



REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

KG ASIA CASUALTY INVESTIGATION REPORT

Enclosed Space Fatality

Boryeong, Republic of Korea | 6 January 2020

Official Number: 7811

IMO Number: 9190377



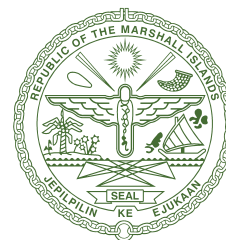
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AUTHORITY

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



Maritime Administrator

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LIST OF ABBREVIATIONS AND ACRONYMS

3/O	Third Officer
C/O	Chief Officer
cm	Centimeter
CPR	Cardiopulmonary Resuscitation
IMO	International Maritime Organization
IMSBC Code	International Maritime Solid Bulk Cargoes Code
ISM Code	International Safety Management Code
m	Meter
MLC, 2006	Maritime Labour Convention, 2006
mt	Metric Ton
PPE	Personal Protective Equipment
SCBA	Self-contained Breathing Apparatus
SMS	Safety Management System
SOLAS	International Convention for the Safety of Life at Sea
STCW Code	Seafarers Training, Certification and Watchkeeping Code



PART 1: EXECUTIVE SUMMARY

On 6 January 2020, the Republic of the Marshall Islands-registered bulk carrier KG ASIA, managed by STX Marine Service Co., Ltd (the “Company”), was berthed at Boryeong, Republic of Korea preparing to discharge coal. The Bosun, Fitter, and Deck Cadet were assigned to open all the cargo hold hatch covers.

After the hatch cover for Cargo Hold No. 1 was opened, the Fitter informed the Bosun that he needed to enter to retrieve an air nozzle. This nozzle had been dropped into the cargo hold while clearing the hatch coaming of cargo debris at the previous port. The Bosun and Fitter then opened the aft access hatch to Cargo Hold No. 1. The Bosun told the Fitter to wait at least 20 minutes before entering the cargo hold.

About 20 minutes later, as the Deck Cadet was walking by the cargo hold, he looked into the open hatch and saw the Fitter lying motionless on the coal cargo by the access ladder. He immediately notified the Bosun using his portable radio. The Bosun went directly to the access ladder and, without taking any precautions, climbed down in an attempt to rescue the Fitter. Shortly after entering the cargo hold, the Bosun also lost consciousness.

The C/O heard the Deck Cadet’s radio transmission and went to the access hatch. He recognized the need to carry out an enclosed space rescue. Crewmembers wearing SCBAs first removed the Bosun, followed by the Fitter. The Bosun regained consciousness after being brought on deck.

The Fitter was not breathing and had no pulse. Despite the efforts of KG ASIA’s crew and emergency medical responders, the Fitter was pronounced deceased at a local hospital.

The marine safety investigation conducted by the Republic of the Marshall Islands Maritime Administrator (the “Administrator”) identified the following:

1. Causal factors that contributed to this very serious marine casualty include:
 - (a) a hazardous atmosphere within Cargo Hold No. 1 as a result of carrying coal;
 - (b) entering Cargo Hold No. 1, via the access ladder, without complying with the Company’s enclosed space entry procedures;
 - (c) inadequately exercising the Company’s Stop Work Authority policy when the Fitter indicated that he intended to enter Cargo Hold No. 1;
 - (d) failure to notify any of the ship’s officers of the need or intention to enter an enclosed space; and
 - (e) immediate entry into the enclosed space to attempt a rescue without initiating the Company’s enclosed space rescue procedures, delaying the removal of the Fitter from the cargo hold.

2. Additional causal factors that may have contributed to this very serious marine casualty include:
 - (a) inadequate communication between the ship’s crewmembers after the air nozzle was dropped into Cargo Hold No. 1;
 - (b) disregarding the requirement posted on the access hatch to request permission from a ship’s officer prior to entering Cargo Hold No. 1;
 - (c) lack of awareness of the hazards of entering a cargo hold containing coal without complying with the Company’s enclosed space entry procedures; and
 - (d) absence of the Fitter and Deck Cadet from the Toolbox Talk conducted by the C/O prior to beginning opening of the hatch covers.

SHIP PARTICULARS		
Ship Name KG ASIA		
Registered Owner Korea Tonnage No. 42 Shipping Company		
ISM Ship Management STX Marine Service Co., Ltd		
Flag State Republic of the Marshall Islands		
IMO No. 9190377	Official No. 7811	Call Sign V7BM7
Year of Build 1999		Gross Tonnage 40,489
Net Tonnage 25,885		Deadweight Tonnage 74,732
Length x Breadth x Depth 218.2 x 32.2 x 19.6 m		
Ship Type Bulk Carrier		
Document of Compliance Recognized Organization Korean Register of Shipping		
Safety Management Certificate Recognized Organization Korean Register of Shipping		
Classification Society Korean Register of Shipping		
Persons on Board 23		

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. KG ASIA is a bulk carrier with seven cargo holds, which are fitted with port and starboard sliding hatch covers (see Figure 1).

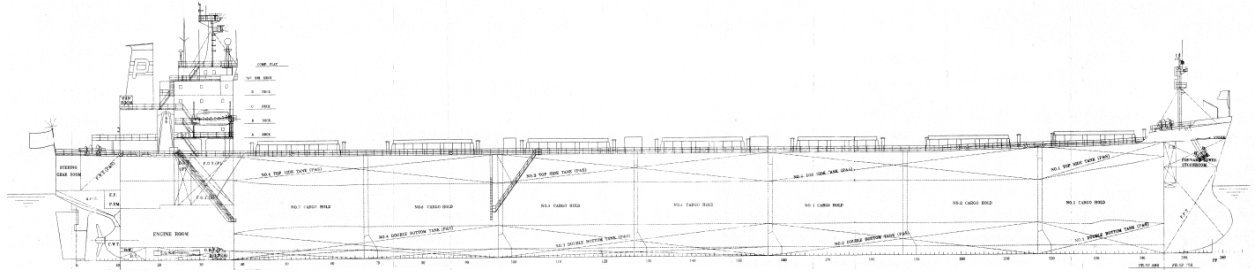


Figure 1: General arrangement of KG ASIA.

3. On 17 December 2019, KG ASIA departed Balikpapan, Republic of Indonesia (hereinafter “Indonesia”) after loading 72,600 mt of coal in all cargo holds. Prior to closing the hatch covers, a compressed air nozzle was used to blow cargo debris off the hatch coamings. While working at Cargo Hold No. 1, the air nozzle was dropped into the cargo hold and landed on top of the coal.¹ The nozzle was left in the cargo hold and the hatch cover was closed.
4. The dropped nozzle was not reported to any of KG ASIA’s officers.
5. On 27 December 2019, KG ASIA arrived at Boryeong, Republic of Korea. The ship anchored to await berthing.
6. On 3 January 2019, a risk assessment was completed for hatch cover operational testing, in preparation for shifting to the berth for discharging. The risk assessment was listed as valid only for the testing conducted that day.
7. At about 1624² on 6 January 2020, the ship shifted to the berth at the Boryeong Thermal Power Complex to discharge the coal.
8. At about 1005 on 7 January 2020, the C/O directed the 3/O (who was the Duty Officer) to open all hatch covers to ventilate the cargo holds. The 3/O subsequently delegated the task to the Bosun, Fitter, and Deck Cadet.
9. Before starting the work, a Toolbox Talk was conducted by the C/O. The 3/O and Bosun attended. The procedure for opening the hatch covers was discussed during the Toolbox Talk.
10. The Bosun, Fitter, and Deck Cadet then went forward and opened the hatch cover for Cargo Hold No. 1 at about 1015. The Bosun operated the hydraulic controls, while the Fitter and Deck Cadet monitored the movement of the hatch covers.
11. Once the hatch covers were open, the Bosun moved aft to the controls for the Cargo Hold No. 2 hatch covers, located between Cargo Holds Nos. 1 and 2.
12. On his way aft, the Bosun assisted the Fitter with opening the aft access hatch for Cargo Hold No. 1. The Fitter indicated that he intended to immediately enter the cargo hold to get the dropped air nozzle. The Bosun stopped the Fitter from entering and told him to wait at least 20 minutes.

¹ It is reported that the Bosun and Fitter were aware of the dropped nozzle. It is not known if additional crewmembers knew about it.

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

13. The Deck Cadet observed that the access hatch was open as he was walking to Cargo Hold No. 2. At about 1035, he looked into the open hatch and saw the Fitter lying on the coal inside Cargo Hold No. 1. The Deck Cadet used his portable radio to notify the Bosun. Following the incident, the Deck Cadet stated that he was not present when the access hatch was opened nor was he aware of the Fitter's intention to enter.
14. The Bosun went to the access hatch and saw the Fitter lying motionless. He immediately entered the hatch and began climbing down to the Fitter. While climbing down, the Bosun became unconscious and fell onto the coal.
15. When the C/O heard the Deck Cadet notifying the Bosun, he also went to the aft access hatch of Cargo Hold No. 1. When the C/O looked down the ladder, he saw the Fitter and Bosun lying motionless on the coal. The C/O notified the Master, then directed all crewmembers to prepare for an enclosed space rescue.
16. Upon being notified, the Master requested emergency medical assistance from shore. Meanwhile, the rest of the crewmembers prepared for the enclosed space rescue.
17. At about 1050, the Bosun was removed from Cargo Hold No. 1 and brought on deck by the rescue team, who were wearing SCBAs. He quickly regained consciousness once on deck.
18. The rescue team removed the Fitter from Cargo Hold No. 1 by 1055. He was not breathing and did not have a pulse. CPR was immediately started, and the Fitter was taken by ambulance to a local hospital. He was subsequently declared deceased at the hospital at 1158.
19. A postmortem examination conducted by authorities in Boryeong, Republic of Korea determined that the Fitter's cause of death was "toxic gas intoxication."

Cargo Hold No. 1 Aft Access Ladder

20. The aft access for Cargo Hold No. 1 leads to an Australian ladder and is located on the starboard side between Cargo Holds Nos. 1 and 2. This access hatch is 700 cm x 700 cm with a hinged cover (see Figure 2). Each cargo hold access hatch on board KG ASIA is marked with a warning prohibiting access without permission from a ship's officer.



Figure 2: Access hatch to the aft ladder for Cargo Hold No. 1.

21. The access ladder consists of a vertical section which extends from the access hatch on the main deck down to a platform at the top of the spiral section (see Figure 3).

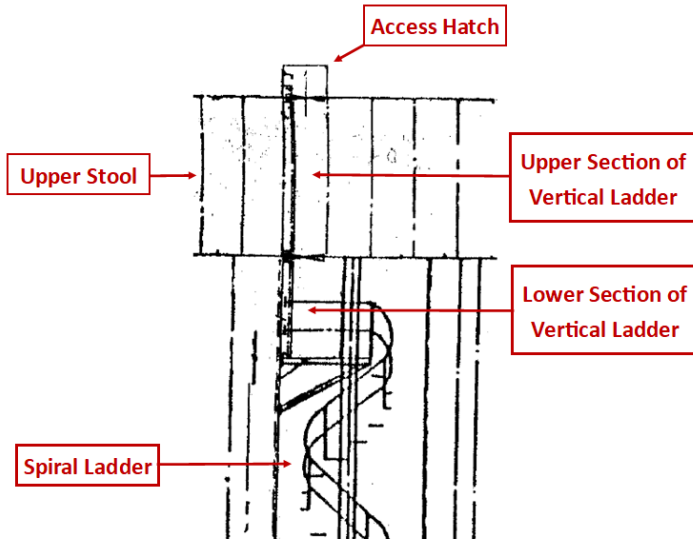


Figure 3: Diagram of the Cargo Hold No. 1 aft access ladder.

22. The upper 2.90 m of the vertical ladder runs through the upper stool space in an enclosed trunk, while the lower 1.86 m is open to the cargo hold. The platform provides access between the vertical and spiral sections of the ladder.
23. At the time of the incident, the lower portion of the vertical ladder, as well as the platform at the top of the spiral section, were covered by the coal (see Figure 4).



Figure 4: Photo of the aft access ladder, taken from the main deck. Note the coal in the cargo hold covering the lower section of the vertical ladder and the platform.

Cargo Hold Ventilation and Atmospheric Testing

24. The IMSBC Code's Individual Schedule of Solid Bulk Cargoes for Coal indicates that coal cargoes may be subject to oxidation, resulting in oxygen depletion and increased carbon monoxide in the cargo hold.
25. The IMSBC Code requires that surface ventilation be provided for the first 24 hours after departing the loading port and that the atmosphere of the spaces be tested during this time. Cargo hold ventilators must then be closed if measured methane levels within the cargo hold are within acceptable levels.
26. Atmospheric monitoring during the first 24 hours after departure did not identify flammable gases in any cargo hold. Therefore, the ventilators were closed on 18 December 2019. They remained closed until the date of the incident.
27. The IMSBC Code also requires that a suitable instrument be provided for measuring methane, oxygen, and carbon monoxide gas concentrations within the cargo holds without entry.
28. KG ASIA had two portable gas detectors. One detector was last calibrated by a manufacturer authorized service agent on 18 November 2018, while the other was last calibrated on 31 July 2019. Certificates issued by the service agent indicate that both detectors were properly functioning and calibrated.
29. KG ASIA had adequate span gas for checking and calibrating the portable gas detectors, which was valid until May 2021.
30. Atmospheric testing of all cargo holds was conducted daily between 17 December 2019 and 5 January 2020, with the exception of 18, 23, and 26 December 2019. During this period, the oxygen levels within Cargo Hold No. 1 varied between 14% and 16% (see Figure 5).

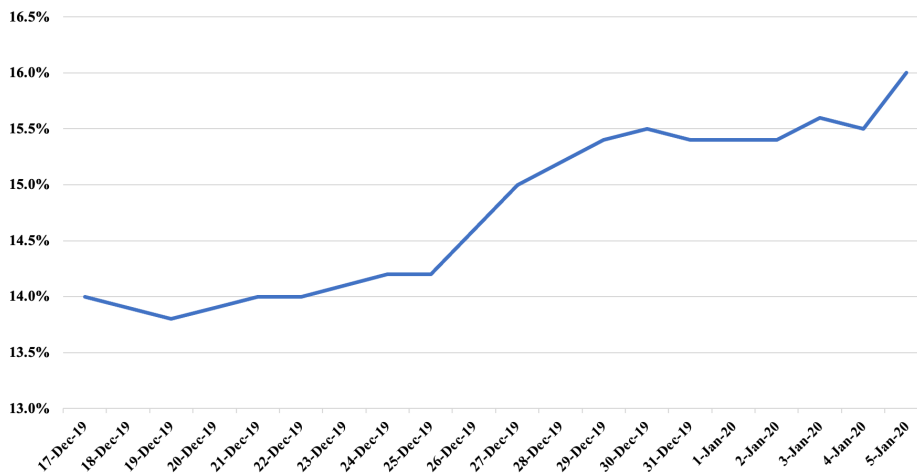


Figure 5: Measured oxygen levels within Cargo Hold No. 1.

31. The atmospheric testing did not detect any carbon monoxide, hydrogen sulfide, or methane in any of the cargo holds during this same period.
32. The two previous cargoes carried by KG ASIA were coal, both of which were also discharged at Boryeong, Republic of Korea.

SMS

33. As required by the ISM Code, the Company’s SMS provided procedures for shipboard tasks including enclosed space entry and rescue, safe work practices, and crewmember training. The SMS also included requirements for PPE use, safe work practices, and hazard identification and mitigation.
34. The Company’s SMS includes a Permit to Work system intended to ensure that hazards associated with planned tasks are identified and mitigated before starting work. The SMS designates all loaded cargo holds as enclosed spaces, requiring a Permit to Work before entry. The Permit to Work requires, among other things, that the space be properly ventilated, the atmosphere tested, and that oxygen concentrations are between 20.6% and 22.0%.³
35. The SMS also includes procedures specific to entry into cargo holds during cargo operations. The procedures require:
 - (a) displaying a notice at all cargo hold entrances prohibiting entry without permission;
 - (b) entry into cargo holds during cargo operations be authorized by the Master and supervised by an officer;
 - (c) a designated person be stationed on deck to monitor the safety of crewmembers working in the cargo holds; and
 - (d) completion of the “Cargo Hold Entry Permit during Cargo Operations.”
36. SOLAS Ch. III/19.3.6 and the Company’s SMS require conducting enclosed space entry and rescue drills at least every two months. The most recent enclosed space entry and rescue drill was conducted on 15 December 2019. Records available on board indicated that the Bosun participated in this drill, but the Fitter had not. The drill simulated the rescue of a victim from Cargo Hold No. 1.
37. The Company’s SMS also requires that all newly joining crewmembers complete a comprehensive initial onboard familiarization training program. This includes familiarization with their assigned responsibilities, basic safety responsibilities, safety warning signs and signals used on board, emergency duties, PPE requirements, the safety procedures in the Company’s SMS, and the Permit to Work system. Records available on board indicated that the Bosun, Fitter, and Deck Cadet all completed the required initial onboard familiarization training.
38. The safe work practices contained in the Company’s SMS details the requirement for the use of PPE. A boiler suit, safety shoes, safety helmet, and gloves are required to be worn while working on deck and while working with cargo. The Bosun and Fitter were wearing the required PPE when the incident occurred.
39. The Company’s SMS includes a Stop Work Authority policy, that allows any crewmember, regardless of rank, to stop work when unsafe actions or conditions are observed. The task or action is required to be reviewed by the Master before resuming. The policy also provides protection from retaliation in the event that it is deemed that the stop work order was unnecessary. The policy specifically identifies three circumstances where the Stop Work Authority policy should be exercised when:
 - (a) work activities are deemed to be immediately dangerous to life or health;
 - (b) actions by an individual or group are not in compliance with the Company’s safe work procedures; and
 - (c) work is not performed in accordance with the issued Permit to Work and associated risk assessment.

³ IMO Resolution A.1050(27) “Revised Recommendations for Entering Enclosed Spaces Aboard Ships” recommends that 21% oxygen concentration be considered acceptable for entry into enclosed spaces.

KG ASIA Crew

40. KG ASIA had a complement of 23 crewmembers, seven more than required by the Minimum Safe Manning Certificate issued by the Administrator.
41. Involved crewmember experience:

RANK	TIME ON BOARD HOUSTON	TIME IN RANK	TIME WITH COMPANY	TOTAL TIME AT SEA
C/O	6 months, 12 days	1 year	5 years, 3 months	5 years, 3 months
Bosun	10 months, 4 days	2 years, 8 months	9 months	10 years, 3 months
Fitter	1 month, 5 days	3 years, 1 month	1 month, 5 days	3 years, 1 month

42. All involved crewmembers held the appropriate Republic of the Marshall Islands-issued seafarer documentation for their positions.
43. The Administrator found no indications that any crewmembers involved with this incident failed to receive the amount of rest mandated by the STCW Code, Section A-VIII/1, paragraphs 2 and 3, and MLC, 2006, Regulation 2.3.

PART 3: ANALYSIS

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

Fitter's Cause of Death

The Fitter's entry into Cargo Hold No. 1 was not witnessed; however, it is presumed that he entered the access ladder shortly after the Bosun instructed him to wait 20 minutes. He was found by the Deck Cadet about 20 minutes after they started opening the hatch cover for Cargo Hold No. 1.

A postmortem examination of the Fitter was conducted by the authorities in Boryeong, Republic of Korea which determined that his cause of death was "toxic gas intoxication."

Atmospheric testing of all cargo holds was conducted daily⁴ during the loaded voyage. No carbon monoxide was detected in any of the cargo holds, while reduced oxygen levels were observed. On the day before the incident, atmospheric testing found that Cargo Hold No. 1 contained 16% oxygen. This is below the 20.6% required by the Company's SMS. While coal cargoes are known to emit carbon monoxide, it is more likely that the Fitter was overcome by a lack of oxygen in the cargo hold and Australian ladder trunk.

Communication

While clearing cargo residue from the hatch coaming of Cargo Hold No. 1 at the loading port, an air nozzle was dropped onto the cargo. The nozzle was left in place and the hatch was closed. It is not known who on board, besides the Bosun

⁴ With the exception of 18, 23, and 26 December 2019.

and Fitter, was aware of the dropped nozzle prior to the incident. It is also reported that none of the ship's officers were informed.

The Fitter only informed the Bosun of his intention to retrieve the nozzle before discharge started. The Bosun, in turn, did not inform any other crewmembers of the Fitter's intention. This prevented the ship's command from ensuring the enclosed space entry procedures were followed before entry into the loaded cargo hold.

Risk Assessment

A risk assessment was carried out prior to the crewmembers conducting operational testing of the hatch covers while the ship was at anchor. This assessment indicated that it was valid only for the operational testing completed on 3 January 2020. However, a new risk assessment was not completed prior to assigning the Bosun, Fitter, and Deck Cadet to open the hatch covers.

Although a risk assessment was not completed for opening the hatch covers on 7 January 2020, the C/O conducted a Toolbox Talk with the 3/O and Bosun. The Fitter and Deck Cadet were not present for this Toolbox Talk.

Enclosed Space Entry Procedures

The Company's SMS includes comprehensive procedures for ensuring safe entry into enclosed spaces. These were not implemented before entering the access ladder trunk. The Fitter and Bosun were the only crewmembers aware of the intended entry. The ship's officers were not made aware and therefore had no opportunity to ensure the procedures were properly implemented.

Enclosed Space Entry Awareness

The access hatches to all cargo holds are provided with a directive that entry is only authorized with the permission of a ship's officer. This directive was not followed by the Fitter or Bosun, as neither notified any ship officer of the intention to enter.

The Bosun participated in enclosed space entry and rescue drills while serving on board KG ASIA. The most recent drill was conducted on 15 December 2019 and simulated a rescue from Cargo Hold No. 1.

The Bosun and Fitter both completed initial familiarization training upon joining KG ASIA. This orientation training included familiarization with the Company's safe work practices and Permit to Work system.

It is not known why the Bosun assisted the Fitter with opening the access hatch or why he told the Fitter to wait 20 minutes before entering, despite the warning posted on the access hatch and having recently participated in an enclosed space rescue drill in the same cargo hold. It is possible that the Bosun considered 20 minutes of natural ventilation through the open hatch covers and access hatch as adequate to allow safe entry, an indication he recognized that the loaded cargo hold was an enclosed space.

The Fitter had not participated in the most recent enclosed space entry and rescue drill, although he would have been required to participate on previous occasions during his career at sea.

Stop Work Authority Policy

Entry into a cargo hold without implementing the enclosed space entry procedures is a situation which the Company specifically identifies as a time when the Stop Work Authority policy should be exercised. Although the Bosun stopped the Fitter from immediately entering the cargo hold, he also told the Fitter to wait 20 minutes before doing so. The Bosun did not notify any other crewmembers, nor did he exercise the Stop Work Authority policy as intended by the Company's SMS. The Company's SMS requires that the Master review any order to stop work prior to work restarting. This was not completed since the Master had not been informed.

Enclosed Space Rescue

After he was notified that the Fitter was unresponsive in the cargo hold, the Bosun immediately entered the space, without taking any precautions, to attempt to rescue him. He quickly became unconscious. The C/O arrived at the cargo hold and recognized the need to carry out an enclosed space rescue. He ensured the Company's enclosed space rescue procedures were implemented and both crewmembers were removed from the cargo hold without further incident.

Although the Bosun participated in enclosed space entry and rescue drills during his time on board KG ASIA, he entered the cargo hold without taking any precautions. This endangered his life and delayed the removal of the Fitter from the cargo hold.

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.

1. Causal factors that contributed to this very serious marine casualty include:
 - (a) a hazardous atmosphere within Cargo Hold No. 1 as a result of carrying coal;
 - (b) entering Cargo Hold No. 1, via the access ladder, without complying with the Company's enclosed space entry procedures;
 - (c) inadequately exercising the Company's Stop Work Authority policy when the Fitter indicated that he intended to enter Cargo Hold No. 1;
 - (d) failure to notify any of the ship's officers of the need or intention to enter an enclosed space; and
 - (e) immediate entry into the enclosed space to attempt a rescue without initiating the Company's enclosed space rescue procedures, delaying the removal of the Fitter from the cargo hold.
2. Additional causal factors that may have contributed to this very serious marine casualty include:
 - (a) inadequate communication between the ship's crewmembers after the air nozzle was dropped into Cargo Hold. No. 1;
 - (b) disregarding the requirement posted on the access hatch to request permission from a ship's officer prior to entering Cargo Hold No. 1;

- (c) lack of awareness of the hazards of entering a cargo hold containing coal without complying with the Company's enclosed space entry procedures; and
- (d) absence of the Fitter and Deck Cadet from the Toolbox Talk conducted by the C/O prior to beginning opening of the hatch covers.

PART 5: PREVENTIVE ACTIONS

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

1. Locking devices were fitted to the access hatches for all cargo holds, and other enclosed spaces on board KG ASIA.
2. The Company's SMS was updated to include the requirement to permanently post signs at the entrance to enclosed spaces to warn crewmembers of the risk of asphyxiation if entered without taking proper precautions.
3. A training initiative was implemented in conjunction with the Company's manning agency to increase awareness of the hazards of entering enclosed spaces without taking proper precautions.
4. The lessons learned were shared with all ships in the Company's managed fleet.
5. All ships in the Company's managed fleet were required to:
 - (a) conduct a special safety meeting to review the enclosed space entry procedures, Permit to Work system, and the proper operation of the portable gas detectors; and
 - (b) inspect the portable gas detectors to ensure proper calibration and operation.

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) review the procedures for enclosed space rescue training to ensure they adequately prepare crewmembers to recognize enclosed space emergencies and the proper actions to be taken;
 - (b) increase crewmember awareness of the hazards posed by frequently carried cargoes; and
 - (c) take actions to further the onboard implementation of the Company's Stop Work Authority policy.

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