the enclosed space rescue procedures;
5. ineffective onboard implementation of "Stop Work" policy when crewmembers observed unsafe actions being taken;
6. ineffective enclosed space entry training; and
7. lack of understanding of nitrogen (N₂) inhalation dangers.

PART 2: FINDINGS OF FACT

The following Findings of Fact are based on the information obtained during the Administrator’s marine safety investigation.

1. Ship particulars: *see* chart to right.
2. On 23 November 2018, LINUS P, after discharging biodiesel at Long Beach, California, USA departed in ballast and proceeded north towards Clatskanie, Oregon, USA to load anhydrous ethanol. The 795 nautical mile voyage was expected to take about 72 hours.
3. The biodiesel was discharged under inerted conditions using N₂ gas as the inerting medium.²
4. Cargo tank cleaning was to be conducted during the ballast voyage to Clatskanie.

Cargo Tank Cleaning System

5. LINUS P had one common tank cleaning line with branches supplying the fixed cleaning machines installed in each cargo tank. This configuration meant it was not possible to supply fresh and salt water at the same time to the cargo tanks through the fixed system alone.
6. Each tank cleaning machine could be isolated from the main tank cleaning line by an isolation valve on the branch line. A ball valve, fitted between the cleaning machine and isolation valve, allowed attachment of a water supply from an alternative source (such as the fire main).
7. The fire pump could supply fresh water to the fire main system through a suction cross-connection to the dedicated freshwater tank. From a fire main connection, a fire hose could supply fresh water to the fixed tank cleaning machine’s secondary water source valve.

² Oxygen concentrations within all tanks were measured at specified intervals in accordance with the ship’s Cargo Operations Manual. Before discharging on 22 November 2018, the No. 2P Cargo Tank was reported to contain 3.60% oxygen. On 24 November 2018 (after discharging), the oxygen concentration within the same tank was recorded as 18.50%.

SHIP PARTICULARS

Ship Name
LINUS P

Registered Owner
Sterling Ocean Chemical
Tankers IV LLC

ISM Ship Management
Fleet Management Limited

Flag State
Republic of the Marshall Islands

IMO No. 9749350	Official No. 6808	Call Sign V7RA8
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Year of Build 2016	Gross Tonnage 17,858
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Net Tonnage 6,427	Deadweight Tonnage 25,000
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Length x Breadth x Depth
161.4 x 25.6 x 15.6 meters

Ship Type
Oil/Chemical Tanker

Document of Compliance
Recognized Organization
DNV-GL

Safety Management Certificate
Recognized Organization
American Bureau of Shipping

Classification Society
American Bureau of Shipping

Persons on Board
22

Cargo Tank Cleaning Plan

8. The tank cleaning plan developed by the C/O³ had five stages:
 - a. Stage 1: fixed machine washing for 30 minutes with moderate temperature salt water;
 - b. Stage 2: fixed machine washing for 60 minutes, with hot salt water;
 - c. Stage 3: recirculation of tank cleaning chemical and fresh water⁴ for 60 minutes;
 - d. Stage 4: fixed machine rinsing for 60 minutes, with hot salt water; and
 - e. Stage 5: fixed machine rinsing for 20 minutes, with fresh water.
9. The C/O's tank cleaning plan called for introducing fresh water into the cargo tanks through an open tank dome during Stage 3.⁵
10. Tanks were to be gas-freed after completing Stage 4. Once all cleaning stages were completed, the tanks would be dried and physically inspected internally by assigned crewmembers.
11. The cargo tank cleaning plan was expected to take about 72 hours.
12. A special watch rotation allowed the tank cleaning operation to be completed while maintaining a proper navigational watch (*see Figure 1*).

HOURS	CARGO CONTROL ROOM	ON DECK	BRIDGE
0600–1200 1800–2400	C/O	ASD3 Ordinary Seafarer (OS) 2	Third Officer (3/O) ASD2
0000–0600 1200–1800	2/O	Pumpman ASD1 OS1	Master Deck Cadet

Figure 1: Modified watch schedule during tank cleaning.

13. The Master reviewed and approved the tank cleaning plan before work began.

Cargo Tank Access Ladder Arrangement

14. The cargo tanks were fitted with ladders accessed through the tank dome. A short vertical ladder led from the main deck to the first platform. Inclined ladders then extended to the tank top. There were two additional intermediate platforms (*see Figure 2*).

³ LINUS P used ChemServe GmbH's "Miracle" software for developing the cleaning plan.

⁴ The cleaning plan called for 4 cubic meters (m³) of fresh water to be introduced into each tank and recirculated using the fixed cargo pump fitted in each tank.

⁵ A risk assessment was completed at the same time as the tank cleaning plan and was approved by the Master. The risk assessment identified the tanks as a confined space and restricted entry; however, it did not identify the hazards of working in and around the open tank domes of inerted tanks.

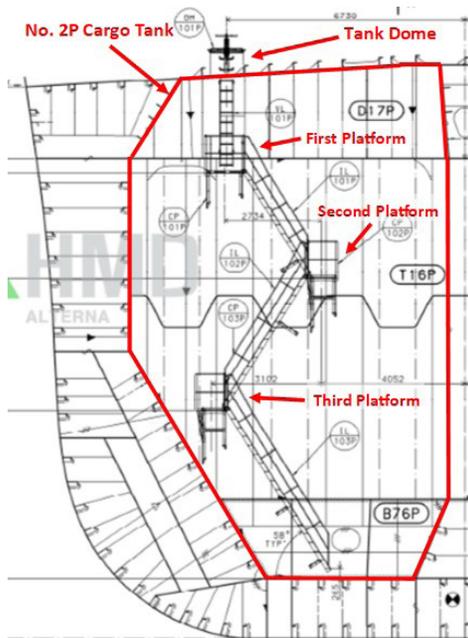


Figure 2: Ladder arrangement for the No. 2P Cargo Tank.

Incident Description

15. Between 0555 and 0610 on 23 November 2018, the C/O conducted a Toolbox Talk in the ship's office with the deck crew to discuss the tank cleaning plan. It is reported that this included a reminder that tank entry was not allowed since the tanks were inerted and that fresh water would be supplied by using a fire hose through open domes.
16. At about 2100 on 23 November 2018, Stage 1 (moderate temperature saltwater wash) was finished for all cargo tanks.
17. At about 2230, Stage 2 (hot saltwater wash) was completed in the Nos. 1P/Starboard (S) and 2P/S Cargo Tanks and began in the Nos. 3P/S and 4P/S Cargo Tanks.
18. Following Stage 2's completion, fire hoses were rigged to put fresh water into the Nos. 1P and 2P Cargo Tanks. The OS1 was monitoring the filling of the No. 1P Cargo Tank while the Pumpman and ASD1 attended to the No. 2P Cargo Tank.
19. Due to the high pressure of the fresh water supply, the Pumpman and the ASD1 decided to tie the hose to a rung of the access ladder inside the tank dome (*see Figure 3*). While doing this, a portable radio fell into the No. 2P Cargo Tank from the ASD1's pocket.⁶ The Pumpman reported that the ASD1 told him he was going to retrieve the radio from the tank after getting a flashlight. The Pumpman also reported that he tried to stop the ASD1 from entering the tank.

⁶ It is reported that leather radio holsters were provided on board and that other crewmembers used them. The ASD1 was not using a radio holster. Instead, he was carrying the radio in a pocket of his coveralls.



Figure 3: No. 2P Cargo Tank dome open.

20. Despite the Pumpman's warning, the ASD1 entered the No. 2P Cargo Tank through the open dome. The Pumpman (on the main deck) reported that the ASD1 quickly became unconscious. He also saw the ASD1's flashlight fall to the tank top. Seeing this, the Pumpman called out to the ASD1. There was no reply.
21. Hearing the yelling, the OS1 (who was standing by at the No. 1P Cargo Tank) went to the No. 2P Cargo Tank dome. The Pumpman told him that the ASD1 had climbed into the tank and was not responding. The Pumpman again called out to the ASD1. There was no response heard.
22. The Pumpman then quickly went to the Cargo Control Room and told the C/O and 2/O that the ASD1 had fallen inside the No. 2P Cargo Tank.
23. When notified, the 2/O went to the cargo tank while the C/O called the Bridge. The C/O then activated the general alarm to begin the response from all crewmembers. Following the alarm, the Master instructed all crewmembers to report to the No. 2P Cargo Tank for an enclosed space rescue.
24. At about 0030 on 24 November 2018, the 2/O entered the cargo tank to attempt the rescue of the ASD1. The 2/O wore an SCBA he took from the Midships Store on his way forward. At the time, no crewmembers with SCBAs were on scene.
25. The 2/O reported that he found the ASD1 unresponsive on the third platform. The 2/O then left the tank to retrieve an emergency escape breathing device (EEBD).
26. By the time the 2/O exited, the remaining crewmembers had mustered near the tank dome with the necessary enclosed space rescue equipment.
27. The 2/O reentered the tank with the ASD2. Both wore SCBAs and carried one EEBD, to attempt the ASD1's rescue. On reaching the third landing, they fixed the EEBD to the ASD1's face. The low-air-pressure alarm on the 2/O's SCBA began sounding and he exited,⁷ while the ASD2 remained in the tank with the ASD1.

⁷ The 2/O did not change the air cylinder for his SCBA before re-entering the tank.

28. After changing his SCBA's air cylinder, the 2/O re-entered the tank. He reported that he found the ASD1 and the ASD2 on the third platform. The ASD1 had removed the EEBD⁸ and the ASD2 had removed his face mask in order to share his SCBA with the ASD1. The 2/O reported that he then removed his face mask to also share his SCBA with both ASDs. Shortly after removing his mask, the 2/O reported that he became dizzy and decided to leave the tank. The Pumpman stated that he saw the 2/O begin to lose consciousness and sit down on the second platform.
29. At about 0041, the C/O and the Able Seafarer Engine (ASE) 1 climbed into the cargo tank wearing SCBAs to rescue the three crewmembers. They first removed the 2/O from the second platform at about 0043.⁹ On returning, they found the ASD1 climbing the ladder near the second platform (he was reported as being semi-conscious). The C/O and the ASE1 helped the ASD1 exit the tank at about 0055.¹⁰
30. At around 0110, the C/O and the ASE1 re-entered the cargo tank and found the ASD2 lying on the tank top. Prior to his fall, he was observed on the second platform by the Pumpman who was on the Main Deck. A stretcher was lowered and an EEBD was placed on the ASD2. Then, the low air pressure alarm on the ASE1's SCBA began sounding and both rescuers left the tank.¹¹
31. While the C/O and ASE1 were changing air cylinders on deck, the Fitter and the OS2, wearing SCBAs, entered the tank to secure the ASD2 on the stretcher. When this was done, the Fitter and the OS2 left the tank.
32. The C/O and the ASE1, with full air cylinders, re-entered to guide the stretcher past obstructions while the crewmembers hoisted it to the main deck.
33. At about 0130, the ASD2 was removed from the cargo tank. Crewmembers reported that no vital signs were detected and his pupils did not react to light. Cardiopulmonary Resuscitation (CPR) was started and medical oxygen was administered.
34. At about 0150, the ship changed course towards Santa Barbara, California to transfer the ASD1 and the ASD2 for shoreside medical treatment.
35. At about 0530, the ASD1 and the ASD2 were transferred on stretchers to an assistance boat for transportation to a shoreside hospital. The Electrician accompanied them.
36. ASD2 was pronounced deceased by shoreside paramedics on the morning of 24 November 2018. A postmortem medical examination indicated that the cause of death was severe injuries to the head, consistent with a fall.

Crew Experience and Condition

37. At the time of the incident, LINUS P's crew was 22, more than required by the Minimum Safe Manning Certificate.

8 The EEBD was found to be empty following the incident.

9 The 2/O was reported to have regained consciousness once removed from the tank.

10 The ASD1 was given medical oxygen and transported to the ship's hospital on a stretcher. The ASD1 reported pain in his shoulder and forehead.

11 It is reported that the C/O changed his air cylinder while the ASE1 did not change his before re-entering the tank.

38. The Company employed the Master for over 10 years, almost six years of which were at this rank. He had about 14 years' experience on chemical tankers and had been on board the ship for almost two months.
39. The C/O had been employed by the Company for about six years, joining as a 3/O. He was promoted to C/O when joining LINUS P two months earlier. The C/O had three years' experience on chemical tankers.
40. For five years, the 2/O worked for the Company, of which one had been in rank. The 2/O had about two and a half years of experience on chemical tankers and had been on board LINUS P for about three and a half months.
41. The Company employed the ASD1 for five years, three of which were in this rank. He had over four years' experience on chemical tankers and had been on board LINUS P for about eight months.
42. ASD2 worked for the Company for about three years in this rank and had 10 months experience on chemical tankers. He joined LINUS P two months before the incident.
43. The Administrator did not observe any indication that crewmembers involved with this incident had failed to receive the amount of rest mandated by the International Maritime Organization's (IMO's) Seafarers Training, Certification and Watchkeeping (STCW) Code, Section A-VIII/1, paragraphs 2 and 3 and the International Labour Organization's Maritime Labour Convention, 2006, regulation 2.3.
44. At about 0200 on 24 November 2018, all involved crewmembers submitted to onboard alcohol testing in accordance with the ship's Safety Management System (SMS).
45. At about 0800 on 24 November 2018, the involved crewmembers also submitted to third party drug and alcohol testing, as required by the United States Coast Guard. No indication of substance abuse was found as a result of this testing.
46. Postmortem toxicology testing was conducted on the ASD2; no drug or alcohol presence was detected.
47. All deck officers held the required Advanced Training for Chemical Tanker Cargo Operations certificate and all deck ratings held the required Basic Training for Oil and Chemical Tanker Cargo Operations certificate.¹²

SMS

48. The Company's SMS provided procedures for carrying out shipboard tasks, including cargo tank cleaning operations and enclosed space entry and rescue operations. This is required by the IMO's International Management Code for the Safe Operation of Ships and for Pollution Prevention (International Safety Management (ISM) Code).
49. The SMS required completing a risk assessment and Enclosed Space Entry Permit before entering any enclosed space, such as the cargo tanks. As an added reminder to the crew, each tank dome was stenciled with a warning that it was considered an enclosed space, that a permit was required, and that a lack of oxygen may exist.

¹² STCW regulation V/1-1 details the mandatory minimum requirements for the training and qualifications of Masters, officers, and ratings on oil and chemical tankers. Both levels of training include knowledge requirements pertaining to the hazards of inerted cargo tanks and responding to enclosed space rescue incidents. In addition, advanced level certification requires knowledge of cargo tank cleaning operations and the hazards presented by these operations.

50. The Company's SMS also included procedures for enclosed space rescue operations. It required completing enclosed space entry and rescue drills at least every two months.¹³ The most recent drill conducted on 11 November 2018 simulated an entry and rescue operation in a void space.

51. The SMS also required conducting a Toolbox Talk with crewmembers before starting work. The C/O conducted a Toolbox Talk with all involved deck crewmembers on the morning of 23 November 2018, before tank cleaning started. During the change of watch, an updated briefing was not conducted with oncoming crewmembers.

52. The Company had a "Stop Work" policy in place on the ship. This provided the authority for any crewmember to stop any activity when a potentially unsafe condition or action is identified.

PART 3: ANALYSIS

The following Analysis is based on the above Findings of Fact.

Cargo Tank Cleaning Plan

When developing the tank cleaning plan, the C/O identified that the fixed tank washing line could only supply either fresh or salt water at any given time. This limited the ability to simultaneously carry out different cleaning stages on different tanks (meaning, saltwater wash some tanks, while introducing fresh water into others). As the voyage and tank cleaning were both expected to take about 72 hours, the C/O decided that fresh water would be introduced into the tanks through the tank domes for Stage 3 (the fresh water was used to recirculate the diluted tank cleaning chemical using fixed pumps). This was to be done with fire hoses connected to the fire main. The fire pump would take its suction from the dedicated freshwater tank.

At the time of the cleaning operations and beginning of Stage 3, the tanks were expected to still be inerted. Gas freeing would follow after Stage 4, since personnel would then need to enter the tanks to be sure they were clean and dry. The C/O failed to identify that the fixed tank washing machines could be supplied through hoses connected to the fire main, as indicated in the Company's SMS. This would have eliminated opening the cargo tank domes and would likely have prevented the incident from occurring.

Risk Identification and Assessment

As part of the cargo tank cleaning plan preparation, the risk assessment failed to adequately identify all the potential hazards. The cargo tanks were inerted at the time of cleaning. Opening the tank domes so that crewmembers could spray fresh water inside created the potential for exposure to reduced oxygen and high N₂ levels. This hazard was not identified and therefore no preventative or protective measures were put in place.

13 On 21 June 2013, the IMO adopted amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974, As Amended, Chapter III, Regulation 19, to require that confined space entry and rescue drills are performed at least once every two months. This amendment entered into force on 1 January 2015. IMO Resolution MSC.350(92). These drills are to take into account guidance provided in the IMO Resolution A.1050(27) – Revised Recommendations for Entering Enclosed Spaces Aboard Ships.

Supervision

A special watch rotation was implemented to carry out the tank cleaning process while maintaining the navigation watches. The schedule for personnel engaged in tank cleaning was six hours on and six hours off. Tank cleaning started during the 1800–2400 watch with the C/O supervising. The C/O did not conduct another Toolbox Talk or an update briefing to the crewmembers coming on watch from 0000–0600, nor did he conduct a walk-through to ensure work was following the plan.

The tank cleaning plan and associated risk assessment, developed by the C/O, were presented to the Master for approval before work started. The Master, by granting permission to carry out the plan as developed, failed to recognize the hazards presented by filling the cargo tanks with fresh water through the open tank domes. Also, the Master failed to ensure the risk assessment accurately documented the potential hazards. At the time, the C/O had less than two months experience serving in that rank. The Master had significantly more experience with almost six years serving as the Master of chemical tankers.

Portable Radios

The ASD1 was reportedly carrying his portable radio in a pocket instead of a purpose-designed radio holder or other secure means, as used by other crewmembers. It was reported by the Company that leather radio holsters were provided to the ship for the crew to use. The ASD1's non-secure method contributed to the radio falling into the tank while he was attempting to tie the fire hose to the ladder rung.

Communication

The ASD1 did not tell the C/O that he had dropped his radio into the cargo tank. Had this been known, proper enclosed space entry procedures might have started. The Pumpman also failed to notify the C/O or other officer when the ASD1 continued entering the cargo tank after being warned of the dangers.

Enclosed Space Entry and Rescue

Actions consistent with the SMS's enclosed space entry requirements were not followed by the ASD1 before he entered the cargo tank to retrieve the dropped radio. Although the ASD1 had participated in the required enclosed space entry training and the tank dome had a warning regarding the hazards, these were not effective in preventing the ASD1 from entering.

Following notification of the ASD1's incapacitation in the cargo tank, several crewmembers failed to follow the SMS's established enclosed space rescue procedures.

During the initial response, the 2/O obtained an SCBA on his way to the No. 2P Cargo Tank. On arrival, he donned the SCBA and immediately entered the tank without waiting for the full rescue team and necessary equipment to arrive. The 2/O was unable to render any assistance to the ASD1 as he did not have an EEBD or extra SCBA with him. This entry and exit from the tank reduced the useable air within his SCBA cylinder. The 2/O then re-entered the tank without changing his air cylinder, requiring him to leave the tank shortly after reaching the ASD1.

In addition, the ASD2 and the 2/O removed their SCBA face masks while inside the cargo tank, which was known to have an oxygen-deficient atmosphere. It is reported they removed their face masks to share the breathing air with the ASD1 and each other. As a result, both the ASD2 and the 2/O were rendered unable to escape the space on their own and required rescue by other crewmembers.

Tragically, the ASD2 fell from the second platform to the tank top, likely due to losing consciousness from the oxygen-deficient atmosphere in the tank. Using the available rescue equipment, such as spare SCBAs and additional EEBDs, would have removed the perceived need to share breathing air.

Another deviation from the enclosed space rescue procedures occurred when the 2/O and the ASD1 failed to maintain entry team integrity. When the low air pressure alarm sounded on the 2/O's SCBA, he exited, while the ASD2 remained in the tank. The 2/O later stated that the ASD2 shared his face mask during this time alone in the tank to provide breathing air to the ASD1.

During the rescue operation, the ASE1 did not change his air cylinder in between tank entries. This resulted in his low air pressure alarm sounding shortly after entering with the C/O and fitting the ASD2 with an EEBD (but before he could be secured into the stretcher). During this entry, both crewmembers left the space and another team entered to finish securing the ASD2. The numerous departures from the enclosed space entry and rescue procedures caused an unnecessary delay in removing all crewmembers from the space.

Drug and Alcohol Testing

All involved crewmembers submitted to post-incident alcohol testing conducted on board by the Master. Drug and alcohol testing was also conducted by a third party as required by the port State. Toxicology screening for drugs and alcohol was conducted by the medical examiner's office for the ASD2. All the test results were negative. Therefore, impairment due to drugs or alcohol is not considered to be a causal factor in this incident.

"Stop Work" Procedures

The Company's SMS included a "Stop Work" policy, giving any crewmember the authority to stop the work if an unsafe act or condition was observed. The Pumpman recognized the danger presented by the ASD1 entering the cargo tank to retrieve his radio and attempted to stop him. However, the ASD1 did not comply with the Pumpman's request. This indicates that, while the policy was in place, the onboard implementation was not effective.

PART 4: CONCLUSIONS

The following Conclusions are based on the above Findings of Fact and Analysis and shall in no way create a presumption of blame or apportion liability:

The causal factors that contributed to the death of the ASD2 and the injury to the ASD1 were:

1. failure of the ASD1 to properly secure his radio while working on deck;

2. failure of the Pumpman to take firm actions to “Stop Work” when the ASD1 advised him that he was going to enter the tank;
3. failure of the ASD1 to comply with the Pumpman’s warning;
4. failure of the ASD1 to follow enclosed space entry procedures when he climbed into the No. 2P Cargo Tank in order to retrieve his radio;
5. failure to follow enclosed space entry procedures when the 2/O entered the tank alone; and
6. failure to follow enclosed space rescue procedures when the 2/O and the ASD2 removed their SCBA masks while inside the enclosed space.

Causal factors which likely contributed to the loss of life and injury include:

1. improper decision making by the C/O when he directed opening the tank domes of inerted tanks for cleaning procedures;
2. improper supervision by the Master when he failed to ensure the appropriateness and accuracy of the tank cleaning plan and risk assessment developed by the less experienced C/O;
3. inadequate onboard implementation of pre-task risk identification, assessment, and control procedures;
4. inefficient organization and execution of the enclosed space rescue procedures;
5. ineffective onboard implementation of the “Stop Work” policy when crewmembers observed unsafe actions being taken;
6. ineffective enclosed space entry training; and
7. lack of understanding of N₂ inhalation dangers.

PART 5: PREVENTIVE ACTIONS

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

1. Shoreside personnel conducted an on board safety meeting and drill including a discussion of N₂ inerted atmosphere hazards and the necessary precautions to take.
2. A safety alert was sent to all Company-managed ships to communicate the lessons learned and to require a safety stand-down to discuss relevant SMS requirements, including an immediate restriction on enclosed space entry without prior approval from the office.
3. Review and verification of the onboard implementation of the enclosed space entry and rescue procedures, the “Stop Work” policy (including reinforcing the authority of all crewmembers to exercise their right to stop any action they perceive as unsafe), and requirements to restrict tank dome opening unless tank is gas free.

4. An operational circular was sent to all Company-managed ships to discuss the specific hazards of N₂, physiological effect of oxygen deficiency on the body, and complete prohibition of opening tank domes of inerted tanks.
5. Communication to all Company office staff to check for compliance with enclosed space entry and rescue procedures during all audits and inspections.
6. The Company has hired a third party to carry out a “Human Factor Analysis” to assist with implementing measures to prevent a reoccurrence.

The Maritime Administrator agrees with these actions.

PART 6: RECOMMENDATIONS

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

1. The Company incorporate the lessons learned from this casualty into a pre-joining training program, which should also be completed by current crewmembers to raise awareness.
2. The Company implements a pre-joining training program pertaining to the hazards of N₂ and the relevant safe work practices, which should also be completed by current crewmembers to raise awareness.
3. The Company review, and update as necessary, the process for addressing and disseminating safety recommendations issued by the Administrator.
4. The Administrator considers submitting a proposal to IMO to amend Resolution A.1050(27) to amend the emergency response section in order to better detail the fundamental actions that should be taken during an enclosed space rescue in order to ensure a safe and effective response.

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