REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

SASEBO ECO MARINE SAFETY INVESTIGATION REPORT

Occupational Fatality

Malacca Strait | 11 May 2023

Official Number: 5607

IMO Number: 9675456

Published by: Republic of the Marshall Islands Maritime Administrator on 22 October 2024

DISCLAIMER

In accordance with national and international requirements, the Republic of the Marshall Islands Maritime Administrator (the "Administrator") conducts marine safety investigations of marine casualties and incidents to promote the safety of life and property at sea and to promote the prevention of pollution. Marine safety investigations conducted by the Administrator do not seek to apportion blame or determine liability. While every effort has been made to ensure the accuracy of the information contained in this Report, the Administrator and its representatives, agents, employees, or affiliates accept no liability for any findings or determinations contained herein, or for any error or omission, alleged to be contained herein.

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

TABLE OF CONTENTS

LIST OF ABBREVIATIONS AND ACRONYMS

2/E . . . . . Second Engineer

3/E . . . . . Third Engineer

C/E . . . . . Chief Engineer

CPR . . . . . Cardiopulmonary Resuscitation

DWT . . . . . Deadweight Tonnage

EU-OSHA . . . . . European Agency for Safety and Health at Work

kg . . . . . Kilograms

m . . . . . Meters

mm . . . . . Millimeters

OOW . . . . . Officer of the Watch

PPE . . . . . Personal Protective Equipment

SMS . . . . . Safety Management System

UK MCA . . . . . United Kingdom Maritime and Coastguard Agency

DOCUMENTS CITED

COSWP . . . . . Code of Safe Working Practices for Merchant Seafarers

E-Facts 14 . . . . . E-Facts 14: Hazards and Risks Associated with Manual Handling in the Workplace

ISM Code . . . . . International Management Code for the Safe Operation of Ships and for Pollution Prevention

MLC, 2006 . . . . . Maritime Labour Convention, 2006

STCW Code . . . . . Seafarers' Training, Certification and Watchkeeping Code

PART 1: EXECUTIVE SUMMARY

On 11 May 2023, the C/E on board the Republic of the Marshall Islands-registered SASEBO ECO found the Fitter pinned under steel plates that were stored vertically on a rack in the Oxygen Bottle Room. The steel plates, which each weighed approximately 294 kg, had fallen and were lying on top of the Fitter's legs and chest so that his body was wedged in a semi-reclined position with his lower body and back on the deck. Only the Fitter's head, which was pressed against two of the oxygen bottles, was visible. The retaining bar used to secure the steel plates was pressed against the Fitter's neck. Crewmembers responded immediately to the C/E's call for assistance and lifted the steel plates off the Fitter, who was not breathing. The crewmembers transported him by stretcher to the Ship's Office where they started to administer CPR. The crewmembers administered CPR for approximately an hour, but the Fitter remained unresponsive and was determined to be deceased.

The Republic of the Marshall Islands Maritime Administrator's (the "Administrator's") marine safety investigation was not able to determine with certainty what caused the steel plates to fall and likely knock the Fitter, who had been alone in the Oxygen Bottle Room, down. It was determined that the retaining bar used to secure the steel plates had possibly been removed by the Fitter sometime before they fell and pinned him against the oxygen bottles.

The Administrator's investigation also determined that although the Fitter needed to go into the Oxygen Bottle Room and Acetylene Bottle Room to open and then close the main supply valves for the supply lines to the cutting equipment in the Engine Room Workshop, he had not been assigned any tasks on 11 May 2023 that required him to work with the steel plates or to remove the retaining bar. It was also determined that contrary to the safe work procedures in the Company's SMS and instructions from the C/E and 2/E, the Fitter had not told either the C/E, 2/E, or any other crewmember what he planned to do after the crew's morning coffee break or that he was going to go to the Oxygen Bottle Room.

Additionally, the investigation determined that although the location and design of the storage rack was effective for storing steel plates securely when the retaining bar was in place, a potential hazard exists whereby the steel plates may fall whenever the retaining bar is removed or fails for any reason.

The following lessons learned were identified:

- The Company's safe work procedures and the C/E's and 2/E's instructions were not followed. This created a situation where whatever work the Fitter may have intended to do in the Oxygen Bottle Room was not subject to being reviewed with either the C/E or 2/E. Such review is an opportunity to ensure the task is planned, the associated risks identified, and appropriate control measures put in place so that it can be completed safely. It also created a situation where no one on board knew where the Fitter was.
- Handling unsecured steel plates, even when they are on a storage rack, is a potentially dangerous activity and should not be attempted without assistance.
- The location and design of storage racks should eliminate or reduce the potential for steel plates to fall while being handled.
- The importance of maintaining positive control of keys for spaces with restricted access.

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.

SASEBO ECO

At the time of this very serious marine casualty, SASEBO ECO was a 221.7 m long, 77,888 DWT, seven hatch, gearless bulk carrier and was registered in the Republic of the Marshall Islands *(see Figure 1)*.

The ship was managed by Fundador Compania Naviera SA (the "Company").

SHIP PARTICULARS

Vessel Name
SASEBO ECO

Registered Owner
Ionion Shipholding Company Limited

ISM Ship Management
Fundador Compania Naviera SA

Flag State
Republic of the Marshall Islands

IMO No.	Official No.	Call Sign
9675456	5607	V7FK2

Year of Build	Gross Tonnage
2014	41,773

Net Tonnage	Deadweight Tonnage
26,057	77,888

Length x Breadth x Depth
221.7 x 32.2 x 20 m

Ship Type
Bulk Carrier

Document of Compliance Recognized Organization
Lloyd's Register

Safety Management Certificate Recognized Organization
Lloyd's Register

Classification Society
ClassNK

Persons on Board
22

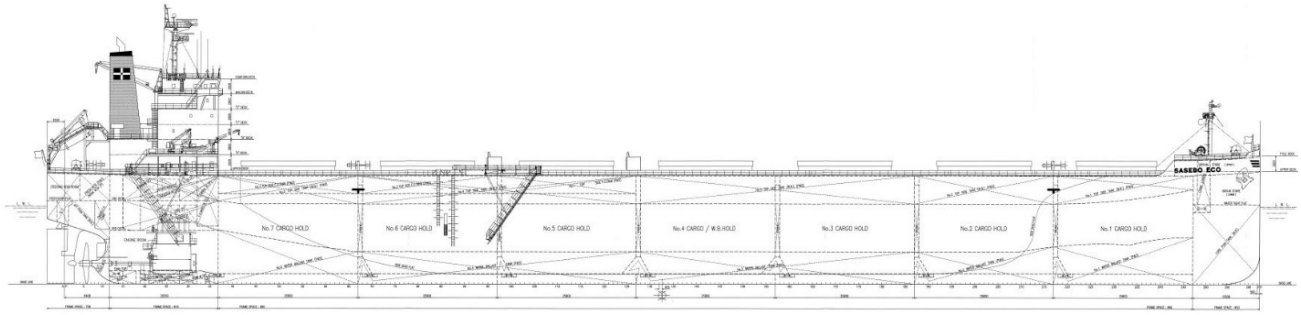

Figure 1: SASEBO ECO General Arrangement.

Narrative

On the morning of 11 May 2023, SASEBO ECO was underway in the Malacca Strait on a west northwesterly heading on a voyage from the Republic of Singapore (hereinafter "Singapore") to Ennore, Republic of India. The weather was good with Beaufort Force 3 winds from the south and calm seas with a swell of 0.5 m. The ship had a crew complement of 22. The ship's crewmembers all held valid Republic of the Marshall Islands seafarer documentation required for their position on board.

At 0800,[1] the ship's engineers met in the Engine Control Room for their morning meeting. The C/E assigned the Fitter, with assistance from the Electrician, to fabricate a steel foundation for a new washing machine that had been received on board in Singapore. Other work planned to be completed during the day by the ship's engineers included cleaning the air diffuser for the boiler and conducting routine maintenance of the rescue boat engine.

It was planned that the foundation would be constructed in the Engine Room Workshop using steel angle bars. All of the steel angle bars and other materials needed to fabricate the foundation were available in the Engine Room Workshop. The C/E also issued a Hot Work Permit for the duration of the work planned for fabrication of the steel foundation.

The main control valves for the supply lines that provided oxygen and acetylene to the Engine Room Workshop were in the Oxygen Bottle Room and the Acetylene Bottle Room, which were located on the port side, aft of the Accommodations, and were accessible through doors off an alley way (*see Figure 2*). As the doors to both spaces were kept locked, the C/E gave the Fitter the keys to the Oxygen Bottle Room and the Acetylene Bottle Room so he could open the main control valves for the oxygen and acetylene supply lines before starting work. It was standard practice on Company-managed ships for the Fitter to not return the keys until after the main control valves for the cutting gases were closed and the assigned job was completed.

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

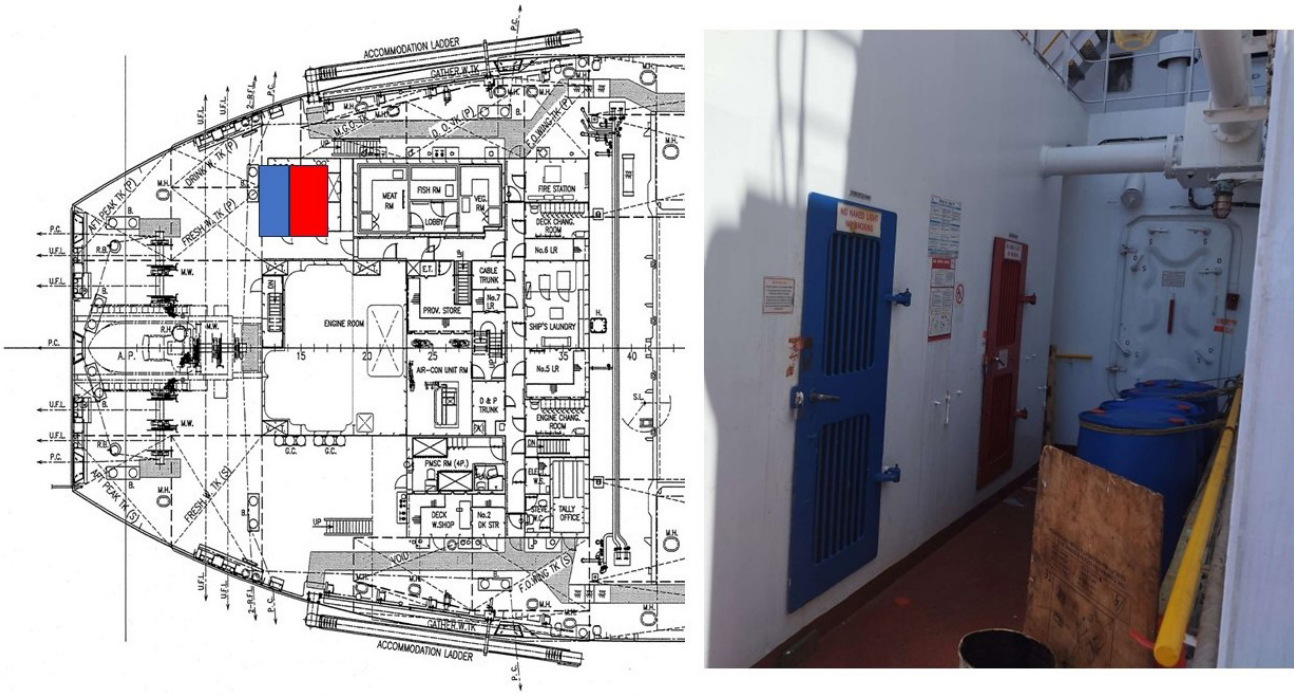

Figure 2: Location of the Oxygen Bottle Room (in blue) and Acetylene Bottle Room (in red). Both were accessible from the Poop Deck. The door leading to the Engine Room is to the right of the weather tight door at the end of the alley way.

By the start of the crew's morning coffee break at 1000, the Fitter and Electrician had completed fabricating and painting the new washing machine foundation. The Fitter did not return the keys to the Oxygen Bottle Room and Acetylene Bottle Room before coffee break. It is not known if the Fitter closed the main control valves for the oxygen and acetylene supply lines before the morning coffee break, however, when checked later in the day, the main control valves for the oxygen and acetylene supply lines to the Engine Room Workshop were found closed.

At 1020, the 3/E, Electrician, and Fitter went to the Changing Room after the morning coffee break to put their boiler suits and safety shoes back on in preparation for returning to work. They left the Changing Room at 1030. The 3/E and Electrician went to the Engine Room. The Fitter did not follow them into the Engine Room, nor did he tell them where he was going.

At 1115, the C/E, who was making his routine daily round of the ship, observed that the door to the Oxygen Bottle Room was open. He looked inside and saw steel plates lying on the Fitter's body in such a way that only his head could be seen. The Fitter's body was wedged in a semi-reclined position with the steel plates lying on top of his legs and chest, the back of his legs and back on the deck, and his head pressed against two of the oxygen bottles (*see Figure 3*). The retaining bar[2] was at the edge of the steel plates pressed against the Fitter's neck.

2 The retaining bar was a piece of steel angle bar.

Figure 3: The approximate position of the steel plates and location of the Fitter when he was found by the C/E. The picture was taken from the door leading into the Oxygen Bottle Room.

The C/E was unable to lift the steel plates off the Fitter by himself and called for assistance. Crewmembers responded immediately and lifted the steel plates off the Fitter, who was not breathing, and transported him by stretcher to the Ship's Office. Immediately after reaching the Ship's Office, the crewmembers started to administer CPR with artificial respiration. The Fitter was not reported to have any significant external injuries. The Master informed the Company and requested arrangements be made for the medical evacuation of the Fitter. The Master then contacted the Hellenic Red Cross for medical instructions.

At 1200, the Master ordered that the main engine be stopped pending receipt of a rendezvous position with a helicopter. The rendezvous position was received from the ship's Agent approximately 30 minutes later. The Master then directed the OOW to proceed to the assigned rendezvous position. The estimated arrival was 2030.

At 1230, CPR and artificial respiration were stopped after the Master determined that the Fitter, who did not have a detectable pulse and was not breathing, was deceased. The Master informed the Company as SASEBO ECO continued toward the assigned rendezvous position. At 1935, the Company directed the Master to proceed to Ulee Leheue, Republic of Indonesia.

The Fitter's body was disembarked at Ulee Leheue at 1300 on 12 May 2023. The excerpt of the death certificate issued by the local authorities did not state the cause of the Fitter's death.

Storage of Steel Plates

The steel plates were stored in a vertical rack located on the aft bulkhead in the Oxygen Bottle Room, which was oriented athwartship. A thin sheet of plywood was between each of the steel plates. The storage rack consisted of a steel angle bar welded to the deck and a retaining bar that was secured by tightening nuts on studs that were welded to a horizontal stiffener (*see Figure 4*). These nuts would have been required to be unscrewed all the way so that the retaining bar could be removed when handling steel plates.[3]

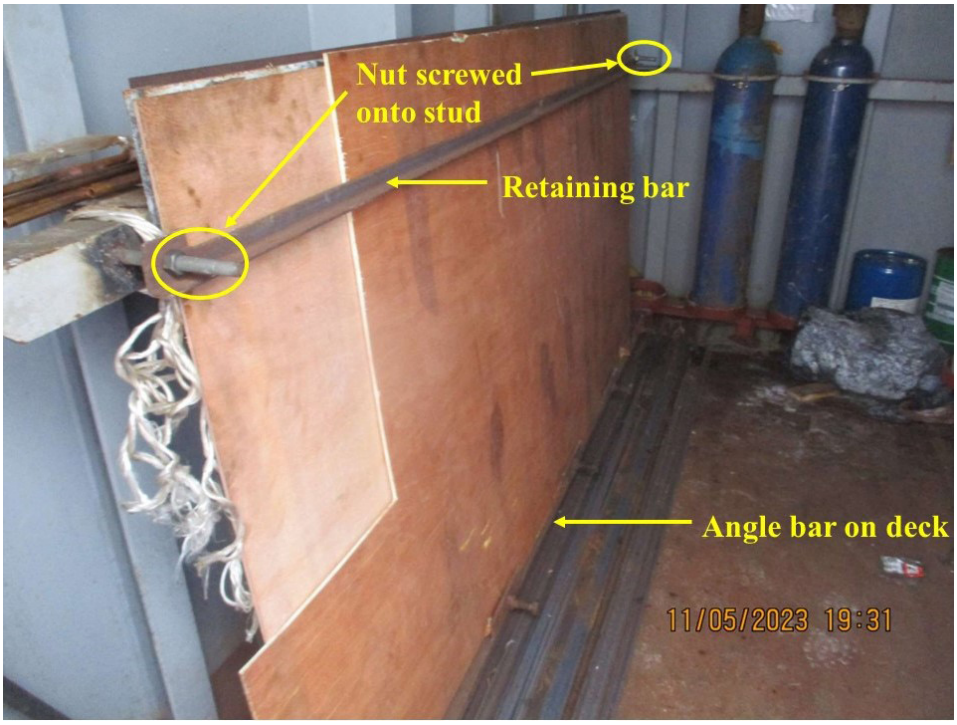

Figure 4: Steel plate stowage rack inside the Oxygen Bottle Room. There were loose pieces of steel angle bar lying on the deck next to the steel plate storage rack.

The retaining bar was supposed to be removed only when steel plates were being handled. The steel plates were leaning at a slight angle against the aft bulkhead of the Oxygen Bottle Room. There was no evidence that the retaining bar had not been put back in place after it had last been removed or that it had not been properly secured. There is also no evidence that any crewmember other than the Fitter had been in the Oxygen Bottle Room on the morning of 11 May 2023.

There were three steel plates on the storage rack when the Fitter was fatally injured. Each of these steel plates, which were 10 x 1,500 x 2,500 mm, weighed approximately 294 kg.

3 The Administrator was unable to confirm if the nuts had been in place before the steel plates fell on 11 May 2023 or if they were recovered.

Safe Work Procedures

As required by the ISM Code, the Company maintained a comprehensive SMS that included guidelines and procedures addressing safe working practices on board Company-managed ships. These guidelines and procedures included a section addressing hazards commonly associated with cold work,[4] and the associated safety measures.[5] The associated safety measures that were identified included the use of proper PPE. They also included a requirement for the officer in charge of a planned task to review the details of what needed to be done and the required PPE with the crewmembers who were assigned to complete the task. The guidelines for safe working practices also included a requirement to consult the UK MCA COSWP as necessary for more detailed guidance.

In addition to the guidelines for safe working practices in the Company's SMS, the C/E and 2/E had issued instructions for the ship's engineers to never conduct any job by themselves and to ensure the C/E or 2/E were aware of where they were working.

Fitter's Experience and Work Arrangements

The Fitter was an experienced seafarer with over 10 years in his current rank and had completed two prior contracts on Company-managed ships before signing on board SASEBO ECO on 16 October 2022. After signing on board, the Fitter completed the Company's required shipboard familiarization, which included reading the Company's guidelines for safe working practices.

The Fitter was a day worker whose regular work hours were 0800-1700 with a break for lunch between 1200–1300. The Administrator did not observe any indication that the Fitter had 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 Factual Information.

Storage and Handling of Steel Plates

The rack used to secure steel plates on board SASEBO ECO was located on the aft bulkhead of the Oxygen Bottle Room. The steel plates were held in place by a steel angle bar welded to the deck and a retaining bar that was secured by tightening nuts on studs that were welded to a horizontal stiffener *(see Figure 4)*. These nuts had to be unscrewed to remove the retaining bar when handling steel plates.

The location and design of the storage rack was effective for storing steel plates securely. However, a hazard inherent with the design was that there was always the potential for the steel plates to fall whenever the retaining bar was removed or failed for any reason. An additional hazard inherent with the location of the storage rack was that it was necessary

4 The Company's SMS defined cold work as "work that cannot create a source of ignition or generate temperature conditions likely to be of sufficient intensity to cause ignition of combustive gases, vapours, material or liquids in or adjacent to the area involved." This definition is consistent with how cold work is commonly understood.

5 Among other things, the guidelines for safe working practices in the Company's SMS also addressed its permit to work system, hot work, working aloft or over the side, enclosed space entry, and use of power tools.

to manually handle steel plates whenever a steel plate was taken from or put on the storage rack. It also required the steel plates to be carried into and out of the Oxygen Bottle Room.[6]

Access to the Oxygen Bottle Room and the Acetylene Bottle Room was restricted since both contained hazardous materials. Although this effectively reduced the risk of crewmembers handling steel plates without having been directed to do so by the C/E or 2/E, the Fitter's duties required him to have both regular access to these two spaces and to handle steel plates.

When found by the C/E at 1115, the Fitter was facing the storage rack pinned in a semi-reclined position by the steel plates, which were lying on his legs and chest. Only his head, which was pressed against two of the oxygen bottles, was visible *(see Figure 3)*. The retaining bar was along the edge of the steel plates and was pressed against the Fitter's neck. It is not known how long the Fitter had been in the Oxygen Bottle Room before he was found by the C/E or what he had been doing before the steel plates fell and likely knocked him down.

The steel plates that were lying on the Fitter each weighed 294 kg and had fallen from the storage rack located inside the Oxygen Bottle Room. Although it is not known what caused the plates to fall, they would not have been able to fall if the retaining bar was in place and properly secured. The fact that the steel plates fell indicates that the retaining bar had either:

(a) not been put back in place after it was last removed;

(b) been put back in place but had not been properly secured;

(c) been put back in place but the system of securing the bar had failed; or

(d) been removed by the Fitter.

If the retaining bar had not been put back in place after it was last removed, it would likely have been left lying on either the deck adjacent to the base of the storage rack or the horizontal stiffener that the studs were welded to *(see Figure 4*). If the retaining bar had been in either of these locations when the steel plates fell, it is unlikely that it would have been found pressed against the Fitter's neck. Rather, it would have been lying under the steel plates on the deck near the Fitter's feet or lying loose on either the horizontal stiffener or on top the steel plates. If the retaining bar had not been put back in place after it was last removed, the steel plates would most likely have fallen previously. Further, either the C/E, while making his daily round of the ship,[7] or the Fitter, when he had gone to the Oxygen Bottle Room to open or close the main control valve for the oxygen supply line either on 11 May 2023 or sometime previously, would likely have noticed that the retaining bar was not in position and taken action to secure it.

There is the possibility that the retaining bar had not been put back in place after it was last removed, and that the Fitter had been in the process of putting it in place when the steel plates fell. If the Fitter had been putting the retaining bar back in place, the retaining bar would most likely have been found underneath the steel plates pressed against his chest rather than at the edge of the plates pressed against his neck. It was not determined if the rope seen in *Figure 4* had been used to secure the steel plates.

---

6 Based on guidance in the UK MCA COSWP, 20-25 kg is the maximum weight a seafarer can be expected to carry. Based on this, 12 to 15 persons would be needed to safely carry a 10 x 1,500 x 2,500 mm steel plate. The EU-OSHA has issued guidance indicating that for most people a weight of 20 to 25 kg is considered heavy to lift. *See* EU-OSHA E-Facts 14.

7 The interior of the Oxygen Bottle Room and the Acetylene Bottle Room are visible from the alleyway since the upper and lower portions of the doors are made of steel bars so that the spaces are open to the atmosphere (*see Figure 2)*.

It is possible that the retaining bar had not been properly secured when it had last been put back in place and that the nuts had, over time, backed off the studs due to vibration and motion of the ship, which would have made it possible for the steel plates to fall. If this had occurred while the Fitter was in the Oxygen Bottle Room, after the coffee break on 11 May 2023, the retaining bar is likely to have been found underneath the steel plates pressed against the Fitter's chest, rather than his neck. Further, if the nuts were loose, it is possible that either the C/E or Fitter would have noticed this previously and ensured that they were secured properly.

It is not known what the Fitter was doing in the Oxygen Bottle Room. It is possible he had removed the retaining bar and laid it on the edge of a steel plate that was on the storage rack. Although the plates were too heavy for him to lift by himself, it would have been possible, after removing the retaining bar, for him to pull the plates, which normally leaned toward the bulkhead, toward him to identify material for a future task or to simply check to see what materials were available on board. Pulling the steel plates away from the bulkhead and toward him would have increased the potential for them to fall and knock the Fitter down. The fact that the retaining bar was found along the edge of the steel plates pressed against the Fitter's neck is consistent with this scenario.

The fact that the orientation of the storage rack was perpendicular to the longitudinal axis of the ship along with the existing weather conditions (i.e., Beaufort Force 3 winds and calm seas with a 0.5 m swell) would have significantly reduced the potential that the steel plates would have fallen due to the ship's motion even if the retaining bar had not been in place or it was not properly secured. Although it cannot be determined with certainty, it is possible that the Fitter had removed the retaining bar and that the steel plates fell as he was handling them.

Safe Work Procedures

The safe work procedures in the Company's SMS included the safety measures that should be adhered to when cold work was performed on board SASEBO ECO and other Company-managed ships. These include the Officer in charge of the task reviewing the planned work and required PPE with the crewmembers assigned to complete the planned task. Consistent with this requirement, the C/E and 2/E had issued instructions for the ship's engineers to never conduct any job by themselves and to ensure the C/E or 2/E were aware of where they were working.

These requirements would have been applicable to any cold work that the Fitter might have been doing while he was in the Oxygen Bottle Room. Why they were not implemented cannot be determined with any degree of certainty. A possible reason was that the Fitter considered whatever he planned on doing in the Oxygen Bottle Room as a routine task that did not warrant reviewing with either the C/E or 2/E. Additionally, the fact that the Fitter had not told the C/E, 2/E, or another crewmember what he planned to do after completing the foundation for the new washing machine prevented them from having the opportunity to intervene.

The Company's safe work procedures did not address management of keys for spaces for which access was restricted, such as the Oxygen Bottle Room and the Acetylene Bottle Room.

PART 4: CONCLUSIONS

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

1. Causal factors that contributed to this very serious marine casualty include the:
   (a) unsecured steel plates falling onto the Fitter, causing him to fall backward and then pinning his head against the oxygen bottles; and
   (b) design of the storage rack required that the retaining bar be removed when handling steel plates.
2. Causal factors that may have contributed to this very serious marine casualty include:
   (a) potential complacency or inadequate assessment regarding the risks associated with the Fitter's possible decision to remove the retaining bar to perform a task he had not reviewed with either the C/E or 2/E as required by the applicable provisions of the Company's safe work procedures and the instructions of the C/E and 2/E; and
   (b) the fact that the keys to the Oxygen Bottle Room and the Acetylene Bottle Room were not returned to the C/E after the fabrication of the foundation for the new washing machine was completed.
3. Additional issues that were identified but that did not contribute to this very serious marine casualty include:
   (a) the location of the storage rack required steel plates be handled manually.

PART 5: PREVENTIVE ACTIONS

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

1. An attending Company Superintendent conducted a review of this very serious marine casualty and provided training regarding the Company's safe work procedures with SASEBO ECO's crewmembers.
2. The lessons learned from this very serious marine casualty were shared with all ships in the Company-managed fleet with instructions that they be reviewed during a meeting of the shipboard Safety Committee. Shipboard Safety Committees were also instructed to focus on accident prevention over a six-month period by reviewing the Company's safe work procedures and relevant safety training videos.
3. The safe work procedures in the Company's SMS were revised to address the handling of heavy materials, including:
   (a) a requirement to consider the ease and safe transport of heavy objects, including the possible use of the ship's provisions crane, exposure to weather conditions, and possible damage of the material when selecting on board storage locations for heavy materials;
   (b) a requirement that doors to spaces where heavy materials are stored on board Company-managed ships were required to be marked "Do Not Attempt Release Unaided – Danger of Collapse;"

(c) recommendations that should be considered prior to handling or moving heavy materials and objects; and

(d) management of keys for spaces where heavy materials are stored.

4. A requirement was established for all crewmembers working on board Company-managed ships to have completed shoreside training on accident prevention and safe working practices.

5. All spare steel plates were moved from the Oxygen Bottle Room to a purpose-built storage rack located in the Bosun's Stores. The retaining bar is at one end so it is not possible for the steel plates to fall from the rack when the retaining bar is removed. An additional rack, also located in the Bosun's Stores was fabricated to store spare pipe and pieces of steel angle stock.

PART 6: RECOMMENDATIONS

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

1. That racks for storing steel plates on all Company-managed ships be configured so that:

(a) there are mechanical means of preventing steel plates from falling when handled; and

(b) to facilitate the ergonomic handling of steel plates.

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